K.S. Rangasamy College of Technology

(Autonomous)

Curriculum & Syllabus

of

B.E. Electronics and Communication Engineering

(For the batch admitted in 2018 – 2022)

R 2018

Courses Accredited by NBA, Accredited by NAAC, Approved by AICTE, Affiliated to Anna University, Chennai.

**KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.**

Vision

To become recognized as a leader in Electronics and Communication Engineering education and research

Mission

- To craft professionals and technology leaders adherent to the professional ethical code in the areas of Electronics and communication Engineering
- To address the needs of the society while advancing boundaries of disciplinary and multidisciplinary research and cultivate universal moral values

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: **Career Growth:** Graduates will be able to have successful technical and professional career growth

PEO2: **Knowledge and Skills:** Graduates will be able to apply the scientific, mathematical and engineering fundamentals to provide solutions to the problems in Electronics and Communication Engineering and related fields

PEO3: **Ethics and Life-long Learning:** Graduates will be able to engage in independent learning, exhibit creativity and innovation with ethical and professional behaviour while addressing societal needs

PROGRAMME OUTCOMES (POs)
Engineering Graduates will be able to:

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design /development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO1: **Solutions for Complex Problems**: Solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication.

PSO2: **Development of products**: Design system components and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering

PSO3: **Interpersonal Skills**: Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMMEOUTCOMES (POs)

The B.E. Electronics and Communication Engineering Programme outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme Educational Objectives	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	3	3	3	3	3	2	2	3	3	3	2	3
PEO 2	3	3	3	3	3	3	3	3	3	3	3	3
PEO 3	2	2	2	2	2	3	2	3	3	3	2	3

Contributions: 1- low, 2- medium, 3- high

MAPPING: Electronics and Communication Engineering (UG)

YEAR	SEM	COURSE CODE	COURSE NAME	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
I	I	50 EN 001	Communication Skills I	1	1	1	1	1	2	1	2	3	3	2	3
		50 MA 001	Calculus and Differential Equations	3	3	2.8	2.4	2.4							2
		50 PH 002	Physics for Electrical Sciences	3	3	2	2	2	2	2	1	1	1	1	
		50 EE 001	Basic Electrical Engineering	3	3	1.7	1.5	2	2	2	2	1.7	2	2.3	1.5
		50 ME 002	Engineering Graphics	3	3	3	3	3	1		1		3	1	1
		50 PH 0P2	Applied Physics Laboratory	3	3	2	2	2	2	2	1	1	1	1	1
		50 ME 0P1	Engineering Practices Laboratory	3	2	2	1	3	2	2	3	1	2	2	1
	II	50 EN 002	Communication Skills II	1	2	1	2	1	2	1	2	3	3	2	3
		50 MA 002	Laplace Transform and Complex Variables	3	3	2.4	2.2	2.8							2
		50 CH 001	Applied Chemistry	3	3	2.8	2.6	2.2	2.4	2.6	2	1.8	1	1.4	2
		50 CS 001	Programming for Problem Solving	1	3		2.4	2.8			2				1.8

		50 ME 003	Engineering Mechanics	3	2	2	3								2
		50 MY 001	Constitution of India								2	2	1		2
		50 CH 0P1	Chemistry Laboratory	3	3	3	3	3	3	2.4	2	2		2.2	1.3
		50 CS 0P1	Programming for Problem Solving Laboratory	1	3		2.4	2.8			2				1.8
II	III	50 MA 004	Partial Differential Equations, Linear Algebra and Numerical Methods	3	3	2	3	2							2
		50 CS 002	Data Structures	1	3	2	2	2.3		2			2		2
		50 EC 301	Electron Devices and Circuits	3	2.8	2.8	2.2	3			3	3	3		3
		50 EC 302	Digital Logic Design	2.8	2.8	3	2.4	2.8			3	3	3		3
		50 EC 303	Network Theory	3	3	3	2	2							
		50 MY 002	Environmental Science	2.6	2.4	2.6	2.6	2.2	2.8	3	3	2.8	2.8	2.5	2
		50 EC 3P1	Analog and Digital Electronics Laboratory	3	2.8	2.8	2.8	2.6	3		3	2.4	3	3	2.8
		50 CS 0P2	Data Structures Laboratory	1	3	2	3	3		3			2		2
		50 TP 0P1	Career Competency Development I	1	1	1	1	1	2	1	2	3	3	2	3
	IV	50 MA 010	Probability and Stochastic Processes	3	3	3	3	2						3	2
		50 EC 401	Linear Integrated Circuits	2.6	2.8	3	3	3			3	3	3		3
		50 EC 402	Electromagnetic Waves	3	3	2.8	2.6		3	3					
		50 EC 403	Signals and Systems	3	3	2.6	2.6	2			3	3	3		3
		50 EC L1*	Open Elective I												
		50 MY 003	Ethics for Engineers						3	2	3	3		2	1
		50 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	3	3	3	3	3	2.8		3	3	3		3
		50 EC 4P2	Electronic Design Project Laboratory	3	3	3	3	3	2.3		2	3	3	3	2
		50 TP 0P2	Career Competency Development II	2	2	1	1	1	2	1	1	2	3	2	3
III	V	50 EC 501	Analog Communication	3	3	3	2.2	3			3	3	3		3
		50 EC 502	Control Systems Engineering	3	3	3	3	3	3						
		50 EC 503	Digital Signal Processing	3	3	3	2.8	3							
		50 EC 504	Microprocessors and Microcontrollers	3	3	2.8	3	3			3	3	3		3
		50 EC 505	CMOS Design	3	3	2.8	2.8	3		3	3	3	3		3
		50 EC E1*	Elective I												
		50 EC 5P1	Digital Signal Processing Laboratory	3	3	2.4	2.2	3			3	3	3	3	3
		50 EC 5P2	CMOS Design Laboratory	3	3	3	2.6	3		3	3	3	3		3
		50 TP 0P3	Career Competency Development III	2	1	2	2	1	1	1	1	2	3	2	3
	VI	50 HS 001	Engineering Economics and Financial Accounting	3	2	3	2	1	3	2	1	2	2	3	1
		50 EC 601	Digital Communication	2.8	2.4	3	2.6	3			3	3	3		3
		50 EC 602	Embedded Systems	3	3	3	3	3			3	3	3		3
		50 EC 603	Machine Learning Techniques	3	2.8	2.8	2.8	3							
		50 EC E2*	Elective II												

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		50 EC L2*	Open Elective II												
		50 MY 014	Start-ups and Entrepreneurship	2.8	2.6	3	2.4	2.2	2.5	1.7	1.8	1.3	2	2.2	2.4
		50 EC 6P1	Analog and Digital Communication Laboratory	3	3	3	3	3	3	3	3	3	3		3
		50 EC 6P2	Embedded Systems Laboratory	3	3	3	2.8	3			3	3	3		3
		50 EC 6P3	Innovation Project Laboratory	3	3	3	3	3	2.8	2.8	3	3	3	3	3
		50 TP 0P4	Career Competency Development IV	2	1	2	2	1	2	1	1	2	3	2	3
IV	VII	50 EC 701	Computer Networks	3	3	3	3	3			3	3	3		3
		50 EC 702	Microwave Engineering	3	3	3	3	3		3	3	3	3		3
		50 EC 703	Mobile Communication and Networks	3	3	3	3	3	3	3	3	3	3		3
		50 EC E3*	Elective III												
		50 EC E4*	Elective IV												
		50 EC L3*	Open Elective III												
		50 AC 001	Research Skill Development -I	3	3	2	2	2	2	1	2	1	3	2	1
		50 EC 7P1	Communication and Networks Laboratory	3	3	3	3	3			3	3	3		3
		50 EC 7P2	Project Work- Phase I	3	3	3	3	3	3	3	3	3	3	3	3
		50 TP 0P5	Career Competency Development V	2	1	2	2	1	2	1	1	2	3	2	3
	VIII	50 EC E5*	Elective V												
		50 EC L4*	Open Elective IV												
		50 AC 002	Research Skill Development - II	3	3	3	2	2	2	1	1	1	2	2	1
		50 EC 8P1	Project Work - Phase II	3	3	3	3	3	3	3	3	3	3	3	3

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 EN 001	Communication Skills I	HS	2	1	1	0	2
2.	50 MA 001	Calculus and Differential Equations	BS	4	3	1	0	4
3.	50 PH 002	Physics for Electrical Sciences	BS	3	3	0	0	3
4.	50 EE 001	Basic Electrical Engineering	ES	3	3	0	0	3
5.	50 ME 002	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
6.	50 PH 0P2	Applied Physics Laboratory	BS	4	0	0	4	2
7.	50 ME 0P1	Engineering Practices Laboratory	ES	4	0	0	4	2
			Total	**26**	**12**	**2**	**12**	**20**

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 EN 002	Communication Skills II	HS	2	1	1	0	2
2.	50 MA 002	Laplace Transform and Complex Variables	BS	4	3	1	0	4
3.	50 CH 001	Applied Chemistry	BS	3	3	0	0	3
4.	50 CS 001	Programming for Problem Solving	ES	3	3	0	0	3

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5.	50 ME 003	Engineering Mechanics	ES	4	3	1	0	4
6.	50 MY 001	Constitution of India	MC	2	2	0	0	0
		PRACTICALS						
7.	50 CH 0P1	Chemistry Laboratory	BS	4	0	0	4	2
8.	50 CS 0P1	Programming for Problem Solving Laboratory	ES	4	0	0	4	2
			Total	**26**	**15**	**3**	**8**	**20**

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 MA 004	Partial Differential Equations, Linear Algebra and Numerical Methods	BS	4	3	1	0	4
2.	50 CS 002	Data Structures	ES	3	3	0	0	3
3.	50 EC 301	Electron Devices and Circuits	PC	3	3	0	0	3
4.	50 EC 302	Digital Logic Design	PC	3	2	1	0	3
5.	50 EC 303	Network Theory	PC	4	3	1	0	4
6.	50 MY 002	Environmental Science	MC	2	2	0	0	0
		PRACTICALS						
7.	50 EC 3P1	Analog and Digital Electronics Laboratory	PC	4	0	0	4	2
8.	50 CS 0P2	Data Structures Laboratory	ES	4	0	0	4	2
9.	50 TP 0P1	Career Competency Development I	EEC	2	0	0	2	0
			Total	**29**	**16**	**3**	**10**	**21**

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 MA 010	Probability and Stochastic Processes	BS	4	3	1	0	4
2.	50 EC 401	Linear Integrated Circuits	PC	3	3	0	0	3
3.	50 EC 402	Electromagnetic Waves	PC	4	3	1	0	4
4.	50 EC 403	Signals and Systems	PC	4	3	1	0	4
5.	50 EC L1*	Open Elective I	OE	3	3	0	0	3
6.	50 MY 003	Ethics for Engineers	MC	2	2	0	0	0
		PRACTICALS						
7.	50 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	PC	4	0	0	4	2
8.	50 EC 4P2	Electronic Design Project Laboratory	EEC	4	0	0	4	2
9.	50 TP 0P2	Career Competency Development II	EEC	2	0	0	2	0
			Total	**30**	**17**	**3**	**10**	**22**

SEMESTER V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 EC 501	Analog Communication	PC	3	2	1	0	3
2.	50 EC 502	Control Systems Engineering	PC	3	2	1	0	3
3.	50 EC 503	Digital Signal Processing	PC	3	2	1	0	3
4.	50 EC 504	Microprocessors and Microcontrollers	PC	3	3	0	0	3
5.	50 EC 505	CMOS Design	PC	3	3	0	0	3
6.	50 EC E1*	Elective I	PE	3	3	0	0	3
		PRACTICALS						

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7.	50 EC 5P1	Digital Signal Processing Laboratory	PC	4	0	0	4	2
8.	50 EC 5P2	CMOS Design Laboratory	PC	4	0	0	4	2
9.	50 TP 0P3	Career Competency Development III	EEC	2	0	0	2	0
			Total	**28**	**15**	**3**	**10**	**22**

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3
2.	50 EC 601	Digital Communication	PC	4	3	1	0	4
3.	50 EC 602	Embedded Systems	PC	3	3	0	0	3
4.	50 EC 603	Machine Learning Techniques	PC	3	3	0	0	3
5.	50 EC E2*	Elective II	PE	3	3	0	0	3
6.	50 EC L2*	Open Elective II	OE	3	3	0	0	3
7.	50 MY 014	Start-ups and Entrepreneurship	MC	2	2	0	0	0
		PRACTICALS						
8.	50 EC 6P1	Analog and Digital Communication Laboratory	PC	4	0	0	4	2
9.	50 EC 6P2	Embedded Systems Laboratory	PC	4	0	0	4	2
10.	50 EC 6P3	Innovation Project Laboratory	EEC	4	0	0	4	2
11.	50 TP 0P4	Career Competency Development IV	EEC	2	0	0	2	0
			Total	**35**	**20**	**1**	**14**	**25**

SEMESTER VII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 EC 701	Computer Networks	PC	3	3	0	0	3
2.	50 EC 702	Microwave Engineering	PC	3	3	0	0	3
3.	50 EC 703	Mobile Communication and Networks	PC	3	3	0	0	3
4.	50 EC E3*	Elective III	PE	4	2	0	2	3
5.	50 EC E4*	Elective IV	PE	3	3	0	0	3
6.	50 EC L3*	Open Elective III	OE	3	3	0	0	3
7.	50 AC 001	Research Skill Development – I	AC	1	1	0	0	0
		PRACTICALS						
8.	50 EC 7P1	Communication and Networks Laboratory	PC	4	0	0	4	2
9.	50 EC 7P2	Project Work - Phase I	EEC	4	0	0	4	2
10.	50 TP 0P5	Career Competency Development V	EEC	2	0	0	2	0
			Total	**30**	**18**	**0**	**12**	**22**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 EC E5*	Elective V	PE	3	3	0	0	3
2.	50 EC L4*	Open Elective IV	OE	3	3	0	0	3
3.	50 AC 002	Research Skill Development -II	AC	1	1	0	0	0
		PRACTICALS						
4.	50 EC 8P1	Project Work - Phase II	EEC	16	0	0	16	8
5.	50 TP 0P6	Internship	EEC	0	0	0	0	3*
			Total	**23**	**7**	**0**	**16**	**14**

Internship *- Extra Credit is offered

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 166

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES- Engineering Science Courses, PC-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses, MC- Mandatory Courses and AC- Audit Courses

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EN 001	Communication Skills I	HS	2	1	1	0	2
2.	50 EN 002	Communication Skills II	HS	2	1	1	0	2
3.	50 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3

BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 MA 001	Calculus and Differential Equations	BS	4	3	1	0	4
2.	50 PH 002	Physics for Electrical Sciences	BS	3	3	0	0	3
3.	50 PH 0P2	Applied Physics Laboratory	BS	4	0	0	4	2
4.	50 MA 002	Laplace Transform and Complex Variables	BS	4	3	1	0	4
5.	50 CH 001	Applied Chemistry	BS	3	3	0	0	3
6.	50 CH 0P1	Chemistry Laboratory	BS	4	0	0	4	2
7.	50 MA 004	Partial Differential Equations, Linear Algebra and Numerical Methods	BS	4	3	1	0	4
8.	50 MA 010	Probability and Stochastic Processes	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EE 001	Basic Electrical Engineering	ES	3	3	0	0	3
2.	50 ME 002	Engineering Graphics	ES	6	2	0	4	4
3.	50 ME 0P1	Engineering Practices Laboratory	ES	4	0	0	4	2
4.	50 CS 001	Programming for Problem Solving	ES	3	3	0	0	3
5.	50 ME 003	Engineering Mechanics	ES	4	3	1	0	4
6.	50 CS 0P1	Programming for Problem Solving Laboratory	ES	4	0	0	4	2
7.	50 CS 002	Data Structures	ES	3	3	0	0	3
8.	50 CS 0P2	Data Structures Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC 301	Electron Devices and Circuits	PC	3	3	0	0	3
2.	50 EC 302	Digital Logic Design	PC	3	2	1	0	3
3.	50 EC 303	Network Theory	PC	4	3	1	0	4
4.	50 EC 3P1	Analog and Digital Electronics Laboratory	PC	4	0	0	4	2
5.	50 EC 401	Linear Integrated Circuits	PC	3	3	0	0	3
6.	50 EC 402	Electromagnetic Waves	PC	4	3	1	0	4

7.	50 EC 403	Signals and Systems	PC	4	3	1	0	4
8.	50 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	PC	4	0	0	4	2
9.	50 EC 501	Analog Communication	PC	3	2	1	0	3
10.	50 EC 502	Control Systems Engineering	PC	3	2	1	0	3
11.	50 EC 503	Digital Signal Processing	PC	3	2	1	0	3
12.	50 EC 504	Microprocessors and Microcontrollers	PC	3	3	0	0	3
13.	50 EC 505	CMOS Design	PC	3	3	0	0	3
14.	50 EC 5P1	Digital Signal Processing Laboratory	PC	4	0	0	4	2
15.	50 EC 5P2	CMOS Design Laboratory	PC	4	0	0	4	2
16.	50 EC 601	Digital Communication	PC	4	3	1	0	4
17.	50 EC 602	Embedded Systems	PC	3	3	0	0	3
18.	50 EC 603	Machine Learning Techniques	PC	3	3	0	0	3
19.	50 EC 6P1	Analog and Digital Communication Laboratory	PC	4	0	0	4	2
20.	50 EC 6P2	Embedded Systems Laboratory	PC	4	0	0	4	2
21.	50 EC 701	Computer Networks	PC	3	3	0	0	3
22.	50 EC 702	Microwave Engineering	PC	3	3	0	0	3
23.	50 EC 703	Mobile Communication and Networks	PC	3	3	0	0	3
24.	50 EC 7P1	Communication and Networks Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

SEMESTER V, ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC E11	Biomedical Electronics	PE	3	3	0	0	3
2.	50 EC E12	Consumer Electronics	PE	3	3	0	0	3
3.	50EC E13	Nano Electronics	PE	3	3	0	0	3
4.	50 EC E14	Measurements and Instrumentation	PE	3	3	0	0	3
5.	50 EC E15	Electromagnetic Interference and Compatibility	PE	3	3	0	0	3
6.	50 EC E16	Automotive Electronics	PE	3	3	0	0	3
7.	50 IT E18	Programming in JAVA	PE	3	3	0	0	3

SEMESTER VI, ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC E21	Digital Image Processing	PE	3	3	0	0	3
2.	50 EC E22	ARM Architecture and Programming	PE	3	3	0	0	3
3.	50 EC E23	Robotics	PE	3	3	0	0	3
4.	50 EC E24	Error Correcting Codes	PE	3	3	0	0	3
5.	50 EC E25	Mixed Signal Design	PE	3	3	0	0	3
6.	50 EC E26	RFID and Biometrics	PE	3	3	0	0	3
7.	50 EC E27	Antennas and Propagation	PE	3	3	0	0	3

SEMESTER VII, ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC E31	Neural Networks	PE	4	2	0	2	3
2.	50 EC E32	High Performance RISC Processor	PE	4	2	0	2	3
3.	50 EC E33	Optical Communication	PE	4	2	0	2	3

4.	50 EC E34	Radar and Navigational Aids	PE	4	2	0	2	3
5.	50 EC E35	VLSI Testing and Verification	PE	4	2	0	2	3
6.	50 EC E36	Adaptive Signal Processing	PE	4	2	0	2	3
7.	50 EC E37	Principles of Medical Imaging	PE	4	2	0	2	3

SEMESTER VII, ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC E41	Artificial Intelligence	PE	3	3	0	0	3
2.	50 EC E42	Real Time System Design	PE	3	3	0	0	3
3.	50 EC E43	Optoelectronic Devices	PE	3	3	0	0	3
4.	50 EC E44	Satellite Communication	PE	3	3	0	0	3
5.	50 EC E45	VLSI Signal Processing	PE	3	3	0	0	3
6.	50 EC E46	Speech and Audio Processing	PE	3	3	0	0	3
7.	50 EC E47	High Speed Networks	PE	3	3	0	0	3

SEMESTER VIII, ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC E51	Deep Learning	PE	3	3	0	0	3
2.	50 EC E52	Micro Electro Mechanical Systems	PE	4	2	0	2	3
3.	50 EC E53	Wireless Sensor Networks	PE	3	3	0	0	3
4.	50 EC E54	Wavelets and Its Applications	PE	3	3	0	0	3
5.	50 EC E55	Green Communication	PE	3	3	0	0	3
6.	50 EC E56	Multimedia Communication	PE	3	3	0	0	3
7.	50 EC E57	Cryptography and Network Security	PE	3	3	0	0	3

SEMESTER VII &SEMESTER VIII, AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 AC 001	Research Skill Development -I	AC	1	1	0	0	0
2.	50 AC 002	Research Skill Development -II	AC	1	1	0	0	0

OPEN ELECTIVES I / II / III / IV (OE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC L01	Internet of Things	OE	3	3	0	0	3
2.	50 EC L02	Wearable Devices	OE	3	3	0	0	3
3.	50 EC L03	Next Generation Wireless Networks	OE	3	3	0	0	3
4.	50 EC L04	Microprocessor and Microcontroller	OE	3	3	0	0	3
5.	50 EC L05	5G Technology	OE	3	3	0	0	3
6.	50 EC L06	Mobile Robotics	OE	3	3	0	0	3

SPECIAL ELECTIVE

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EC SE01	Long Range (LoRa) Wireless Communication for IoT Applications	SE	60	30	0	30	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 TP 0P1	Career Competency Development I	EEC	2	0	0	2	-
2.	50 TP 0P2	Career Competency Development II	EEC	2	0	0	2	-
3.	50 TP 0P3	Career Competency Development III	EEC	2	0	0	2	-
4.	50 TP 0P4	Career Competency Development IV	EEC	2	0	0	2	-
5.	50 TP 0P5	Career Competency Development V	EEC	2	0	0	2	-
6.	50 EC 4P2	Electronic Design Project Laboratory	EEC	4	0	0	4	2
7.	50 EC 6P3	Innovation Project Laboratory	EEC	4	0	0	4	2
8.	50 EC 7P2	Project work- Phase I	EEC	4	0	0	4	2
9.	50 EC 8P1	Project work - Phase II	EEC	16	0	0	16	8

SUMMARY

S.No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1.	HS	2	2	-	-	-	3	-	-	**7**	**4.21**
2.	BS	9	9	4	4	-	-	-	-	**26**	**15.67**
3.	ES	9	9	5	-	-	-	-	-	**23**	**13.86**
4.	PC	-	-	12	13	19	14	11	-	**69**	**41.57**
5.	PE	-	-	-	-	3	3	6	3	**15**	**9.04**
6.	OE	-	-	-	3	-	3	3	3	**12**	**7.22**
7.	EEC	-	-	-	2	-	2	2	8	**14**	**8.43**
8.	MC	-	MC I	MC II	MC III	-	MC IV	-	-	**-**	**-**
9	AC	-	-	-	-	-	-	AC I	AC II	**-**	**-**
Total		**20**	**20**	**21**	**22**	**22**	**25**	**22**	**14**	**166**	**100**

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EN 001 – Communication Skills I								
Common to all Branches								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	1	1	0	30	2	50	50	100
Objective(s)	• To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts • To help learners develop strategies that could be adopted while reading texts • To help learners acquire the ability to speak effectively in English in real life and career related situations • To equip students with effective speaking and listening skills in English • To facilitate learners to enhance their writing skills with coherence and appropriate format effectively							
Course Outcomes	**At the end of the course, the student will be able to** CO1: Utilize digital literacy tools to develop listening skills & make use of contextual clues to infer meanings of unfamiliar words CO2: Able to select, compile & synthesize information using communication strategies for an effective oral presentation CO3: Skim &Scan the textual content & infer meanings of unfamiliar words to develop reading & vocabulary skills CO4: Generate ideas from sources to develop coherent content and support with relevant details in writing CO5: Recognize the basic phonetic patterns of language & execute it for competent loud reading							

Note: Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

Listening

Listening to Short Audios – Watching Short Videos - answering MCQs and Vocabulary Check- Listening to Short Comprehension Passages – Guided Listening – Listening to songs and cognizing the lyrics [8]

Speaking

Brainstorming – Group Discussion (unstructured) – Self Introduction - Just a Minute (JaM) - Short Narratives – Cue Cards – Picture Cards – Conversational Practices (Preliminary) [8]

Reading

Silent Reading – Scanning and Skimming - Reading short and Medium Passages – Cognition of Theme and Inferential Meaning - Academic and Functional Vocabulary List (350 words) – Word Power Check - Loud Reading – Modulation and Pronunciation Check [8]

Writing

Functional Vocabulary and Word Power – Data Interpretation - Paragraph Writing – Letter Writing –Email Writing – Conversational Fill Ups [6]

Total hours:30

Text book(s):

1.	M.Ashraf Rizvi, 'Effective Technical Communication', 2nd Edition, McGraw Hill Education (India) Private Limited, Chennai, 2018
2.	Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020

Reference(s):

1.	Paul Emmerson and Nick Hamilton , 'Five Minute Activities for Business English', Cambridge University Press, N.York, 2005
2.	Arthur Brookes and Peter Grundy ,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, N.York, 2003
3.	Michael McCarthy and Felicity O Dell , 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012
4.	https://learningenglish.britishcouncil.org/en/listening

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CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1	2	2	2	2	2	3	3	3	3	1	2	1
CO2	2	2	1	3	2	2	2	2	3	3	3	3	1	3	1
CO3	1	3	1	2	2	2	2	2	2	3	3	3	1	1	1
CO4	1	2	2	2	2	2	2	2	2	3	3	3	1	2	1
CO5	1	1	1	1	1	1	1	1	3	3	1	3		1	

COs	POs/PSOs	Level	Justification
CO1	PO1	1	In order to apply the knowledge and finding solution to complex engineering problems, inferring meanings of unfamiliar words plays a peripheral role.
	PO2	2	Inferring meanings of unfamiliar words will be of moderate help while identifying and receiving research literature and analyzing complex engineering problems as well.
	PO3	1	For designing and development of solutions to complex engineering problems, inferring meanings of unfamiliar words play a peripheral role.
	PO4	2	For conducting investigations of complex problems, we are in need of inferring meanings of unfamiliar words at a moderate level for using research-based knowledge and methods.
	PO5	2	For modern tool usage, inferring meanings of unfamiliar words proves reasonable while selecting and applying appropriate techniques and resources with an understanding of the limitations
	PO6	2	Inferring of meanings of unfamiliar words becomes rational to assess the consequent responsibilities relevant to the professional practice
	PO7	2	Understanding the impact of solutions in environmental contexts and thereafter demonstrating the knowledge for sustainable development, inferring meanings of unfamiliar words contributes to a measurable way.
	PO8	2	For understanding norms of engineering practice so as to apply professional ethical principles, inferring of meaning of unfamiliar words is required at a moderate level.
	PO9	3	Inferring of meanings of unfamiliar words is highly required for functioning effectively as an individual, and as a member of diverse teams with multi disciplinary settings.
	PO10	3	As far as communication is concerned, deciphering meanings of unfamiliar words is mandatory to comprehend and write effective documentations such as reports.
	PO11	3	For demonstrating knowledge and understanding engineering and management principles, inferring meanings of unfamiliar words is indispensable
	PO12	3	For lifelong learning in the broadest context of technological evolutions, inferring meanings of unfamiliar words become pre-requisite.
	PSO1	1	Apply the knowledge and finding solution to complex engineering problems by inferring meanings of unfamiliar words
	PSO2	2	Develop communication tool which best describes the unfamiliar words
	PSO3	1	Comprehend and Write effective documentations such as reports describing meanings of unfamiliar words as far as communication is concerned
CO2	PO1	2	For application of mathematics, science and engineering fundamentals, selecting, compiling and synthesizing information using communication strategies for effective oral presentation offers moderate contribution.
	PO2	2	To identify, formulate, review research literature, analyse complex engineering problems and to arrive at a conclusion by applying mathematics, science and engineering principles using communication strategies for oral presentation

			play a reasonable role.
	PO3	1	For designing and development of solutions to complex engineering problems, inferring meanings of unfamiliar words play a peripheral role.
	PO4	3	Synthesis of information is a prerogative for the experimental design, analysis and interpretation of data and for conducting research based investigation of complex problems.
	PO5	2	In modern tool usage, prediction and modeling to complex engineering activities compiling and synthesizing information is necessary at a moderate level.
	PO6	2	To assess issue at various levels and relevant responsibilities to the professional engineering practices, synthesizing information using communication strategies become reasonable.
	PO7	2	Understanding the impact of solutions in environmental contexts and thereafter demonstrating the knowledge for sustainable development requires the synthesis of information for effective oral presentation contributes at a moderate level.
	PO8	2	To comprehend the norms of engineering practice and applying ethical principles, synthesis of information is required at a moderate level.
	PO9	3	Inferring of meanings of unfamiliar words is highly required for functioning effectively as an individual, and as a member of diverse teams with multi disciplinary settings.
	PO10	3	On complex engineering activities, synthesis using communication strategies is indispensable for making effective presentation.
	PO11	3	Synthesis of information is highly required to demonstrate knowledge for better management of projects and finance.
	PO12	3	To persist on lifelong learning in the face of technological evolution and innovation, synthesis of information is imperative.
	PSO1	1	Solve complex engineering problems by applying engineering knowledge, effective oral presentation is important in describing the concepts in a easy way
	PSO2	3	For designing and development of solutions to complex engineering problems, development of oral communication among students play a peripheral role
	PSO3	1	synthesis using communication strategies is indispensable for making effective presentation as a team
CO3	PO1	1	For the application of knowledge and finding solutions to complex engineering problems, inferring the textual context by skimming and scanning is required peripherally.
	PO2	3	To identify and review research literature and for analyzing complex engineering problems, skimming and scanning of textual content is a pre-requisite for inferring meanings of unfamiliar words.
	PO3	1	For designing and developing solutions to complex engineering problems, using communication strategies for effective oral presentation plays a peripheral role.
	PO4	2	Skimming and scanning of textual content and inferring meaning is moderately require for conducting investigations of complex problems.
	PO5	2	To understand the usage manual of modern tool, techniques and resources of complex engineering activities, skimming and scanning of textual content is required in an appreciable way.
	PO6	2	Skimming and scanning of textual information is moderately required for reasoning and assessing issues at various levels.
	PO7	2	To understand the impact of professional engineering solutions, skimming and scanning of content in societal and environmental context is required considerably.
	PO8	2	Application of ethical principles is flanked by responsibilities and norms of engineering practice require skimming and scanning of textual content at moderate level.
	PO9	2	Comprehending the textual content is needed at mediocre level to function effectively both in diverse and multidisciplinary teams.
	PO10	3	To comprehend and write effective reports for making effective presentation skimming and scanning of textual content is absolutely necessary for communication on complex engineering activities.
	PO11	3	For understanding and applying engineering and management principles, comprehension of textual content is imperative.
	PO12	3	To engage in independent and lifelong learning in the technological context,

			the comprehension of textual content is prerogative.
	PSO1	1	Inferring the textual context by skimming and scanning is required peripherally for finding solutions to complex engineering problems by applying the engineering knowledge
	PSO2	1	developing tools for Skimming and scanning of textual content and inferring meaning is moderately require for conducting investigations of complex problems
	PSO3	1	Comprehend and write effective reports for making effective presentation by skimming and scanning of textual content is absolutely necessary for communication on complex engineering activities
CO4	PO1	1	Developing coherent content and support with relevant ideas is required for the application of engineering knowledge peripherally.
	PO2	2	For identifying and analyzing complex engineering problems with substantiated conclusions, ideas of coherent content from various sources is required at a moderate level.
	PO3	2	For designing solutions of complex engineering problems, development of coherent content is needed appropriately and considerably.
	PO4	2	Idea for developing coherent content with relevant details is required at a moderate level for analysis and interpretation of data and synthesis of information for valid conclusions as well.
	PO5	2	To create and apply appropriate resources pertaining to engineering and IT tools, coherent idea generation is required considerably
	PO6	2	To assess issues at various levels relevant to professional engineering practice, coherent ideas are required at a moderate level.
	PO7	2	For demonstrating knowledge of sustainable development with proper understanding of environmental impact of the professional engineering solutions, development of coherent ideas with relevant details are required considerably.
	PO8	2	To apply ethical principles and norms of engineering practice, coherent content with relevant details is required at a moderate level.
	PO9	2	Coherent ideas from various sources are needed for functioning effectively both in diverse team and multidisciplinary settings.
	PO10	3	As far as communication is concerned, generating coherent ideas from various sources is mandatory to comprehend and write effective documentation.
	PO11	3	Generating coherent content from diverse sources is indispensable for better project and finance management.
	PO12	3	To pursue lifelong learning in the broadest context of technological evolution, generating coherent content from various sources becomes a pre-requisite.
	PSO1	1	Initiating coherent content and support with relevant ideas is required for the application of engineering knowledge peripherally.
	PSO2	2	Development of coherent content is needed appropriately and considerably for providing solutions to complex engineering problems
	PSO3	1	Generating coherent ideas from various sources is mandatory to comprehend and write effective documentation as far as communication is concerned,
CO5	PO1	1	Recognizing the basic phonetic patterns of the language is required peripherally for the application of mathematics science and engineering knowledge.
	PO2	1	Identifying the basic phonetic patterns of the language contributes peripherally in the analysis and research of complex engineering problems.
	PO3	1	For designing and development of solutions to complex engineering problems with cultural and societal considerations understanding the phonetic pattern is required at a basic level.
	PO4	1	To conduct investigation of complex problems, the understanding of the phonetic aspects of the language is required at a preliminary level.
	PO5	1	To apply appropriate technique with regard to modern engineering and IT tools, the comprehension of the phonetic aspect of the language is relevant at a peripheral level.
	PO6	1	To apply reasoning of contextual knowledge and to assess responsibilities at various levels with reference to professional engineering practice, comprehension f the phonetic aspects of language is required at a preliminary level.
	PO7	1	To comprehend the impact of solutions in environmental contexts and to demonstrate the knowledge for sustainable development, the identification of

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			phonetic aspects of the language contribute to a peripheral level.
	PO8	1	To understand the norms of ethics and to apply them in professional practice by taking responsibilities, the knowledge of the phonetics of the language is required at a basic level.
	PO9	3	To function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings, the knowledge of the phonetics of the language is needed at a strong level.
	PO10	3	To communicate effectively on complex engineering activities to the engineering community and society, the knowledge of the basic phonetic pattern of the language is highly relevant.
	PO11	1	The execution of basic phonetic of the language as a recognition for demonstrating knowledge of engineering and management principles in project and finance management is peripheral.
	PO12	3	To engage in independent and lifelong learning, execution of basic phonetics of the language is mandatory.
	PSO2	1	For development of solutions to complex engineering problems with cultural and societal considerations understanding the phonetic pattern is required at a basic level.

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MA 001 - Calculus and Differential Equations								
Common to All Branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	1	0	60	4	50	50	100
Objective(s)	• The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. • The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. • Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. • This course deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines. • Development of mathematical skills to solve the differential equations.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply Cayley - Hamilton theorem and to reduce quadratic form into canonical form CO2: Compute the equation of the circle of curvature, evolute and envelope of the curves CO3: Analyze Jacobian methods and constrained maxima and minima functions. CO4: Apply various methods in differential equations to solve linear and simultaneous differential equations. CO5: Evaluate definite and indefinite integrals using different techniques							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

Matrices

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (without proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation - Nature of quadratic form. [8]

Differential Calculus

Curvature – radius of curvature (Cartesian and polar co-ordinates) – Centre of curvature – Circle of curvature – Involute and evolute – envelope. [9]

Functions of Several Variables

Partial differentiation – Homogeneous functions and Euler's theorem – Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers. [9]

Differential Equations

Linear differential equations of second and higher order with constant co-efficient - R.H.S is $e^{\alpha x}$, $\sin\alpha x, \cos\alpha x, x^n\ n>0$, $e^{\alpha x}\sin\beta x$, $e^{\alpha x}\cos\beta x$, $e^{\alpha x}x^n$, $x^n\sin\alpha x$ and $x^n\cos\alpha x$ – Differential equations with variable co-efficients : Cauchy's and Legendre's form of linear equation – Method of variation of parameters – Simultaneous first-order linear equations with constant co-efficients. [9]

Integral Calculus

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. [10]

Total Hours: 45 + 15(Tutorial) = 60

Text book(s):

1.	B S Grewal, 'Higher Engineering Mathematics', 43rd Edition, Khanna Publishers, Delhi, 2014. Web site: https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2.	T Veerarajan., 'Engineering Mathematics', for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi., 2010.

Reference(s):

1.	Kreyszig Erwin, 'Advanced Engineering Mathematics', 10thEdition, John Wiley and Sons (Asia)Limited, New Delhi, 2016.
2.	Dr P N Agrawal and Dr D N Pandey,' Integral Equations,calculus of variations and its applications', NPTEL online video courses.
3.	Dr S K Gupta and Dr Sanjeev Kumar, 'Matrix Analysis with Applications' and Prof Somnath Roy 'Matrix Solvers' , NPTEL online video courses.
4.	Dr P Kandasamy , Dr K Thilagavathy and Dr K Gunavathy , 'Engineering Mathematics-II', S.Chand& Company Ltd, New Delhi.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3							2	3		
CO2	3	3	2	2	2							2	3		
CO3	3	3	3	2	2							2	3		
CO4	3	3	3	3	2							2	3		
CO5	3	3	3	2	3							2	3		

COs	POs/PSOs	Level	Justification
CO1	PO1	3	The knowledge of Matrices can be applied to solve a complex engineering problem.
	PO2	3	The concept of Matrices will help to formulate and analyse the engineering problems
	PO3	3	The concept of Matrices can be used to develop a solution for a complex engineering problem
	PO4	2	The concept of Matrices can be used to interpret the data to provide the valid solutions in engineering problems
	PO5	3	Appropriate technique related to Matrices can be applied to complex engineering problems.
	PO12	2	New concepts related to Matrices can be developed to find the better solutions to complex engineering problems
	PSO1	3	The concept of Matrices will help to provide the solutions for the problems involving in communication engineering.
CO2	PO1	3	The principles of differential calculus can be applied to solve a complex engineering problem.
	PO2	3	The concept of differential calculus can be used to formulate and analyse the complex engineering problems.
	PO3	2	The solutions of complex engineering problems can be developed by applying calculus.
	PO4	2	The concepts of calculus can be used to interpret the data to provide valid solutions in engineering problems.
	PO5	3	Appropriate techniques related to calculus can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to differential calculus and used to find the better solutions in communication engineering
	PSO1	3	The principles of curvature will help to provide the solutions for the problems

			involving in engineering problems.
CO3	PO1	3	Fundamental knowledge in functions of several variables will help to analyse the engineering problems very easily.
	PO2	3	Concepts of partial differentiation will help to analyse various problems in engineering fields.
	PO3	3	Maxima and minima will help to design solutions to various engineering problems.
	PO4	2	The concept of functions of several variables can be used to interpret the data and provide valid solutions in engineering problems
	PO5	2	Appropriate techniques related to Maxima and Minima can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to Maxima and Minima and used to find the better solutions in complex engineering problems.
	PSO1	3	The principles of Maxima and minima will help to analyse the complex engineering problems.
CO4	PO1	3	Differential Equations will help to simplify the problems with high complexity in Engineering.
	PO2	3	The knowledge about differential equations can be used to formulate and analyse various complex engineering problems
	PO3	2	Differential Equations will help to design solutions to various complex engineering problems
	PO4	2	Differential Equations can be used to interpret the data to provide valid solutions in engineering problems
	PO5	3	Appropriate techniques related to differential equations can be applied to find solutions in engineering problems.
	PO12	2	Develop the new concepts related to solutions of differential equations to find the better solutions to engineering problems.
	PSO1	3	The principles of differential equation will help to provide the better solutions for the problems involving in communication engineering.
CO5	PO1	3	The fundamental concepts of Integral calculus can be applied to solve a complex engineering problem.
	PO2	3	Identity and formulate the suitable integration to analyse the complex engineering problems.
	PO3	2	It helps to develop the solutions of complex problems by considering societal considerations.
	PO4	3	Conduct the detailed literature survey on existing methods of integral calculus.
	PO5	3	Appropriate methods can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to integration and used to find the better solutions to complex engineering problems.
	PSO1	3	The concept of integrals can be applied to solve the problems in communication engineering.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PH 002- Physics For Electrical Sciences								
Common to all Branches (ECE,EEE,EIE)								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	• To enhance students knowledge of the theoretical and modern technological aspects in wave optics. • To explain the principles of laser, types of laser and demonstrate the applications of laser. • To instill knowledge on physics of semiconductors, determination of charge carriers and device Applications • To enable the students in understanding the importance of quantum physics. • To study the advanced materials and nanotechnology for various engineering applications.							

Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognize the physical concepts and terminology used in optics. CO2: Demonstrate the principle of laser emission, classification and its applications. CO3: Analyze the basic ideas of semiconductors and apply the concept in devices CO4: Assess the fundamentals of quantum mechanics and apply to one dimensional motion of particles CO5: Relate the properties of new engineering materials and nanomaterials for potential applications.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

Wave Optics

Huygens' Principle- Superposition of waves and interference of light by wave front splitting and amplitude splitting: Young's double slit experiment, Newton's rings, Michelson interferometer, Fraunhofer diffraction from a single slit and a circular aperture- Rayleigh's criterion for limit of resolution and its application to vision; Diffraction grating and their resolving power. [10]

Lasers

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion-different types of lasers: gas lasers (CO_2), solid-state lasers (Nd: YAG), dye lasers, Semiconductor laser (Homojunction and Hetero junction)-Properties of laser beams-applications of lasers in science and engineering. [8]

Semiconductor Physics

Density of states, Fermi-Dirac statistics; p-n junction formation-Metal-semiconductor junction (Ohmic and Schottky)-Elemental and Compound Semiconductors - Carrier Concentration in intrinsic and Extrinsic semiconductors-photodetectors: PIN and Avalanche characteristics- Hall effect-Hall Coefficient-Experimental Determination of Hall Coefficient- Applications: Solar cells. [9]

Quantum Physics

Introduction to Quantum mechanics-Wave nature of Particles- de-Broglie hypothesis –Matter waves -Time-dependent and time independent Schrodinger equation for wave function- Applications: Particle in a box (one dimensional and three dimensional), - Uncertainty principle and its applications- Electron microscope: Scanning electron microscope. [9]

Advanced Materials and Nanotechnology

New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications – advantages and disadvantages of SMA

Nano Materials: Nanomaterials: Properties- Top-down process: Ball Milling method – Bottom-up process: Vapour Phase Deposition method- Carbon Nano Tube (CNT): Properties, preparation by electric arc method, Applications. [9]

Total Hours: 45

Text book(s):

1	Rajendran V, 'Engineering Physics', Tata McGraw Hill, New Delhi, 2011.
2	William D.Callister, 'Material Science and Engineering,' Wiley India, 2006

Reference(s) :

1	Dattuprasad ,Ramanlal Joshi 'Engineering Physics', Tata McGraw Hill Education, 2016.
2	Kongbamchandramanisingh, 'Basic Physics', PHI, 2015.
3	Subrahmanyam N., Brijlal , 'A Text Book of Optics', S.Chand& Co. Ltd, New Delhi , 2010.
4	M.N.Avathanalu, P.G.Kshirsagar, 'A text book of engineering physics', S.Chand&company Ltd, 2005.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	2	2	2	2	1	2	1	1	3	3	-
CO2	3	2	3	2	2	3	2	1	1	1	-	-	3	2	-
CO3	3	2	3	2	2	3	2	1	1	1	-	1	2	2	-
CO4	3	3	2	2	2	2	1	1	-	-	1	-	2	2	-

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO5	3	3	2	2	2	2	1	2	1	1	2	-	3	1	-

Cos	POs/PSOs	Level	Justification
CO1	PO1	3	Concept of interference, diffraction and its applications based on wave theory in engineering field strongly (PO1) helps in problem analysis to greater extent (PO2)
	PO2	3	
	PO3	2	Fundamental concepts may help in design and development of solutions moderately
	PO4	3	Use the wave optics research-based knowledge and research methods including design of experiments, analysis and interpretation of data to full extent
	PO5	2	Students can be able to model the electro-optic device using modern engineering tools in average (PO5) and it promotes moderate engineer society relation (PO6), helps to improve the environment in a sustainable manner serving engineering ethics (PO7, PO8) to certain limit.
	PO6	2	
	PO7	2	
	PO8	2	
	PO9	1	By connecting engineering concepts and practical applications to real world challenges and it promotes slightly in an individual and team work (PO9) and helps for communication (PO10) a little.
	PO10	2	
	PO11	1	The idea about the electronic devices promotes slightly for the projects in multi disciplinary environments (PO11) and Life-long learning (PO12) slightly
	PO12	1	
	PSO1	3	By knowing the concept of wave theory, students are able to analyse electrical system using modern tools and improvement considering safety standards (PSO1) greatly and helps to develop smart systems in Electronics and communication Engineering domain solidly (PSO2)
	PSO2	3	
CO2	PO1	3	The basic ideas about classification of laser and various applications of laser, Engineering knowledge are developed solidly.
	PO2	2	Understanding the basics will help to Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using principles of engineering sciences partially
	PO3	3	In design and development of laser (PO3) and in investigation of complex problems like how electromagnetic energy is propagated as wave (PO4) it attributes strappingly
	PO4	2	
	PO5	2	Understanding the concept helps in apply appropriate techniques, resources, and modern engineering and IT tools averagely
	PO6	3	It promotes strong engineer society relation (PO6), helps in moderate environment and sustainability (PO7) and optimization technique leading to modern tool usage in applying slight ethical principles (PO8)
	PO7	2	
	PO8	1	
	PO9	1	By connecting engineering concepts and practical applications to real world challenges and it promotes a slight individual and team work
	PO10	1	Learning the properties of lasers used to know electro optic modulators and communicate to the students (PO10) to manage the projects in this field work slightly
	PSO1	3	Applying the basic concept of lasers students able to analyse electrical system using modern tools and improvement considering safety standards (PSO1) greatly and helps to develop smart systems in Electronics and communication Engineering domain moderate (PSO2)
	PSO2	2	
CO3	PO1	3	Applying the fundamentals and applications of semiconductors in Engineering field strongly (PO1) helps in problem analysis to an average extent (PO2)
	PO2	2	
	PO3	3	This may help in design and development of solutions strongly
	PO4	2	In design and development of semiconducting devices and in investigation of complex problems like how semiconducting material behave as insulator (PO4) it attributes partially.
	PO5	2	Design and development of semiconducting devices helps in apply appropriate techniques, resources, and modern engineering and IT tools partially
	PO6	3	Design and development promotes engineer strong society relation (PO6), helps in moderate environment and sustainability (PO7) and optimization technique leading to modern tool slight usage in applying ethical principles (PO8)
	PO7	2	
	PO8	1	
	PO9	1	Knowing properties of semiconducting materials used to the fabrication of electronic components and communicate to the students (PO9, PO10) to manage the projects in this field work slightly. It helps in effective project management moderately and lifelong learning a little (PO12)
	PO10	1	
	PO12	1	

	PSO1	2	Understanding partly the semiconductor physics is the basic criteria needed to design any electronic system
	PSO2	2	A moderate knowledge about basic semi conductors will help a candidate in his/her higher studies and research
CO4	PO1	3	Applying the concepts of quantum electron theories, and energy band structures strongly (PO1) helps to analyse the problems strongly (PO2)
	PO2	3	
	PO3	2	This will help in design and development of solution to average extent.
	PO4	2	In design and development of electronic devices and in investigation of complex problems like how light rays behave as wave and particle it attributes partly.
	PO5	2	Design and development of electronic devices helps in apply appropriate techniques, resources, and modern engineering and IT tools partially
	PO6	2	It promotes moderate engineer society relation (PO6), helps in a little for environment and sustainability (PO7) and optimization technique leading to modern tool in a little usage in applying ethical principles (PO8)
	PO7	1	
	PO8	1	
	PO11	1	Knowing concept of quantum wave theory in photoelectric effect, Compton effect helps in effective project management slightly
	PSO1	2	Understanding quantum physics is the important criteria needed to design any electronic system partially
	PSO2	2	A good knowledge about basic ideas about quantum wave theory will help a candidate in their higher studies and research moderately
CO5	PO1	3	Understand the basics of advanced materials, nano structures and their applications in electronics, robotics, computers, sensors, mobile electronic devices attributes to strong Engineering knowledge.
	PO2	3	This will help in solid problem solving (PO2) as well as design and development of solution (PO3) to an average extent. Investigation of complex problems like how properties of nano materials are varying with particle size (PO4) it attributes moderately
	PO3	2	
	PO4	2	
	PO5	2	Investigation of complex problems helps in apply appropriate techniques, resources, and modern engineering and IT tools partially.
	PO6	2	It promotes engineer moderate society relation (PO6), helps in slight environment and sustainability (PO7) and optimization technique leading to modern tool usage in applying ethical principles (PO8) moderately
	PO7	1	
	PO8	2	
	PO9	1	Knowing properties of nano materials used to fabricate modern devices and communicate to the students (PO9, PO10) to manage the projects in this field work slightly
	PO10	1	
	PO11	2	Field work helps in effective project management moderately
	PSO1	3	Understanding basics of advanced materials and nano materials are the basic criteria needed to design any electronic system strongly
	PSO2	1	A good knowledge about basic ideas about nano material will helps to develop smart systems in Electronics and communication Engineering domain somewhat.

K.S.Rangasamy College of Technology – Autonomous R2018									
50 EE 001- Basic Electrical Engineering									
Common to All Branches									
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**			
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**	
I	3	0	0	45	3	50	50	100	
Course Objectives	• To familiarize the basic DC and AC networks used in electrical circuits. • To explain the concepts of electrical machines and their characteristics. • To explore the sources of electric power generation and various types of power plant. • To identify the various components of low voltage electrical installation • To describe various energy conservation methods useful in industry and commercial purpose.								
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the basic laws of electric circuits to calculate the unknown quantities. CO2: Acquire knowledge about the constructional details and principle of operation of DC machines and AC machines CO3: Impart the knowledge of generation of electricity based on conventional and non-conventional energy sources CO4: Recognize the significance of various components of low voltage electrical installations.								

	CO5: Create awareness of energy conservation and electrical safety

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

Prerequisite : Physics

DC and AC Circuits - Electrical circuit elements (R, L and C), Voltage and current sources - Kirchhoff's current and voltage laws - Serial and parallel circuits - Analysis of simple circuits with DC excitation. Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation, Real power, Reactive power, Apparent power, Power factor. Analysis of single phase AC circuits consisting of R, L, C, RL, RC, RLC combinations. [12]

DC&AC Machines - Construction, Types and Operation-Faraday's laws of electromagnetic induction - Transformers: Construction, Working principle, Types, Losses in transformers, Regulation, Efficiency and applications-Simple Problems - Applications

Generation of rotating magnetic fields - Three phase induction motor: Construction, working principle, Characteristics, Starting - Single phase induction motor: Construction, working principle and applications - Synchronous generators: Construction, Working principle and applications. [14]

Electrical Power Generation Systems - Sources of electrical energy: Renewable and non-renewable - Principles and schematic diagram of Hydroelectric power plant, Thermal power plant, Nuclear power plant, Solar PV system and Wind energy conversion systems. [5]

Electrical Installations and House Wiring - Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB - Types of Batteries, Important Characteristics for Batteries - UPS.

Single phase and three phase systems: Three phase balanced circuits, Phase sequence, voltage and current relations in star and delta connections - Basic house wiring tools and components - Domestic wiring: Service mains, meter board, distribution board, energy meter. Different types of wiring: staircase, fluorescent lamp and ceiling fan. [[8]

Electrical Energy Conservation & Safety - Elementary calculations for energy consumption - BEE Standards - Electrical energy conservation - Methods. Electric shock, Precautions against shock, Objectives of earthing, Types of earthing - Basic electrical safety measures at home and industry. [6]

Total Hours: 45

Text book(s):

1	D. P. Kothari and I. J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, 2017.
2	D. C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill, 2017.

Reference(s):

1	L. S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press, 2011.
2	E. Hughes, 'Electrical and Electronics Technology', Pearson, 2016.
3	V. D.Toro, 'Electrical Engineering Fundamentals', Prentice Hall India, 2015.
4	Rajendra Prasad, 'Fundamentals of Electrical Engineering' ,PHI Learning, 2014

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3			2					2	3		2	2	
CO2	3	3	2	2			2		2		2	2	3	2	
CO3	3	3	2	2			2	2	2			2	3	3	
CO4	3	3		2		2					3	3	3	2	
CO5	3	3	2	2	2	2			2		2	2	3	2	

COs	POs/ PSOs	Level	Justification
CO1	PO1	3	Strongly mapped as the students will be able to use basic knowledge of mathematics to solve electric circuits with circuit laws
	PO2	3	Strongly mapped as the students will be able to analyse problem in solving electric circuits.

	PO5	2	Moderately mapped as the students could able to use modern tools to solve electric circuits
	PO10	2	Moderately mapped as the students could able to communicate and prepare the document about the process of solving electric circuits.
	PO11	3	Strongly mapped as the students will be able to find the cost of the circuit
	PSO1	2	Moderately mapped as the students could able to use modern tools for solving circuits
	PSO2	2	Moderately mapped as the students could able to monitor the electric circuits with smart tools
CO2	PO1	3	Strongly mapped as the students will be able to apply basic science knowledge to understand the construction of DC and AC machines.
	PO2	3	Strongly mapped as the students will be able to analyse problem in calculation of losses, regulations, efficiency
	PO3	2	Moderately mapped as the students could able to design the machines
	PO4	2	Moderately mapped as the students could able to investigate the complex problems in machines
	PO7	2	Moderately mapped as the students could able to run the machine considering the environment conditions.
	PO9	2	Moderately mapped as the students could able to work as an individual and as a leader in a team.
	PO11	2	Moderately mapped as the students could able to design the machine economically.
	PO12	2	Moderately mapped as the students could able to update the machine with developing technology.
	PSO1	3	Strongly mapped as the students will be able to modern tools to design a machine.
	PSO2	2	Moderately mapped as the students could able to construct a machine with smart systems.
CO3	PO1	3	Strongly mapped as the students will be able to : Impart the knowledge of generation of electricity based on conventional and non-conventional energy sources
	PO2	3	Strongly mapped as the students will be able to analyse problems Single phase and three phase systems.
	PO3	2	Moderately mapped as the students could able to develop a solution for energy demand
	PO4	2	Moderately mapped as the students could able to investigate the complex problems in power generation
	PO7	2	Moderately mapped as the students could able to generate power without affecting the environment.
	PO8	2	Moderately mapped as the students could able to provide demand power by following the engineering norms
	PO9	2	Moderately mapped as the students could able to work as an individual and as a leader in a team to generate a power
	PO12	2	Moderately mapped as the students could able to generate power with upcoming technologies.
	PSO1	3	Strongly mapped as the students will be able to use modern tools to generate power
	PSO2	3	Strongly mapped as the students will be able to make power generation with smart systems.
	PO1	3	Strongly mapped as the students will be able to basic science to understand electrical installation.
	PO2	3	Strongly mapped as the students will be able to analyse the problem in electric circuits

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CO4	PO4	2	Moderately mapped as the students could able to investigate the problem due to electrical variations
	PO6	2	Moderately mapped as the students could able to help the society with safety power distribution
	PO11	3	Strongly mapped as the students will be able to economically protect the devices
	PO12	3	Strongly mapped as the students will be able to update the protective devices based on new technology
	PSO1	3	Strongly mapped as the students will be able to use modern tools for protection
	PSO2	2	Moderately mapped as the students could able to provde smart protective systems
CO5	PO1	3	Strongly mapped as the students will be able to apply science knowledge To understand the energy consumption
	PO2	3	Strongly mapped as the students will be able to analyse the problem in the energy conservation.
	PO3	2	Moderately mapped as the students could able to design safety systems
	PO4	2	Moderately mapped as the students could able to investigate the hazards in energy generation
	PO5	2	Moderately mapped as the students could able to design modern tools for electrical safety
	PO6	2	Moderately mapped as the students could able to provide safety electrical system for society
	PO9	2	Moderately mapped as the students could able to work as an individual and as a leader in a team to create awareness
	PO11	2	Moderately mapped as the students could able to conserve the energy effectively
	PO12	2	Moderately mapped as the students could able to update the safety systems
	PSO1	3	Strongly mapped as the students will be able to use modern tools for electrical safety
	PSO2	2	Moderately mapped as the students could able to provide smart system for electrical safety

K. S. Rangasamy College of Technology – Autonomous R2018								
50 ME 002– Engineering Graphics								
Common to EEE, ECE, E&I, CSE, IT, Bio-Tech, NST and FT branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	2	0	4	90	4	50	50	100
Objective(s)	• To learn Computer Aided Drawing skills to enable graphical communication. • To learn drawing formats and conversion of pictorial views into orthographic views. • To emphasize skills to project simple solids and sectional views. • To impart the knowledge on use of drafting software to draw the isometric projection. • To acquire graphical skills to illustrate design project.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Demonstrate the Impact of computer technologies on graphical communication CO2: Convert the pictorial views in to orthographic views using drafting software CO3: Draw the projection of simple solids and true shape of sections CO4: Construct the isometric projections of objects using drafting software CO5: Interpret a design project illustrating engineering graphical skills							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Introduction to Computer Aided Drafting (CAD) software Theory of CAD software – Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension) – Drawing Area (Background, Crosshairs, Coordinate System) – Dialog boxes and windows – Shortcut menus (Button Bars) – The Command Line and Status Bar – Different methods of zoom as used in CAD – Select and								

erase objects. [5+12]

Orthographic Projection

Theory of projection – Terminology and Methods of projection – first angle and Third angle projection – Conversion of pictorial views into orthographic views. [6+12]

Projection of Solids and Sections of Solids

Projections of simple solids: prism, pyramid, cylinder and cone (Axis parallel to one plane and perpendicular to other, axis inclined to one plane and parallel to other).

Sections of simple solids: prism, pyramid, cylinder and cone in simple positions (cutting plane is inclined to one of the principal planes and perpendicular to the other) – True shape of sections. [6+12]

Isometric Projection

Principles of Isometric projection – Isometric scale, Isometric views, Conventions – Isometric views of lines, Planes, Simple and compound Solids – Conversion of Orthographic views in to Isometric view. [6+12]

Application of engineering graphics

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids – Geometric dimensioning and Tolerancing– Use of solid modeling software for creating associative models – Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc. – Applying colour coding according to building drawing practice – Drawing sectional elevation showing foundation to ceiling – Introduction to Building Information Modelling (BIM).

[7+12]

Total Hours: 90 (Lecture: 30 Hours; Hands on Practice: 60 Hours)

Text Book(s):

1.	Bhatt N.D., ‘Engineering Drawing’, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2014.
2.	Venugopal K., ‘Engineering Graphics’, New Age International (P) Limited, 2014.

Reference(s):

1.	Shah M.B., Rana B.C., and V.K.Jadon., ‘Engineering Drawing’, Pearson Education, 2011.
2.	Natarajan K.V., ‘A Text Book of Engineering Graphics’, Dhanalakshmi Publishers, Chennai, 2014.
3.	Agrawal B. & Agrawal C. M., ‘Engineering Graphics’, TMH Publication, 2012.
4.	Narayana, K.L. & P Kannaiah, ‘Text book on Engineering Drawing’, Scitech Publishers, 2008.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	3	3	1	1	1		3	2	2	1	3	
CO2	3	3	3	3	3	1		1		3	1	1	1	3	
CO3	3	3	3	3	3	1		1		3	1	1	1	3	
CO4	3	3	3	3	3	1		1		3	1	1	1	3	
CO5	3	2	3	3	3	1	1	1		3	2	2	1	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using Graphical communication.
	PO3	3	Graphical communication for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration.
	PO4	3	Graphical communication use research-based knowledge and research methods including design of experiments.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex

			engineering activities.
	PO6	1	Consequent responsibilities relevant to Graphical communication
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO8	1	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	P10	3	Graphical communication effectively on complex engineering activities with the engineering community.
	P11	2	Demonstrate knowledge and understanding of the engineering and management principles
	P12	2	Graphical communication has the preparation and ability to engage in independent and life-long learning
	PSO1	1	Graphical communication will solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication
	PSO2	3	Design system components and develop products that meet the specific needs of industry
CO2	PO1	3	Apply the knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using Graphical communication.
	PO3	3	Graphical communication for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration.
	PO4	3	Graphical communication use research-based knowledge and research methods including design of experiments.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities.
	PO6	1	Consequent responsibilities relevant to Graphical communication
	PO8	1	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	P10	3	Graphical communication effectively on complex engineering activities with the engineering community.
	P11	1	Demonstrate knowledge and understanding of the engineering and management principles
	P12		Graphical communication has the preparation and ability to engage in independent and life-long learning
	PSO1	1	Graphical communication will solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication
	PSO2	3	Design system components and develop products that meet the specific needs of industry
CO3	PO1	3	Apply the knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using Graphical communication.
	PO3	3	Graphical communication for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration.
	PO4	3	Graphical communication use research-based knowledge and research methods including design of experiments.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities.
	PO6	1	Consequent responsibilities relevant to Graphical communication
	PO8	1	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	P10	3	Graphical communication effectively on complex engineering activities with the engineering community.
	P11	1	Demonstrate knowledge and understanding of the engineering and management principles
	P12	1	Graphical communication has the preparation and ability to engage in

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			independent and life-long learning
	PSO1	1	Graphical communication will solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication
	PSO2	3	Design system components and develop products that meet the specific needs of industry
CO4	PO1	3	Apply the knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using Graphical communication.
	PO3	3	Graphical communication for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration.
	PO4	3	Graphical communication use research-based knowledge and research methods including design of experiments.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities.
	PO6	1	Consequent responsibilities relevant to Graphical communication
	PO8	1	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	P10	3	Graphical communication effectively on complex engineering activities with the engineering community.
	P11	1	Demonstrate knowledge and understanding of the engineering and management principles
	P12	1	Graphical communication has the preparation and ability to engage in independent and life-long learning
	PSO1	1	Graphical communication will solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication
	PSO2	3	Design system components and develop products that meet the specific needs of industry
CO5	PO1	3	Apply the knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using Graphical communication.
	PO3	3	Graphical communication for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration.
	PO4	3	Graphical communication use research-based knowledge and research methods including design of experiments.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities.
	PO6	1	Consequent responsibilities relevant to Graphical communication
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO8	1	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	P10	3	Graphical communication effectively on complex engineering activities with the engineering community.
	P11	2	Demonstrate knowledge and understanding of the engineering and management principles
	P12	2	Graphical communication has the preparation and ability to engage in independent and life-long learning
	PSO1	1	Graphical communication will solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication
	PSO2	3	Design system components and develop products that meet the specific needs of industry

K. S. Rangasamy College of Technology – Autonomous R2018									
50 PH 0P2 - Applied Physics Laboratory									
Common to – ECE, EEE, EI, CSE, IT									
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**			
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**	
I	0	0	4	60	2	60	40	100	

Objective(s)

- To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To demonstrate an ability to make physical measurements and understand the limits of precision in measurements
- To introduce different experiments to test basic understanding of physics concepts applied in optics and electronics.
- To enable the students to correlate the theoretical principles with application oriented studies.
- To analyze the behavior and characteristics of various materials for its optimum utilization

Course Outcomes

At the end of the course, thestudents will able to

CO1: Analyze the wavelength of laser and the particle size by diffraction phenomenon.(1)
CO2: Apply the knowledge of interference to produce Newton rings and air wedge.(2-3)
CO3: Extend the knowledge of diffraction property of light through grating and fiber optic cable (4,6)
CO4: Infer the concept of refractive index and dispersion of light by a prism(5)
CO5: Interpret the knowledge of semiconductor band gap, Hall coefficient, photovoltaic effect, Zener diode characteristics for its potential applications(7-10)

LIST OF EXPERIMENTS

1. Determination of wavelength of laser and particle size – diffraction.
2. Determination of radius of a plano convex lens – Newton's ring.
3. Determination of a thickness of thin wire – Air wedge method.
4. Determination of wavelength of mercury spectral lines – spectrometer grating.
5. Determination of dispersive power of a prism.
6. Determination of numerical aperture (NA) & acceptance angle of an optical fiber
7. Determination of band gap of a semiconductor PN junction diode.
8. V-I characteristics of solar cell.
9. Characteristics of Zener diode.
10. Determination of Hall coefficient of a given semiconductor and its charge carrier density

Lab Manual :

1. 'Physics Lab Manual', Department of Physics , KSRCT.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	2	2	2	2	1	2	1	1	3	3	
CO2	3	2	3	2	2	3	2	1	1	1	-	-	3	2	-
CO3	3	2	3	2	2	3	2	1	1	1	-	2	2	2	
CO4	3	3	2	2	2	2	1	1	-	-	2	-	2	2	-
CO5	3	3	2	2	2	2	1	2	1	1	2	2	3	1	-

Cos	Pos/PSOs	Level	Justification
CO1	PO1	3	The basic ideas about laser and various applications of laser, Engineering

			knowledge are developed solidly
	PO2	3	This will help in Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using principles of engineering sciences strongly
	PO3	2	In design and development of laser (PO3) and in investigation of complex problems like how electromagnetic energy is propagated as wave (PO4) attributes strongly
	PO4	3	
	PO5	2	It helps in apply appropriate techniques, resources, and modern engineering and IT tools averagely
	PO6	2	It promotes strong engineer society relation (PO6), helps in moderate environment and sustainability (PO7) and optimization technique leading to modern tool usage in applying slight ethical principles (PO8)
	PO7	2	
	PO8	2	
	PO9	1	By connecting engineering concepts and practical applications to real world challenges and it promotes a little individual and team work (PO9). Learning the properties of lasers used to know electro optic modulators and communicate to the students (PO10) to manage the projects in this field work slightly
	PO10	2	
	PO11	1	The idea about the concept of laser promotes slightly for the projects in multi disciplinary environments (PO11) and Life-long learning (PO12) slightly
	PO12	1	
	PSO1	3	Applying the basic concept of lasers students able to analyse electrical system using modern tools and improvement considering safety standards (PSO1) greatly and helps to develop smart systems in Electronics and communication Engineering domain moderate (PSO2)
	PSO2	3	
CO2	PO1	3	By designing the basic concept of producing inference pattern, to find radius of curvature of a plano convex lens using Newton's rings and thickness of thin wire using airwedge method, Electronics and communication Engineering Students will have adequate knowledge to solve engineering problems which maps to great extent.
	PO2	2	Students can analyze complex engineering problems which improves his/her problem analysing skills which maps to average extent.
	PO3	3	In design and development of experimental arrangements (PO3) and in investigation of complex problems like how light rays propagated as wave (PO4) it attributes strappingly
	PO4	2	
	PO5	2	It helps in apply appropriate techniques, resources, and modern engineering and IT tools averagely
	PO6	3	It promotes strong engineer society relation (PO6), helps in moderate environment and sustainability (PO7) and optimization technique leading to modern tool usage in applying slight ethical principles (PO8)
	PO7	2	
	PO8	1	
	PO9	1	It promotes individual and team work (PO9) slightly and Communication (PO10) moderately.
	PO10	1	
	PSO1	3	Professionally competent and apply the concepts of mathematics, science and engineering to solve problems in Electronics and communication Engineering and related field (PSO1) moderately and to integrate slight lifelong learning and demonstrate social and ethical responsibility (PSO2)
	PSO2	2	
CO3	PO1	3	By using the spectrometer, with the help of diffraction, to find wavelength of mercury spectral lines and fiber optic cable, Electronics and communication Engineering Students will be able to learn engineering fundamentals which maps strongly with PO1
	PO2	2	Students can analyze complex engineering problems which improves his/her problem analysing skills which maps to average extent with PO2
	PO3	3	In design and development of experimental set up (PO3) and in investigation of complex problems like how light rays are propagating through optical fiber (PO4) attributes strappingly. It helps in apply appropriate techniques, resources, and modern engineering and IT tools averagely (PO5).
	PO4	2	
	PO5	2	
	PO6	3	It promotes strong engineer society relation (PO6), helps in moderate environment and sustainability (PO7) and optimization technique leading to modern tool usage in applying slight ethical principles (PO8)
	PO7	2	
	PO8	1	
	PO9	1	It promotes individual and team work (PO9) slightly and Communication (PO10) moderately
	PO10	1	
	PO12	2	Students can slightly implement their knowledge in engineering and for moderate lifelong learning.
	PSO1	2	Professionally competent and apply the concepts of mathematics, science and

	PSO2	2	engineering to solve problems in Electronics and communication Engineering and related field (PSO1) moderately and to integrate slight lifelong learning and demonstrate social and ethical responsibility (PSO2)
CO4	PO1	3	By using the spectrometer, with the help of diffraction, dispersive power of prism, Electronics and communication Engineering Students will be able to learn engineering fundamentals which maps strongly with PO1
	PO2	3	Students can analyze complex engineering problems which improves his/her problem analysing skills which maps to average extent with (PO2)
	PO3	2	In design and development of experimental setup (PO3) and in investigation of complex problems like how white lights are splitted as different spectral lines (PO4) attributes strappingly. It helps in apply appropriate techniques, resources, and modern engineering and IT tools averagely (PO5)
	PO4	2	
	PO5	2	
	PO6	2	It promotes strong engineer society relation (PO6), helps in moderate environment and sustainability (PO7) and optimization technique leading to modern tool usage in applying slight ethical principles (PO8)
	PO7	1	
	PO8	1	
	PO11	2	Students can slightly implement their knowledge in engineering and for moderate lifelong learning
	PSO1	2	Professionally competent and apply the concepts of mathematics, science and engineering to solve problems in Electronics and communication Engineering and related field (PSO1) moderately and to integrate slight lifelong learning and demonstrate social and ethical responsibility (PSO2)
	PSO2	2	
CO5	PO1	3	Applying the fundamentals and applications of semiconductors in Engineering field (PO1) helps in problem analysis to strongly (PO2)
	PO2	3	
	PO3	2	This may help in design and development of solutions moderately.
	PO4	2	In design and development of semiconducting devices and in investigation of complex problems like how voltage is with response of temperature, how light rays are converted to electrical energy (PO4) attributes partially. It helps in apply appropriate techniques, resources, and modern engineering and IT tools partially (PO5)
	PO5	2	
	PO6	2	It promotes engineer strong society relation (PO6), helps in environment and sustainability some extent (PO7) and optimization technique leading to modern tool slight usage in applying ethical principles (PO8)
	PO7	1	
	PO8	2	
	PO9	1	Knowing properties of semiconducting materials used to the fabrication of electronic components and communicate to the students (PO9, PO10) to manage the projects in this field work slightly
	PO10	1	
	PO11	2	The idea about the basic concept of semiconductor promotes slightly for the projects in multi disciplinary environments.
	PO12	2	It helps in effective project management moderately and lifelong learning a little
	PSO1	3	Professionally competent and apply the concepts of mathematics, science and engineering to solve problems in Electronics and communication Engineering and related field (PSO1) moderately and to integrate slight lifelong learning and demonstrate social and ethical responsibility (PSO2)
	PSO2	1	

K. S. Rangasamy College of Technology – Autonomous R 2018								
50 ME 0P1 – Engineering Practices Laboratory								
Common to all branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	0	0	4	60	2	60	40	100
Objective(s)	• To acquire skills in basic engineering practices. • To identify the hand tools and instruments. • To provide hands on experience in Fitting, Carpentry, Sheet metal, Welding and lathe shop. • To provide practical training on house hold wiring and electronic circuits. • To offer real time activity on plumbing connections in domestic applications.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Perform facing, plain turning, drilling. CO2: Make a model of fitting and carpentry: Square, Dovetail and Cross lap joints. CO3: Fabricate the models of sheet metal and welding joints.							

	CO4: Construct and demonstrate electrical and electronic wiring circuit. CO5: Construct the water pipe line in plumbing shop.

Machine shop
Safety aspects in machine shop, Study of Lathe and Radial drilling machine, Turning, Facing and Drilling.

Fitting and Carpentry
Safety aspects in Fitting and Carpentry, Study of tools and equipments, Preparation of models- Square, Dove tail joint, Cross Lap.

Sheet Metal and Welding
Safety aspects in Sheet metal and Welding, Study of tools and equipments, Sheet metal models - Scoope, Cone, Tray, Preparation weld joints -Lap, butt, T-joints. Study of Gas Welding and Equipments.

Electrical Wiring & Electronics
Safety aspects of Electrical wiring, Study of Electrical Materials and wiring components, Wiring circuit for a lamp using single and stair case switches. Wiring circuit for fluorescent lamps, Basic electronic circuit.

Plumbing
Study of plumbing tools, assembly of G.I. pipes/ PVC and pipe fittings, Cutting of threads in G.I.Pipes/PVC by thread cutting dies.

Smithy, Plastic moulding and Glass cutting
Safety aspects in smithy, plastic moulding and glass cutting, Study of tools and equipments.

Lab Manual :

1. ‘Engineering Practices Lab Manual’, Department of Mechanical Engineering, KSRCT.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	3	2	2	3	1	2	2	1	3	1	2
CO2	3	2	2	1	3	2	2	3	1	2	2	1	3	1	2
CO3	3	2	2	1	3	2	2	3	1	2	2	1	3	1	2
CO4	3	2	2	1	3	2	2	3	1	2	2	1	3	1	2
CO5	3	2	2	1	3	2	2	3	1	2	2	1	3	1	2

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamental process parameters for using in the lathe to removal of materials.
	PO2	2	Conduct the detailed study on existing process and identify the problems.
	PO3	2	Functions effectively to ensure the safety of the operators.
	PO4	1	Conduct the detailed literature survey on existing process and identify the problems
	PO5	3	Use the relevant tools for the conducting the experiment.
	PO6	2	Apply knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
	PO7	2	Demonstrate the knowledge of, and need for sustainable development of professional engineering solutions.
	PO8	3	Apply ethical responsibilities to develop the new level of conducting the experiment.
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary setting
	PO10	2	Communicate effectively the way of writing the all the activity to conducting the experiment,
	PO11	2	Demonstrate knowledge and understanding of the engineering principles and apply based on your work.

	PO12	1	Implementing new methods and application for to learn the contextual knowledge of lifelong learning.
	PSO1	3	Use of modern tools to perform and analysis the basic fundamental process.
	PSO2	1	Solve the multidisciplinary problems to enhance the various process.
	PSO3	2	Adopt creative and innovative approaches to address real- time industrial challenges.
CO2	PO1	3	Apply the basic fundamental process parameters for using in the lathe to removal of materials.
	PO2	2	Conduct the detailed study on existing process and identify the problems.
	PO3	2	Functions effectively to ensure the safety of the operators.
	PO4	1	Conduct the detailed literature survey on existing process and identify the problems
	PO5	3	Use the relevant tools for the conducting the experiment.
	PO6	2	Apply knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
	PO7	2	Demonstrate the knowledge of, and need for sustainable development of professional engineering solutions.
	PO8	3	Apply ethical responsibilities to develop the new level of conducting the experiment.
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary setting
	PO10	2	Communicate effectively the way of writing the all the activity to conducting the experiment,
	PO11	2	Demonstrate knowledge and understanding of the engineering principles and apply based on your work.
	PO12	1	Implementing new methods and application for to learn the contextual knowledge of lifelong learning.
	PSO1	3	Use of modern tools to perform and analysis the basic fundamental process.
	PSO2	1	Solve the multidisciplinary problems to enhance the various processes.
	PSO3	2	Adopt creative and innovative approaches to address real- time industrial challenges.
CO3	PO1	3	Apply the basic fundamental process parameters for using in the lathe to removal of materials.
	PO2	2	Conduct the detailed study on existing process and identify the problems.
	PO3	2	Functions effectively to ensure the safety of the operators.
	PO4	1	Conduct the detailed literature survey on existing process and identify the problems
	PO5	3	Use the relevant tools for the conducting the experiment.
	PO6	2	Apply knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
	PO7	2	Demonstrate the knowledge of, and need for sustainable development of professional engineering solutions.
	PO8	3	Apply ethical responsibilities to develop the new level of conducting the experiment.
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary setting
	PO10	2	Communicate effectively the way of writing the all the activity to conducting the experiment,
	PO11	2	Demonstrate knowledge and understanding of the engineering principles and apply based on your work.
	PO12	1	Implementing new methods and application for to learn the contextual knowledge of lifelong learning.
	PSO1	3	Use of modern tools to perform and analysis the basic fundamental process.
	PSO2	1	Solve the multidisciplinary problems to enhance the various process.
	PSO3	2	Adopt creative and innovative approaches to address real- time industrial challenges.
CO4	PO1	3	Apply the basic fundamental process parameters for using in the lathe to removal of materials.
	PO2	2	Conduct the detailed study on existing process and identify the problems.
	PO3	2	Functions effectively to ensure the safety of the operators.
	PO4	1	Conduct the detailed literature survey on existing process and identify the problems

	PO5	3	Use the relevant tools for the conducting the experiment.
	PO6	2	Apply knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
	PO7	2	Demonstrate the knowledge of, and need for sustainable development of professional engineering solutions.
	PO8	3	Apply ethical responsibilities to develop the new level of conducting the experiment.
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary setting
	PO10	2	Communicate effectively the way of writing the all the activity to conducting the experiment,
	PO11	2	Demonstrate knowledge and understanding of the engineering principles and apply based on your work.
	PO12	1	Implementing new methods and application for to learn the contextual knowledge of lifelong learning.
	PSO1	3	Use of modern tools to perform and analysis the basic fundamental process.
	PSO2	1	Solve the multidisciplinary problems to enhance the various process.
	PSO3	2	Adopt creative and innovative approaches to address real- time industrial challenges.
CO5	PO1	3	Apply the basic fundamental process parameters for using in the lathe to removal of materials.
	PO2	2	Conduct the detailed study on existing process and identify the problems.
	PO3	2	Functions effectively to ensure the safety of the operators.
	PO4	1	Conduct the detailed literature survey on existing process and identify the problems
	PO5	3	Use the relevant tools for the conducting the experiment.
	PO6	2	Apply knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
	PO7	2	Demonstrate the knowledge of, and need for sustainable development of professional engineering solutions.
	PO8	3	Apply ethical responsibilities to develop the new level of conducting the experiment.
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary setting
	PO10	2	Communicate effectively the way of writing the all the activity to conducting the experiment,
	PO11	2	Demonstrate knowledge and understanding of the engineering principles and apply based on your work.
	PO12	1	Implementing new methods and application for to learn the contextual knowledge of lifelong learning.
	PSO1	3	Use of modern tools to perform and analysis the basic fundamental process.
	PSO2	1	Solve the multidisciplinary problems to enhance the various process.
	PSO3	2	Adopt creative and innovative approaches to address real- time industrial challenges.

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2018</th></tr>
<tr><th colspan="9">50 EN 002 – Communication Skills II</th></tr>
<tr><th colspan="9">Common to all Branches</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hours</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>II</td><td>1</td><td>1</td><td>0</td><td>30</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
• To help learners develop strategies that could be adopted while reading texts.
• To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
• Improve listening, observational skills, and problem solving capabilities
• Develop message generating and delivery skills</td></tr>
</table>

Course Outcomes	**At the end of the course, the students will be able to** CO1: Identify speaker's purpose and tone, comprehend relationship between ideas and respond to the listening content CO2: Use communication strategies, vocabulary and appropriate grammatical structures for effective oral interactions CO3: Make inferences and predictions, develop reading speed, build academic vocabulary by utilizing digital literacy tools on textual comprehension CO4: Use a variety of accurate sentence structures with functional vocabulary, apply the conventions of academic writing and use peer and teacher feedback for effective writing. CO5: Demonstrate proficiency in communication skills in academic and professional contexts

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

Advanced English Listening Module

Extended Listening to Podcasts – Listen and Watch Video Clips - answering Inferential Multiple Choice Questions and Vocabulary Check- Listening to Lengthy Discourses – Structured Listening – Listening to Songs and Cognizing the Lyrics-Listening to popular speeches, news briefs and stories [8]

Oral Communication

Debates – Group Discussion (Structured) and rotate roles – Elevator Speech – Prepared Talk – Extempore – Brief Technical presentations- Spin-a-Yarn – Short Film reviews – talk on silent videos – Dialogues and Role plays (Intermediate & Higher Level) – Interviews [8]

Critical Reading Process

Silent Reading – Scanning and Skimming - Reading comprehension with logical reasoning questions – Cognition of Theme and Inferential Meaning – advanced Academic and Functional Vocabulary List (1000 words) – word webs and semantic threads - Loud Reading – Modulation and Pronunciation Check – Mind maps – Note making – Deep Reading Skills [8]

Academic Writing Practices

Sentence Equivalence and Text completion tasks – Data Interpretation - Essay Writing – Letter Writing – Business Emails – Conversational Fill Ups-Rewordify (select a text and simplify/enhance the language)-Reports on events [6]

Total hours: 30

Text books

1.	M.Ashraf Rizvi, 'Effective Technical Communication', 2nd Edition, McGraw Hill Education (India) Private Limited, Chennai, 2018
2.	Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020

References:

1.	Baul Emmerson and Nick Hamilton , 'Five Minute Activities for Business English', Cambridge University Press, N.York, 2005
2.	Ruth Wainry b, 'Stories: Narrative Activities for The Language Classroom', Cambridge University Press, N.York, 2005
3.	Stuart Redman, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.Y, 2006
4.	https://www.khanacademy.org/test-prep/sat/sat-reading-writing-practice

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	2	1	2	2	2	3	3	2	3	1	2	2
CO2	2	2	2	3	2	2	2	3	3	3	2	3	1	3	3
CO3	2	2	2	2	2	2	2	2	2	3	2	3	1	3	1
CO4	2	3	2	3	2	3	3	2	2	3	3	3	1	2	1

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CO5	2	2	2	2	2	3	3	3	3	3	2	3	1	2	2

COs	POs/PSOs	Level	Justification
CO1	PO1	2	Application of knowledge of mathematics, science engineering fundamentals requires the identification of speakers tone and response to the listening content at a moderate level.
	PO2	2	To identify and review research literature and for analyzing complex engineering problems, active listening skills are required considerable.
	PO3	1	To design and develop solutions to complex engineering problems, effective listening skills are needed at peripheral level.
	PO4	2	To conduct investigations of complex problems using research based knowledge and methods, active listening skills are required at moderate level.
	PO5	1	To create and apply appropriate resources pertaining to engineering and IT tools, effective listening skills are needed at a basic level.
	PO6	2	To apply reasoning informed by contextual knowledge to assess issues at various levels, efficient listening skills are needed considerably.
	PO7	2	Understanding the impact of professional engineering solutions requires active listening skills at reasonable level.
	PO8	2	Effective listening skills are required for the application of ethical principles flanked by responsibilities and norms of engineering practice.
	PO9	3	For functioning effectively both in diverse team and multidisciplinary settings, active listening skills are prerequisites.
	PO10	3	Communicating effectively on complex engineering activities to the engineering community requires efficient listening skills.
	PO11	2	For demonstrating knowledge and understanding engineering and management principles requires active listening skills at moderate level.
	PO12	3	Effective listening skills are prerequisite to engage in independent and lifelong learning in the technological context.
	PSO1	1	Applying knowledge of mathematics, science engineering fundamentals requires the identification of speakers tone and response to the listening content at a moderate level.
	PSO2	2	Effective listening skills are needed at peripheral level to design and develop solutions to complex engineering problems
	PSO3	2	Efficient listening skills are required for communicating effectively the complex engineering activities to the engineering community
CO2	PO1	2	For application of mathematics, science and engineering fundamentals, use of communication strategies standard vocabulary and grammatical accuracy are needed at moderate level.
	PO2	2	To identify, formulate, review research literature, analyse complex engineering problems and to arrive at a conclusion by applying mathematics, science and engineering principles using communication strategies play a reasonable role.
	PO3	2	Use of communication strategies is required at moderate level for designing and development of solutions to complex engineering problems.
	PO4	3	Effective communication strategies are a prerequisite to conduct investigations of complex problems using research based knowledge and methods.
	PO5	2	In modern tool usage, prediction and modeling to complex engineering problem, communication strategy of vocabulary and grammatical accuracy is necessary at a moderate level.
	PO6	2	To assess the various levels of professional engineering practices, synthesizing of information using communication strategies become practical.
	PO7	2	To Understand the impact of solutions in environmental contexts, the various levels of professional engineering practices requires the synthesis of information for effective oral presentation contributes at a moderate level.
	PO8	3	To comprehend the norms of engineering practice and applying the professional engineering practices, synthesis of information is needed in a stronger level.
	PO9	3	Synthesis of information for effective oral communication is mandatory for functioning both in diverse teams and multi disciplinary settings.
	PO10	3	On complex engineering activities, synthesis of using communication strategies is essential for making effective oral presentation.
	PO11	2	Synthesis of information is highly essential to exhibit knowledge for better

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			management of projects and finance.
	PO12	3	To carry on lifelong learning in the face of technological evolution and innovation, synthesis of information is crucial.
	PSO1	1	Use of communication strategies standard vocabulary and grammatical accuracy are needed at moderate level for the application of mathematics, science and engineering fundamentals,
	PSO2	3	Use of communication strategies is required at moderate level for designing and development of solutions to complex engineering problems.
	PSO3	3	On complex engineering activities, synthesis of using communication strategies is essential for making effective oral presentation.
CO3	PO1	2	To develop reading speed, use of digital literacy tools on textual comprehension is required moderately.
	PO2	2	To identify and review research literature and for analyzing complex engineering problems, digital literacy tools on textual comprehension is pre-requisite for inferring meanings of academic vocabulary.
	PO3	2	For designing and development of solutions to complex engineering problems, inferring textual context comprehension and vocabulary play a moderate role.
	PO4	2	For conducting investigations of complex problems, requires moderate level of textual content and vocabulary.
	PO5	2	To understand the usage manual of modern tool, techniques and resources of complex engineering activities, textual content is required in a considerable way.
	PO6	2	For reasoning and assessing issues at various levels, a digital literacy tool on textual comprehension is required moderately.
	PO7	2	To understand the impact of professional engineering solutions, build academic vocabulary by utilizing digital literacy tools on textual comprehension is required considerably.
	PO8	2	Application of ethical principles is flanked by responsibilities and norms of engineering practice require digital literacy tools on textual comprehension at moderate level.
	PO9	2	Comprehending the digital literacy tools on textual comprehension is needed at mediocre level to function effectively both in diverse and multidisciplinary teams.
	PO10	3	To comprehend and write effective reports for making effective presentation, digital literacy tools on textual comprehension is absolutely essential for communication on complex engineering activities.
	PO11	2	For understanding and applying engineering and management principles, digital literacy tools on textual comprehension is crucial.
	PO12	3	To engage in independent and lifelong learning in the technological context, the comprehension of digital literacy tools is imperative.
	PSO1	1	Use of digital literacy tools on textual comprehension is required moderately to develop reading speed
	PSO2	3	Inferring textual context comprehension and vocabulary play a moderate role for designing and development of solutions to complex engineering problems.
	PSO3	1	Comprehending and writing effective reports for making effective presentation by using digital literacy tools on textual comprehension for communication on complex engineering activities
CO4	PO1	2	To apply the knowledge of mathematics, science engineering fundamentals, use of standard sentence structure with functional vocabulary and conventions of academic writing is moderately required.
	PO2	3	Use of standard sentence structure with functional vocabulary and conventions of academic writing are mandatory for identifying, formulating and reviewing research literature in analyzing complex engineering problems
	PO3	2	The use of language accuracy, functional vocabulary and applying the conventions of academic writing are required at moderate level to design and develop solutions to complex engineering problems
	PO4	3	Use of standard sentence structure with functional vocabulary and conventions of academic writing are prerequisite for conducting investigations of complex problems using research based knowledge and methods.
	PO5	2	Applying standard sentence structure with functional vocabulary and conventions of academic writing are required at moderate level to create and apply appropriate resources pertaining to engineering and IT tools
	PO6	3	Employing standard sentence structure with functional vocabulary and

			conventions of academic writing are imperative for applying reasoning informed by contextual knowledge to assess issues at various levels.
	PO7	3	The use of standard sentence structure with functional vocabulary and conventions of academic writing are absolutely necessary for understanding the impact of professional engineering solutions in societal and environmental contexts.
	PO8	2	The application of ethical principles with a commitment to ethical engineering practice requires the use of standard sentence structure with functional vocabulary and conventions of academic writing at moderate level.
	PO9	2	Applying standard sentence structure with functional vocabulary and conventions of academic writing are necessary at moderate level to functioning effectively both in diverse team and multidisciplinary settings.
	PO10	3	Employing standard sentence structure with functional vocabulary and conventions of academic writing are prerogative to communicate effectively on complex engineering activities to the engineering community.
	PO11	3	The application of standard sentence structure with functional vocabulary and conventions of academic writing is mandatory to demonstrate knowledge and understanding engineering and management principles.
	PO12	3	The use of standard sentence structure with functional vocabulary and conventions of academic writing is imperative to engage in independent and lifelong learning in the technological context.
	PSO1	1	Apply the knowledge of mathematics, science engineering fundamentals; the standard sentence structure with functional vocabulary and conventions of academic writing is used moderately required.
	PSO2	2	Develop solutions to complex engineering problems with the help of language accuracy, functional vocabulary and applying the conventions of academic writing
	PSO3	1	For complex engineering activities to the engineering community, employing standard sentence structure with functional vocabulary and conventions of academic writing are prerogative to communicate effectively
CO5	PO1	2	Communication skill proficiency in academic and professional contexts is required at moderate level for the application of mathematics, science engineering fundamentals.
	PO2	2	For identifying, formulating and reviewing research literature in analyzing complex engineering problems, proficiency in communication skills in academic and professional contexts is required at moderate level.
	PO3	2	Expertise in communication skills in academic and professional contexts is required at moderate level to design and develop solutions to complex engineering problems.
	PO4	2	For conducting investigations of complex problems using research based knowledge and methods, proficiency in communication skills in academic and professional contexts is required at moderate level.
	PO5	2	Expert use of communication skills in academic and professional contexts contributes moderately to create and apply appropriate resources pertaining to engineering and IT tools.
	PO6	3	For applying reasoning informed by contextual knowledge to assess issues at various levels, proficient use of communication skills in academic and professional contexts is mandatory.
	PO7	3	Expert use of communication skills in academic and professional contexts contributes significantly to understand the impact of professional engineering solutions in societal and environmental contexts.
	PO8	3	To apply ethical principles with a commitment to ethical engineering practices, proficiency in communication skills in academic and professional contexts is mandatory.
	PO9	3	Expert use of communication skills in academic and professional contexts is prerogative to function effectively both in diverse team and multidisciplinary settings.
	PO10	3	Effective communication on complex engineering activities to the engineering community requires proficiency in communication skills in academic and professional contexts at expert level.
	PO11	2	To demonstrate knowledge and understanding in engineering and management principles, proficient use of communication skills in academic and professional contexts is required at a moderate level.

	PO12	3	To engage in independent and lifelong learning in the technological context, proficiency in communication skills in academic and professional contexts is mandatory.
	PSO1	1	For the application of mathematics, science engineering fundamentals, communication skill proficiency in academic and professional contexts is required at moderate level
	PSO2	2	Design and develop tools that make expertise in communication skills in academic and professional contexts is required at moderate level
	PSO3	2	Effective communication on complex engineering activities to the engineering community requires proficiency in communication skills in academic and professional contexts at expert level.

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MA 002 - Laplace Transform and Complex Variables								
Common to All Branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	Maximum Marks		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	1	0	60	4	50	50	100
Objective(s)	• Multiple integration is used to solve problems involving volume and surface area. • Vector calculus can be widely used for modeling the various of physics. • Introduce the fundamental ideas of the functions of complex variables and developing a clear understanding of the fundamental concepts of complex analysis such as analytic function and complex integral. • Identify and construct complex - differentiable function. • Laplace Transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Evaluate double and triple integrals and analyse Beta and Gamma functions CO2: Analyse the basic concepts of vector calculus to verify Green's, Stoke's and Gauss Divergence theorems. CO3: Construct the analytic functions and Bilinear transformation. CO4: Apply Cauchy's integral formula and Cauchy's residue theorem to evaluate the complex integrals. CO5: Apply Laplace transform techniques for solving differential equations							

The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the numbers hours indicated.

Multiple Integrals
Double integration – Cartesian and polar coordinates – Change of order of integration – Area between two curves – Area as double integral – Triple integration in Cartesian coordinates.
Beta and Gamma functions**:** Relationship between Beta and Gamma functions – Properties – Problems**.** [9]

Vector Calculus
Introduction - gradient of a scalar point function - directional derivative - angle of intersection of two surfaces – divergence and curl(excluding vector identities) - solenoidal and irrotational vectors - Green's theorem in the plane - Gauss divergence theorem -Stokes' theorem(without proof)- verification of the above theorems and evaluation of integrals using them. [9]

Analytic Functions
Analytic functions – Necessary conditions (Cauchy–Riemann equations)- Polar form of Cauchy–Riemann equations – Sufficient conditions (without proof) – Properties of analytic functions – Harmonic function –Harmonic conjugate – Construction of analytic functions– Conformal mapping: w = z + a, az, 1/z -Bilinear transformation. [9]

Complex Integration
Cauchy's Integral theorem (without proof) – Cauchy's integral formula – Taylor's and Laurent's series (without proof) – Classification of singularities – Cauchy's residue theorem – Contour integration – Circular and semi-circular contours (excluding poles on real axis). [8]

Laplace Transforms
Conditions for existence – Transform of elementary functions – Basic properties – Shifting theorems- Derivatives and integrals of transforms –– Transform of unit step function – Dirac's delta function- Initial and final value theorem– Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Solution of second order ordinary differential equation with constant co-efficients – simultaneous equations of first order with constant co-efficients. [10]

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	Total Hours: 45 + 15(Tutorial) = 60
Text book(s):	
1	B S Grewal, 'Higher Engineering Mathematics', 43rd Edition, Khanna Publishers, Delhi, 2014. Website:https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2	Kreyszig Erwin, 'Advanced Engineering Mathematics', 10thEdition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.
Reference(s):	
1	N P Bali and Dr Manish Goyal, 'A text book of Engineering Mathematics',8thEdition,Laxmi Publications (P) LTD,2011
2	T Veerarajan, 'Engineering Mathematics', for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi., 2010.
3	Dr P Kandasamy , Dr K Thilagavathy and Dr K Gunavathy , 'Engineering Mathematics -II', S.Chand& Company Ltd, New Delhi.
4	SWAYAM online video courses.(www.swayamprabha.gov.in)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3							2	3		
CO2	3	3	2	2	3							2	3		
CO3	3	3	3	2	2							2	3		
CO4	3	3	2	2	3							2	3		
CO5	3	3	2	3	3							2	3		

COs	POs/PSOs	Level	Justification
CO1	PO1	3	The knowledge of multiple integrals can be applied to solve a complex engineering problem.
	PO2	3	The concept of multiple integrals will help to formulate and analyze the engineering problems
	PO3	3	The concept of multiple integrals can be used to develop a solution for a complex engineering problem
	PO4	2	The concept of beta and gamma functions can be used to interpret the data to provide valid solutions in engineering problems
	PO5	3	Appropriate technique related to multiple integrals can be applied to complex engineering problems.
	PO12	2	New concepts related to multiple integrals can be developed to find the better solutions to complex engineering problems
	PSO1	3	The concept of multiple integrals will help to provide the conclusion for the problems involving in signal and image processing.
CO2	PO1	3	The principles of vector calculus can be applied to solve a complex engineering problem.
	PO2	3	The concept of directional derivative can be used to formulate and analyze the complex engineering problems
	PO3	2	The solutions of complex engineering problems can be developed by applying Gauss divergence theorem
	PO4	2	The concept of irrotational and solenoidal vector fields can be used to interpret the data to provide valid solutions in engineering problems
	PO5	3	Appropriate technique related to vector calculus can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to vector calculus to find the better solutions to complex engineering problems
	PSO1	3	The principles of Gauss divergence, Stokes and Green's theorems will help to provide the conclusion for the problems involving in signal and image processing
CO3	PO1	3	Fundamental knowledge in complex analysis will help to analyze the

			Engineering problems very easily
	PO2	3	Concepts of conformal mapping will help to model various problems in engineering fields
	PO3	3	Bilinear transformation will help to design solutions to various Engineering problems
	PO4	2	The concept of complex analysis can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate technique related to bilinear transformation can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to conformal mapping to find the better solutions to complex engineering problems
	PSO1	3	The principles of conformal mapping will help to provide the conclusion for the problems involving in image processing.
CO4	PO1	3	Complex integration will help to simplify problems with high complexity in Engineering.
	PO2	3	The knowledge about contour integration can be used to formulate and analyze various complex engineering problems
	PO3	2	Singularities and Series expansions will help to design solutions to various complex engineering problems
	PO4	3	The Cauchy's residue theorem can be used to interpret the data to provide valid solutions in engineering problems
	PO5	3	Appropriate technique related to contour integration can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to complex integration to find the better solutions to complex engineering problems
	PSO1	3	The principles of Contour integration will help to provide the conclusion for the problems involving in signal and image processing.
CO5	PO1	3	The fundamental concepts of Laplace transform can be applied to solve a complex engineering problem
	PO2	3	Identity and formulate the suitable transform function to analyse the given numerical data related to complex engineering problem
	PO3	2	It helps to develop the solutions of complex problems by considering societal considerations.
	PO4	3	Conduct the detailed literature survey on existing transform methods by understanding the limitations of Laplace transform
	PO5	3	Appropriate inverse Laplace transform technique can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to Laplace transform to find the better solutions to complex engineering problems
	PSO1	3	The concept of a Laplace transform and inverse Laplace transform methods can be applied to solve the problems in signal and image processing.

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 CH 001 - Applied Chemistry								
Common to all Branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	• To endow with the periodic properties of elements and molecular orbitals variation of orbitals • To assist the learners to apply the thermodynamic functions to electro chemical reactions and its application • To help the learners to analyze the hardness of water and its removal techniques • To endow with various spectroscopy techniques and its applications • To facilitate the students with the basics of stereochemistry and types of chemical reactions with their mechanism							

Course Outcomes	**At the end of the course, the students will be able to** CO1: Rationalize the periodic properties of elements and molecular orbitals variation of orbitals CO2: Apply the thermodynamic functions to electro chemical reactions and its application CO3: Analyse the cause and effects of hardness of water and its removal techniques CO4: Interpret the various spectroscopy techniques and its applications CO5: Infer the types of stereochemistry and chemical reactions with their mechanism

Note: Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

Periodic properties
Effective nuclear charge - atomic and ionic sizes - ionization energies - electron affinity - electronegativity - polarizability - oxidation states - penetration of orbitals- variations of s, p, d and f orbital energies of atoms - electronic configurations, ionic, dipolar and Vander- waals interactions. Hard soft acids and bases (HSAB).Molecular orbitals of diatomic molecules - plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbital of butadiene and benzene. [9]

Chemical equilibria and corrosion
Thermodynamic functions - energy - entropy - enthalpy- free energy - Gibbs-Helmholtz equation - Van 't Hoff isotherm.Cell potentials - Nernst equation - applications - EMF series - applications - Poteniometric and Conductometric titrations. Corrosion- types of corrosion - chemical and electrochemical corrosion - mechanism - Factors influencing corrosion - Corrosion control methods (impressed current and sacrificial anode methods) - Corrosion inhibitors. [9]

Water chemistry
Sources- Water quality parameters - impurities in water and their effects. Hardness- Estimation of hardness-effect of hard water in various industries-Softening of water- external treatment-zeolite process- ion-exchange process-internal treatment-carbonate, phosphate and calgon conditioning-Desalination-reverse osmosis-electrodialysis. Boiler troubles- methods of prevention. [9]

Analytical techniques and applications
Absorption laws - Ultra violet spectroscopy (UV) - Principle - Instrumentation (Block diagram) - applications. Infra red spectroscopy (IR)- Instrumentation (Block diagram) - selection rule - types of fundamental vibrations - applications. Nuclear magnetic resonance spectroscopy (NMR) - Principle - selection rule - Instrumentation (Block diagram) - chemical shift - factors influencing the chemical shift -applications. Atomic absorption spectroscopy (AAS) - Principle - Instrumentation (Block diagram) -applications. [9]

Concepts in Organic chemistry
Structural isomerism- types - Stereoisomerism - geometrical (Maleic and Fumaric acids) - optical isomerism (Lactic and Tartaric acids) - symmetry - chirality- enantiomers - diastereomers - optical activity - absolute configurations.
Introduction to reactions - substitution - addition - oxidation - reduction - cyclization and ring openings - mechanism.
[9]

Total hours: 45

Text book(s) :

1.	Jain. P.C. and Monica Jain, 'Engineering Chemistry', Dhanpatrai publishing co. New Delhi, 17th Edition, 2021.
2.	Vairam, S. and Suba Ramesh, 'Engineering Chemistry', Wiley India Private Limited , 2 nd Edition, January 2013

Reference(s) :

1.	Puri B. R., Sharma L.R., and Pathania M.S., 'Principles of Physical Chemistry', Vishal Publishing Company, Delhi, 47th Edition, 2020.
2.	Dara. S.S, 'A Text Book of Engineering Chemistry', S Chand & co. Ltd., 2014
3.	Bahl B.S. and Arun Bahl, 'Advanced Organic Chemistry', S.Chand, New Delhi, 2014
4.	Sharma BK. 'Instrumental methods of chemical analysis', Goel Publishing House Meerut, 23rd Edition; 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	2	2	2							
CO2	3	3	3	2	2	2	3	2					3	2	
CO3	3	3	3	3	2	3	3	3	3		2	3	2	2	2
CO4	3	3	3	3	3	3	3		2		2	3	3	3	3
CO5	3	3	3	3	2	2	2	2							

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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COs	POs/PSOs	Level	Justification
CO1	PO1	3	Mapped strongly as the students will able to apply the knowledge of periodic properties for the solution of complex engineering problems.
	PO2	3	Mapped strongly as the students gain the ability to identify the energy level of molecular and atomic orbitals.
	PO3	2	Mapped moderately as the students will able to design the 3D structure for electronics configuration of elements.
	PO4	2	Mapped moderately as the students gain the skills on calculating the effective nuclear charge.
	PO5	2	Mapped moderately as the students will gain skills to design and develop solution for π molecular orbital clusters.
	PO6	2	Mapped moderately as the students gain sufficient knowledge about HSAB principle.
	PO7	2	Mapped moderately as the students gain knowledge on impacts various molecular interaction.
	PO8	2	Mapped moderately as the students attain ability to apply principle on trends in periodic properties.
CO2	PO1	3	Mapped strongly as the students will able to apply the knowledge on thermo dynamic function for the solution of complex engineering problems.
	PO2	3	Mapped strongly as the students gain the ability to identify and identify the impacts of corrosion.
	PO3	3	Mapped strongly as the students will able to design the solution for protection of metals form corrosion.
	PO4	2	Mapped moderately as the students gains the research based knowledge on electro chemical series and its application.
	PO5	2	Mapped moderately as the students gain knowledge to identify and select the materials for corrosion.
	PO6	2	Mapped moderately as the students get sufficient knowledge about corrosion protection methods.
	PO7	3	Mapped strongly as the student acquires knowledge on the impact of electro chemical corrosion related to environmental issues.
	PO8	2	Mapped moderately as the students gain the ability to apply the ethical thermodynamic principles to engineering practice.
	PSO1	3	Mapped strongly as the students apply knowledge for corrosion sensors by using signal/image processing.
	PSO2	2	Mapped moderately as the students able to design components and develop corrosion resistance material for the needs of industry.
CO3	PO1	3	Mapped strongly as the students able to know the knowledge water quality parameter to the complex engineering problems.
	PO2	3	Mapped strongly as the students will able to identify and formulate the effects of hard water in various industries.
	PO3	3	Mapped strongly as the students will able to design the water softening method for meet the specific needs.
	PO4	3	Mapped strongly as the students will able to design the methods for boilers problems due to hard water.
	PO5	2	Mapped strongly as the students will gain information to select the appropriate techniques for desalination.
	PO6	3	Mapped strongly as the students gain sufficient knowledge on health and safety uses relevant to hardness of water.
	PO7	3	Mapped strongly as the students gain skills on water characteristics for sustainable development.
	PO8	3	Mapped strongly as the students gain knowledge to apply ethical principles on water softening methods.
	PO9	3	Mapped strongly as the students gain ability to function effectively as a team or individual in water purification techniques.
	PO11	2	Mapped moderately as the students gain knowledge to apply principles to manage projects in water treatment.
	PO12	3	Mapped strongly as the students gain ability of lifelong learning in water quality.
	PSO1	2	Mapped moderately as the students apply knowledge to identify water resources by using signal/image processing.

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	PSO2	2	Mapped moderately as the students able to develop sensors for water purification process.
	PSO3	2	Mapped moderately as the students develop teamwork to produce compact desalination technique.
CO4	PO1	3	Mapped strongly as the students will able to apply the knowledge of analytical techniques to the solution of complex engineering problems.
	PO2	3	Mapped strongly as the students will able to identify the principles of spectroscopic techniques.
	PO3	3	Mapped strongly as the students will able to design suitable spectroscopic techniques and provide the valid conclusion for specific needs in public health and safety.
	PO4	3	Mapped strongly as the students will able to analyze and interpret spectroscopic data and provide valid conclusion.
	PO5	3	Mapped strongly as the students will gain knowledge to select suitable techniques for prediction of new samples.
	PO6	3	Mapped strongly as the students gain sufficient knowledge on health and safety issues related to purity of samples.
	PO7	3	Mapped strongly as the students gain knowledge on understanding the impacts of AAS for sustainable development.
	PO9	2	Mapped moderately as the students gain ability to function as individuals or a member in interpretation of NMR data.
	PO11	2	Mapped moderately as the students gain knowledge to apply the techniques in identification of unknown samples using spectroscopic techniques
	PO12	3	Mapped strongly as the students gain ability in lifelong learning on various instrumentations.
	PSO1	3	Mapped strongly as the students apply knowledge in field of MRI scanning by using image processing.
	PSO2	3	Mapped strongly as the students develop products for the needs of industry by reframing UV spectroscopy.
	PSO3	3	Mapped strongly as the students will be able develop interpersonal skill to analyze NMR data.
CO5	PO1	3	Mapped strongly as the students able to apply the knowledge of stereo chemistry to give solutions of complex problems.
	PO2	3	Mapped strongly as the students will able to identify and formulate about the configuration of organic compounds.
	PO3	3	Mapped strongly as the students will be able to select suitable redox reagent for chemical reaction.
	PO4	3	Mapped strongly as the students will gain knowledge on synthesis of organic compounds by substitution reaction.
	PO5	2	Mapped moderately as the students gain the skill to predict the way of mechanism of organic reaction.
	PO6	2	Mapped moderately as the students acquire knowledge on optical activity of various application oriented compounds.
	PO7	2	Mapped moderately as the students gain knowledge on understanding the impacts of symmetry.
	PO8	2	Mapped moderately as the students gain information to apply ethical principles on optical isomerism of lactic and tartaric acid.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 CS 001 - Programming for Problem Solving								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100
Objective(s)	• To learn the evolution of computers and examines the most fundamental element of the C language • To examine the execution of branching, looping statements, arrays and strings. • To understand the concept of functions , pointers and the techniques of putting them to use • To apply the knowledge of structures and unions to solve basic problems in C language • To enhance the knowledge in file handling functions for storage and retrieval of data							

Course Outcomes	**At the end of the course, the student will be able to:** CO1: Infer the evolution, generation, representation of problem and recognize the concepts of data types and expressions CO2: Annotate the concept of console Input and output features and examine the execution of branching, looping statements, arrays and strings CO3: Recognize the concepts of functions, recursion, storage class specifies and pointers with its features CO4: Comprehend basic concepts of structures ,unions ,user defined data types and preprocessor CO5: Interpret the file concepts using proper standard library functions

Note: Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.

Introduction to Computer and Programming

Introduction to Computers - Evolution of computers - Generations of computers and Programming Languages– Introduction to components of a computer system -Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart–Pseudocode with examples. From algorithms to programs– variables (with data types)– Type Qualifiers - Constants – Operators –expressions and precedence [9]

Suggested Activities:

Knowing the history of computers

Developing Pseudocodes and flowcharts for real life activities

Developing algorithms for basic mathematical expressions using arithmetic operations.

Suggested Evaluation Methods:

Group Discussion on Introduction to Computers and its generation

Assignments on pseudocodes and flowcharts

I/O ,Branching ,Loops and Arrays

Console I/O– Unformatted and Formatted Console I/O – Conditional Branching and Loops -Writing and evaluation of conditionals and consequent branching -Iteration and loops - Arrays (1-D, 2-D), Character arrays and Strings [9]

Suggested Activities:

Simple programs using I/O statements, arithmetic operations

Implementation of simple programs using **Branching ,Loops and Arrays**

Performing String operations

Suggested Evaluation Methods:

Tutorial for the above activities

Group discussion on role of Branching, loop and Arrays in Programming Language

Functions and Pointers

Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes – Function Categorization - Function Arguments - Arguments to main function - The return Statement - Recursion - Passing Arrays to Functions– Storage class Specifiers.Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions - Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers– Dynamic memory allocation [9]

Suggested Activities:

Develop simple applications like Calculator, Various Conversion Process using functions

Develop a simple programs by applying pointer cobcepts

Suggested Evaluation Methods:

Tutorial for the above activities

Group discussion on Function and Pointers

Structures, Unions, Enumerations, Typedef and Preprocessors

Structures - Arrays of Structures- Arrays and Structures within Structures - Passing Structures to Functions - Structure Pointers - Unions – BitFields - Enumerations - typedef – The preprocessor and comments. [9]

Suggested Activities:

Develop simple programs using **Structures, Unions, Enumerations, Typedef and Preprocessors**

Suggested Evaluation Methods:

Tutorial for the above activities

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File File: Streams –Reading and Writing Characters - Reading and Writing Strings -,File System functions - Random Access Files [9] **Suggested Activities:** Develop simple applications to apply files operations **Suggested Evaluation Methods:** Tutorial for the above activities Group discussion on Files Concepts
Total hours: 45

Text book:	
1	Herbert Schildt, 'The Complete Reference C', 4th Edition, Tata McGraw Hill Edition, 2010.
2	Byron Gottfried, 'Programming with C', 3rd Edition, McGraw Hill Education, 2014.
Reference(s):	
1	E.Balagurusamy, 'Programming in ANSI C', 7th Edition, Tata McGraw Hill Edition, New Delhi, 2016.
2	Brian W. Kernighan and Dennis M. Ritchie, 'C Programming Language', Prentice-Hall.
3	Reema Thareja, 'Computer Fundamentals and Programming in C', 2nd Edition, Oxford Higher Education, 2016.
4	K N King, 'C Programming: A Modern Approach', 2nd Edition, W.W.Norton, New York, 2008.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	3	-	2	2	_	_	_	_	_	-	1	-	-	
CO2	1	3	-	3	3	_	_	2	-	_	-	2	3	3	
CO3	1	3	-	2	3	_	_	2	-	_	-	2	2	2	
CO4	1	3	-	3	3	_	_	2	-	_	-	2	3	3	
CO5	1	3	-	2		_	_	2	-	_	-	3	3	2	

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO1	1	Moderately mapped as problem analysis is necessary for solving and developing any application using C programming using simple data structure.
	PO2	3	Strongly mapped students can gain knowledge to apply C language principles in software design process, the students will be able to analyze complex engineering problems in the domain of software development with better effectiveness.
	PO4	2	Moderately mapped for the problem statement, design experiment and interpretation of data for complex problems.
	PO5	2	Moderately mapped for the problem statement solution using appropriate techniques using data structures.
	PO12	1	Moderately mapped as the students can apply the basic concepts of C programming in new technology developments.
CO2	PO1	1	Moderately mapped to know the structure and logics for developing the engineering problems with the use of C programming features like string arrays.

	PO2	3	Strongly mapped as the essential features like arrays is necessary for the programming methodsto solve C programming features.
	PO4	3	Moderately mapped for the problem statement, design experiment and interpretation of data for C problems using multidimensional arrays.
	PO5	3	Strong team work is needed to solve the C multidimensional array in the field of computer science and engineering.
	PO8	2	Moderately mapped as the students can acquire the knowledge of tool usage for different language construct in C.
	PO12	2	Moderately mapped for the development of some applications in computer science using computational solutions will be applicable in feature technological era.
	PSO1	3	Moderately the students will be able to build a strong foundation for C Programming language to develop quality product for business success.
	PSO2	3	Moderately the students will be able to build a strong foundation for C programming language to develop the ability to identify, analyze and design solutions for complex engineering problems.
CO3	PO1	1	Moderately mapped as the students know the usage of functionsin real time applications for obtaining the solutions.
	PO2	3	Strongly mapped that students can do review and analyze the concept of user defined functions for any complex engineering problems.
	PO4	2	Strongly mapped to design different types of parameter passing for solving complex problems.
	PO5	3	Moderately mapped to use the top down design solutions for complex problem.
	PO8	2	Moderately mapped to efficient usage of tools
	PO12	2	Strongly mapped for life-long learning to suit the technology change requirements.
	PSO1	2	Strongly mapped for pointers, files and structures which provides better solution for software project development.
	PSO2	2	Highly delivers the fundamental knowledge on pattern matching, which will further be utilized in the design and development of solution to real time problems.
CO4	PO1	1	Moderate knowledge about array of structures which helps to find the solution of complex engineering problems.
	PO2	3	Strongly mapped for the knowledge of formulating the preprocessor macros that helps to solve complex C problems.
	PO4	3	Strongly mapped students to learn the C problems and to solve the problems like nesting of structures.
	PO5	3	Strongly mapped to understand the use of resources for structure and union creation for solving complex problem.
	PO8	2	Modernly mapped the Individual and team work effectively help to understand the array of structure process associated to memory usage.
	PO12	2	Moderately mapped as students understand use of union.
	PSO1	3	Strongly mapped as students understand fundamentals of declaring the attributes and defining functions to develop a C application.

	PSO2	3	Strongly mapped as students understand the dynamic memory allocation to develop a C application.
CO5	PO1	1	Moderately mapped as students can have knowledge of develop additional features in the existing source code to solve complex engineering problems.
	PO2	3	Strongly mapped as students will gain knowledge on different types of file handling functions.
	PO4	2	Strongly able to understand sequential file operation for any design experiments to solve complex problems.
	PO8	2	Moderately mapped to solve complex problem related reading and writing string and integer to the file using tools.
	PO12	3	Strongly mapped as students apply the concepts file handling in development of new application.
	PSO1	3	Strongly mapped as students applies to include additional features to develop and solve real world application related to random access files.
	PSO2	2	Moderately mapped as students understand the concept of types of binary files in developing and build efficient application.

<table>
<tr><th colspan="9">K. S. Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 ME 003 – Engineering Mechanics</th></tr>
<tr><th colspan="9">Common to all branches</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours / Week</th><th rowspan="2">Total Hours</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>II</td><td>3</td><td>1</td><td>0</td><td>60</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn a process for analysis of static objects, concepts of force, moment, and mechanical equilibrium in two and three dimensions.
• To learn the equilibrium of rigid bodies such as frames, trusses, beams.
• To identify the properties of surfaces and solids by using different theorem.
• To impart basic concept of dynamics of particles.
• To acquire the concept of friction and elements of rigid body dynamics.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Use scalar and vector analytical techniques for analysing forces in statically determinate structures.
CO2: Apply basic knowledge of scientific concepts to solve real-world problems.
CO3: Compute the properties of surfaces and solids using various theorems.
CO4: Analyse and solve problems on kinematics and kinetics.
CO5: Draw a shear force and bending moment diagrams, analysis of rigid body dynamics and calculation of frictional forces on contact surfaces.</td></tr>
<tr><td colspan="9">Note:The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.</td></tr>
<tr><td colspan="9">Basics and Statics of Particles
Introduction -Units and Dimensions-Laws of Mechanics–Principle of transmissibility-Lame's theorem, Parallelogram and triangular Law of forces–Vectors–Vectorial representation of forces and moments.
Vector operations
Addition, subtraction, dot product, cross product-Coplanar Forces–Resolution and Composition of forces–Equilibrium of a particle–Forces in space-Equilibrium of a particle in space-Equivalent systems of forces-Single equivalent force.
[12]
Equilibrium of Rigid Bodies
Free body diagram–Types of supports and their reactions–requirements of stable equilibrium–Static determinacy, Moments and Couples–Moment of a force about a point and about an axis–Vectorial representation of moments and couples–Varignon'stheorem-Equilibrium of Rigid bodies in two dimensions.
Trusses: Introduction, axial members, calculation of forces on truss members using method of joints-Method of sections.
[12]
Properties of Surfaces and Solids
Determination of Areas and Volumes-Centroid, Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method; T section, I section, Angle section, Hollow section using standard formula) - Parallel axis theorem and perpendicular</td></tr>
</table>

axis theorem- Polar moment of inertia -Mass moment of inertia of thin rectangular section -Relation between area moment of inertia and mass moment of inertia. [12] **Dynamics of Particles** Displacement, Velocity, acceleration and their relationship–Relative motion -Projectile motion in horizontal plane– Newton's law–Work Energy Equation – Impulse and Momentum. [12] **Elements of Rigid Body Dynamics, friction and Beams** Translation and Rotation of Rigid Bodies: Velocity and acceleration–General Plane motion: Crank and Connecting rod mechanism. **Friction** Frictional force–Laws of Coloumb friction–Simple contact friction–Ladder friction-Rolling resistance–Ratio of tension in belt. **Transverse bending on beams** Types of beams: Supports and loads – Shear force and bending moment in beams – Cantilever, simply supported and overhanging beams. [12]
Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):	
1.	Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2017.
2.	Beer, F.P and Johnson Jr. E.R, 'Vector Mechanics for Engineers', Statics and Dynamics, McGraw-Hill International, 11th Edition, 2016.
Reference(s)	
1.	Jayakumar, V. and Kumar, M, 'Engineering Mechanics', PHI Learning Private Ltd, New Delhi, 2012
2.	Hibbeller, R.C., 'Engineering Mechanics', Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd.,
3.	Bansal R.K,' Engineering Mechanics' Laxmi Publications (P) Ltd, 2011.
4.	Irving H. Shames, Engineering Mechanics: Statics and Dynamics', Pearson Education Asia Pvt. Ltd, 4th Edition, 2003.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	3								2	3	1	1
CO2	3	2	2	3								2	3	1	1
CO3	3	2	2	3								2	3	1	2
CO4	3	2	2	3								2	3	1	2
CO5	3	2	2	3								2	3	1	2

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge of mathematics and mechanical engineering fundamentals to solve the problems related to statics
	PO2	2	Apply the principles of statics and vectors to analyse the problems
	PO3	2	Develop the solution for solving statics and vectors related problems
	PO4	3	Conduct the detailed analysis and interpolate data on existing problems to provide valid solutions
	PO12	2	Recognize the need for lifelong learning in statics and vector operations in Engineering mechanics
	PSO1	3	Solve complex problems related to statics of particles and vector operations
	PSO2	1	Use the knowledge of statics and vector operations principle to design the components
	PSO3	1	Develop the skills related to statics and vector operation principles
CO2	PO1	3	Apply the knowledge of mathematics and mechanical engineering fundamentals to solve the problems related to equilibrium of rigid bodies
	PO2	2	Identify and formulate the equilibrium principles to analyse the problem related to equilibrium of rigid bodies
	PO3	2	Develop the solution for solving equilibrium of rigid body and truss related problems
	PO4	3	Conduct the detailed analysis and interpolate data on existing problems related to equilibrium to provide valid solutions
	PO12	2	Recognize the need for lifelong learning related to equilibrium of rigid bodies

	PSO1	3	Solve complex problems related to equilibrium and truss.
	PSO2	1	Use the knowledge of particle and rigid body to solve the problems related to equilibrium
	PSO3	1	Develop the skills related to equilibrium of rigid body principles
CO3	PO1	3	Apply the knowledge of mathematics and mechanical engineering fundamentals to solve the problems related to centroid and moment of Inertia
	PO2	2	Apply the principles of centroid and moment of Inertia to analyse the problems
	PO3	2	Develop the solution for solving centroid and moment of Inertia related problems
	PO4	3	Conduct the detailed analysis and interpolate data on existing problems to provide valid solutions for centroid and moment of Inertia problems
	PO12	2	Recognize the need for lifelong learning in centroid and moment of Inertia
	PSO1	3	Solve complex problems related to centroid and moment of Inertia
	PSO2	1	Use the knowledge of centroid and moment of Inertia principle to design the components
	PSO3	2	Develop the skills related to centroid and moment of Inertia principles
CO4	PO1	3	Apply the knowledge of mathematics and mechanical engineering fundamentals to solve the problems related to dynamics of particles
	PO2	2	Apply the principles of dynamics to analyse the problems related to dynamics of particles
	PO3	2	Develop the solution based on the principle of dynamics to solve dynamics of particle related problems
	PO4	3	Conduct the detailed analysis and interpolate data on existing problems on dynamics of particles to provide valid solutions
	PO12	2	Recognize the need for lifelong learning in dynamics of particles
	PSO1	3	Solve complex problems related to dynamics of particles applying dynamics principles
	PSO2	1	Use the knowledge of dynamics principles to design the components
	PSO3	2	Develop the skills related to dynamics principles
CO5	PO1	3	Apply the knowledge of mathematics and mechanical engineering fundamentals to solve the problems related to rigid body dynamics, friction and beams
	PO2	2	Apply the principles of rigid body dynamics, friction and beams and vectors to analyse the problems
	PO3	2	Develop the solution for solving rigid body dynamics, friction and beams related problems
	PO4	3	Conduct the detailed analysis and interpolate data on existing rigid body dynamics, friction and beams problems to provide valid solutions
	PO12	2	Recognize the need for lifelong learning in rigid body dynamics, friction and beams
	PSO1	3	Solve complex problems related to rigid body dynamics, friction and beams
	PSO2	1	Use the knowledge of rigid body dynamics, friction and beams principle to design the components
	PSO3	2	Develop the skills related to rigid body dynamics, friction and beams

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MY 001 - Constitution of India								
Common to all Branches								
Semester	Hours / Week			Total	Credit	Maximum Marks		
	L	T	P	Hrs	C	CA	ES	Total
II	2	0	0	30	0	100	00	100
Objectives	• To know the premises informing the twin themes of liberty and freedom from a civil rights perspective. • To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism. • To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution. • To gain knowledge on bill passing • To acquire knowledge on function of election commission							

Course Outcomes	**At the end of the course the students will be able to:** CO1: Discuss the framing of constitution and its features CO2: Explain about the fundamental rights and duties. CO3: Expound the powers and functions of various members of governance. CO4: Describe the local administration and the roles of its members. CO5: Explicate the roles and functions of election commission

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

History of Making of the Indian Constitution:
History - Drafting Committee, (Composition& Working)
Philosophy of the Indian Constitution: Preamble - Salient Features [6]
Contours of Constitutional Rights & Duties:
Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties. [6]
Organs of Governance:
Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions. [6]
Local Administration:
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy. [6]
Election Commission:
Election Commission: Role and Functioning- Chief Election Commissioner and Election Commissioners- State Election Commission: Role and Functioning- Institute and Bodies for the welfare of SC/ST/OBC and women.[6]

Total Hours: 30

Text book:

1	The Constitution of India, 1950 (Bare Act), Government Publication
2	S.N, Busi, Ambedkar, B.R.,'Framing of Indian Constitution', 1st Edition, 2015.

Reference(s):

1	Basu, D D., 'Introduction to the Constitution of India', Lexis Nexis, 2015.
2	M.P Jain, 'Indian Constitution Law', 7th Edition, Lexis Nexis, 2014.
3	S R Bhansali, Textbook on The Constitution of India, Universal Publishers, 2015
4	M P Jain, Outlines of Indian Legal and Constitutional History, Lexisnexis, 2014

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								2	2	1		2			
CO2								2	2	1		2			
CO3								2	2	1		2			
CO4								2	2	1		2			
CO5								2	2	1		2			

COs	POs/PSOs	Level	Justification
CO1	PO8	2	Apply ethical responsibilities to develop the system.
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	1	Communicate effectively with proper documentation in various technical events like paper presentation etc.

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Department of ECE
K.S.Rangasamy College of Technology,
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	PO12	2	Develop interest in building more reliable system considering wider technological changes
CO2	PO8	2	Apply ethical responsibilities to develop the system
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	1	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	2	Develop interest in building more reliable communication system considering wider technological changes
CO3	PO8	2	Apply ethical responsibilities to develop the system
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	1	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	2	Develop interest in building more reliable communication system considering wider technological changes
CO4	PO8	2	Apply ethical responsibilities to develop the system
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	1	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	2	Develop interest in building more reliable communication system considering wider technological changes
CO5	PO8	2	Apply ethical responsibilities to develop the system
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	1	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	2	Develop interest in building more reliable communication system considering wider technological changes

K.S.Rangasamy College of Technology - Autonomous R 2018								
50 CH 0P1 - Chemistry Laboratory								
Common to all branches								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	0	0	4	60	2	60	40	100
Objective(s)	• To test the knowledge of theoretical concepts. • To develop the experimental skills of the learners. • To facilitate data interpretation. • To enable the learners to get hands-on experience on the principles discussed in theory sessions. • To expose the learners to various industrial and environmental applications.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Calculate the amount of hardness, alkalinity, chloride ion and dissolved oxygen in water sample CO2: Estimate the amount of barium chloride and mixture of acids by conductometry CO3: Inferthe amount of acid by pH metry and ferrous ion by potentiometry CO4: Examine the amount of ferrous ion by spectrophotometry CO5: Determine the percentage of corrosion by weight loss method							
LIST OF EXPERIMENTS								

CHAIRMAN BOARD OF STUDIES
Department of ECE
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of chloride content in water sample (Argentometric method).
4. Determination of dissolved oxygen in boiler feed water (Winkler's method).
5. Estimation of barium chloride by conductometric precipitation titration.
6. Estimation of mixture of acids by conductometric titration.
7. Estimation of ferrous ion by potentiometric titration.
8. Estimation of HCl, beverages and other biological samples by pH meter.
9. Estimation of iron content by spectrophotometry method.
10. Determination of corrosion rate and inhibitor efficiency by weight loss method.

Lab Manual:	
1.	S.Vairam 'Engineering Chemistry', Wiley India, Delhi, 2nd Edition, 2013.

Reference:	
1.	Mendham. J, Denney. R.C, Barnes. J.D and Thomas. N.J.K, 'Vogel's Text Book of Quantitative Chemical Analysis', Pearson Education, 6th Edition, 2009.
2.	S SDara, 'A Textbook On Experiments And Calculations In Engineering Chemistry', S Chand&Co, New Delhi 6th Edition, 2015
3.	SunitaRattan, 'Experiments in Applied Chemistry', S K Kataria&Sons,New Delhi,2011

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	3	3	3	2		3	2			
CO2	3	3	3	3	3	3	2	3			2				
CO3	3	3	3	3	3	3	3	2	3		2		3	3	3
CO4	3	3	3	3	3	3	2				2		3	3	3
CO5	3	3	3	3	3	3	2				2				

COs	**POs/PSOs**	**Level**	**Justification**
C O1	PO1	3	Mapped strongly as the students will able to acquire the knowledge in estimation of water quality parameters.
	PO2	3	Mapped strongly as the students gain the ability to analyze the concentration of chloride ion.
	PO3	3	Mapped strongly as the students will able to design the solution for engineering problem due to hardness of water sample
	PO4	3	Mapped strongly as the students gain the skills on analysis of water sample
	PO5	3	Mapped strongly as the students can select appropriate technique for estimation of dissolved oxygen.
	PO6	3	Mapped strongly as the students gain sufficient knowledge relevant to hardness for engineering practice.
	PO7	3	Mapped strongly as the students gain knowledge to understand the impacts of dissolved oxygen in water sample.
	PO8	3	Mapped strongly as the students attain ability to apply ethical principle on water analysis.
	PO9	2	Mapped moderately as the students function effectively as an individual or a member or a leader in the analysis of water sample.
	PO11	3	Mapped strongly as the students gain the information to manage the project based on water quality assurance.
	PO12	2	Mapped moderately as the students recognize the need of water analysis

			by lifelong learning.
CO2	PO1	3	Mapped strongly as the students will able to gain the knowledge about conductometric titration
	PO2	3	Mapped strongly as the students will able to analyze the concentration of HCL in mixture of acids.
	PO3	3	Mapped strongly as the students gian the ability to design the process of conductometric titration for environmental considerations.
	PO4	3	Mapped strongly as the students gains the research based knowledge on conductometric precipitation titration.
	PO5	3	Mapped strongly as the students gain knowledge to identify and select appropriate technique for mixture of acid estimation.
	PO6	3	Mapped strongly as the students get sufficient knowledge relevant to conductance of solutions.
	PO7	2	Mapped moderately as the student acquires knowledge on the impact of conductance in various solutions.
	PO8	3	Mapped strongly as the students understand the ethical principles of conductometric titration.
	PO11	2	Mapped moderately as the students gain knowledge to manage the project based in conductivity measurements.
CO3	PO1	3	Mapped strongly as the students able to know the knowledge in estimation of ferrous ion using potentiometer.
	PO2	3	Mapped strongly as the students will able to identify the concentration of H^+ ion using pH meter.
	PO3	3	Mapped strongly as the students gain the capacity to design the solution for engineering problem based on pH.
	PO4	3	Mapped strongly as the students gain research based knowledge in analysis of ferrous ion.
	PO5	3	Mapped strongly as the students can select the appropriate techniques for the estimation of pH in acid.
	PO6	3	Mapped strongly as the students gain sufficient knowledge relavant to pH in acid.
	PO7	3	Mapped strongly as the students acquire knowledge to understand the impacts of pH for sustainable development.
	PO8	2	Mapped moderately as the student acquires knowledge to apply ethical principles in iron estimation.
	PO9	3	Mapped strongly as the students gain ability to function effectively as a team or individual in Instrumentation techniques
	PO11	2	Mapped moderately as the students gain knowledge to manage projects on pH.
	PSO1	3	Mapped strongly as the students able to find solution problems in potentiometry.
	PSO2	3	Mapped strongly as the students can develop cell for industry needs.
	PSO3	3	Mapped strongly as the students develop interpersonal skill to relate pH data.
CO4	PO1	3	Mapped strongly as the students will able to apply the knowledge in Ferrous ion estimation by spectrophotometer.
	PO2	3	Mapped strongly as the students will able to identify the concentration of spectrophotometer.
	PO3	3	Mapped strongly as the students will able to design solution for engineering problems based on iron estimation.
	PO4	3	Mapped strongly as the students gain research based knowledge in analysis of ferrous ion.
	PO5	3	Mapped strongly as the students will gain knowledge to select suitable techniques for estimation.
	PO6	3	Mapped strongly as the students gain sufficient knowledge relevant to iron estimation for engineering practices.
	PO7	2	Mapped strongly as the students gain knowledge on understanding the impacts of iron estimation for sustainable development.
	PO11	2	Mapped moderately as the students gain knowledge to manage projects based on iron estimation.
	PSO1	3	Mapped strongly as the students able to solve absorption intensity in spectroscopy using signal processing.

	PSO2	3	Mapped strongly as the students develop components for spectrophotometer.
	PSO3	3	Mapped strongly as the students develop teamwork for sample analysis.
CO5	PO1	3	Mapped strongly as the students able to know the knowledge in corrosion.
	PO2	3	Mapped strongly as the students will able to identify and formulate for corrosion experiment.
	PO3	3	Mapped strongly as the students will be able to design the solution for corrosion relevant problem in engineering practices
	PO4	3	Mapped strongly as the students will gain research based knowledge in estimation of corrosion.
	PO5	3	Mapped strongly as the students able to predict the way for corrosion rate.
	PO6	3	Mapped strongly as the students acquire knowledge relevant to loss of material by corrosion.
	PO7	2	Mapped moderately as the students understand the impact of rate of corrosion in sustainable development.
	PO11	2	Mapped moderately as the students gain knowledge to manage projects based on corrosion chemistry

K.S.Rangasamy College of Technology - Autonomous R2018

50 CS 0P1 - Programming for Problem Solving Laboratory

Common to all Branches

Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100

Objective(s)

- To enable the students to apply the concepts of C to solve simple problems
- To use selection and iterative statements in C programs
- To apply the knowledge of library functions in C programming
- To implement the concepts of arrays, functions, structures and pointers in C
- To implement the file handling operations through C

Course Outcomes

At the end of the course the students will be able to

CO1: Apply how to read, display basic information and use selection and iterative statements

CO2: Demonstrate C program to manage collection of related data

CO3: Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts

CO4: Develop a C program to manage collection of different data using structures, Union, user-defined datatypes and preprocessor directives

CO5: Demonstrate C program to store and retrieve data using file concepts

LIST OF EXPERIMENTS

1 Implementation of Simple computational problems using various formulas.

2 Implementation of Problems involving Selection statements.

3 Implementation of Iterative problems e.g., sum of series.

4 Implementation of 1D Array manipulation.

5 Implementation o f 2D Array manipulation.

6 Implementation of String operations.

7 Implementation of Simple functions and different ways of passing arguments to functions and Recursive Functions.

8 Implementation of Pointers

9 Implementation of structures and Union.

10 Implementation of Bit Fields, Typedef and Enumeration.

11 Implementation of Preprocessor directives.

12 Implementation of File operations.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	-	2	2	_	_	_	_	_	-	1	-	-	
CO2	1	3	-	3	3	_	_	_	-	_	-	2	3	-	
CO3	1	3	-	2	3	_	_	2	-	_	-	2	-	1	
CO4	1	3	-	3	3	_	_	2	-	_	-	2	2	-	
CO5	1	3	-	2	3	_	_	2	-	_	-	2	-	1	

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Slightly mapped as problem analysis is necessary for solving and developing any application using C programming.
	PO2	3	Strongly mapped students can gain knowledge to apply C programming principles in software design process, the students will be able to analyze complex engineering problems in the domain of software development with better effectiveness.
	PO4	2	Strongly mapped for the problem statement, design experiment and interpretation of data for complex problems.
	PO5	2	Strongly mapped for the problem statement solution using appropriate techniques.
	PO12	1	Moderately mapped as the students can apply the basic concepts of C programming in new technology developments.
CO2	PO1	1	Moderately mapped to know the structure and logics for developing the engineering problems with the use of object C programming features.
	PO2	3	Strongly mapped as the essential features is necessary for the programming methods to solve C Programming features like array of structures.
	PO4	3	Strongly mapped for the problem statement, design experiment and interpretation of data for complex problems using structures.
	PO5	3	Strongly mapped for the problem statement solution using appropriate techniques for handling structures and nested structures.
	PO12	2	Moderately mapped for the usage structure in life-long learning.
	PSO1	3	Strongly the students will be able to build a strong foundation for C programming language to develop quality product for business success.
CO3	PO1	1	Moderately mapped to know the logics of functions for developing the engineering problems with the use of object C programming features.

	PO2	3	Strongly mapped as the essential features is necessary for the programming methods to solve C Programming features like passing arrays and structures to functions
	PO4	2	Strongly mapped for the problem statement, design experiment and interpretation of data for complex problems using structures.
	PO5	3	Strongly mapped for the problem statement solution using appropriate techniques for handling pointers.
	PO8	2	Moderate usage of tools for handling functionsin the field of computer science and engineering.
	PO12	2	Moderately mapped for the usage functions in life-long learning.
	PSO2	1	Strongly the students will be able to build a strong foundation C programming language to develop the ability to identify, analyze and design solutions for complex engineering problems.
CO4	PO1	1	Moderately mapped to know the logics of structure for developing the engineering problems with the use of C programming features.
	PO2	3	Strongly mapped as the essential features is necessary for the programming methods to solve C Programming features like array of structures
	PO4	3	Strongly mapped for the problem statement, design experiment and interpretation of data for complex problems using structures.
	PO5	3	Strongly mapped for the problem statement solution using appropriate techniques for handling structures and nested structures.
	PO8	2	Moderate usage of tools for handling structures and unionin the field of computer science and engineering.
	PO12	2	Moderately mapped for the usage structures in life-long learning.
	PSO1	2	Strongly the students will be able to build a strong foundation for C programming language to develop quality product using nested structures for business success.
CO5	PO1	1	Moderately mapped to know the logics of sequential file for developing the engineering problems with the use of C programming features.
	PO2	3	Strongly mapped as the essential features is necessary for the programming methods to solve C Programming features like reading and writing integer and text data to the file
	PO4	2	Strongly mapped for the problem statement, design experiment and interpretation of data for complex problems using binary files.
	PO5	3	Strongly mapped for the problem statement solution using appropriate techniques for handling random access files.
	PO8	2	Moderate usage of tools for handling filesin the field of computer science and engineering.
	PO12	2	Moderately mapped for the usage different types of files in life-long learning.
	PSO2	1	Strongly the students will be able to build a strong foundation C programming language to develop the ability to identify, analyze and design solutions for complex engineering problems related to random files.

K.S.Rangasamy College of Technology – Autonomous R 2018

50 MA 004 - Partial Differential Equations, Linear Algebra and Numerical Methods

BE-Electronics and Communication Engineering

Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	50	50	100

Objective(s)

- To develop the mathematical skills for solving partial differential equations.
- To introduce the concepts of linear algebra in the fields of communication systems and signal processing.
- To describe the concepts of solving system of equations and first order linear differential equations.
- To handle large datasets using interpolation
- To solve initial value problems of ordinary differential equations numerically.

Course Outcomes

At the end of the course the students will be able to

CO1: Construct partial differential equations and find the solutions of non-linear partial differential equations of first and higher orders.

CO2: Describe the concepts of linear transformation and vectors spaces.

CO3: Apply the different techniques for solving an algebraic and transcendental equations and the system of linear equations.

CO4: Compute intermediate values from a set of tabular values by using interpolation techniques and apply different integration techniques to evaluate the definite integrals.

CO5: Compute the point wise solutions for first order initial value problems using single and multi step methods.

The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the numbers hours indicated.

Partial Differential Equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Non-linear partial differential equations of first order (Type I – IV) – Solution of partial differential equations of first order – Lagrange's linear equations – Linear partial differential equations with constant coefficients. [9]

Linear Algebra

Row reduction and Echelon forms – Vector equations – Linear combinations of vectors – Linear independence - Introduction to linear transformation – Matrix of a linear transformation – Transformation from R^n to R^m– Vector spaces and subspaces – Null spaces – Row and column spaces – basis and dimension of vector spaces – rank-nullity theorem. [11]

Solution of Equations and Eigen Value Problems

Linear interpolation methods (method of false position) – Newton-Raphson method – Horner's method – Graeffe's root squaring method – Solution of linear system by Gaussian elimination and Gauss-Jordan methods – inverse of a matrix by Gauss Jordan method– Iterative methods: Gauss-Jacobi and Gauss-Seidel methods – Eigen value of a matrix by power method. [9]

Interpolation and Integration

Lagrangian polynomials – Divided differences – Newton's forward and backward difference formulae – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and three point Gaussian quadrature formulae – Double integrals using Trapezoidal and Simpson's rules. [10]

Initial Value Problems for Ordinary Differential Equations

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first order equations – Multistep methods: Milne's and Adam's predictor and corrector methods. [6]

Total Hours: 45 + 15(Tutorial) = 60

Text book(s):

1	David C. Lay, 'Linear Algebra and its Applications', Pearson Education, 5th Edition, 2014.
2	P Kandasamy,KThilagavathy and K Gunavathi, 'Numerical Methods', S.Chand& Company Ltd, 3rd Edition , 2003.

Reference(s):	
1	E. Kreyszig, 'Advanced Engineering Mathematics', John Wiley and Sons (Asia) Limited, Ninth (Reprint), 2012.
2	Howard Anton and Chris Rorres, 'Elementary Linear Algebra', John Wiley & Sons, 10^{th} Edition, 2010.
3	Gilbert Strang, 'Linear Algebra and Its Applications', Brooks/Cole/Cengage, 4^{th} Edition, 2006.
4	C.F. Gerald and P.O. Wheatley, 'Applied Numerical Analysis', Pearson Education (Asia), 7^{th} Edition, 2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	2							2	3		
CO2	3	3	3	3	2							2	3		
CO3	3	3	2	3	2							2	3		
CO4	3	3	2	3	2							2	3		
CO5	3	3	2	3	2							2	3		

COs	POs/PSOs	Level	Justification
CO1	PO1	3	The partial differential can be used to solve a complex engineering problems.
	PO2	3	The concept of partial differential will help to enrich the analysis of Engineering problems
	PO3	3	Considering environmental and societal requirements, the solutions of complex engineering problems can be developed by applying the concept of partial differential.
	PO4	3	The concept of partial differential can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate technique related to partial differential can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to partial differential to find the better solutions to complex engineering problems
	PSO1	3	The principles of partial differential will help to provide the conclusion for the problems involving in communication engineering,
CO2	PO1	3	The principles of linear algebra can be used to solve a complex engineering problem.
	PO2	3	The concepts of linear algebra can be used to formulate and analyse the complex engineering problems
	PO3	3	Considering environmental and societal requirements, the solutions of complex engineering problems can be developed by applying the concepts algebra.
	PO4	3	The concept of linear algebra can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate techniques related to algebra can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to algebra to find the better solutions of complex engineering problems
	PSO1	3	The principles of algebra will help to provide the conclusion for the problems involving in communication engineering.
CO3	PO1	3	The concepts of system of equations can be applied to simplify problems with high complexity in Engineering.
	PO2	3	The concepts of system of equations can be used to formulate and analyse various complex engineering problems
	PO3	3	System of equations will help to design solutions to various Engineering problems

	PO4	3	The concept of system of equations can be used to interpret the data to provide valid solutions in engineering problems.
	PO5	2	Appropriate techniques related to system of equations can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to system of equations to find the better solutions to complex engineering problems
	PSO1	3	The concept of system of equations allows to study about systems involving communication engineering.
CO4	PO1	3	The concepts of Numerical differentiation and integration can be used to solve various complex problems.
	PO2	3	The knowledge about Numerical differentiation and integration can be used to formulate and analyse various complex engineering problems.
	PO3	3	Numerical differentiation and integration will help to design solutions for various Engineering problems
	PO4	3	Numerical differentiation and integration can be used to interpret the data to provide valid solutions in engineering problems.
	PO5	2	Appropriate techniques related to Numerical differentiation and integration can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to Numerical differentiation and integration to find the better solutions of complex engineering problems.
	PSO1	3	The concept of a Numerical differentiation and integration allows to study about systems involving complex engineering problems.
CO5	PO1	3	Apply the fundamental concepts of Numerical methods of initial value problem to find the solutions of complex engineering problems.
	PO2	3	Identify and formulate the suitable techniques to analyse the given numerical equations related to complex engineering problems.
	PO3	3	It helps to develop the solutions of complex problems by considering societal considerations.
	PO4	3	Conduct the detailed literature survey on existing techniques by understanding the concepts of Numerical equations.
	PO5	2	Appropriate Numerical techniques can be applied to complex engineering problems.
	PO12	2	Develop new concepts related to numerical algorithms to find the better solutions of complex engineering problems
	PSO1	3	The concepts of Numerical methods of initial value problem allows to study about the day to life problems in electronics and communication engineering.

<table>
<tr><th colspan="9">K.S. Rangasamy College of Technology – Autonomous R2018</th></tr>
<tr><th colspan="9">50 CS 002 –Data Structures</th></tr>
<tr><th colspan="9">Common to CS,IT,EE,EC</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>III</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To choose the appropriate data structure for a specified application
To design and implement abstract data types such as linked list, stack, queue and trees
To demonstrate various sorting, searching and graph algorithms
To Learn and implement the hashing techniques
To design a Priority Queue ADT and its applications</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Express the concept of Linear data structures, applications and its implementations
CO2: Appraise the knowledge of Tress with its operations
CO3: Recognize the concept of Sorting ,Searching and its types
CO4: Review various implementations and operations of Priority Queue and Hashing Techniques
CO5: Apply Shortest Path and Minimum Spanning Tree algorithms and Biconnectivity</td></tr>
</table>

CHAIRMAN BOARD OF STUDIES
Department of ECE
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

Note: Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

Lists, Stacks And Queues
Abstract Data Type (ADT) – The List ADT – The Stack ADT – The Queue ADT [12]

Suggested Activities:
Converting an algorithm from recursive to non-recursive using stack.
Demonstrating stack for Towers of Hanoi application.
Developing any application (student's choice) using all the linear data structures.
Suggested Evaluation Methods:
Tutorials on applications of linear data structures.
Checking output of programs implemented.

Trees
Preliminaries – Binary Trees – The Search Tree ADT – Binary Search Trees – AVL Trees – Tree Traversals – B – Trees –B+Trees. [9]
Suggested Activities:
Implementing binary tree and tree traversals.
Solving expressions using expression trees by determining infix, prefix and postfix expressions.
Developing any application using trees.
Suggested Evaluation Methods:
Tutorials on trees
Check output of programs implemented.
Quiz on various topics of the unit.

Sorting and Searching
Preliminaries – Insertion Sort – Shellsort – Heapsort – Mergesort – Quicksort – External Sorting –Searching: Sequential search- Binary Search –Hashed list searches [7]
Suggested Activities:
External learning - External sorting implementation.
Implementation of all sorting techniques in C language.
Demonstration of searching techniques under best and worst case inputs.
Suggested Evaluation Methods:
Tutorials on external sorting.
Checking output of programs implemented

Hashing and Priority Queues (Heaps)
Hashing – Hash Function – Separate chaining – Open addressing – Rehashing – Extendible hashing – Priority Queues (Heaps) – Model – Simple Implementations – Binary Heap – Applications of Priority Queues – d –Heaps. [7]
Suggested Activities:
Implementation of Hashing
Implementation of simple applications of Priority queue
Suggested Evaluation Methods:
Tutorials on hashing
Check output of programs implemented.
Quiz on various topics of the module.

Graphs
Definitions – Topological Sort – Shortest-Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm, Kruskal's Algorithm – Applications of Depth-First Search – Undirected Graphs – Biconnectivity. [10]
Suggested Activities:
Implementation of various shortest path algorithms

Implementation of Minimum Spanning Tree **Suggested Evaluation Methods:** Tutorials on various topic of the module Check output of programs implemented. Quiz on various topics of the module.
Total Hours: 45

Text book:	
1.	M. A. Weiss, 'Data Structures and Algorithm Analysis in C', 2nd Edition, Pearson Education Asia.2008
2.	Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, 'Data Structures using C', Pearson Education Asia, 2009
Reference(s) :	
1.	Rajesh K.Sukla,' Data structure using C & C++', Wiley India,2012
2	A. Tannenbaum, 'Data Structure Using C', Pearson Education, 2003.
3	Goodrich &Tamassia, 'Data Structures and Algorithms in C++', 2nd Edition, JohnWiley & Sons, 2011
4	Reema Thareja, 'Data Structures Using C', 2nd Edition, Oxford Higher Education, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	2									2		3	
CO2	1	3	2	2								2		3	
CO3	1	3	2	2	2					2		2		3	
CO4	1	3	2	2	3					2		2		3	
CO5	1	3	2		2		2			2		2		3	

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Slightly the student having the fundamental concept of data structures to provide the solutions of linear data structures and its applications
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various aspects of linear Data Structures and its applications.
	PO3	2	Moderately the student using the knowledge of linear Data Structures concepts, we can design and develop solutions for complex engineering problems
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of linear Data Structures
	PSO2	3	Strongly the student will know the need of linear data structures and its applications for data analytic models
CO2	PO1	1	Slightly the student having the knowledge of mathematics Engineering fundamentals to the solutions of tree data structure and its operations
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various operations of Tree data structure.
	PO3	2	Moderately the student using the knowledge of tree data Structures concepts, we can design and develop solutions for complex engineering problems
	PO4	2	Moderately the student using the Knowledge of tree data structures can be used to conduct experiments in real life problems to provide valid conclusions
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of tree data structure
	PSO2	3	Strongly the student will know the need of tree data structure and its operations for data analytic models
CO3	PO1	1	Slightly the student having the knowledge of mathematics Engineering fundamentals to the solutions Sorting and Searching Techniques
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various types of

			Sorting and Searching techniques.
	PO3	2	Moderately the student using the knowledge of sorting and searching techniques, we can design and develop solutions for complex engineering problems
	PO4	2	Moderately the student using the Knowledge of sorting and searching techniques can be used to conduct experiments in real life problems to provide valid conclusions
	PO5	2	Moderately the student using the Knowledge of sorting and searching techniques by applying tools and techniques
	PO10	2	Moderately the student can communicate effectively with proper documentation in sorting and searching techniques
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of sorting and searching techniques
	PSO2	3	Strongly the student will know the need of sorting and searching techniques for data analytic models
CO4	PO1	1	Slightly the student having the knowledge of mathematics Engineering fundamentals to the solutions for the concept of Hashing and priority queues
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various aspects of Hashing and priority queues
	PO3	2	Moderately the student using the knowledge of Hashing and priority queues, we can design and develop solutions for complex engineering problems
	PO4	2	Moderately the student using the Knowledge of Hashing and priority queues can be used to conduct experiments in real life problems to provide valid conclusions
	PO5	3	Strongly the student using the Knowledge of priority queues and Hashing techniques by applying tools and techniques
	PO10	2	Moderately the student can communicate effectively with proper documentation in priority queues and Hashing techniques
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of priority queues and Hashing techniques
	PSO2	3	Strongly the student will know the need of priority queues and Hashing techniques for data analytic models
CO5	PO1	1	Slightly the student having the knowledge of mathematics Engineering fundamentals to the solutions for the concept of shortest path algorithms and minimum spanning tree ,Biconnectivity algorithms
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various aspects of shortest path algorithms and minimum spanning tree ,Biconnectivity algorithms
	PO3	2	Moderately the student using the knowledge of shortest path algorithms and minimum spanning tree, Biconnectivity algorithms, we can design and develop solutions for complex engineering problems
	PO5	2	Moderately the student using the Knowledge of shortest path algorithms and minimum spanning tree, Biconnectivity algorithms by applying tools and techniques
	PO7	2	Moderately the student having the knowledge of shortest path algorithms and minimum spanning tree, Biconnectivity algorithms to provide solutions for societal contexts
	PO10	2	Moderately the student can communicate effectively with proper documentation in shortest path algorithms and minimum spanning tree, Biconnectivity algorithms
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of shortest path algorithms and minimum spanning tree, Biconnectivity algorithms
	PSO2	3	Strongly the student will know the need of shortest path algorithms and minimum spanning tree, Biconnectivity algorithms for data analytic models

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100

Objective(s)

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Amplifiers
- To understand the operation of power amplifiers and the effect of negative feedback on amplifier circuits
- To reinforce theory and techniques taught in the classrooms through experiments and projects in laboratory

Course Outcomes

At the end of the course, the students will be able to

CO1: Describe the construction, working and characteristics of BJT & FET

CO2: Design and analyze transistor biasing circuits & single stage amplifiers

CO3: Discuss the low and high frequency analysis of BJT & FET amplifiers

CO4: Describe the concepts and characteristics of negative feedback amplifiers and power amplifiers

CO5: Paraphrase the construction, working and characteristics of special semiconductor devices and their applications

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Transistors

Introduction – operation of NPN and PNP transistors – BJT voltages and currents - Input and Output characteristics of CE, CB and CC configurations - Construction and Operation of n- channel and p- channel JFET –Drain and Transfer characteristics - JFET parameters , MOSFET C-V characteristics, Transistor applications. [9]

Biasing & Small Signal Analysis of Amplifiers

Biasing – Different types of BJT& FET biasing – bias stability– CE, CB and CC amplifiers -Small signal analysis of a transistor amplifier using complete h - parameter model, low frequency model of FET – CS, CG and CD amplifiers.

[9]

Frequency Response of Amplifiers

Low frequency analysis of amplifiers - Hybrid – π equivalent circuit of BJT – Miller effect capacitance – High frequency analysis of BJT amplifiers– High frequency equivalent circuit of FET – High frequency analysis of FET amplifiers.

[9]

Feedback & Power Amplifiers

Topological classification : Voltage series, Voltage shunt, Current series, Current shunt - Effect of feedback on gain, stability, distortion, bandwidth, input and output impedances – Practical feedback amplifier circuits and their analysis – Power amplifiers(Class A & B) – Calculation of power output, efficiency and power dissipation– Crossover distortion and its elimination.

[9]

Special Semiconductor Devices

Varactor diode, Tunnel diode, Schottky barrier diode, Photodiode, phototransistor, Photoconductive cell, photovoltaic cell, UJT, SCR, TRIAC, DIAC, LASER diode, LED, LCD, Metal -Semiconductor Junction- MESFET.

[9]

Total Hours: 45

Text book(s):

1	David A. Bell, ‘Electronic Devices and Circuits ‘, 5th Edition, Oxford University press, 2017.
2	Robert L. Boylestad, Louis Nashelsky, ‘Electronic Devices and circuit theory’, Pearson Education, 11th Edition, 2015.

Reference(s):

1	Anil K. Maini, Varsha Agrawal, ‘Electronics Devices and Circuits’, Wiley India Pvt.Ltd, 2018.
2	Ben G. Streetman and Sanjay Banerjee, ‘Solid State Electronic Devices’, 7th Edition, Pearson Education, 2015.
3	S.Salivahanan, N.Sureshkumar, ‘Electronic Devices and circuits’, 4th Edition, McGraw Hill, 2016.
4	Jacob Millman, Christos C.Halkias, ‘Electronic Devices and Circuits’,4thEdition,Tata McGraw Hill

	Publishing Limited, 2015.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	2	
CO2	3	3	3	2	3			3	3	3		3	3	3	3
CO3	3	3	2	2									2	2	
CO4	3	3	3	2	3								3	3	
CO5	3	2	3	2				3	3	3		3	3	2	3

COs	POs/ PSOs	Level	Justification
CO1	PO1	3	Knowledge in mathematics is required to understand the basics operation of semiconductor devices
	PO2	3	Apply the knowledge to analyse the characteristics of transistors under various voltage and current levels
	PO3	3	Understands the working of different devices considering environmental and societal requirements
	PO4	3	Identify and analyse the problems in the operation of semiconductor devices and provide a valid solution
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge
	PSO2	2	Design the electronic circuits by considering industrial and societal requirements
CO2	PO1	3	Knowledge in mathematics is required to analyze& design electronic circuits
	PO2	3	Able to analyze electronic circuits formed of discrete components.
	PO3	3	Design electronic circuits considering environmental and societal requirements
	PO4	2	Identify and analyse complex electronic circuit problems and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on electronic circuits
	PO8	3	Apply ethical responsibilities in developing the electronic systems
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	3	Able to solve the problems related to electronic circuits
	PSO2	3	Knowledge in electronic circuit design can be used for research studies related to electronic circuits
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of electronic products
CO3	PO1	3	Knowledge in mathematics is required for low& high frequency analysis of electronic circuits
	PO2	3	Able to analyze complex low& high frequency equivalent circuits
	PO3	2	Develop the amplifiers considering environmental and societal requirements
	PO4	2	Identify and analyse the complex electronic problems and provide a valid solution
	PSO1	2	Able to design & develop amplifier circuits by applying basic engineering knowledge

	PSO2	2	Knowledge in frequency analysis can be used for research studies related to electronic circuits
CO4	PO1	3	Knowledge in mathematics is required to analyze& design various electronic amplifiers
	PO2	3	Analyze and design various complex electronic amplifier circuits
	PO3	3	Develop the feedback and power amplifiers considering environmental and societal requirements
	PO4	2	Identify and analyse the complex electronic problems and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on different amplifier circuits
	PSO1	3	Able to design & develop electronic amplifier circuits
	PSO2	3	Knowledge in analysis and design of various electronic amplifier circuits can be used for research studies related to electronic circuits
CO5	PO1	3	Knowledge in mathematics is required to understand the operation of various semiconductor devices
	PO2	2	Apply the engineering knowledge to analyse the performance of different semiconductor devices
	PO3	3	Design electronic systemsthat meet the specified needs with appropriate consideration for the public health and safety.
	PO4	2	Identify and analyse the complex electronic problems and provide a valid solution
	PO8	3	Apply ethical responsibilities to develop the electronic systems
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering the technological changes
	PSO1	3	Able to design & develop electronic circuits for solving complex problems
	PSO2	2	Design and develop products considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 302 - Digital Logic Design</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>III</td><td>2</td><td>1</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To introduce number systems and codes, basic postulates of Boolean algebra and show the correlation between Boolean expressions.
• To design and analyse combinational circuits
• To study the concept of sequential circuits.
• To introduce the concept of HDL
• Reinforce theory and techniques taught in the classroom through experiments and projects in laboratory</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Explain the fundamentals of numbering system and apply Boolean algebra to design digital systems
CO2: Design and analyze combinational circuits and semiconductor memories
CO3: Design and analyze synchronous sequential logic circuits
CO4: Analyse the asynchronous sequential circuits.
CO5: Deign and verify the digital circuits using HDL.</td></tr>
<tr><td colspan="9">Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.</td></tr>
</table>

Digital Fundamentals

Review of Number Systems- representation-conversions–error detection and error correction – Boolean postulates and laws – De-Morgan's Theorem - Logic Gates- Minimization of Boolean expressions – Sum of Products (SOP) – Product of Sums (POS)- Canonical forms –– Karnaugh map Minimization –Implementation of Boolean expressions using universal gates. [9]

Combinational Circuits

Combinational logic circuits-adders, sub tractors, BCD adder, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions-using multiplexers. Memories –ROM-organization, expansion. PROMs. Types of RAMs –Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs. [9]

Sequential Circuits

Flip flops SR, JK, T, D and Master slave – Characteristic table and equation – Application table – Edge triggering – Level Triggering –Ripple counters – Synchronous counters –Modulo – n counter– Design of Synchronous FSM – Analysis of clocked sequential circuits: state equation – State table – State diagram – State reduction & assignment – Register : shift registers – Universal shift register– Shift counters.

[9]

Asynchronous Sequential Circuits

Analysis procedure – Transition table – Flow table – Race conditions –Design of fundamental mode circuits – Primitive flow table – Reduction of state and flow table – Race free state assignment – Hazards –Overview and comparison of logic families

[9]

Introduction To HDL

Design flow of VLSI, Different modelling styles in Verilog HDL, Structural, Dataflow and behavioural modelling of combinational and sequential logic circuits [9]

Total Hours: 30+15(Tutorial) = 45

Text book(s):

1	M. Morris Mano, Michael D. Ciletti, 'Digital Design', 5th Edition, Pearson Education, New Delhi, 2016.
2	Samir Palnitkar, 'Verilog HDL – A Guide to Digital Design and Synthesis', 2nd Edition, Pearson Education, 2016.

Reference(s):

1	Anand Kumar, 'Fundamentals of Digital Circuits', 4th Edition, Prentice Hall, 2016.
2	Donald P.Leach and Albert Paul Malvino, GoutamSaha, 'Digital Principles and Applications', 8th Edition, Tata McGraw-Hill, New Delhi, 2016.
3	S. Salivahanan and S. Arivazhagan, 'Digital Circuits and Design',5thEdition, Oxford University press, 2018.
4	John F.Wakerly, 'Digital Design: principles and practices', 5th Edition, Pearson Education, 2018.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2								2	2	
CO2	3	3	3	2	3			3	3	3		3	2	3	3
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3								3	3	
CO5	2	2	3	2	3								3	3	

COs	POs/PSOs	Level	Justification
	PO1	3	Apply Boolean laws to design digital systems
	PO2	3	Apply the knowledge to analyse the given problem to design the digital systems
	PO3	3	Design the Digital system components considering environmental and societal requirements

CO1	PO4	2	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	2	Apply the relevant simulators to perform the complex investigations
	PSO1	2	Perform the signal processing by applying basic engineering knowledge
	PSO2	2	Design the Digital system components considering industrial and societal requirements
CO2	PO1	3	Apply the Boolean laws for design of various Combinational circuits
	PO2	3	Apply the knowledge to analyse the Boolean Laws to design Different combinational circuits
	PO3	3	Design the reliable semiconductor memory circuits considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing combinational circuits and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on combinational circuits.
	PO8	3	Apply ethical responsibilities to develop the different semiconductor memories implementing different combinational circuits ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like project presentation etc.
	PO12	3	Develop interest in building more reliable digital system considering wider technological changes
	PSO1	2	Perform the different usage of Boolean laws techniques by applying basic engineering knowledge
	PSO2	3	Design the reliable digital system modules considering different environmental conditions
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. By acquiring essential interpersonal skills
CO3	PO1	3	Apply the digital techniques for different sequential circuits
	PO2	3	Apply the knowledge to analyse the given problem to design the sequential circuits
	PO3	3	Develop the digital system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing design techniques and identify the problems for further investigations
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on sequential circuits
	PO8	3	Apply ethical principles to compare sequential circuits techniques ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable digital sequential circuits techniques considering wider technological changes
	PSO1	3	Compare the various digital techniques by applying basic engineering knowledge
	PSO2	3	Design the digital system components considering Digital electronics industrial requirements

	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. By acquiring essential interpersonal skills
CO4	PO1	3	Apply the different techniques for Analyse the asynchronous sequential circuits.
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the asynchronous sequential circuits.
	PO3	3	Develop the Digital systems schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to study the performance of different techniques
	PSO1	3	Measure the analysis of asynchronous sequential circuitsby applying basic engineering knowledge
	PSO2	3	Develop the digital system components considering industrial and societal requirements
CO5	PO1	2	Apply the fundamental concepts of Deign and verify the digital circuits using HDL
	PO2	2	Apply the engineering knowledge to analyse the Deign and verify the digital circuits using HDL
	PO3	3	Develop the algorithms for analysis of asynchronous sequential circuits
	PO4	2	Conduct the detailed literature survey on analysis of asynchronous sequential circuits
	PO5	3	Apply the relevant simulators to perform the analysis of asynchronous sequential circuits
	PSO1	3	Apply analysis of asynchronous sequential circuits for solving complex problems
	PSO2	3	Design the digital system components considering industrial and societal requirements

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 303 - Network Theory</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td>Total</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>hrs</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>III</td><td>3</td><td>1</td><td>0</td><td>60</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To analyze any given electrical network by applying circuit analysis techniques
• To calculate the response of electric networks using network theorems
• To determine the response of two port networks and its equivalents
• To analyze the characteristics of filters and the frequency response of resonant circuits
• To analyze the transient behavior series RL, RC and RLC circuits with DC and AC inputs</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Apply the basic laws to analyse the electric circuits using circuit analysis techniques.
CO2: Apply network theorems to reduce complicated circuits and find the response of electric circuits.
CO3: Analyse two port circuit behavior in terms of Z, Y, h and ABCD parameters and interrelate them.
CO4: Analyze different types of filters and the frequency response of electric circuits under resonance.
CO5: Apply Laplace Transform for steady state and transient analysis of RC, RL, and RLC networks.</td></tr>
</table>

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.
Circuit Analysis Node and Mesh Analysis for DC and AC circuits, matrix approach of network containing voltage and current sources, source transformation, star delta transformations and duality, simulation examples. [9] **Network Theorems** Superposition, Thevenin's, Norton's, and Maximum power Transfer theorems as applied to DC and AC. Circuits, simulation examples. [9] **Two Port Networks** Analysis of two port networks: Network parameters - Impedance, admittance, transmission and hybrid, Conversion formulae. Equivalents of T, π Ladder, bridged T and Lattice networks. [9] **Filters and Resonance** Introduction to filters, classification, filter networks, equations, pass band stop band, characteristic impedance and types of low pass, high pass, band pass and band reject filters. Behavior of series and parallel resonant circuits, frequency response, quality factor and bandwidth. [9] **Transients** Transient analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions for DC & AC inputs, State equations for networks. [9]
Total Hours: 45+15(Tutorial) = 60

Text book(s):	
1	Sudhakar A and Shyammohan S Pali, 'Circuits and Networks', 5th Edition, Tata McGraw Hill, 2015.
2	Ravish R Singh, 'Network Analysis and Synthesis', 2nd Edition, McGraw Hill Education Pvt Limited, 2019.
Reference(s):	
1	Mahmood Nahvi and Joseph Edminister, 'Electric Circuits', 6th Edition, Schaum's Outline series, Tata McGraw-Hill, 2014.
2	William H Hayt& Jack E Kemmerly, 'Engineering Circuit Analysis', 8th Edition, McGraw Hill Education, 2013.
3	Franklin F. Kuo, 'Network Analysis and Synthesis', 5th Edition, Wiley International, 2012.
4	John D Ryder, 'Networks, Lines and Fields', 2nd Edition, Pearson Education, 2015.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2								3	3	
CO2	3	3	3	2	2								3	3	
CO3	3	3	3	2									3	3	
CO4	3	3	3	2									3	3	
CO5	3	3	3	2	2								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply mesh and nodal analysis in different circuit.
	PO2	3	Apply the mesh and nodal analysis both AC and DC circuits.
	PO3	3	Design the circuit the accordance with constraint using source transformation.
	PO4	2	Simulate and verify the mesh and nodal analysis for different configuration.

	PO5	2	Using Modern tool and simulate the Mesh and nodal analysis for both AC and DC circuits.
	PSO1	3	Perform the distributed real time Circuits by applying basic engineering knowledge
	PSO2	3	Design the standard Electronic components considering industrial and societal requirements
CO2	PO1	3	Apply the applications of Superposition theorem for various circuit analyses.
	PO2	3	Design and simulate and analysis the various circuit analysis.
	PO3	3	Design the formal methods in system specification Network analysis considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on case study like Requirements and performance analysis techniques and identify the problems
	PO5	2	Using Modern tool and simulate the and verify the network theorems
	PSO1	3	Perform the real time analysis applying basic engineering knowledge
	PSO2	3	Design the reliable Electronic network modules considering different environmental conditions
CO3	PO1	3	Apply concept of two port network in engineering problems.
	PO2	3	Formulate the two port networking concept to solve the engineering problems.
	PO3	3	Design multiport network to establish the continuity between them by considering public safety
	PO4	2	Conduct experiment interpretation of data between the ports to ensure the result
	PSO1	3	Perform the two port network by applying basic engineering knowledge
	PSO2	3	Design two port network with suitable system components considering industrial and societal requirements
CO4	PO1	3	Apply the knowledge of resonance at various condition in engineering problems.
	PO2	3	Formulate types of filters to solve the engineering problems.
	PO3	3	Design frequency response circuit to establish the resonance by considering public safety
	PO4	2	Literature and reviewing the various processor and identify the possibility filtering system development to address the solution of society
	PSO1	3	Compare the various filter and resonance circuits by applying basic engineering knowledge
	PSO2	3	Design the resonance system components considering electronics industrial requirements
CO5	PO1	3	Apply Laplace Transform for steady state and transient state knowledge in engineering problems.
	PO2	3	Literature R, L and C combined transient circuit to develop the quick response circuit.
	PO3	3	Design steady state response circuit to establish the resonance by considering public safety
	PO4	2	Literature type of transient circuit to identify fast response system to address the solution for industry.
	PO5	2	Using Modern tool and simulate the and verify the response of the circuit in R,L and C combination
	PSO1	3	Perform the steady state response by applying basic engineering knowledge
	PSO2	3	Design R,L C combined system components considering industrial and societal requirements

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MY 002 - Environmental Science								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	2	0	0	30	0	100	00	100
Course Objectives	• To help the learners to analyze the importance of environment, ecosystem and biodiversity.							

- To familiarize the learners with the impacts of pollution and control.
- To enlighten the learners about waste and disaster management.
- To endow with an overview of food resources and human health.
- To enlighten awareness and recognize the social responsibility in environmental issues.

Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognize the concepts and importance of environment, ecosystem and biodiversity. CO2: Analyze the source, effects, and control measures of pollution. CO3: Enlighten of solid waste and disaster management. CO4: Alertness about food resources, population and health issues. CO5: Analyze the social issues and civic responsibilities.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Environmental Studies, Ecosystem and Biodiversity

Environmental studies - Scope and multidisciplinary nature - Need for public awareness - Ecosystem - Structure and function. Biodiversity - Values of biodiversity - Endangered and endemic species - Hot spots - India a mega biodiversity nation - Threats - Conservation - In-situ and ex-situ - Case studies. [6]

Environmental Pollution

Pollution - Air, water, soil, noise and nuclear - sources, effects and control measures - Impacts of mining - Environment protection act- Case studies. [6]

Waste and Disaster Management

Waste - Solid waste - e-waste - sources, effects and control measures. Disaster management - Earth quakes - Landslides - Floods - Cyclones - Tsunami - Disaster preparedness - Case studies. [5]

Food Resources, Human Population and Health

World food problems - over grazing and desertification - effects of modern agriculture. Population - Population explosion and its impacts - HIV/AIDS - Cancer- Role of IT in environment and human health - Case studies. [6]

Social Issues and The Environment

Unsustainable to sustainable development - Use of alternate energy sources - Rain water harvesting - Water shed management - Deforestation - Green house effect - Global warming - Climate change - Acid rain - Ozone layer depletion - Waste land reclamation. Consumerism and waste products - Role of an individual in conservation of natural resources - Case studies. [7]

Total Hours:30

Text book:

1.	AnubhaKaushik and C P Kaushik, ‘Perspectives in Environmental Studies ‘ , New Age International Publishers, New Delhi, 6th Edition , January 2018.
2.	Tyler Miller. G, ‘Environmental Science’, Cengage Publications, Delhi, 16th Edition, 2018

Reference(s):

1.	Gilbert M.Masters and Wendell P. Ela, ‘Environmental Engineering and Science’, Phi learning private limited, New Delhi, 3rdEdition, 2013.
2.	Rajagopalan. R, ‘Environmental Studies’, Oxford University Press, New Delhi, 3rd Edition, 2016.
3.	Deeksha Dave and Katewa. S.S, ‘Environmental Studies’, 2ndEdition, Cengage Publications, Delhi, 2013.
4.	Cunningham, W.P. and Saigo, B.W.,‘Environment Science’, Mcgraw-Hill, USA. 9th Edition, 2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2			2	3	3	3	3		2	2	2	3
CO2	3	3	3	3	2	3	3	3	3	3	2	2	3	3	3
CO3	3	3	3	3	2	3	3	3	3	3	2	2		2	3
CO4	2	2	2	3	3	3	3	3	2	2	3	2	3	3	3

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CO5	3	3	3	3	3	3	3	3	3	3	3	2	2	2	3

COs	POs/PSOs	Level	Justification
CO1	PO1	2	Mapped moderately as the students apply their knowledge in conservation of biodiversity
	PO3	2	Mapped moderately, as the students will be able to design the methods to protect endangered species.
	PO6	2	Mapped moderately as the students will develop new ideas to assess the legal issues of ecosystem
	PO7	3	Mapped strongly as the students understand the solution and gain information about sustainable development.
	PO8	3	Mapped strongly as the students recognize the responsibilities and apply ethical principles to various ecosystem.
	PO9	3	Mapped strongly as the students can function effectively as a team or individual to protect the environment.
	PO10	3	Mapped strongly as the students achieve the ability to write effective reports about the environment.
	PO12	2	Mapped moderately as the students gain information about ecosystem and environment throughout life long process.
	PSO1	2	Mapped moderately as the students can solve ecosystem issues using signal processing.
	PSO2	2	Mapped moderately as the students can design the methods for conservation of biodiversity
	PSO3	3	Mapped strongly as the students can develop skill to solve the threats in environment.
CO2	PO1	3	Mapped strongly as the students apply their knowledge in effective manner to control pollution.
	PO2	3	mapped strongly as the students are able to identify the sources of types of pollution
	PO3	3	Mapped strongly as the students gain the knowledge to develop the procedure for control the pollution
	PO4	3	Mapped strongly as the students gain the capacity to investigate the impacts of nuclear pollution.
	PO5	2	Mapped moderately as the students are able to apply the appropriate techniques for pollution control in all aspects.
	PO6	3	Mapped moderately as the students are capacity find out the reason for pollution.
	PO7	3	Mapped strongly as the students attain ability to recognize the impacts of biodiversity.
	PO8	3	Mapped strongly as the students gain the skill to apply the ethical principles to conserve biodiversity.
	PO9	3	Mapped moderately as the students are able to function effectively to identify the major polluting industries.
	PO10	3	Mapped moderately as the students gain the knowledge to design the documentation on impacts of wildlife conservation Act.
	PO11	2	Mapped moderately as the students gain the ability to frame the project related to pollution.
	PO12	2	Mapped moderately as the students make use of the lifelong learning process in causes and impacts of pollution Act.
	PSO1	3	Mapped strongly as the students can solve pollution related issues using signal communication.
	PSO2	3	Mapped strongly as the students can design material for pollution control
	PSO3	3	Mapped strongly as the students develop essential interpersonal skills to interpret data of pollution act.
CO3	PO1	3	Mapped strongly as the students apply their basic knowledge to dispose biomedical waste

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	PO2	3	Mapped strongly as the students can identify the sources and techniques of solid waste
	PO3	3	Mapped strongly as the students gain knowledge to design the solution for solid waste disposal.
	PO4	3	Mapped strongly as the students apply research based knowledge to predict the occurrence of disaster.
	PO5	2	Mapped moderately as the students can able to create the modern engineering technique for e-waste management
	PO6	3	Mapped moderately as the students gain the information to accesses the societal and health issues of solid waste.
	PO7	3	Mapped strongly as the students are to understand the impacts of vermi compositing in solid waste management.
	PO8	3	Mapped strongly as the students understand the ethical principles on recovery from disaster.
	PO9	3	Mapped strongly as the students are able to function effectively as an individually or as a team in cyclone management.
	PO10	3	Mapped strongly as the students acquire ability to communicate the disaster preparedness.
	PO11	2	Mapped moderately as the students gain knowledge to frame the project on various case studies related to disaster
	PO12	2	Mapped moderately as the students able to recognize the response and recovery from disaster through lifelong learning.
	PSO2	2	Mapped moderately as the students can develop products to meets the needs of disaster management.
	PSO3	3	Mapped strongly as the students can develop attitude for solid waste management.
CO4	PO1	2	Mapped moderately as the students apply the knowledge to the solution of human health.
	PO2	2	Mapped moderately as the students will identify the sources of food in different regions.
	PO3	2	Mapped moderately as the students gain knowledge to design for food related problems.
	PO4	3	Mapped strongly as the students acquire research based knowledge to provide valid conclusion for modern agriculture.
	PO5	3	Mapped strongly as the students able to apply modern agriculture techniques for resolving world food problems.
	PO6	3	Mapped strongly as the students gain knowledge to assess the effects of modern agriculture
	PO7	3	Mapped strongly as the students able to understand the impacts of HIV/AIDS.
	PO8	3	Mapped strongly as the students are able to apply ethical principles
	PO9	2	Mapped moderately as the students able to function effectively in analyzing the pesticide related problems.
	PO10	2	Mapped moderately as the students able to write reports effectively on population explosion
	PO11	3	Mapped strongly as the students acquire the knowledge to frame IT projects related to environmental issues.
	PO12	2	Mapped moderately as the students gain the ability in lifelong learning about the population explosion.
	PSO1	3	Mapped strongly as the students able to give solutions for agricultural related problems.
	PSO2	3	Mapped strongly as the students develop products for cancer treatment.
	PSO3	3	Mapped strongly as the students can develop essential ethical leadership for presentation about world food problems.
CO5	PO1	3	Mapped strongly as the students able to apply the knowledge of energy resources to solve the problems.
	PO2	3	Mapped strongly as the students can identify the cause and effects of climate change.
	PO3	3	Mapped strongly as the students get knowledge to design solutions for

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			energy conservation process.
	PO4	3	Mapped strongly as the students acquire research based knowledge in interrupting about the sustainable development for future.
	PO5	3	Mapped strongly as the students able to create appropriate techniques to use renewable energy.
	PO6	3	Mapped strongly as the students are able to apply their knowledge in safety and cultural issues
	PO7	3	Mapped strongly as the students can understand the impacts of global warming.
	PO8	3	Mapped strongly as the students able to apply ethical principles in their environment.
	PO9	3	Mapped strongly as the students gain information to function effectively in analyze the needs of water conservation techniques.
	PO10	3	Mapped strongly as the students can communicate defectively about the need of energy conversion process
	PO11	3	Mapped strongly as the students to acquire information to frame the project on conservation of natural resources.
	PO12	2	Mapped moderately as the students gain the ability of lifelong learning process on green house effect, global warming acid rain.
	PSO1	2	Mapped moderately as the students apply knowledge to identify deforestation using image processing.
	PSO2	2	Mapped moderately as the students can design and develop methods to control ozone layer depletion.
	PSO3	3	Mapped strongly as the students develop interpersonal skills for waste and consumerism.

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 3P1 - Analog and Digital Electronics Laboratory								
B.E. Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	4	60	2	60	40	100
Objective(s)	• To demonstrate the characteristics of electronic devices • To illustrate the working principle of power amplifier • To understand and analyze the effect of feedback in amplifiers • To find series RL- RC circuits steady state & transient response • To design combinational and sequential circuits for practical applications							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Test the characteristics of BJT, photo diode and photo transistor CO2: Construct different biasing circuits for BJT & MOSFET and test power amplifiers CO3: Design, implement and obtain the frequency response of feedback amplifiers CO4: Design, implement & simulate combinational and sequential logic circuits CO5: Determine the steady state & transient response of series RL & RC circuit							
LIST OF EXPERIMENTS								
1. Test the characteristics of BJT in Common Emitter configuration and evaluate h- parameters 2. Study of different biasing circuits for BJT& MOSFET 3. Characteristics of photo diode and photo transistor 4. Class B Complementary symmetry power amplifier 5. Series and Shunt feedback amplifiers 6. Design and implementation of combinational circuits using logic gates 7. Design and implementation of synchronous sequential circuits 8. Design and implementation of asynchronous sequential circuits 9. Design and implementation of FSM (Finite State Machine) 10. Construct and simulate combinational / synchronous & asynchronous sequential circuits using HDL 11. Determine the steady state & transient response of series RL & RC circuit								

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	3	2	3			2	3		2	3	2	
CO2	3	3	3	3	3				2	3		3	3	2	
CO3	3	3	3	3	2	3			2	3		3	2	3	
CO4	3	3	3	3	3	3		3	3	3	3	3	3	3	3
CO5	3	3	3	2	3				3	3			3	2	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Knowledge in mathematics is required to test the characteristics of transistors
	PO2	2	Apply the knowledge to analyse the characteristics of transistors under various voltage and current levels
	PO3	2	Understands the working BJT considering environmental and societal requirements helps to design circuits using transistors
	PO4	3	Analysis and interpretation of transistor parameters helps to provide a valid conclusion s for complex electronic circuit problems involving transistors
	PO5	2	Use the relevant simulators to perform the complex investigations on electronic circuits
	PO6	3	Able to design simple electronic circuits considering societal, legal, cultural and health issues
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	2	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	3	Solve simple Engineering problems by applying basic engineering knowledge
	PSO2	2	Design simple electronic circuits by considering industrial and societal requirements
CO2	PO1	3	Knowledge in mathematics is required to esign different biasing circuits for BJT & MOSFET
	PO2	3	Able to analyze biasing circuits for BJT & MOSFET formed of discrete components.
	PO3	3	Design the biasing circuits for BJT & MOSFET considering environmental and societal requirements
	PO4	3	Identify and analyse complex problems related to biasing circuits and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on biasing circuits
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	3	Able to solve the problems related to biasing circuits
	PSO2	2	Knowledge in electronic circuit design can be used for research studies related to electronic circuits
CO3	PO1	3	Knowledge in mathematics is required for low & high frequency analysis of

			feedback amplifier circuits
	PO2	3	Able to analyze feedback amplifier circuits
	PO3	3	Develop the feedback amplifiers considering environmental and societal requirements
	PO4	3	Identify and analyse the complex electronic problems and provide a valid solution
	PO5	2	Use the relevant simulators to perform the complex investigations on different amplifier circuits
	PO6	3	Able to design feedback amplifier circuits considering societal, legal, cultural and health issues
	PO9	2	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	2	Able to design feedback amplifier circuits considering societal, legal, cultural and health issues amplifier circuits by applying basic engineering knowledge
	PSO2	3	Knowledge in frequency analysis of feedback amplifier can be used for the development of products related to electronic circuits considering industrial and societal requirements
CO4	PO1	3	Knowledge in mathematics is required to design combinational and sequential logic circuits
	PO2	3	Analyze and design various combinational and sequential logic circuits
	PO3	3	Develop various combinational and sequential logic circuits considering environmental and societal requirements
	PO4	3	Identify and analyse the various combinational and sequential logic circuits poblems and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on different combinational and sequential logic circuits
	PO6	3	Able to design various combinational and sequential logic circuits considering societal, legal , cultural and health issues
	PO8	3	Apply ethical responsibilities in developing the combinational and sequential logic circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO11	3	Able to develop projects and work in a multidisciplinary environment
	PO12	3	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	3	Able to provide solution related to the operation of both combinational and sequential logic circuits
	PSO2	3	Knowledge in analysis and design of various combinational and sequential logic circuits helps to develop products related that meet the society and industry needs
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products
CO5	PO1	3	Knowledge in mathematics is required to understand the steady state & transient response of series RL & RC circuit
	PO2	3	Apply the engineering knowledge to analyse the performance the steady state & transient response of series RL & RC circuit
	PO3	3	Able to design RL and RC circuits that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	2	Identify and analyse the complex RL and RC circuits problems and provide a valid solution
	PO5	3	Apply the relevant simulators to perform the investigations on RL and RC circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations

	PSO1	3	Able to solve RL and RC circuits problems
	PSO2	2	Design and develop products considering industrial and societal requirements

K. S. Rangasamy College of Technology – Autonomous R2018

50 CS 0P2 - Data Structures Laboratory

Common to CS,IT,EE,EC

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P	60	C	CA	ES	Total
III	0	0	4		2	60	40	100

Objective(s)

- To design and implement simple linear and non linear data structures
- To strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To program for storing data as tree structure and implementation of various traversal techniques
- To implement sorting and searching techniques
- To gain knowledge of graph applications

Course Outcomes

At the end of the course, the students will be able to

CO1: Demonstrate the implementation of Linear Data structures and its applications
CO2: Investigate Balanced Parenthesis and Postfix expressions with the help of Stack ADT
CO3: Implement Non-Linear Data Structure
CO4: Implement sorting and searching techniques
CO5: Implement Shortest Path and Minimum Spanning Tree algorithm

1. Implementation of List Abstract Data Type (ADT)
2. Implementation of Stack ADT
3. Implementation of Queue ADT
4. Implementation of stack applications:
   (a) Program for 'Balanced Parenthesis'
   (b) Program for 'Evaluating Postfix Expressions'
5. Search Tree ADT
6. Implementation of Internal Sorting
7. Develop a program for external sorting
8. Develop a program for various Searching Techniques.
9. Implementation of Shortest Path algorithm
10. Implementation of Minimum Spanning tree algorithm.

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CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	3	2	3						2		2		3	
CO2	1	3	2	3						2		2		3	
CO3	1	3	2	3						2		2		3	
CO4	1	3	2	3	3					2		2		3	
CO5	1	3	2	3	3		3			2		2		3	

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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COs	POs/PSOs	Level	Justification
CO1	PO1	1	Slightly the student having the fundamental concept of data structures to provide the solutions of linear data structures and its applications
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various aspects of linear Data Structures and its applications.
	PO3	2	Moderately the student using the knowledge of linear Data Structures concepts, we can design and develop solutions for complex engineering problems
	PO4	3	Strongly the student using the Knowledge of linear data structures and its applications can be used to conduct experiments in real life problems to provide valid conclusions
	PO10	2	Moderately the student can communicate effectively with proper documentation in linear data structures and its applications
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of linear Data Structures and its applications
	PSO2	3	Strongly the student will know the need of linear data structures and its applications for data analytic models
CO2	PO1	1	Slightly the student having the knowledge of mathematics ,Engineering fundamentals to the solutions of Stack applications
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in Stack applications
	PO3	2	Moderately the student using the knowledge of Stack applications, we can design and develop solutions for complex engineering problems
	PO4	3	Strongly the student using the Knowledge of Stack applications can be used to conduct experiments in real life problems to provide valid conclusions
	PO10	2	Moderately the student can communicate effectively with proper documentation in Stack applications
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of Stack applications
	PSO2	3	Strongly the student will know the need of Stack applications for data analytic models
CO3	PO1	1	Slightly the student having the knowledge of mathematics ,Engineering fundamentals to the solutions of non linear data structure
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in of non linear data structure
	PO3	2	Moderately the student using the knowledge of non linear data structure, we can design and develop solutions for complex engineering problems
	PO4	3	Strongly the student using the Knowledge of non linear data structure can be used to conduct experiments in real life problems to provide valid conclusions
	PO10	2	Moderately the student can communicate effectively with proper documentation in non linear data structure
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of non linear data structure
	PSO2	3	Strongly the student will know the need of non linear data structure for data analytic models
CO4	PO1	1	Slightly the student having the knowledge of mathematics ,Engineering fundamentals to the solutions for the concept of Sorting and Searching techniques
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various aspects of Sorting and Searching techniques
	PO3	2	Moderately the student using the knowledge of Sorting and Searching techniques we can design and develop solutions for complex engineering problems

	PO4	3	Strongly the student using the Knowledge of Sorting and Searching techniques can be used to conduct experiments in real life problems to provide valid conclusions
	PO5	3	Strongly the student using the Knowledge of Sorting and Searching techniques by applying tools and techniques
	PO10	2	Moderately the student can communicate effectively with proper documentation in Sorting and Searching techniques
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of Sorting and Searching techniques
	PSO2	3	Strongly the student will know the need of Sorting and Searching techniques for data analytic models
CO5	PO1	1	Slightly the student having the knowledge of mathematics ,Engineering fundamentals to the solutions for the concept of shortest path algorithms and minimum spanning tree ,algorithms
	PO2	3	Strongly the student will know Principles of mathematics and engineering sciences are used in various aspects of shortest path algorithms and minimum spanning tree algorithms
	PO3	2	Moderately the student using the knowledge of shortest path algorithms and minimum spanning tree algorithms, we can design and develop solutions for complex engineering problems
	PO5	3	Strongly the student using the Knowledge of shortest path algorithms and minimum spanning tree algorithms by applying tools and techniques
	PO7	3	Strongly the student having the knowledge of shortest path algorithms and minimum spanning tree algorithms to provide solutions for societal contexts
	PO10	2	Moderately the student can communicate effectively with proper documentation in shortest path algorithms and minimum spanning tree algorithms
	PO12	2	Moderately the student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge of shortest path algorithms and minimum spanning tree algorithms
	PSO2	3	Strongly the student will know the need of shortest path algorithms and minimum spanning tree algorithms for data analytic models

<table>
<tr><th colspan="10">K. S. Rangasamy College of Technology – Autonomous R2018</th></tr>
<tr><th colspan="10">Semester III</th></tr>
<tr><th colspan="10">Common to all Branches</th></tr>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Course Name</th><th colspan="3">Hours/Week</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>50 TP 0P1</td><td>Career Competency Development I</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Course Objectives</td><td colspan="8">To help learners to enrich their grammatical correctness and vocabulary efficacy in the academic and professional contexts.
To help the learners to frame syntactical structures of sentences and comprehend the meaning of reading passages effectively
To help learners to adeptly sequence the information, draft letters and correct usage of foreign words with correct spelling and punctuation.
To help the learners to introduce themselves and involve in situation conversations professionally
To help learners to make various modes of presentations and express their opinion in a conducive way.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the student will be able to
CO1: Reinforce the essential grammatical correctness and vocabulary efficacy in the academic and professional contexts
CO2: Generate syntactical structures and infer the semantics in the reading passages effectively
CO3: Reorganize and compose the sequential information, letter drafts, and interpret the</td></tr>
</table>

	appropriate usage of foreign words with correct spelling and punctuation CO4: Demonstrate their introduction and relate to situational conversations adeptly CO5: Exhibit various modes of presentations and organize their opinions in an expressive way

Unit–1	Written Communication–Part 1	Hrs
Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition - Change of Voice - Change of Speech - Synonyms & Antonyms - One Word Substitution- Using the Same Word as Different Parts of Speech- Odd Man Out **Materials:** Instructor Manual, Word Power Made Easy Book		8
Unit–2	**Written Communication – Part 2**	6
Analogies - Sentence Formation - Sentence Completion - Sentence Correction - Idioms & Phrases - Jumbled Sentences, Letter Drafting (Formal Letters) - Reading Comprehension(Level 1) – Contextual Usage- **Materials:** Instructor Manual, Word Power Made Easy Book		
Unit–3	**Written Communication – Part 3**	4
Jumbled Sentences, Letter Drafting (Formal Letters)-Foreign Language Words used in English — Spelling & Punctuation (Editing) **Materials:** Instructor Manual, News Papers		
Unit–4	**Oral Communication–Part 1**	6
Self-Introduction-Situational Dialogues / Role Play (Telephonic Skills)- Oral Presentations-Prepared- 'Just A Minute' Sessions (JAM) **Materials:** Instructor Manual, News Papers		
Unit–5	**Oral Communication – Part 2**	6
Describing Objects / Situations /People, Information Transfer – Picture Talk- News Paper and Book Review **Materials:** Instructor Manual, News Papers		
	Total	**30**

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation1 Written Test	50 Questions–30 Questions from Unit 1&2, 20Questions from Unit3, (External Evaluation)	50
2	Evaluation2 OralCommunication1	Self-Introduction, Role Play & Picture Talk from Unit-4 (External Evaluation by English and MBA Dept.)	30
3	Evaluation3 OralCommunication2	Book Review & Prepared Speech from Unit-5 (External Evaluation by English and MBA Dept.)	20
		Total	**100**

Reference Books

1. Aggarwal, R.S. "A Modern Approach to Verbal and Non- verbal Reasoning", Revised Edition 2008, Reprint2009, S.Chand & Co Ltd. ,New Delhi.
2. Word Power Made Easy by Norman Lewis W.R.GOYAL Publications

Note:

- Instructor can cover the syllabus by Classroom activities and Assignments (5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20questions from Unit1, 2 and Unit5 and 5 questions from Unit 3 and 4
- Evaluation has to be conducted as like Lab Examination.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1	1		2	1	2	3	3	2	3	1	1	3
CO2	1	1	1	1	1	2	1	2	3	3	3	3	2	2	3
CO3	1	1	1	1	1	2	1	2	3	3	2	3		1	3

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO4	1	1	1	1		2	1	1	2	3	2	3		1	3
CO5	1	1	1	1	1	2	1	2	3	3	2	3	1	1	3

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Understand the efficacy of the complex engineering problems
	PO2	1	Reviewing the literature and understanding the substantiated conclusions
	PO3	1	Efficacy of using grammatical correctness with appropriate vocabulary while developing solutions
	PO4	1	Ensuring the grammatical correctness in the synthesis of information after conducting investigations of complex problems
	PO6	2	Using appropriate vocabulary while applying reasoning to assess contextual responsibilities
	PO7	1	Bringing forth grammatical correctness and vocabulary efficacy in the demonstration and necessity of sustainable development
	PO8	2	Understand and apply with syntactical appropriateness for ethical norms and responsibilities
	PO9	3	Vocabulary expertise and grammar finesse to function effectively as a individual
	PO10	3	Implement grammatical correctness and word power while communicating effectively on complex engineering activities
	PO11	2	Syntactical correctness with suitable words in demonstrating knowledge in multidisciplinary environments
	PO12	3	Need for the ability to apply grammatical and vocabulary efficacy in the context of life-longlearning
	PSO1	1	Ensuring syntactical correctness and refined usage of words in solving complex engineering problems
	PSO2	1	Write ups in designing and development of components and products
	PSO3	3	Applying grammatical correctness and right usage of semantics in enriching interpersonal skills and attitude
CO2	PO1	1	Understand the efficacy of the complex engineering problems by identifying syntactic structures and semantics
	PO2	1	Understand and apply with syntactical appropriateness and inferring meaning for ethical norms and responsibilities
	PO3	1	Effective use of syntactic and semantic appropriateness while developing solutions
	PO4	1	Efficacy of generating grammatical syntaxwith correct semantics in the synthesis of information after conducting investigations of complex problems
	PO5	1	Applying appropriate techniques by best using syntax and semanticsin the prediction and modelling of complex problems
	PO6	2	Enriching with suitable semantic structures while applying reasoning to assess contextual responsibilities
	PO7	1	Cohesive employment of syntactic and semantic forms in the demonstration and necessity of sustainable development.
	PO8	2	Understand and apply with syntactical appropriateness and semantics for ethical norms and responsibilities
	PO9	3	Individual development in the application of lexical expertise

	PO10	3	Communicating effectively on complex engineering activities by the effective use of syntactic and semantics
	PO11	3	Syntactical correctness with suitable words and phrases in demonstrating knowledge in multidisciplinary environments
	PO12	3	Knowledge of generating syntactic structures and inferring semantics in Life-long learning
	PSO1	2	Ensuring syntactical correctness and refined usage of words in solving complex engineering problems
	PSO2	2	Design and develop components and products with the efficacy of structural semantics
	PSO3	3	Enriching interpersonal skills and attitude by showcasing expertise in syntax and right use of words
CO3	PO1	1	Composing information and interpretation of foreign words to find solution to complex engineering problems
	PO2	1	Reorganising sequential information to analyse complex engineering problems
	PO3	1	Composition of sequential information in designing solutions with societal and environmental considerations
	PO4	1	Synthesizing information in a sequential way for arriving at valid conclusions
	PO5	1	Reorganising information for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	2	Assessing the contextual knowledge in sequentially and professionally with relevance to best engineering practice
	PO7	1	Demonstrating the engineering solutions in an orderly and cohesive manner for sustainable development
	PO8	2	Logically applying the ethical norms with required reorganisation
	PO9	3	Showcasing the individual fitness in diverse scenario with logical presentation of information
	PO10	3	Understand and write effective reports with the composition of information in documents systematically
	PO11	2	Ability to organise information logically to manage projects effectively in diverse teams
	PO12	3	Reorganising information with the wider context of technical changes and engage independently
	PSO2	1	Design and develop components and products with the sequential presentation of information
	PSO3	3	Enriching interpersonal skills and attitude by showcasing sequential presentation of information
CO4	PO1	1	Demonstrating the application of engineering knowledge and find solutions to complex engineering problems
	PO2	1	Relate adeptly the contingent factors to analyse complex engineering problems
	PO3	1	Present adeptly the design of solutions to complex engineering problems
	PO4	1	Deliberating the synthesis of information to arrive valid conclusions to the complex engineering problems

	PO6	2	Presenting tactfully the assessed contextual knowledge for professional relevance
	PO7	1	Showcasing the impact of engineering solutions for sustainable development
	PO8	1	Demonstrate the ethical principles and norms of engineering practice
	PO9	2	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and present effectively
	PO11	2	Demonstrate knowledge on projects in diverse multi-disciplinary ambience
	PO12	3	Ability to demonstrate and engage independently in the broadest situational context of changing technology
	PSO2	1	Design and develop components and products with proper demonstration and introduction
	PSO3	3	Enriching interpersonal skills and attitude by showcasing effective demonstration of information
CO5	PO1	1	Making presentationsin an organised way and applying engineering knowledge and find solutions to complex engineering problems
	PO2	1	Ability to present in an organised manner about the contingent factors to analyse complex engineering problems
	PO3	1	Present expressively the design of solutions to complex engineering problems
	PO4	1	Organising and exhibiting the synthesis of information to arrive valid conclusions to the complex engineering problems
	PO5	1	Exhibiting expressivelythe prediction and modelling to complex engineering problems with its limitations
	PO6	2	Presentingthe assessed contextual knowledge expressively and in organised manner for professional relevance
	PO7	1	Presenting the impact of engineering solutions for sustainable development expressively
	PO8	2	Present in organised way the ethical principles and norms of engineering practice
	PO9	3	Making various modes of presentation presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and present expressively in orderly way
	PO11	2	Exhibit knowledge on projects in diverse multi-disciplinary ambience
	PO12	3	Ability to exhibit and organise the life-long learning in the broadest situational context of changing technology
	PSO1	1	Exhibit the complex engineering problems with solutions
	PSO2	1	Present and exhibit the design and develop components and products
	PSO3	3	Exhibit various presentation modes to enrichinterpersonal skills and attitude

K.S.Rangasamy College of Technology – Autonomous R 2018

50 MA 010 - Probability and Stochastic Processes

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	50	50	100

Objective(s)

- To introduce the basic concepts of probability and distributions.
- To know the difference between a discrete and a continuous random variables
- To understand the concept of random process and its application to the various fields.
- To comprehend about the correlation functions and spectral densities
- To introduce a variety of statistical models for time series.

Course Outcomes

At the end of the course, the students will be able to

CO1: Explain the basic concepts of probability and distributions.

CO2: Analyze the concept of two dimensional random variable, Characteristic functions and central limit theorem.

CO3: Classify the different types of random processes.

CO4: Examine the relationship between spectral density and correlation function

CO5: Apply suitable methods for measuring trend values and seasonal variations in time series

The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the numbers hours indicated.

Probability and Standard Distributions

Axioms of probability – Conditional probability- Total probability and Baye's theorems – Random variable – Probability mass function – Probability density function - Standard distributions – Binomial – Poisson - Uniform and Normal - excluding problems. [9]

Two Dimensional Random Variables

Joint distributions - Marginal and conditional distributions – Characteristic functions – Bounds on probabilities - Chebycheff inequality - Central limit theorem - problems. [10]

Classification of Random Processes

Definitions and examples of first order, second order, strictly stationary, wide-sense stationary and ergodic processes – Markov process – Binomial, Poisson and Normal processes – Sine wave process. [10]

Correlation and Spectral Densities

Auto correlation –Cross correlation – Properties –Power spectral density – Cross spectral density – Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function. [8]

Time Series

Components of a time series – Method of least square – Parabolic trend – Exponential trend – Method of seasonal variations – Ratio to trend method – Ratio to moving average method – Link relative method. [8]

Total Hours: 45 + 15(Tutorial) = 60

Text book(s):

1	T.Veerarajan, 'Probability, Statistics and Random process', Tata McGraw-Hill Publications, 2nd Edition, 2002
2	P N Arora and S Arora, 'Statistics for Management', S. Chand & company Ltd, 2007.

Reference(s):

1	Peebles Jr. P.Z, 'Probability Random Variables and Random Signal Principles', Tata McGraw-Hill Publications, 4th Edition, 2002. (Chapters 6, 7 and 8).
2	I Miller and J E Freund, 'Probability and Statistics for Engineers', Prentice Hall, 2010.
3	Henry Stark and John W Woods 'Probability and Random Processes with Applications to Signal Processing',

	Pearson Education, 3rd Edition , 2002
4	D C Montgomery and L A Johnson ‘Forecasting and Time Series Analysis’, McGraw Hill, 1976.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	2							2	3		
CO2	3	3	3	3	2							2	3		
CO3	3	3	3	3	2							2	3		
CO4	3	3	3	3	2							2	3		
CO5	3	3	3	3	2						3	2	3		

COs	POs/PSOs	Level	Justification
CO1	PO1	3	The principles of probability and random variable can be used to solve a complex engineering problem.
	PO2	3	The concept of random variable will help to enrich the analysis of Engineering problems
	PO3	3	Considering environmental and societal requirements, the solutions of complex engineering problems can be developed by applying the concept of probability and random variable.
	PO4	3	The concept of probability and random variable can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate technique related to random variable can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to random variable to find the better solutions to complex engineering problems
	PSO1	3	The principles of probability and random variable will help to provide the conclusion for the problems involving in signal and image processing.
CO2	PO1	3	The principles of two dimensional random variables can be used to solve a complex engineering problem.
	PO2	3	The concept of two dimensional random variables can be used to formulate and analyze the complex engineering problems
	PO3	3	Considering environmental and societal requirements, the solutions of complex engineering problems can be developed by applying Tchebycheff’s inequality and central limit theorem.
	PO4	3	The concept of random variables and central limit theorem can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate technique related to random variables can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to random variables to find the better solutions to complex engineering problems
	PSO1	3	The principles of random variables will help to provide the conclusion for the problems involving in signal and image processing.
CO3	PO1	3	The concepts of random process can be applied to simplify problems with high complexity in Engineering
	PO2	3	The concepts of random process can be used to formulate and analyze various complex engineering problems
	PO3	3	Random process will help to design solutions to various Engineering problems
	PO4	3	The concept of random process can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate technique related to random process can be applied to complex

			engineering problems.
	PO12		Develop the new concepts related to random process to find the better solutions to complex engineering problems
	PSO1	3	The concept of a random process allows to study about systems involving signals that are not entirely predictable.
CO4	PO1	3	The concepts of spectral density of a random process can be used to solve various complex problems
	PO2	3	The knowledge about spectral density of a random process can be used to formulate and analyze various complex engineering problems
	PO3	3	Spectral density of a random process will help to design solutions to various Engineering problems
	PO4	3	The autocorrelation and spectral density can be used to interpret the data to provide valid solutions in engineering problems
	PO5	2	Appropriate technique related to spectral density can be applied to complex engineering problems.
	PO12	2	Develop the new concepts related to spectral density to find the better solutions to complex engineering problems
	PSO1	3	The concept of a random process allows to study about systems involving signals that are not entirely predictable.
CO5	PO1	3	Apply the fundamental concepts of time series theory to the solution of complex engineering problem
	PO2	3	Identity and formulate the suitable trend techniques to analyse the given numerical data related to complex engineering problem
	PO3	3	It helps to develop the solutions of complex problems by considering societal considerations.
	PO4	3	Conduct the detailed literature survey on existing techniques by understanding the limitations of time series
	PO5	2	Appropriate time series technique can be applied to complex engineering problems.
	PO11	3	The concepts of time series theory can be applied in project management and finance.
	PO12	2	Develop the new concepts related to algorithm to find the better solutions to complex engineering problems
	PSO1	3	The concept of a time series allows to study about the life time of components of products in electronics and communication engineering

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 401 - Linear Integrated Circuits								
B.E. Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	50	50	100
Objective(s)	• To introduce the basic building blocks of linear integrated circuits. • To learn the linear and non-linear applications of operational amplifiers. • To introduce the theory and applications of analog multipliers and PLL. • To learn the theory of ADC and DAC. • To introduce the concepts of waveform generation and introduce some special function ICs.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain the basic principles and characteristics of an op-amp CO2: Design linear and non-linear circuits using op-amps CO3: Explain the operation and applications of analog multiplier and PLL CO4: Design ADC and DAC circuits using op – amps CO5: Design and analyze the working principle of waveform generators using op – amp & special function ICs							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required								

for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.
Basics of Operational Amplifiers Current mirror and current sources, Current sources as active loads, BJT Differential amplifier with active loads, Basic information about op-amps, Ideal operational amplifier, General operational amplifier stages and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, open and closed loop configurations. [9] **Applications of Operational Amplifiers** Sign changer, Scale changer, Voltage follower, Adder, Subtractor, V-to-I and I-to-V converters, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass filters. [9] **Analog Multiplier and PLL** Analog multiplier using emitter coupled transistor pair – Gilbert Multiplier cell – Variable trans-conductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation. [9] **Analog to Digital and Digital to Analog Converters** Analog and Digital data conversions, D/A converter – specifications – Weighted resistor type, R-2R Ladder type - Voltage mode and Current mode– Sample-and-hold circuits, A/D Converters – specifications – Flash type, Successive approximation type, Single slope type, Dual slope type. [9] **Waveform Generators and Special Function ICs** Sine-wave generators - Phase shift oscillator, Wein bridge oscillator- Multivibrators – Astable and Monostable multivibrator -Triangular wave generator, 555 Timer – functional diagram, Monostable and Astable operation - IC 723 general purpose regulator, Frequency to Voltage and Voltage to Frequency converters, Audio power amplifier. [9]
Total Hours:45

Text book(s):

1	D.RoyChoudry ,Shail Jain , 'Linear integrated Circuits', 5th Edition, New Age International Pvt Ltd, 2018.
2	Ramakant A., Gayakwad, 'Op – Amps and Linear Integrated Circuits', 4th Edition, Prentice Hall, 2017.

Reference(s) :

1	Sergio Franco., 'Design with Operational Amplifiers and Analog Integrated Circuits', 4th Edition, Tata McGraw-Hill, 2014.
2	S.Salivahanan& V.S. KanchanaBhaskaran, 'Linear Integrated Circuits', 3rd Edition, TMH, 2018
3	Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', 5th Edition, Wiley International, 2010.
4	J.Michael Jacob, 'Applications and Design with Analog Integrated Circuits', 2nd Edition, Prentice Hall, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	2	2	3	3	3								3	3	
CO3	2	3	3	3				3	3	3		3	3	3	3
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3								3	3	

Rev.No. 3 / w.e.f. 13/02/2022
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COs	POs/PSOs	Level	Justification
CO1	PO1	3	Knowledge in mathematics is required to understand the basics principles and characteristics of an op-amp
	PO2	3	Apply the knowledge to analyse the characteristics of an op-amp
	PO3	3	Understands the working of op-amp considering environmental and societal requirements
	PO4	3	Identify and analyse the problems to the operation of op-amp and provide a valid solution
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge
	PSO2	3	Design the electronic circuits using op-amp by considering industrial and societal requirements
CO2	PO1	2	Knowledge in mathematics is required to design linear and non-linear circuits using op-amps
	PO2	2	Able to analyze linear and non-linear circuits using op-amps
	PO3	3	Design op-amp circuits considering environmental and societal requirements
	PO4	3	Identify and analyse complex electronic circuit problems and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on operational amplifier circuits
	PSO1	3	Able to solve the problems related to operational amplifiers
	PSO2	3	Design and develop products using op-amp considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of electronic products
CO3	PO1	2	Knowledge in mathematics is required to understand the operation ofanalog multiplier and PLL
	PO2	3	Able to analyze problems in the operation of analog multipliers and PLL and provide a valid solution
	PO3	3	Develop an analog multiplier considering environmental and societal requirements
	PO4	3	Identify and analyse the complex electronic circuit problems related to analog multipliers and provide a valid solution
	PO8	3	Apply ethical responsibilities in developing the analog multipliers circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system using multipliers considering wider technological changes
	PSO1	3	Able to provide solutions for complex problems in the multiplier circuits by applying basic engineering knowledge
	PSO2	3	Design and develop products using analog multipliers and PLL considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products
CO4	PO1	3	Knowledge in mathematics is required to understand the operation of ADC and DAC circuits using op – amps
	PO2	3	Analyzethe various ADC and DAC circuits using op – amps
	PO3	3	Develop the ADC and DAC circuits using op – amps considering environmental and societal requirements
	PO4	3	Identify and analyse the problems involved in data convertors circuits and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on different data convertors circuits
	PO8	3	Apply ethical responsibilities in developing the data convertor circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects

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	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system using data convertors considering wider technological changes
	PSO1	3	Able to provide solutions for complex problems in the data convertor circuits by applying basic engineering knowledge
	PSO2	3	Knowledge in analysis and design of various data convertor circuits can be used for design and development of electronic products
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products
CO5	PO1	3	Knowledge in mathematics is required to understand the operation of waveform generators using op – amp & special function ICs
	PO2	3	Apply the engineering knowledge to analyse the performance of different waveform generators
	PO3	3	Design different waveform generators that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Identify and analyse the problems in waveform generatorsand provide a valid solution
	PO5	3	Apply the relevant simulators to perform the investigations on various waveform generators
	PSO1	3	Able to provide solutions for complex problems in the waveform generatorscircuits by applying basic engineering knowledge
	PSO2	3	Design and develop products considering industrial and societal requirements

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 402 - Electromagnetic Waves</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours / Week</th><th rowspan="2">Total hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>IV</td><td>3</td><td>1</td><td>0</td><td>60</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To introduce the concept of vector analysis
• To develop an understanding of electromagnetic laws and its application in boundaries
• To introduce the concept of signal propagation through transmission lines and high frequency lines
• To illustrate the propagation of TE, TM and TEM waves in rectangular waveguide structures
• To give an introduction to circular guides , resonators and microwave components</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Describe the vector quantities and apply vector integration and differentiation in different coordinate systems
CO2: Apply the laws of electromagnetic to evaluate the boundary conditions for electric and magnetic fields and describe the propagation of plane electromagnetic waves
CO3: Evaluate the characteristics and wave propagation in high frequency transmission lines
CO4: Analyze and design rectangular waveguides and understand the propagation of electromagnetic waves
CO5: Describe the circular waveguides and evaluate the resonance frequency of cavity resonators</td></tr>
<tr><td colspan="9">Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.</td></tr>
</table>

Vector Analysis Basics of Vectors, Position and Distance vectors, – Components of a Vector – Coordinate Systems and transformation: Cartesian, Cylindrical and Spherical Coordinates – Constant coordinate Surfaces – Vector Calculus: Differential Length, Area and Volume – Line, Surface and Volume Integrals – Del Operator – Gradient of a Scalar – Divergence of a Vector – Divergence Theorem – Curl of a Vector – Stokes Theorem – Laplacian of a scalar – Classification of vector fields. [9]
Electromagnetics Basic laws of electromagnetics and applications: Coulomb's law, Gauss law, Ampere's law, Biotsavart law, Faraday's law and Lenz's law, Maxwell's equations, Boundary Conditions for electric and magnetic fields at media interface, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization. [9]
Transmission Lines Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, Reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart - Application of the Smith Chart – Impedance to Admittance conversion and vice versa. [9]
Rectangular Waveguides Waves between parallel planes and rectangular waveguide ,Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE_{10} and TM_{11} modes in rectangular waveguides – Wave impedances – characteristic impedance – Excitation of modes. [9]
Circular Wave Guides and Resonators Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of modes – Microwave Resonators - Rectangular cavity resonators, circular cavity resonator, Q factor of a cavity resonator for TE101 mode. [9]
Total Hours: 45+15(Tutorial) = 60

Text book(s):

1	Matthew N.O.Sadiku , 'Elements of Electromagnetics', 7th Edition , Oxford University Press , 2018.
2	E.C. Jordan & K.G. Balmain, 'Electromagnetic waves & Radiating Systems', 2nd Edition, Prentice Hall, 2013.

Reference(s) :

1	William H.Hayt, John A.Buck , 'Engineering Electromagnetics', 8th Edition, McGraw Hill Education, 2017.
2	John. D. Ryder, 'Network Lines and Fields', 2nd Edition, Pearson Education India, 2015.
3	David K.Cheng, 'Field and Wave Electromagnetics', 2nd Edition, Pearson Education, 2015.
4	Umesh Sinha, 'Transmission Lines and Networks', Satya Prakashan Publishing Company, New Delhi, 2010.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2									3	2	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3		3	3						3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	2									3	2	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the vector analysis concepts for different components
	PO2	3	Apply the knowledge to analyse the given problem in coordinate systems and transformations

	PO3	2	Apply the solutions to divergence theorem and Stokes theorem considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on classification of vector fields and identify the problems
	PSO1	3	Find solutions to the coordinate systems by applying basic engineering knowledge
	PSO2	2	Develop the electromagnetic fields by applying different theorems considering industrial and societal requirements
CO2	PO1	3	Apply the electromagnetic concepts to different laws
	PO2	3	Apply the knowledge to analyse the given Maxwell's equation and Boundary Conditions for electric and magnetic fields at media interface
	PO3	3	Develop the solutions wave equations and pointing vector considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on reflection, refraction and polarization in plane waves and identify the problems
	PSO1	3	Apply different laws for complex electromagnetic fields by applying basic engineering knowledge
	PSO2	3	Develop the relevant electromagnetic fields by applying basic laws considering different environmental conditions
CO3	PO1	3	Apply the transmission line concepts to Equations of voltage and current
	PO2	3	Apply the knowledge to analyse primary and secondary constants of transmission lines in the given problem and using smith chart
	PO3	3	Develop the lossless and low loss transmission line considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on Smith chart and identify the problems for further investigations
	PO6	3	Apply the contextual knowledge to measure societal issues and the consequent responsibilities relevant to engineering problems
	PO7	3	Understand the impact of transmission lines in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PSO1	3	Apply the transmission line concepts for propagation and characteristic impedance by applying basic engineering knowledge
	PSO2	3	Analyse the reflection coefficient, standing wave ratio and impedance by considering transmission lines in industrial requirements
CO4	PO1	3	Apply the basic concepts for waves between parallel planes and rectangular waveguide
	PO2	3	Apply the knowledge of engineering to analyse the given problem in transverse magnetic waves and transverse electric waves of rectangular waveguides
	PO3	3	Apply the methods to find attenuation in TE and TM modes in rectangular waveguide considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on wave impedances, characteristic impedance and excitation modes
	PSO1	3	Develop the solutions for rectangular waveguides by applying basic engineering knowledge
	PSO2	3	Design the rectangular waveguides with different modes of operation considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of waves with Bessel function for circular waveguides
	PO2	3	Apply the engineering knowledge to analyse the characteristics of TM and TE waves in circular waveguides
	PO3	3	Develop the methods to analyse microwave cavity resonators, resonance frequency considering different environmental factors
	PO4	2	Conduct the detailed literature survey on excitation modes in circular waveguides, microwave resonators and Q factor
	PSO1	3	Apply the concepts of circular waveguides for solving complex problems
	PSO2	2	Design the circular waveguide applications, phase shifters and attenuators considering industrial and societal requirements

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 403 - Signals and Systems								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	50	50	100

Objectives	• To understand the basic properties of signal & systems and the various methods of classification • To know the methods of characterization of LTI systems in time domain • To analyze continuous time signals and system in the Fourier transform • To analyze discrete time signals and system in the Fourier transform • To analyze signals and systems using z-transform
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the classification of signals and systems with their properties. CO2: Characterize the input-output relationship of LTI systems using impulse response CO3: Analyze continuous-time using Fourier series and Fourier transform CO4: Analyze discrete-time signals using Fourier series and Fourier transform CO5: Analyze discrete-time systems using z-transform

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Signals and Systems
Introduction-Continuous-time (CT) & Discrete-Time (DT) signals-Classification of CT & DT Signals – Basic CT and DT signals -Signal operations – Properties of CT & DT systems [8]

Time Domain Analysis of Linear Time Invariant (LTI) Systems
Continuous time LTI systems: Convolution Integral– Properties of convolution Integral - Graphical method-stability of LTICT Systems - LTI systems represented by Linear Constant Coefficient differential -Natural response, forced Response, Complete response.
Discrete time LTI systems: Convolution Sum - properties of convolution sum - linear Convolution – Graphical method–LTI systems represented by Linear Constant Coefficient difference equations - Natural response – forced Response – Complete response. [9]

Fourier Analysis of Continuous Time Signals and Systems
Representation of CT periodic signals by Continuous Time Fourier Series (CTFS) - Convergence of CTFS – Properties of CTFS - Representation of CT aperiodic signals by Continuous Time Fourier Transform (CTFT) – CTFT of CT periodic signals - Convergence of CTFT - Properties of CTFT - Response of CT LTI systems to complex exponentials - Frequency response of systems characterized by differential equations. [9]

Fourier Analysis of Discrete Time Signals and Systems
Representation of DT periodic signals by Discrete Time Fourier Series (DTFS) - Properties of DTFS - Representation of DT aperiodic signals by Discrete Time Fourier Transform (DTFT) – DTFT of DT periodic signals - Convergence of DTFT - Properties of DTFT - Response of DT LTI systems to complex exponentials - Frequency response of systems characterized by difference equations. [9]

Transform Analysis of Discrete Time Signals and Systems
Sampling and reconstruction of signal - Z transform - two sided and one sided Z transform - Properties of Z transform - Poles, zeros and ROC – Properties of ROC – Inverse Z transform, System function - System analysis using Z transform - frequency response and impulse response. [9]

Total Hours: 44+16(Tutorials) = 60

Text book(s):

1	Alan V.Oppenheim, Alan S.Willsky with S.Hamid Nawab, 'Signals & Systems', 2nd Edition, Pearson Education, 2013.
2	B P Lathi, 'Signal processing and Linear systems', Oxford University Press, 2010.

Reference(s):

1	John G.Proakis and Dimitris G.Manolakis, 'Digital Signal Processing, Principles, Algorithms and Applications',

	4th Edition, Prentice Hall, 2013.
2	M.J.Roberts, 'Signals and Systems Analysis using Transform method and MATLAB', 3rd Edition, Tata McGraw-Hill, 2018.
3	Simon Haykin and Barry Van Veen, 'Signals and Systems', 2nd Edition, John Wiley & Sons, 2012
4	Ashok Ambardar, 'Analog and Digital Signal Processing', 2nd Edition, CL Engineering,1999

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2								3		
CO2	3	3	2	2									3		
CO3	3	3	3	3				3	3	3		3	3	3	3
CO4	3	3	3	3				3	3	3		3	3	3	3
CO5	3	3	3	3	2								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to understand the basic properties of signal & systems and the various methods of classification
	PO2	3	Apply the knowledge to given complex problems in classification of signals and systems and its properties
	PO3	2	Design continuous time & discrete time systems for given complex problems
	PO4	2	Conduct the detailed literature survey on research based issues in continuous time & discrete time signals and systems and identify the problems
	PO5	2	Apply the modern engineering tools to perform the complex problems survey on research based issues in CT & DT signals and systems
	PSO1	3	Perform complex engineering problems by applying engineering knowledge in the field of Signal processing and Communication.
CO2	PO1	3	Apply the knowledge to analyse the input-output relationship of LTI systems using impulse response
	PO2	3	Apply the knowledge to given complex problems using impulse response in continuous and discrete time LTI systems
	PO3	2	Design Linear Time Invariant (LTI) Systems using impulse response
	PO4	2	Conduct the detailed literature survey on continuous and discrete time LTI systems and identify the problems
	PSO1	3	Apply the concepts of continuous and discrete time LTI systemsfor solving complex problems
CO3	PO1	3	Apply the knowledge to analyse the continuous time signals and systems using Fourier series and Fourier transform.
	PO2	3	Apply the knowledge to given complex problems in continuous time signals and systems using Fourier series and Fourier transform
	PO3	3	Design continuous time signals and systems using Fourier series and Fourier transform
	PO4	3	Conduct the detailed literature survey on continuous time signals and systems using Fourier series and Fourier transform and identify the problems
	PO8	3	Apply ethical principles to compare various continuous time systems using Fourier series and Fourier transformfor ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable continuous time systems using Fourier series and Fourier transform considering wider technological changes

	PSO1	3	Apply the concepts of continuous time systems using Fourier series and Fourier transform for solving complex problems
	PSO2	3	Design continuous time system components using Fourier series and Fourier transform with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the knowledge to analyse the discrete time signals and systems using Fourier series and Fourier transform
	PO2	3	Apply the knowledge toanaylse the complex engineering problems in discrete time signals and systems using Fourier series and Fourier transform
	PO3	3	Design discrete time systems using Fourier series and Fourier transform for identified complex problems
	PO4	3	Conduct the detailed literature survey on discrete time systems using Fourier series and Fourier transform and identify the problems
	PO8	3	Apply ethical principles to compare various discrete time systems using Fourier series and Fourier transform for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable discrete time systems using Fourier series and Fourier transform considering wider technological changes
	PSO1	3	Apply the concepts of discrete time systems using Fourier series and Fourier transform for solving complex problems
	PSO2	3	Design discrete time system components using Fourier series and Fourier transform with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the knowledge to analyse the discrete time systems using Z-transform.
	PO2	3	Apply the knowledge to design the complex engineering problems using Z-transform for discrete time systems
	PO3	3	Design discrete time systems using Z-transform for identified complex problems
	PO4	3	Conduct the detailed literature survey discrete time systems using Z-transform and identify the problems
	PO5	2	Use the modern engineering tools to perform the complex problems survey on discrete time systems using Z-transform
	PSO1	3	Apply the concepts of discrete time systems using Z-transform for solving complex problems
	PSO2	3	Design discrete time system components using Z-transform with needs of industry and society

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MY 003 Ethics for Engineers								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	2	0	0	30	0	100	-	100
Objectives	• To impart the value of professional practices with code of conduct and ethical values. • To discuss the various outlooks of roles and responsibilities with work ethics. • To introduce the ethical and moral practices by citizens • To analyze the ethical commitments to be hold safety, responsibility and rights. • To impart knowledge about the global issues pertaining to ethics							
Course Outcomes	**At the end of the course, the student will be able to** CO1: Practice the moral values that ought to guide the Engineering profession. CO2: Apply the core values towards the ethical behaviour of an engineer. CO3: Apply the ethical and moral principles in engineering experimentation.							

	CO4: Apply the ethical and moral principles in engineering for safety and standard codes of moral conduct towards the ethical behavior of an engineer. CO5: Apply ethical and moral principles for engineers as managers, consultants, expert witness and resolve global issues of ethics concerning weapon development and multinational companies.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Human Values

Morals values and Ethics-Integrity-Work ethic-Service learning-Civic virtue-Respect for others-Living peacefully-caring-Sharing-Honesty-Courage-Valuing time-Cooperation-commitment-Empathy-Self confidence-Character-Spirituality – Introduction to yoga and meditation for professional excellence and stress management. [6]

Engineering Ethics

Senses of 'Engineering Ethics'-Variety of moral issues-Types of inquiry-Moral dilemmas – Moral Autonomy – Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self – interest – Customs and Religion – Uses of Ethical Theories. [6]

Engineering as social experimentation

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics A Balanced Outlook on Law. [6]

Safety, Responsibilities and rights

Safety and Risk – Assessment of Safety and Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Right – Employee Right – Intellectual Property Rights (IPR) – Discrimination. [6]

Global Issues

Multinational Corporations – environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineering – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility. [6]

Total Hours: 30

Text book(s):

1	Mike W. Martin and Roland Schinzinger, 'Ethics in Engineering', Tata McGraw Hill, New Delhi, 2003.
2	Gail Baura, 'Engineering Ethics 1st Edition An Industrial Perspective', Imprint: Academic Press,2006.

Reference(s):

1	Charies B. Fleddermann, 'Engineering Ethics', Pearson Prentice Hall New Jersey, 2004.
2	Charies E. Harris, Michael S. Pritchard and Michael J. Rabins, 'Engineering Ethics – Concepts and Cases', Cengage Learning, 2009.
3	John R Boatright, 'Ethics and the Conduct of Business', Pearson Education, New Delhi, 2003.
4	S.A.Sherlekar, 'Ethics in Management', Himalaya Publishing House, 2009.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						3	2	3	3			1			3
CO2						3	2	3	3			1			3
CO3						3	2	3	3			1			3
CO4						3	2	3	3		2	1			3

CO5						3	2	3	3		2	1			3

COs	POs/PSOs	Level	Justification
CO1	PO6	3	Apply the moral values in engineering practice
	PO7	2	Respect the societal values in sustainable development
	PO8	3	Apply ethical principles towards professional excellence and stress management
	PO9	3	Develop self confidence and team management personalities
	PO12	1	Apply the principles of honesty in conducting complex investigations
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership in character modulation
CO2	PO6	3	Study the moral issues in engineering practice
	PO7	2	Respect the societal values in professional roles
	PO8	3	Apply ethical principles towards Consensus and Controversy
	PO9	3	Develop self confidence in Customs and Religion
	PO12	1	Apply the principles of honesty in conducting complex investigations
	PSO3	3	Explore the essential interpersonal skills and attitude needed for ethical leadership in right action
CO3	PO6	3	Experiment engineering as responsible experimenters
	PO7	2	Respect the code of ethics in solving environment related issues
	PO8	3	Apply ethical principles towards responsible experimenters
	PO9	3	Develop self confidence and team management personalities as engineers
	PO12	1	Value the value of conducting complex investigations
	PSO3	3	Develop essential interpersonal skills and attitude needed for law makers
CO4	PO6	3	Solve the safety issues as responsible engineers
	PO7	2	Study the impact of the professional engineering in professionalism
	PO8	3	Commit to professional and employee rights
	PO9	3	Understand the occupational crime in team work
	PO11	2	Solve the issues related to bargaining
	PO12	1	Manage the finance related issues in engineering
	PSO3	3	Develop essential interpersonal skills and attitude needed for IPR
CO5	PO6	3	Solve the environmental issues as responsible engineers
	PO7	2	Become responsible managers to societal and environmental issues
	PO8	3	Commit to professional rights in weapon developments
	PO9	3	Understand the computer ethics in team work
	PO11	2	Solve the issues related to bargaining
	PO12	1	Maintain the code of conduct while acting as advisors
	PSO3	3	Develop Corporate Social Responsibility forleadership and teamwork

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 4P1 - Linear Integrated Circuits and Electromagnetics Laboratory</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours / Week</th><th rowspan="2">Total hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>IV</td><td>0</td><td>0</td><td>4</td><td>60</td><td>2</td><td>60</td><td>40</td><td>100</td></tr>
<tr><td>Course Objectives</td><td colspan="8">• To design and test the various circuits using Op-amp
• To design and test the various circuits using 555 timer
• To construct and test the phase locked loop
• To construct and test different data convertor circuits
• To demonstrate the electric field variations in different geometries and waveguides</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Design and test the various applications of op-amp
CO2: Design and test the various applications of NE555 timer
CO3: Design and test the various applications of PLL
CO4: Design and test the different data convertors</td></tr>
</table>

	CO5: Simulate the electric field variations in different geometries and waveguides

LIST OF EXPERIMENTS

1. Application circuits using op-amp
2. Application circuits using NE555 Timer
3. Application circuits using PLL
4. Data convertors
5. Simulation of the variation of electric field in point charge geometry and parallel plate capacitor geometry
6. Simulation of Transverse electric modes in rectangular waveguide

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3		3	3	3		3	3	3	3
CO2	3	3	3	3	3	3		3	3	3		3	3	3	3
CO3	3	3	3	3	3	3							3	3	
CO4	3	3	3	3	3	3		3	3	3		3	3	3	3
CO5	3	3	3	3	3	2							3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Knowledge in mathematics is required to understand the various applications of op-amp
	PO2	3	Apply the knowledge to analyse the characteristics of various application circuits of op-amp under various voltage and current levels
	PO3	3	Understands the working of various opamp linear and non linear circuits considering environmental and societal requirements
	PO4	3	Identify and analyze opamp linear and non linear circuits and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on electronic circuits
	PO6	3	Able to design simple electronic circuits considering societal, legal , cultural and health issues
	PO8	3	Apply ethical responsibilities in developing the applications circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering the technological changes
	PSO1	3	Solve the engineering problems by applying basic knowledge about op-amp application circuits
	PSO2	3	Design simple electronic circuits by considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products
CO2	PO1	3	Knowledge in mathematics is required to understand the operation of astable and monostable multivibrator using 555 timer
	PO2	3	Able to identify and analyze problems in the operation of multivibrators and provide a valid solution

	PO3	3	Design the multivibrator circuits considering environmental and societal requirements
	PO4	3	Identify and analyse complex problems related to multivibrators using 555 timer and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on multivibrator circuits
	PO5	3	Use the relevant simulators to perform the complex investigations on multivibrator circuits
	PO8	3	Apply ethical responsibilities in developing the multivibrator circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	3	Able to solve the problems related to multivibrator circuits
	PSO2	3	Design and develop products using 555 IC considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products
CO3	PO1	3	Knowledge in mathematics is required for understanding the operation of PLL
	PO2	3	Able to analyze the capture range and lock in range of PLL
	PO3	3	Understands the applications of PLL considering environmental and societal requirements
	PO4	3	Identify and analyse the complex electronic and communication problems and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on PLL circuits
	PO6	3	Able to design simple electronic circuits using PLL considering societal, legal , cultural and health issues
	PSO1	3	Able to design feedback amplifier circuits considering societal, legal , cultural and health issues amplifier circuits by applying basic engineering knowledge
	PSO2	3	Knowledge in PLL circuits can be used for the development of products considering industrial and societal requirements
CO4	PO1	3	Knowledge in mathematics is required to understand the operation of data convertors using op-amp
	PO2	3	Able to identify and analyze problems in the data convertors circuits using op-amp and provide a valid solution
	PO3	3	Design the data convertors circuits using op-amp considering environmental and societal requirements
	PO4	3	Identify and analyse complex problems related to data convertors circuits using op-amp and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on data convertors circuits using op-amp
	PO6	3	Use the relevant simulators to perform the complex investigations on data convertors circuits using op-amp
	PO8	3	Apply ethical responsibilities in developing the data convertors circuits
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable electronic system considering wider technological changes
	PSO1	3	Able to solve the problems related to data convertors circuits using op-amp circuits
	PSO2	3	Design and develop products using data convertors circuits considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products
CO5	PO1	3	Knowledge in mathematics is required for understanding the Vectors

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	PO2	3	Able to analyze the variations in electric field and find solutions to the given problems
	PO3	3	Understand the applications of electromagnetic fields considering environmental and societal requirements
	PO4	3	Identify and analyze the complex rectangular and circular waveguide problems and provide a valid solution
	PO5	3	Use the relevant simulators to perform the complex investigations on variation of electric fields
	PO6	2	Able to simulate electric field and parallel plate capacitor considering societal, legal , cultural and health issues
	PSO1	3	Able to simulate variation in electric field and parallel plate capacitor by applying basic engineering knowledge
	PSO2	3	Develop the methods to simulate waveguides in Transverse electric modes considering industrial and societal requirements

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50 EC 4P2 - Electronic Design Project Laboratory

B.E. Electronics and Communication Engineering

Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	4	60	2	60	40	100

Objective(s)

- To design, analyse, simulate and synthesize digital logic circuits using modeling languages
- To illustrate the design, application and limitations of electronic circuits through laboratory experience
- To introduce the analysis, testing and prototyping of electronic circuits
- To design various power supply blocks needed for electronic circuits
- To stimulate student interests and help solve circuit problems using basic concepts

Course Outcomes

At the end of the course, the students will be able to

CO1: Design & build electronic circuits/systems using discrete components, FET transistors, Operational amplifiers, IC 555 timer and other Linear ICs to meet the desired specifications

CO2: Develop digital circuits using HDL for the given specifications and troubleshoot them.

CO3: Exhibit creativity in the design of systems, circuits or processes and implement them

CO4: Design unregulated power supplies

CO5: Switch to design mode of thinking with increased competence and success in circuit implementation

Students have to design application circuits/systems using analog and digital electronic components. Circuits can be chosen from the given list but need not be confined to it.

1. Design of Low-noise, high-performance analog circuits
2. Digital circuit modeling and analysis using HDL
3. Electronic circuit prototyping, circuit debugging, and testing
4. Design of power supply.
5. **5.** Simulate a given air filled waveguide to obtain the field patterns, intrinsic impedance and wavelength for the first three modes

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**

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Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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K.S.Rangasamy College of Technology
Tiruchengode - 637 215.

CO1	3	3	3	3	3	3		3	3	3	3	3	3	3	3
CO2	3	3	3	3	3			3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3		3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2			3	3	3	2	3	3	3
CO5	3	3	3	3	3	2			3	3	3	2	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1 –PO6 PO8-PO12	3	Students apply the fundamentals of mathematics and science in engineering to design and build sustainable, cost-effective electronic circuits/systems conforming to the standards using discrete components and test them using state of art tools
CO2	PO1 –PO5 PO8-PO12	3	Students apply the fundamentals of mathematics and science to design and develop digital circuits using HDL for the given specifications conforming to the standards, simulate and test them.
CO3	PO1 –PO6 PO8-PO12	3	Students identify, formulate and solve engineering problems exhibiting creativity in the design of systems, circuits or processes and implement them conforming to the standards
CO4	PO1 –PO6 PO8-PO12	3,2	Students apply knowledge of engineering to analyze, design, test and simulate unregulated power supplies
CO5	PO1 –PO6 PO8-PO12	3,2	Students apply basic concepts, design and develop successful solutions for engineering problems, managing projects effectively in teams

K.S. Rangasamy College of Technology – Autonomous R 2018									
Semester IV									
Common to all Branches									
CourseCode	**Course Name**	**Hours/Week**			**Credit**	**Maximum Marks**			
		L	**T**	**P**	**C**	**CA**	**ES**	**Total**	
50 TP 0P2	**Career Competency Development II**	**0**	**0**	**2**	**0**	**100**	**00**	**100**	
Course Objectives	• To help the learners to paraphrase the reading passages, to draft continuous writing and review texts in the academic and professional contexts • To help the learners to acquire the phonetic skills of the language and express themselves precisely for effective professional presentations • To help the learners to enrich their verbal reasoning and ability to match the employability requirements of the corporates • To help the learners to comprehend the preliminary level of aptitude skills required to attend placement and competitive online exams • To help the learners to comprehend the Pre - Intermediate level of aptitude skills required to attend placement and competitive online exams								
Course Outcomes	**At the end of the course, the student will be able to** CO1: Interpret and infer the meaning in the reading passages, organize continuous writing and review texts both academically and professionally. CO2: Adapt to and demonstrate the phonetic skills accurately for effective presentations professionally. CO3: Interpret the various concepts of verbal reasoning and relate for the concepts to the requirements of the competitive exams and employability CO4: Infer the concepts of preliminary level of aptitude skills pertaining to competitive exams and company recruitments. CO5: Infer the concepts of pre-intermediate level of aptitude skills pertaining to competitive								

	exams and company recruitments.

Unit–1	Written Communication – Part 3	Hrs
Reading Comprehension Level 2 (Paraphrasing Poems) - Letter Drafting - Email Writing – Paragraph Writing - Newspaper and Book Review Writing - Skimming and Scanning - Interpretation of Pictorial Representations. **Practices:** Sentence Completion – Sentence Correction – Jumbled Sentences – Synonyms & Antonyms – Using the Same Word as Different Parts of Speech-Editing **Materials:** Instructor Manual, Word power Made Easy Book, News Papers		6
Unit–2	**Oral Communication – Part 3**	4
Self-Introduction-Miming (Body Language) – Introduction to the Sounds of English-Vowels, Diphthongs & Consonants, Introduction to Stress and Intonation - Extempore - News Paper and Book Review-Technical Paper Presentation. **Material:** Instructor Manual, News Papers		
Unit–3	**Verbal Reasoning–Part 1**	8
Analogies- Alphabet Test-Theme Detection-Family Tree – Blood Relations (Identifing relationships among group of people) -Coding &Decoding-Situation Reaction Test –Statement & Conclusions **Material:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit–4	**Quantitative Aptitude –Part 1**	6
Problem on Ages-Percent ages-Profit and Loss-Simple & Compound Interest-Averages- Ratio, Proportion **Material:** Instructor Manual, Aptitude Book		
Unit–5	**Quantitative Aptitude –Part 2**	6
Speed, Time & Work and Distance – Pipes and Cisterns – Mixtures and Allegations – Races – Problem on Trains - Boats and Streams **Practices**: Puzzles, Sudoku, Series Completion, Problem on Numbers **Material:** Instructor Manual, Aptitude Book		
	Total	**30**

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation1 – Written Test	15Questions Each from Unit1,3,4&5 (External Evaluation)	50
2	Evaluation2 – Oral Communication	Extempore & Miming– Unit 2 (External Evaluation by English, MBA Dept.)	30
3	Evaluation3 – Technical Paper Presentation	Internal Evaluation by the Dept.	20
		Total	**100**

ReferenceBooks

1. Aggarwal, R.S.“A Modern Approach to Verbal and Non – verbal Reasoning”, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., NewDelhi.
2. Abhijit Guha,“ Quantitative Aptitude”,TMH, 3rd Edition
3. Objective Instant Arithmetic by M.B.Lal & Goswami Upkar Publications.
4. Word Power Made Easy by Norman Lewis W.R.GOYAL Publications

Note:

- Instructor can cover the syllabus by Classroom activities and Assignments (5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20 questionsfromUnit1,3,4 and Unit 5 and 5 questions from Unit 2.
- Evaluation has to be conducted as like Lab Examination.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1	1	1	1	1	1	1	3	2	3		1	3
CO2		1		1	1	1	1	1	2	3	2	3	1	1	3

CO3	1	1	1	1	2	3	1	1	2	3	2	3	1	2	2
CO4	3	2	2	2	1	2	1	1	2	3	2	3	2	2	1
CO5	3	2	2	2	1	2	1	1	2	3	2	3	2	2	1

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Interpret and infer the complex engineering problems for better understanding
	PO2	2	Interpret and infer the literature and understanding the substantiated conclusions
	PO3	1	Developing solutions for the complex engineering problems with professional interpretation and inference
	PO4	1	Interpret the synthesis of information after conducting investigations of complex problems
	PO5	1	Interpreting the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	1	Interpreting the assessment of contextual responsibilities
	PO7	1	Professionally and academically interpreting the demonstration and necessity of sustainable development
	PO8	1	Interpret and infer the ethical norms and responsibilities professionally
	PO9	1	Interpret the functions effectively bothas individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper interpretation
	PO11	2	Inference of the demonstration of knowledge in multidisciplinary environments
	PO12	3	Ability to interpret and infer in the broadest situational context of changing technology
	PSO2	1	Interpreting the design and development of components and products
	PSO3	3	Infer and interpretation of enriching interpersonal skills and attitude
CO2	PO2	1	Demonstrating professionally the literature and understanding the substantiated conclusions
	PO4	1	Professionally presenting the synthesis of information after conducting investigations of complex problems
	PO5	1	Presenting the application of appropriate techniques in the prediction and modelling of complex problems
	PO6	1	Adapt to demonstrate while applying reasoning to assess contextual responsibilities
	PO7	1	Demonstrate the necessity of sustainable development professionally
	PO8	1	Demonstrate professionally the ethical norms and responsibilities
	PO9	2	Adapt to demonstrate the functions of Individual development and member in team
	PO10	3	Communicating effectively on complex engineering activities by professional presentation
	PO11	2	Demonstrating knowledge in multidisciplinary environments and professional way

	PO12	3	Make demonstration in the broadest situational context of changing technology
	PSO1	1	Professional demonstration to solve complex engineering problems
	PSO2	1	Design and develop components and products with the efficacy of professional demonstration
	PSO3	3	Enriching interpersonal skills and attitude by showcasing expertise in demonstrating professionally
CO3	PO1	1	Interpret various concepts to find solution to complex engineering problems
	PO2	1	Relate the interpreted concepts to analyse complex engineering problems
	PO3	1	Interpret and relate concepts in designing solutions with societal and environmental considerations
	PO4	1	Relate concepts a sequential way for arriving at valid conclusions
	PO5	2	Make concept relations for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	3	Interpret the contextual knowledge in conceptually and relate it to the best engineering practice
	PO7	1	Interpret and relate the engineering solutions in an orderly and cohesive manner for sustainable development
	PO8	1	Interpret and relatethe application the ethical norms with required reorganisation
	PO9	2	Showcasing the individual fitness in diverse scenario with the interpretation of related concepts
	PO10	3	Understand and write effective reports with the interpretation of information in documents.
	PO11	2	Ability to interpret and infer logically to manage projects effectively in diverse teams
	PO12	3	Relate the concepts the wider context of technical changes and engage independently
	PSO1	1	Interpret and relate the concepts to solve complex engineering problems
	PSO2	2	Design and develop components and products with the appropriate relation of concepts
	PSO3	2	Enriching interpersonal skills and attitude by showcasing the interpreting skills of concepts
CO4	PO1	3	Infer the application of engineering knowledge and find solutions to complex engineering problems
	PO2	2	Infer the contingent factors to analyse complex engineering problems
	PO3	2	Infer the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems

	PO5	1	Infer the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	2	Infer the assessed contextual knowledge for professional relevance
	PO7	1	Infer with aptitude the impact of engineering solutions for sustainable development
	PO8	1	Infer the ethical principles and norms of engineering practice
	PO9	2	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and infer the concepts effectively
	PO11	2	Infer knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to infer and showcase the aptitude in the broadest situational context of changing technology
	PSO1	2	Infer with aptitude to solve the complex engineering problems
	PSO2	2	Design and develop components and products with proper inference and aptitude
	PSO3	1	Enriching interpersonal skills and attitude by showcasing effective inference and aptitude
CO5	PO1	3	Infer the application of engineering knowledge and find solutions to complex engineering problems
	PO2	2	Infer the contingent factors to analyse complex engineering problems
	PO3	2	Infer the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems
	PO5	1	Infer the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	2	Infer the assessed contextual knowledge for professional relevance
	PO7	1	Infer with aptitude the impact of engineering solutions for sustainable development
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	PO9	2	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and infer the concepts effectively
	PO11	2	Infer knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to infer and showcase the aptitude in the broadest situational context of changing technology
	PSO1	2	Infer with aptitude to solve the complex engineering problems
	PSO2	2	Design and develop components and products with proper inference and aptitude

	PSO3	1	Enriching interpersonal skills and attitude by showcasing effective inference and aptitude

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 501 - Analog Communication								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	1	0	45	3	50	50	100
Objective(s)	• To impart the fundamentals of basic communication system and the need of modulation • To introduce the modulation processes and different amplitude modulation and demodulation schemes • To introduce angle modulation schemes with generation and detection methods • To describe different types of noise and predict its effect on various analog communication systems. • To study various radio receivers with their parameters.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain the spectral characteristics, generation & detection techniques of AM & DSB SC CO2: Explain the spectral characteristics, generation & detection of SSB &VSB CO3: Describe the generation & detection of angle modulation CO4: Analyze noise in continuous wave modulation systems CO5: Explain the parameters of various radio receivers							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Amplitude Modulation
Introduction to communication system, Need for modulation- FDM, Amplitude Modulation, Definition, Time domain and frequency domain description, power relations in AM waves, Generation of AM waves - square law Modulator, Detection of AM Waves - Square law detector, Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves -, Ring Modulator, Coherent detection of DSB-SC Modulated waves - COSTAS Loop. [9]

SSB Modulation
Introduction to Hilbert Transform, Frequency domain description, Generation of AM - SSB Modulated Wave: Frequency discrimination method, Phase discrimination method, Time domain description, Demodulation of SSB Waves.
Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems. [9]

Angle Modulation
Basic concepts, Frequency Modulation: Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves: Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop, Threshold effect in Angle Modulation System, Pre-emphasis and de-emphasis, Comparison of FM and AM. [9]

Noise
Resistive Noise Source (Thermal), Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties
Noise in DSB, SSB, AM and Angle Modulation System. [9]

Radio Receivers
Heterodyne Receivers, Image Reject Receivers - Hartley Architecture, Weaver Architecture, Zero IF Receivers, Low IF Receivers, Issues in Direct Conversion Receivers – Noise, LO Leakage and Radiation, Phase and Amplitude Imbalance, DC Offset, Inter modulations, Architecture Comparison and Trade-off. [9]

Total Hours: 30+15(Tutorial) = 45

Text book(s):

1	Simon Haykin, 'Communication Systems', 4th Edition, John Wiley & sons, 2013.
2	Dennis Roddy and John Coolean , 'Electronic Communications ', 4th Edition , PEA, 2014.

Reference(s):

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1	B.P.Lathi, 'Communication Systems', BS publications, 2013.
2.	Joy Laskar, Babak Matinpour, Sudipto Chakraborty, 'Modern Receiver Front- Ends Systems, Circuits, and Integration', Wiley- Interscience, 2007.
3.	Bruce Carlson et al, 'Communication System', 5th Edition, McGraw-Hill, 2013.
4.	Wayne Tomasi, 'Electronics Communication Systems-Fundamentals through Advanced', 5th Edition, PHI, 2009.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3								3	3	
CO2	3	3	3	2									3		
CO3	3	3	3	2	3								3	3	
CO4	3	3	3	3									3	2	
CO5	3	3	3	2				3	3	3		3	3		3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Amplitude modulation concepts
	PO2	3	Analyse the concepts of different types in generation of AM waves
	PO3	3	Design and develop square law detector in Amplitude demodulation
	PO4	2	Analyse the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to perform the different modulation experiments
	PSO1	3	Perform the modulation techniques by applying fundamental Engineering knowledge
	PSO2	3	Design the analogy Communication systems components considering industrial and societal requirements
CO2	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of SSB modulation concepts
	PO2	3	Review the concepts of different types in generation of SSB modulated wave
	PO3	3	Develop Phase discriminator method in Generation of SSB modulation
	PO4	2	Conduct the detailed literature survey on existing SSB systems and identify the problems
	PSO1	3	Perform the SSB modulation techniques by applying fundamental Engineering knowledge
CO3	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Angle modulation concepts
	PO2	3	Apply the concepts of different types in generation of Angle modulated signals
	PO3	3	Develop the Generation of angle modulation scheme considering environmental and society requirements
	PO4	2	Conduct the detailed literature survey on existing angle modulation systems and identify the problems
	PO5	3	Apply the relevant simulators to perform the different angle modulation experiments
	PSO1	3	Compare the various analogy modulation techniques by applying fundamental Engineering knowledge
	PSO2	3	Design the analogy Communication systems components considering telecommunication requirements

CO4	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Noise in communication concepts
	PO2	3	Analyse the concepts of different types of noise model in Analog communication
	PO3	3	Design and develop square law detector in Amplitude demodulation
	PO4	3	Analyse the detailed literature survey on existing noise systems and identify the problems
	PSO1	3	Perform the various noise modulation techniques by applying fundamental Engineering knowledge
	PSO2	2	Compare the various noise analogy Communication systems components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Radio receivers concepts
	PO2	3	Analyse the concepts of AM and FM radios
	PO3	3	Develop AM and FM radio model scheme considering environmental and society requirements
	PO4	2	Analyse the detailed literature survey on existing AM and FM radio systems and identify the problems
	PO8	3	Apply ethical principal to compare analogy communication techniques ensuring environmental safety
	PO9	3	Lead effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation, Group discussion etc...
	PO12	3	Develop and build more analogy communication system considering wider technological changes
	PSO1	3	Perform the various noise modulation techniques by applying fundamental Engineering knowledge
	PSO3	3	Communicate effectively with proper documentation in various technical events by acquiring essential skills

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 502 - Control Systems Engineering</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td>Total</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>hrs</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>2</td><td>1</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To understand the concepts of mathematical models, transfer function, block diagram reduction techniques and signal flow graphs
• To gain adequate knowledge in time response and frequency response.
• To learn the concepts of stability analysis in time domain and frequency domain.
• To learn the different types of compensator.
• To understand the concepts of state variable approach.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Derive the mathematical modeling of the systems and compute the transfer function of a system using block diagram reduction/signal flow graph.
CO2: Analyse time response of first and second order control systems and analyse the stability of the system by Routh stability criterion and root locus technique.
CO3: Apply different types of frequency response method to determine the stability of the system.
CO4: Design the various types of compensator for the given specifications using Bode plot.
CO5: Analyse the state variable model of a continuous time control systems.</td></tr>
<tr><td colspan="9">Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.</td></tr>
</table>

Systems modeling Control systems – open loop and closed loop systems- effect of feedback – Transfer function -Models of Mechanical systems- Electrical systems – analogous systems – Block diagram reduction– Signal flow graphs and Mason's gain rule- Transfer function of antenna azimuth position control system – human eye movement. [9] **Time Response and stability analysis** Standard test signals-Time response of first and second order systems– time response specification - steady state error –static error constants and system-type number–Introduction to P, PI, and PID controllers- concept of stability-Routh stability criterion –Root locus concept- Sketching the Root locus. [9] **Frequency Response and system analysis** Closed loop frequency response-Performance specifications in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nquist stability criterion. [9] **Compensator design** Introduction to compensator-Realization of basic compensators-Design of compensator using Bode plot- Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation. [9] **Control system analysis using state variable methods** State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to canonical state variable models-Solution of state equations-state transition matrix - Controllability and Observability. [9]
Total Hours: 30+15(Tutorial) = 45

Text book(s):

1	M.Gopal, 'Control Systems, Principles & Design', 4th Edition, Tata McGraw Hill, 2012.
2	I.J. Nagrath& M. Gopal, 'Control Systems Engineering', 6th Edition, New Age International Publishers, 2018.

Reference(s):

1	Norman S.Nise, 'Control Systems Engineering', 8th Edition, Wiley, 2019.
2	K.Ogata, 'Modern Control Engineering', 5th Edition, Pearson Education India,2015
3	Benjamin.C. Kuo, FaridGolnaraghi, 'Automatic Control Systems', 10th Edition, McGraw-Hill Education, 2017.
4	Smarajit Ghosh, 'Control systems:Theory and applications', 2nd Edition, Pearson Education India, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3	3	3							3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the mathematical modeling of the systems
	PO2	3	Apply the knowledge of engineering to analyse the given block diagram technique and signal flow graph of a systems
	PO3	3	Develop solutions for the block diagram representation and signal flow graph of a system to meet the specifications.
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems of a control systems

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	PSO1	3	Apply the mathematical models of a control systems for solving complex problems
	PSO2	3	Develop the mathematical model of a control systems that meet the specifications.
CO2	PO1	3	Apply the knowledge of engineering mathematics to the solution of time response and stability of control systems.
	PO2	3	Apply the knowledge to analyse the time response and stability of a control systems.
	PO3	3	Develop the first and second order control systems and stability of control systems considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing stability techniques and identify the problems on control systems
	PO5	3	Apply the relevant simulators to perform the complex investigations on time response and stability of control systems.
	PO6	3	Apply the contextual knowledge to measures societal issues and the consequent responsibilities relevant to engineering pproblems
	PSO1	3	Perform the time response and stability of control systems by applying engineering knowledge
	PSO2	3	Design control systems components considering industrial and societal requirements
CO3	PO1	3	Apply the different frequency response methods for control systems.
	PO2	3	Apply the engineering knowledge to analyse the frequency response and stability in frequency domain.
	PO3	3	Develop solutions for complex engineering problems of control systems in frequency domain
	PO4	3	Conduct the detailed literature survey on existing frequency response methods for control systems and identify the problems
	PO5	3	Apply the relevant simulators to analyse the performance of control systems in frequency domain
	PSO1	3	Solve the different frequency response methods for complex engineering problems by applying engineering knowledge
	PSO2	3	Design the control system components considering industrial and societal requirements
CO4	PO1	3	Apply the different types of compensator for control systems
	PO2	3	Apply the knowledge to analyse the given specification to design the compensator
	PO3	3	Design the different compensator that meet the given specification for considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems for further investigations
	PSO1	3	Apply the concepts of compensator for solving complex problems
	PSO2	3	Design the control system components that meet the given specification of industrial and societal requirements
CO5	PO1	3	Apply the concepts of state variable approach for continuous time control systems
	PO2	3	Apply the engineering knowledge to analyse the given state variable model
	PO3	3	Develop the different state variable methods for complex engineering problems for considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing state variable models and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on state variable methods
	PSO1	3	Apply the concepts of state variable models for solving complex problems

	PSO2	3	Design the control system components that meet the specification for considering industrial and societal requirements

K.S.Rangasamy College of Technology – Autonomous R 2018

50 EC 503 - Digital Signal Processing

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	1	0	45	3	50	50	100

Objective(s)

- To study about discrete time systems and to learn about FFT algorithms.
- To design and analyze DSP system FIR and IIR filters.
- To study the fundamentals of multi rate filters.
- To understand finite word length effects
- To study of digital signal processors systems for given specifications and applications

Course Outcomes

At the end of the course, the students will be able to

CO1: Explain the concept of Discrete Fourier Transform and apply FFT for computation of DFT, linear filtering and correlation

CO2: Design IIR filters using Impulse Invariant and Bilinear Transformation Techniques

CO3: Design linear phase FIR filters using Windowing Techniques and sampling method

CO4: Explain the concept of sampling rate conversation of digital signals in DSP applications

CO5: Analyse the effects of Finite word length on digital filters and describe the architecture of TMS320C6x DSP processor

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Fourier Analysis of Discrete Time Signals

Introduction – Frequency Domain Sampling: Discrete Fourier Transform (DFT) – Properties of DFT – Efficient computation of the DFT: FFT algorithms – Radix 2 FFT algorithms: Decimation in Time and Decimation in Frequency – Applications of DFT algorithms in Linear filtering and correlation. [9]

Design of IIR Filters

Design of IIR filters from Analog filters – Frequency Transformation – IIR filters (Butterworth): Properties Design: Impulse Invariant Technique – Bilinear Transformation – Realization of IIR filters. [9]

Design of FIR filters

Design of FIR filters – Symmetric and Anti symmetric FIR filters – Design of Linear Phase FIR filters: Windowing Techniques (Rectangular, Hamming, Hanning) – Frequency Sampling – Realization of FIR filters. [9]

Multirate Signal Processing

Introduction – Basic Multirate Operations – Decimation and Interpolation – Fractional sampling rate alteration – Interconnection of building blocks –The Noble identities – The poly phase representation – Efficient structure of Decimation and Interpolation filters – Application of Multirate systems: Digital audio system – Sub band coding of speech and image signals. [9]

Digital Signal Processors

Finite word length effects: Representation of numbers – Fixed point and Floating point representation – Errors resulting from rounding and truncation – Quantization process and error.

Introduction to programmable DSPs – TMS320C6X DSPs, Basic architectures features – DSP building blocks– Memory space organization – External bus interfacing signals – Memory interface – Parallel I/O interface– Programmed I/O – Interrupts and I/O –Direct memory access(DMA). [9]

Total Hours: 30+15(Tutorial) = 45

Text book(s):

1	John G Proakis, Dimitris G Manolakis, 'Digital Signal Processing Principles, Algorithms and Application', 4th Edition, Pearson, 2014.
2	B. Venkataramani &M.Bhaskar, 'Digital Signal Processor Architecture, Programming and Application', 2nd Edition, McGraw-Hill, 2014.

Reference(s):

1	S.K.Mitra, 'Digital Signal Processing: A Computer based approach', 4th Edition, McGraw-Hill, 2011.
2	Alan V Oppenheim, Ronald W Schafer, John R Back, 'Discrete Time Signal Processing', 3rd Edition, Pearson, 2013.

3	P.Ramesh Babu, 'Digital Signal Processing', 6th Edition, Scitech Publications, 2015.
4	Avtar Singh, S.Srinivasan, 'DSP Implementation using DSP microprocessor with Examples from TMS32C54XX', Thomson/Brooks/Cole, 2004.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3									3	2	
CO5	3	3	3	2									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to understand concept and the basic properties of DFT and FFT
	PO2	3	Apply the knowledge to analyse the Fourier concept of Discrete Time Signals
	PO3	3	Develop the DFT and FFT computation method for discrete time signal processing considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on research based issues in DFT and FFT computation and identify the problems
	PSO1	3	Solve the Fourier concept of Discrete Time Signals by applying basic engineering knowledge
	PSO2	3	Develop the DFT and FFT algorithm processes considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge to analyse the concept of digital IIR filter design
	PO2	3	Apply the engineering knowledge to analyse the given problem to design a IIR filter
	PO3	3	Design IIR filter using impulse invariant and Bilinear transformation method
	PO4	3	Conduct the detailed literature survey on digital IIR filter design and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on digital IIR filter design
	PSO1	3	Solve the digital filter design using transformation methods with the needs of industry and society
	PSO2	3	Design the digital IIR filter for considering industrial and societal requirements
CO3	PO1	3	Apply the knowledge to analyse the concept of digital FIR filter design
	PO2	3	Apply the engineering knowledge to analyse the given problem to design a FIR filter
	PO3	3	Design FIR filter using windows methods
	PO4	3	Conduct the detailed literature survey on digital FIR filter design and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on digital FIR filter design

	PSO1	3	Solve the digital filter design using windows methods with the needs of industry and society
	PSO2	3	Design the digital FIR filter for considering industrial and societal requirements
CO4	PO1	3	Apply knowledge and understand the concepts of multirate signal processing
	PO2	3	Apply the engineering knowledge to analyse the problem to multirate signal processing
	PO3	3	Develop the multirate signal processing system for considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on different multirate filter and identify the problems for further investigations
	PSO1	3	Solve multirate Signal Processing by applying engineering in the field of signal processing
	PSO2	3	Design multirate system components for considering industrial and societal requirements.
CO5	PO1	3	Apply the knowledge to understand the concept of Digital signal processor.
	PO2	3	Apply the knowledge to analyse the Digital signal processor
	PO3	3	Develop the Digital signal processing algorithms considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on digital signal processor and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on digital signal processor
	PSO1	3	Solve Finite word length effects by applying engineering methods with the needs of industry and society
	PSO2	3	Develop the Digital signal processor considering industrial and societal requirements

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 504 - Microprocessors and Microcontrollers</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To introduce the architecture and programming of 8085 microprocessor
• To introduce the architecture, programming and interfacing of 8051 microcontroller
• To develop skill in simple applications development with programming 8085 & 8051
• Interfacing an external device with the processors/controllers
• Develop systems using different microcontrollers</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Describe the functionality of each block in a microprocessor
CO2: Illustrate the interrupts, stack in a microprocessor, microcontroller and demonstrate peripherals by writing appropriate program
CO3: Demonstrate programming proficiency using the various addressing modes and instructions of the 8051 microcontroller
CO4: Do interfacing design of peripherals like I/O, A/D, D/A, timer, external communication, etc.
CO5: Demonstrate an application by accessing the peripherals in ASM and C programming of the target board</td></tr>
<tr><td colspan="9">Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.</td></tr>
</table>

Fundamentals of Microprocessors Fundamentals of Microprocessor Architecture- 8-bit-16 bit -32 bit-64 bit- Microprocessors and Microcontrollers, Comparison - 8085 Architecture - Instruction set - Interrupts - Assembly language programming - Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. [9] **The 8051 Architecture** Overview of the 8051 family, Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles. [9] **Instruction Set and Programming** Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools. [9] **Memory and I/O Interfacing** Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as Port expansion with 8255, General Purpose I/O, ADC, DAC, timers, counters, memory devices. External Communication Interface - Synchronous and Asynchronous Communication, RS232, Introduction and interfacing to protocols like Blue-tooth and Zig-bee. [9] **Applications** SPI, I2C, LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing. [9]
Total Hours: 45

Text book(s):

1	Ramesh S Gaonkar, 'Microprocessor Architecture, Programming and application with 8085', 6th Edition, Penram International Publishing, 2015.
2	Mohamed Ali Mazidi, Janice GillispieMazidi, Rolin Mc Kinlay, 'The 8051 Microcontroller and Embedded Systems: Using Assembly and C', 2nd Edition, Pearson Education, 2011.

Reference(s):

1	Krishna Kant, 'Microprocessors and microcontrollers Architecture, Programming and System design 8085, 8086, 8051, 8096', 3rd Reprint, Prentice Hall of India, 2014.
2	Soumitra Kumar Mandal, 'Microprocessors and Microcontrollers Architecture, Programming and Interfacing using 8085, 8086 and 8051', 6th Reprint, McGraw Hill, 2012.
3	K. J. Ayala, '8051 Microcontroller', Delmar Cengage Learning, 3rd Edition, 2007
4	NPTEL video lectures by M. Krishna Kumar, IISc.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3									3	2	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO 1	3	Apply the knowledge of functions of a microprocessor
	PO 2	3	Analyze engineering problems where microprocessor are used
	PO 3	3	Research and investigate the problem to design solution
	PO 4	3	Design a solution use of microprocessor that meet the needs for society

	PSO 1	3	Compare the various functionality of each block in a microprocessor applying basic engineering knowledge
	PSO 2	3	Develop product that meet the needs of society
CO2	PO 1	3	Apply the knowledge of microprocessor, microcontroller by writing appropriate program
	PO 2	3	Analyzes the working of microprocessor, microcontroller and demonstrate
	PO 3	3	Development of solution with microprocessor, microcontroller in various levels
	PO 4	3	Conduct the detailed survey on problems and identify the solutions for investigations
	PO 5	3	Apply modern technology tools to interrupts, stack in a microprocessor and microcontroller
	PSO 1	3	Compare the techniques by applying basic engineering knowledge
	PSO 2	3	Design a product with microprocessor and microcontroller to meet the specific needs of industry and society
CO3	PO 1	3	Apply the knowledge of demonstrating program proficiency using the various addressing modes
	PO 2	3	Analyzes the problem of programming in microprocessors and microcontrollers
	PO 3	3	Develop a solution to solve the problem in programming proficiency using the various addressing modes
	PO 4	3	Conduct the detailed survey on the programming proficiency of microcontroller
	PO 5	3	Use the modern tools to work with microprocessors and microcontrollers
	PSO 1	3	Compare the various addressing modes by applying basic engineering knowledge
	PSO 2	3	Design a project with the developed technology
CO4	PO 1	3	Apply the knowledge of interfacing design of peripherals like I/O, A/D, D/A, timer, external communication, etc.
	PO 2	3	Analyzes interfacing design and develop peripherals like I/O, A/D, D/A, timer
	PO 3	3	Develop interfacing design to meet the specific needs of the environment
	PO 4	3	Conduct the detailed investigation on interfacing design and problems faced
	PO 5	3	Apply modern tools to design of peripherals like I/O, external communication
	PO 8	3	Apply ethical principles in development of solution
	PO 9	3	Function effectively in teams and as individual to develop solution
	PO 10	3	Write effective reports and design document to represent ideas like paper presentation
	PO 12	3	Develop interest to learn further interfacing design and implement the idea in societal problems
	PSO 1	3	Compare the various interfacing techniques and apply them in engineering
	PSO 2	3	Design a project with I/O, A/D, D/A, timer, external communication
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO5	PO 1	3	Apply the knowledge of accessing the peripherals in ASM and C programming of the target board
	PO 2	3	Analyzes concepts and design of accessing the peripherals
	PO 3	3	Development of solution for complex engineering using ASM and C programming of the target board
	PO 4	3	Conduct the detailed survey and identify the problems for further development in programming microprocessors
	PO 5	3	Apply the modern tools in the field of programming of the target board

	PO 8	3	Apply ethical principles in development of solution in accessing the peripherals in ASM
	PO 9	3	Function effectively in teams and as individual to develop solution
	PO 10	3	Write effective reports and design document to represent idea
	PO 12	3	Develop interest to learn further application and learning C programming of the target board
	PSO 1	3	Compare the various application in ASM and C programming and apply them in developing solution
	PSO 2	3	Design a project and develop the peripherals in ASM and C programming of the target board
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork

K.S.Rangasamy College of Technology – Autonomous R 2018

50 EC 505 - CMOS Design

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100

Objective(s)

- To study the fundamentals of CMOS circuits and its characteristics
- To analyze, design, optimize and simulate digital and analog circuits using CMOS logic
- To know the arithmetic building blocks and memory architecture
- To write the coding for different digital logic circuits using HDL
- To learn different design methodology and testability of VLSI circuits

Course Outcomes

At the end of the course, the students will be able to

CO1: Describe the concepts of digital circuits using CMOS logic and layout design rules.
CO2: Analyse the combinational circuits using alternative CMOS logic.
CO3: Analyse the sequential circuits using alternative CMOS logic.
CO4: Illustrate the subsystem modules for CMOS system.
CO5: Design digital logic using HDL and describe the testing techniques for VLSI circuits.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to MOS Transistor and CMOS Circuit

Issues and challenges in digital IC design, Overview of VLSI design flow, Integration density and Moore's law, MOS transistors: Long channel I-V Characteristics, VTC parameters (DC Characteristics), second order effects, CMOS Logic, CMOS fabrication: p-well and n-well processes, Layout design rules.Circuit performance estimation: RC delay model, Linear delay model and Logical effort of paths, Static power, Dynamic power.
Advanced technologies: Overview of Giga-scale dilemma, FinFET, TFET. [12]

Combinational Circuit Design

Circuit families: Static CMOS, Ratioed Circuits, Cascode voltage switch logic, Dynamic circuits, Pass transistor logic, Circuit pitfalls. [6]

Sequential Circuit Design

Static latches and registers, Dynamic latches and registers, Pulse registers, Sense amplifier based register, pipelining, Schmitt trigger, Monostable sequential circuits, Astable sequential Circuits. Timing classification of digital system: Overview of synchronous design. [9]

Datapath Subsystems Design

Arithmetic building blocks: Data paths, Adders: Single-bit addition, Carry-propagate addition, Multipliers: Unsigned array multiplication, Two's complement array multiplication, Booth encoding, Barrel shifter, Array subsystems: Array architecture of SRAM & DRAM. [8]

Digital Design using HDL and Implementation Strategies

Electronic Design Automation(EDA), Introduction to hardware modeling with the Verilog HDL. System Verilog (SV) HDL: Modules & files-Identifiers, Spaces and comments-Basic gate models, Simple Netlist-Logic values-Continuous assignments, Delays and parameters, Introduction to scripting language.
Design methods: FPGA, Full custom, Semicustom and platform based design, Testing and verification: Manufacturing test principles, Design for Testability: Ad-Hoc testing, BIST. [10]

Total Hours: 45

Text book(s):	
1	Neil.H.E.Weste and David Money Harris, 'CMOS VLSI Design - A Circuits and Systems Perspective', 4th Edition,Pearson Education, 2017.
2	Jan M.Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 'Digital Integrated Circuits-A Design Perspective', 2nd Edition, Pearson Education, 2016.
Reference(s):	
1	J. P. Uyemura, 'Introduction to VLSI Circuits and Systems', John Wiley & Sons (Asia), 2002.
2	M.J. Smith, 'Application Specific Integrated Circuits', Addison Wesley, 2002.
3	Samir Palnitkar, 'Verilog HDL – A Guide to Digital Design and Synthesis', 2nd Edition, Pearson Education, 2011.
4	Mark Zwolinski, 'Digital System Design with System Verilog', 1st Impression, Pearson Education, 2011.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3		3	3	3	3		3	3	3	3
CO5	3	3	3	3	3		3	3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification

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CO1	PO1	3	Apply the basic MOS transistor concept to compare first order effects with second order effects of MOS transistor for analyzing its characteristics
	PO2	3	Apply the knowledge to given complex problems in first order and second order effects of MOS transistor
	PO3	2	Design various CMOS circuits using layout design rules for given complex problems
	PO4	2	Conduct the detailed literature survey on research based issues in CMOS digital circuits and identify the problems
	PO5	3	Apply the modern engineering tools to perform the complex problems survey on research based issues in CMOS digital circuits
	PSO1	3	Perform complex engineering problems by applying engineering knowledge in the field of Signal processing and Communication.
	PSO2	3	Design VLSI system components with needs of industry and society
CO2	PO1	3	Apply CMOS logic to design alternative circuit families for analyzing combinational circuits
	PO2	3	Apply the knowledge to given complex problems using alternative CMOS logic in combinational circuits design
	PO3	3	Design combinational circuit using alternative circuit families
	PO4	3	Conduct the detailed literature survey on combinational CMOS circuit families and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on combinational CMOS circuit families
	PSO1	3	Apply the concepts of combinational circuit families for solving complex problems
	PSO2	3	Design VLSI system components with needs of industry and society
CO3	PO1	3	Apply CMOS logic to design alternative circuit families for analyzing sequential circuits.
	PO2	3	Apply the knowledge to given complex problems in sequential circuits design using alternative CMOS logic
	PO3	3	Design sequential circuits using alternative circuit families
	PO4	3	Conduct the detailed literature survey on CMOS sequential circuit families and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on sequential CMOS circuit families
	PSO1	3	Apply the concepts of sequential circuit families for solving complex problems
	PSO2	3	Design VLSI system components with needs of industry and society
CO4	PO1	3	Apply the knowledge to design basic building block for data path subsystem
	PO2	3	Apply the knowledge to anaylse the complex engineering problems in data path subsystem
	PO3	3	Design data path subsystem for identified complex problems
	PO4	3	Conduct the detailed literature survey on data path subsystem and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on adders, multipliers and array subsystems
	PO7	3	Show the need of CMOS subsystems in VLSI domain for sustainable development
	PO8	3	Apply ethical principles to compare various CMOS subsystem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable CMOS subsystems considering wider technological changes
	PSO1	3	Apply the concepts of data path subsystems for solving complex problems
	PSO2	3	Design VLSI subsystem components with needs of industry and society

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	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the knowledge to design digital logic circuits using HDL for developing hardware with respect to area, power and speed.
	PO2	3	Apply the knowledge to design the complex engineering problems for developing hardware
	PO3	3	Design digital logic circuits using HDL for identified complex problems
	PO4	3	Conduct the detailed literature survey on power, area and speed of the digital logic circuits and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on digital logic circuits using HDL
	PO7	3	Analyze the power, area and speed of the digital logic circuits in VLSI domain for sustainable development
	PO8	3	Apply ethical principles to compare various digital logic circuits with respect to area, power and speed for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable CMOS digital logic circuits considering wider technological changes
	PSO1	3	Apply the concepts of CMOS digital logic circuits for solving complex problems
	PSO2	3	Design digital VLSI circuits components with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 5P1 - Digital Signal Processing Laboratory</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours / Week</th><th rowspan="2">Total hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>0</td><td>0</td><td>4</td><td>60</td><td>2</td><td>60</td><td>40</td><td>100</td></tr>
<tr><td>Course Objectives</td><td colspan="8">• To perform basic signal processing operations on signals using MATLAB
• To analyse the effects of sampling and quantization errors in signals
• To perform computation of FFT and verifying the properties of DFT using MATLAB
• To implement FIR and IIR filters in MATLAB and DSP Processor and to design a DSP system to demonstrate the Multi-rate signal processing concepts
• To simulate the concepts of Digital Signal processing and to design DSP systems for given specifications and applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Generate and perform operations on signals using MATLAB
CO2: Evaluate the effects of sampling and quantization errors in signals
CO3: Compute DFT with FFT and verify its properties using MATLAB
CO4: Design of IIR,FIR, multirate and adaptive filters and verify its performance using MATLAB and Digital Signal Processor
CO5: Generate standard waveform, compute arithmetic operation and analysis the effect of delay, echo and flang using Digital Signal Processor.</td></tr>
<tr><th colspan="9">LIST OF EXPERIMENTS</th></tr>
</table>

Using MATLAB

1. Generation and performing operations on signals
2. Verification of properties of DFT
3. Types and applications FFT
4. Design of digital filters
5. Design of multirate filters

Using Virtual lab

6. Study of sampling theorem, effect of under sampling
7. Study of quantization of continuous-amplitude, discrete-time analog signals

Using DSP trainer kit

1. Generation of standard waveforms
2. Implementation of arithmetic operations
3. Implementation of adaptive filter
4. Design and implementation of FIR & IIR filter for real time applications
5. Analysis of delay, echo and flang

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	3										
CO2	3	3	2	2	3			3	3	3	3	3	3	3	3
CO3	3	3	2	2	3			3	3	3	3	3	3	3	3
CO4	3	3	3	3	3			3	3	3	3	3	3	3	3
CO5	3	3	3	2	3			3	3	3	3	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the mathematical concepts for perform the various signals.
	PO2	3	Apply the knowledge to analyse the given signals to perform the different types of signals
	PO3	2	Develop the different basic signals for considering environmental and societal requirements
	PO4	2	Conduct the experiments, analyse and interpret of different signals.
	PO5	3	Apply the relevant simulators to generate and perform the operations on different signals
CO2	PO1	3	Apply the concepts of sampling and quantization error
	PO2	3	Apply the knowledge to analyse the effects of sampling and quantization error on the signals.
	PO3	2	Develop effects of sampling and quantization for signals considering environmental requirements
	PO4	2	Conduct the experiments, analyse and interpret of sampling process and quantization errors by the given signals.
	PO5	3	Apply the relevant simulators to perform the complex investigations on sampling process and quantization errors for different signals.
	PO8	3	Apply ethical principles on developing sampling process and quantization error implementing digital signal processing
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like project presentations based on the concepts learnt.

	PO11	3	Demonstrate knowledge and understanding of the different quantization error and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
	PO12	3	Develop interest in building more algorithms signal processing considering wider technological changes
	PSO1	3	Perform the sampling process and different types of quantization error by basic engineering knowledge.
	PSO2	3	Knowledge in sampling process and quantization error can be used for develop the digital processors.
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of digital processors.
CO3	PO1	3	Apply the concepts of DFT and FFT in digital signal processing.
	PO2	3	Apply the engineering knowledge to solve the DFT and FFT and its properties.
	PO3	2	Develop the radix FFT considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on different FFT and identify the problems.
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on FFT filter
	PO8	3	Apply ethical principles on developing DFT and FFT algorithms for implementing digital signal processing.
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation related to digital signal processing applications
	PO11	3	Demonstrate knowledge and understanding of the different radix FFT and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
	PO12	3	Develop interest in building different radix FFT considering wider technological changes.
	PSO1	3	Perform the DFT and FFT by applying basic engineering knowledge
	PSO2	3	Design the Fast Fourier Transform considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like project presentation as a team by acquiring essential interpersonal skills
CO4	PO1	3	Apply different methods for digital filters, multirate signal processing and adaptive filters
	PO2	3	Apply the engineering knowledge to analyse the given problem to design the digital filters and adaptive filters
	PO3	3	Develop the multirate signal processing methods and adaptive filters considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on different adaptive filter algorithms and identify the problems for further investigations
	PO5	3	Apply the relevant simulators to perform the complex investigations on multirate signal processing and adaptive filters
	PO8	3	Apply ethical principles for implementing adaptive filter algorithms and multirate signal processing ensuring industrial safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation on application of multirate signal processing.
	PO11	3	Demonstrate knowledge and understanding of the multirate signal processing and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
	PO12	3	Develop more reliable different adaptive filters and multirate signal processing considering industrial requirements

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	PSO1	3	Perform the various digital filters and adaptive algorithm by applying basic engineering knowledge
	PSO2	3	Develop the digital signal processing algorithms for considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the knowledge of engineering fundamentals for digital signal processors.
	PO2	3	Apply the knowledge of engineering to generate the standard waveform, basic arithmetic operation etc., in digital signal processor.
	PO3	3	Understand the effect of delay, echo and flang considering environmental and societal requirements.
	PO4	2	Conduct the detailed literature survey on existing digital signal processors and identify the problems
	PO5	3	Apply the relevant simulators to study the performance of different digital signal processors
	PO8	3	Apply ethical responsibilities in developing the digital signal processors.
	PO9	3	Function effectively in teams to develop and manage industrial projects.
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation on different digital signal processors.
	PO11	3	Demonstrate knowledge and understanding of the digital signal processors principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
	PO12	3	Develop interest in building more digital signal processors considering wider technological changes
	PSO1	3	Able to write the program related to basic operations on digital signal processors.
	PSO2	3	Knowledge in digital signal processors can be used for research studies related to digital signal processing.
	PSO3	3	Communicate effectively with proper documentation in various technical events like project presentation as a team by acquiring essential interpersonal skills.

K.S.Rangasamy College of Technology – Autonomous R 2018

50 EC 5P2 - CMOS Design Laboratory

B.E. Electronics and Communication Engineering

Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	0	0	4	60	2	60	40	100

Objective(s)

- To design and verify the different digital logics using HDL
- To familiarize fusing of logical modules on FPGA
- To understand the static and dynamic circuits using CMOS logic
- To know the verification methodology in VLSI
- To provide hands on experience with EDA platforms

Course Outcomes

At the end of the course, the students will be able to

CO1: Demonstrate FPGA implementation of various digital logic circuits and its application

CO2: Perform DC and Transient analysis of static and dynamic CMOS circuits using SPICE tool

CO3: Analyze the performance of layout with schematic using SPICE tool

CO4: Design adder and multiplier using arithmetic building blocks

CO5: Design circuits and protocols using verification logic

LIST OF EXPERIMENTS

1. Verify the functionality of digital logic circuits using test bench.
2. Application circuit model by Finite State Machine (FSM).

   Compare pre synthesis and post synthesis report by using scripting language (Perl/TCL), implement by FPGA for experiments 1 & 2

3. DC and transient characteristics of static and dynamic CMOS circuits.
4. Layout diagram for above circuits (Ex. No.3).

   Analyse the power, area and delay for experiments 3 & 4 by performing pre layout and post layout simulations.

5. Digital circuit logic using System Verilog (SV).
6. Adder and multiplier logic using arithmetic building blocks by Verilog HDL.
7. Design a protocol (APB/SPI/UART/I2C) using Verilog/System Verilog and verify using UVM methodology.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	3			3	3	3		3	3	3	3
CO2	3	3	3	2	3			3	3	3		3	3	3	3
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3		3	3	3	3		3	3	3	3
CO5	3	3	3	3	3			3	3	3		3	3	3	3

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to design digital logic circuits using HDL for verifying its function with respect to area, power and speed.
	PO2	3	Apply the knowledge to design the complex engineering problems in digital circuits for implementing in FPGA hardware
	PO3	3	Design digital circuits for real time application using HDL for identified complex problems
	PO4	2	Conduct the detailed literature survey on power, area and speed of the digital logic circuits and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on digital logic circuits using HDL
	PO8	3	Apply ethical principles to compare various digital logic circuits with respect to area, power and speed for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of digital logic circuits using HDL for solving complex problems
	PSO2	3	Design digital VLSI circuits components using HDL with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO2	PO1	3	Apply CMOS logic to design static and dynamic circuits for analyzing its characteristics with respect to area, power and speed.
	PO2	3	Apply the knowledge to given complex problems using alternative CMOS logic for developing VLSI product
	PO3	3	Design digital circuits using alternative circuit families
	PO4	3	Conduct the detailed literature survey on static and dynamic CMOS circuits and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on digital CMOS circuit families
	PO8	3	Apply ethical principles to compare various CMOS digital circuits with respect to area, power and speed for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of static and dynamic circuit families for solving complex problems
	PSO2	3	Design VLSI system components with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO3	PO1	3	Apply basic CMOS logic to design layout circuits for analyzing its characteristics with respect to area, power and speed.
	PO2	3	Apply the knowledge to given complex problems using layout rules for alternative CMOS logic
	PO3	3	Design various CMOS circuits using layout design rules for given complex problems

	PO4	3	Conduct the detailed literature survey on research based issues in CMOS digital circuits and identify the problems
	PO5	3	Apply the modern engineering tools to perform the complex problems survey on research based issues in CMOS digital circuits
	PO8	3	Apply ethical principles to compare various CMOS digital circuits using layout rules with respect to area, power and speed for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of static and dynamic circuits using layout rules for solving complex problems
	PSO2	3	Design VLSI system components with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the knowledge to design basic building block for VLSI subsystems
	PO2	3	Apply the knowledge to anaylse the complex engineering problems in VLSI data path subsystems
	PO3	3	Design VLSI data path subsystem for identified complex problems
	PO4	3	Conduct the detailed literature survey on VLSI data path subsystem and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on adders, multipliers and array subsystems
	PO7	3	Show the need of CMOS subsystems in VLSI domain for sustainable development
	PO8	3	Apply ethical principles to compare various CMOS subsystem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable CMOS subsystems considering wider technological changes
	PSO1	3	Apply the concepts of VLSI data path subsystems for solving complex problems
	PSO2	3	Design VLSI subsystem components with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the knowledge to design digital logic circuits and protocols using verification logic for analyzing its function with respect to area, power and speed.
	PO2	3	Apply the knowledge to design the complex engineering problems in digital logic circuits and protocols using verification logic for implementing in FPGA hardware
	PO3	3	Design digital circuits and protocols using verification logic for real time application for identified complex problems
	PO4	3	Conduct the detailed literature survey on power, area and speed of the digital logic circuits and protocols using verification logic and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on digital logic circuits and protocols using verification logic
	PO8	3	Apply ethical principles to compare various digital logic circuits and protocols with respect to area, power and speed for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects

	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable digital logic circuits and protocols considering wider technological changes
	PSO1	3	Apply the concepts of digital logic circuits and protocols using verification logic for solving complex problems
	PSO2	3	Design digital VLSI circuits components using HDL with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology - Autonomous Regulation R 2018</th></tr>
<tr><th colspan="9">50 TP 0P3 - Career Competency Development III</th></tr>
<tr><th colspan="9">Common to all Branches</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>0</td><td>0</td><td>2</td><td>30</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Course Objectives</td><td colspan="8">• To help the learners to enrich the written and oral communication skills in the academic and professional contexts
• To help the learners to enrich their verbal and logical reasoning ability to meet out the employability requirements of the companies
• To help the learners to comprehend the Intermediate level of aptitude skills required to attend placement and competitive online exams
• To help the learners to enhance their knowledge in the quantitative aptitude skills in algebraic and linear equations.
• To help the learners to augment the core technical and coding skills of their respective domains to compete in coding contests</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the student will be able to
CO1: Examine the written and oral communication skills in the academic and professional contexts
CO2: Interpret the concepts of verbal reasoning and relate for the concepts to the requirements of the competitive exams and employability
CO3: Infer the concepts of intermediate level of aptitude skills pertaining to competitive exams and company recruitments.
CO4: Assess their comprehension in the quantitative aptitude skills in algebraic and linear equations.
CO5: Review the core technical and coding skills of their respective domains to compete in coding contests</td></tr>
<tr><td>Unit – 1</td><td colspan="7">Written and Oral Communication – Part 1</td><td>Hrs</td></tr>
<tr><td colspan="8">Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions
Practices: Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations-Editing-GD-Debate.
Materials: Instructor Manual, Word power Made Easy Book, News Papers</td><td>6</td></tr>
<tr><td>Unit – 2</td><td colspan="7">Verbal & Logical Reasoning – Part 1</td><td rowspan="2">8</td></tr>
<tr><td colspan="8">Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions - Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements
Practices: Analogies - Blood Relations - Statement & Conclusions
Materials: Instructor Manual, Verbal Reasoning by R.S.Aggarwal</td></tr>
<tr><td>Unit – 3</td><td colspan="7">Quantitative Aptitude – Part 3</td><td></td></tr>
</table>

Probability - Calendar- Clocks - Logarithms - Permutations and Combinations **Materials:** Instructor Manual, Aptitude Book			6
Unit – 4	Quantitative Aptitude – Part 4		6
Algebra - Linear Equations - Quadratic Equations - Polynomials **Practices:** Problem on Numbers - Ages - Train - Time and Work - Sudoku - Puzzles **Materials:** Instructor Manual, Aptitude Book			
Unit – 5	Technical & Programming Skills – Part 1		4
Core Subject – 1,2,3 **Practices :**Questions from Gate Material **Materials:** Text Book, Gate Material			
		Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions each from Unit 1, 2, 3, 4 & 5 (External Evaluation)	50
2	Evaluation 2 - Oral Communication	GD and Debate (External Evaluation by English, MBA Dept& External Trainers)	30
3	Evaluation 3 – Technical Paper Presentation	Internal Evaluation by the Dept.	20
		Total	**100**

Reference Books

1. Aggarwal, R.S.'A Modern Approach to Verbal and Non-verbal Reasoning', Revised Edition 2008,Reprint 2009, S.Chand& Co Ltd., New Delhi.
2. Abhijit Guha, 'Quantitative Aptitude', TMH, 3rd Edition
3. Objective Instant Arithmetic by M.B. Lal& Goswami Upkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note :

- Instructor can cover the syllabus by Class room activities and Assignments (5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20 Questions from Unit 1,2,3,4 and 5 and 5 Questions from Unit1
- Evaluation has to be conducted as like Lab Examination.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1	1	1	1	1	1	2	3	2	3	1	1	3
CO2	2	1	2	2	1	2	1	1	2	3	3	3	1	1	2
CO3	2	1	2	2	1	1	1	1	2	3	2	3	3	2	2
CO4	2	1	2	2	1	1	1	1	2	3	2	3	3	2	2
CO5	2	2	2	2	2	2	2	2	2	3	2	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Examine the complex engineering problems for better understanding in academic and professional contexts

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	PO2	1	Examine the literature and understanding the substantiated conclusions
	PO3	1	Examine solutions for the complex engineering problems in the academic and professional contexts
	PO4	1	Assessing the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	1	Examining the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	1	Examining the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Assess the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be examined professionally
	PO9	2	Analyse the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper analysis
	PO11	2	Inference of the demonstration of knowledge in multidisciplinary environments
	PO12	3	Examine the broadest situational context of changing technology
	PSO1	1	Assess with academic and professional context to solve the complex engineering problems
	PSO2	1	Examining the design and development of components and products
	PSO3	2	Enriching interpersonal skills and attitude with proper examination
CO2	PO1	2	Interpret and infer the complex engineering problems for better understanding
	PO2	1	Interpret and infer the literature and understanding the substantiated conclusions
	PO3	2	Developing solutions for the complex engineering problems with professional interpretation and inference
	PO4	2	Interpret the synthesis of information after conducting investigations of complex problems
	PO5	1	Interpreting the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	2	Interpreting the assessment of contextual responsibilities
	PO7	1	Professionally and academically interpreting the demonstration and necessity of sustainable development
	PO8	1	Interpret and infer the ethical norms and responsibilities professionally
	PO9	2	Interpret the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper interpretation
	PO11	3	Inference of the demonstration of knowledge in multidisciplinary environments
	PO12	3	Ability to interpret and infer in the broadest situational context of changing technology
	PSO1	1	Interpreting the design and development of components and products

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	PSO2	1	Infer and interpretation of enriching interpersonal skills and attitude
	PSO3	2	Interpret and infer the complex engineering problems for better understanding
CO3	PO1	2	Infer the application of engineering knowledge and find solutions to complex engineering problems
	PO2	1	Infer the contingent factors to analyse complex engineering problems
	PO3	2	Infer the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems
	PO5	1	Infer the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	1	Infer the assessed contextual knowledge for professional relevance
	PO7	1	Infer with aptitude the impact of engineering solutions for sustainable development
	PO8	1	Infer the ethical principles and norms of engineering practice
	PO9	2	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and infer the concepts effectively
	PO11	2	Infer knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to infer and showcase the aptitude in the broadest situational context of changing technology
	PSO1	3	Infer with aptitude to solve the complex engineering problems
	PSO2	2	Design and develop components and products with proper inference and aptitude
	PSO3	2	Enriching interpersonal skills and attitude by showcasing effective inference and aptitude
CO4	PO1	2	Assess the complex engineering problems for better understanding in academic and professional contexts
	PO2	1	Assess the literature and understanding the substantiated conclusions
	PO3	2	Assess solutions for the complex engineering problems in the academic and professional contexts
	PO4	2	Assessing the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	1	Assess the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	1	Assess the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Assess the demonstration and necessity of sustainable development to be examined

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	PO8	1	The ethical norms and responsibilities to be examined professionally
	PO9	2	Analyse the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper analysis
	PO11	2	Assess of the demonstration of knowledge in multidisciplinary environments
	PO12	3	Examine the broadest situational context of changing technology
	PSO1	3	Assess with academic and professional context to solve the complex engineering problems
	PSO2	2	Examining the design and development of components and products
	PSO3	2	Enriching interpersonal skills and attitude with proper assessment
CO5	PO1	2	Infer the application of engineering knowledge and find solutions to complex engineering problems
	PO2	2	Infer the contingent factors to analyse complex engineering problems
	PO3	2	Infer the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems
	PO5	2	Infer the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	2	Infer the assessed contextual knowledge for professional relevance
	PO7	2	Infer with aptitude the impact of engineering solutions for sustainable development
	PO8	2	Infer the ethical principles and norms of engineering practice
	PO9	2	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and infer the concepts effectively
	PO11	2	Infer knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to infer and showcase the aptitude in the broadest situational context of changing technology
	PSO1	3	Infer with aptitude to solve the complex engineering problems
	PSO2	3	Design and develop components and products with proper inference and aptitude
	PSO3	3	Enriching interpersonal skills and attitude by showcasing effective inference and aptitude

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 HS 001 - Engineering Economics and Financial Accounting								
Common to all Branches								
Semester	**Hours / Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100
Course Objective(s)	• To make the Engineering student to know about the basic of economics & how to organize a business • To know the financial aspects related to business. • To know about functions of banks. • To understand the different methods of appraisal of projects • To know about the pricing & capital techniques.							
Course Outcomes	**At the end of the course, the students will be able to** 1. Identify suitable demand forecasting techniques and prevailing market structure 2. Describe the forms of business and differentiate between proprietorship and partnership 3. Explain the kinds of banks and illustrate the Balance sheet with suitable example 4. Interpret fixed cost and variable cost and technical feasibility and economic feasibility 5. Apply break even analysis and summarize the managerial uses of break even analysis							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.								

Basic Economics
Definition of economics – nature and scope of economics – basic concepts of economics – factors of production – demand analysis – definition of demand – Law of demand – Exception to law of demand – Factors affecting demand – elasticity of demand – demand forecasting – definition of supply – factors affecting supply – elasticity of supply – market structure – perfect competition – imperfect competition - monopoly – duopoly – oligopoly and bilateral monopoly. [9]

Organization and Business Financing
Forms of business – proprietorship – partnership - joint stock company - cooperative organization – state Enterprise - mixed economy - Money and banking – kinds of banking - commercial banks - central banking functions - control of credit - monetary policy - credit instrument – Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations [9]

Financial Accounting and Capital Budgeting
The balance Sheet and related concepts – The profit and loss statement and related concepts – Financial ratio analysis – Cash flow analysis – fund flow analysis – Capital budgeting– Average rate of return – Payback period– Net present value and internal rate of return. [9]

Cost Analysis
Types of costing – traditional costing approach - activity based costing - fixed Cost – variable cost – marginal cost – cost output relationship in the short run and in long run – pricing practice – full cost pricing – marginal cost pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project profitability - cost benefit analysis – feasibility reports – appraisal process – technical feasibility - economic feasibility – financial feasibility. [9]

Break Even Analysis
Basic assumptions –break even chart – managerial uses of break even analysis - applications of break even analysis in engineering projects. [9]

Total Hours : 45

Textbook(s):

1. Khan, M Y, Jain, ‘Basic Financial Management ‘, 3rd Edition, McGraw Hill Education, 2017.
2. Maheshwari K. L., Varshney R.L., ‘Managerial economics’,22nd Edition, S Chand and Co., New Delhi, ,2014.

Reference(s):

1. Samuelson P.A, ‘Economics - An Introductory’, New Age Publications, New Delhi, 2009.
2. Barthwal R.R., ‘Industrial Economics - An Introductory’, New Age Publications, New Delhi, 2010.
3. S.K.Bhattacharyya , John Deardon and Y.K.Koppikar, Accounting for Management Text and Cases’.
4. V.L.Mote,Samuel and G.S.Gupta, ’Managerial Economics - Concepts and Cases’, Tata McGraw Hill, 2011.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	1	2	3	2	3	1	2	1	3	3	1
CO2	3	2	3	1	1	2	1	1	3	2	3	2	2	2	2
CO3	2	1	2	1	2	3	3	1	1	3	2	1	2	3	1
CO4	3	2	3	3	2	2	1	2	2	1	3	2	3	2	2
CO5	2	1	3	1	1	3	2	1	2	2	3	1	2	2	2

COs	POs/PSOs	Level	Justification
	PO1	3	Apply the knowledge of management science in forecasting techniques
	PO2	3	Identifying the problems in demand forecasting and market structure

CO1	PO3	3	Designing the new market structure for selling the products
	PO4	2	Investigating various demand forecasting techniques to know about the future demand in short time
	PO5	1	Identifying the tools for predicting the future demand and supply
	PO6	2	The demand and forecasting technique to assess societal, health and cultural issues relevant to professional engineering practice
	PO7	3	Identifying environment and sustainability by demand forecasting techniques in prevailing market
	PO8	2	Applying ethical principles in the existing market structure
	PO9	3	Conduct demand and forecasting to identify individual teamwork of diverse teams
	PO10	1	Communicate effectively on the prevailing market structure and make effective presentations
	PO11	2	Demonstrate knowledge to identify forecasting techniques
	PO12	1	Perform suitable forecasting techniques to recognize the need for life-long learning
	PSO1	3	Provide solutions for complex problems in the prevailing market structure
	PSO2	3	Designing and developing system that meet the needs of the prevailing market structure
	PSO3	1	Develop essential inter-personal skills that suits the prevailing market
CO2	PO1	3	Applying the knowledge in describing the forms of business
	PO2	2	Analyzing the complex engineering problems and differentiate proprietorship and partnership
	PO3	3	Design solutions for complex engineering problems under the different forms of business
	PO4	1	Conduct investigation on complex problems between proprietorship and partnership
	PO5	1	Apply IT tools in prediction and modelling of different forms of business
	PO6	2	Apply reasoning informed by contextual knowledge to assess the forms of business and the differentiation existing in them
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental context with regards to the business
	PO8	1	Apply ethical principles and commit to professional ethics to describe the forms of business
	PO9	3	Differentiating the individual and team work in terms of proprietorship and partnership
	PO10	2	Communicate effectively with proper documentation stating the forms of business
	PO11	3	Demonstrate knowledge and understanding to manage projects in multidisciplinary forms of business environment
	PO12	2	The ability to engage in independent and long-term learning in context of business environment
	PSO1	2	The application of engineering knowledge in the field of business environment
	PSO2	2	Develop products that meet the specific needs of the business industry
	PSO3	2	Develop essential inter-personal skills and attitudes needed for ethical leadership and teamwork in business environment
CO3	PO1	2	Apply the knowledge of mathematics and engineering fundamentals for maintaining balance sheet
	PO2	1	Identify, formulate and analyze complex engineering problems in the balance sheet
	PO3	2	Design and develop the balance sheet that meet the specific needs
	PO4	1	Use research-based knowledge and explain the kinds of bank
	PO5	2	Usage of modern tools in formulation of balance sheet
	PO6	3	Apply reason informed by contextual knowledge with an understanding of the kinds of banks
	PO7	3	Understand the need for sustainable development and the need for maintaining balance sheet

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	PO8	1	Applying ethical principles when handling with different kinds of bank
	PO9	1	Illustrate the individual and team work in formulation of balance sheet
	PO10	3	Communicate effectively to comprehend and write effective reports on balance sheet
	PO11	2	Project management and finance on differentiating the banks
	PO12	1	Recognize the need for having balance sheet
	PSO1	2	Solving complex engineering problems that arises during identification of different kinds of bank
	PSO2	3	Design system components with regards to the banking function
	PSO3	1	Perform leadership and teamwork in team building for communicating the forms of bank
CO4	PO1	3	Interpret fixed cost and variable cost with the application of knowledge of mathematics
	PO2	2	Identify and formulate the fixed and variable cost, technical feasibility and economic feasibility
	PO3	3	Design and development of solutions for technical and economic feasibility
	PO4	3	Conduct investigation on complex problems on fixed and variable cost
	PO5	2	Perform modern tool usage to develop technical feasibility and economic feasibility
	PO6	2	Apply reasoning informed by contextual knowledge to support technical feasibility
	PO7	1	Understand the impact of professional engineering solutions to fixed and variable cost calculation
	PO8	2	Apply ethical principles to provide economic feasibility
	PO9	2	Commute individual and team work in interpretation of fixed and variable cost
	PO10	1	Communicate effectively to maintain technical feasibility and economic feasibility
	PO11	3	Demonstrate knowledge and understanding of fixed and variable cost problems
	PO12	2	Recognize the need and the ability to engage in technical feasibility and economic feasibility
	PSO1	3	Solve complex problems on fixed and variable cost using Engineering knowledge
	PSO2	2	Design system components and develop products in solving fixed and variable costs
	PSO3	2	Develop essential interpersonal skills and abilities to maintain technical feasibility and economic feasibility
CO5	PO1	2	Apply break even analysis to the solution of complex engineering problems
	PO2	1	Problem analysis using break even analysis
	PO3	3	Design solutions of complex engineering problems using break even analysis
	PO4	1	Use research-based knowledge to summarize the managerial use of breakeven analysis
	PO5	1	Create, select and apply appropriate brake even analysis to complex engineering activities
	PO6	3	Apply reasoning informed by the contextual knowledge of breakeven analysis
	PO7	2	Understand the impact of professional engineering solutions in managerial use of breakeven analysis
	PO8	1	Apply ethical principles in managerial use of breakeven analysis
	PO9	2	Individual and team work in summarizing the managerial uses of breakeven analysis
	PO10	2	Communicate effectively on the managerial use of breakeven analysis
	PO11	3	Demonstrate the knowledge and understanding of breakeven analysis
	PO12	1	Recognize the need for break even analysis in the broadest context of technological change

	PSO1	2	Solving complex engineering problems using breakeven analysis
	PSO2	2	Design system components and develop products using breakeven analysis
	PSO3	2	Develop essential interpersonal skills to summarize the managerial use of breakeven analysis

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 601 - Digital Communication								
B.E. Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	50	50	100
Objective(s)	• To study signal space representation of signals and discuss the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals • To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels • To understand baseband signal transmission and reception techniques • To understand passband signal transmission and reception techniques • To discuss fundamental concepts and limits in information theory in the context of digital communication systems							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyze the sampling process and various waveform coding techniques CO2: Describe the different channel coding techniques which are used to provide reliable transmission of digital information over the channel CO3: Design of optimum receivers and explain the transmission of digital data over a band pass channel CO4: Examine the transmission of a signal at high modulation rate through a band-limited channel and discuss the baseband data transmission systems CO5: Discuss the fundamental concepts and limits in information theory in the context of a digital communication system							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.								

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Waveform Coding Techniques
Pulse code modulation – Sampling, Quantizing, Encoding – Quantization noise and robust quantization- Differential pulse code modulation – Adaptive differential pulse code modulation - Delta modulation –Adaptive Delta Modulation. [9]

Error Control coding
Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes (CRC) – Convolutional codes – Viterbi decoding (Soft/Hard decision decoding). [9]

Baseband Modulation
Gram-Schmidt orthogonalization procedure - Maximum-likelihood detector – Correlation receiver – Matched filter receiver - Generation, Detection, Signal space diagram, BER analysis for Coherent binary modulation schemes: BPSK, BFSK – Coherent quadrature modulation schemes: QPSK, MSK – Non coherent binary modulation schemes: BFSK, DPSK - Comparison of binary and quaternary modulation schemes – M-ary modulation schemes - Carrier and symbol synchronization, Basics of MIMO and OFDMA. [9]

Baseband Pulse transmission
Line codes – PSDs – ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - M-ary schemes –Eye pattern. [9]

Fundamentals of Information theory
Measure of information – Entropy – Source coding theorem – Discrete memoryless channels – lossless, deterministic, noiseless, BEC, BSC – Mutual information – Channel capacity – Shannon-Hartley law - Shannon-Fano coding, Huffman Coding, run length coding, LZW algorithm. [9]

Total Hours: 45+15(Tutorial) = 60

Text book(s):

1.	Simon Haykin, 'Digital Communications', 1st Edition, Wiley Publishers, 2013.
2.	John G.Proakis, 'Digital Communication", 5th Edition, Tata McGraw Hill, 2014.

Reference(s):

1.	Bernard Sklar& Ray, 'Digital Communications - Fundamentals and applications', 2nd Edition, Pearson Education, 2012.
2.	Taub& Schilling, 'Principles of Digital Communication', 4th Edition, McGraw-Hill, 2015.
3.	Simon Haykin, 'Communication Systems', 4th Edition, Wiley Publishers, 2013.
4.	B.P.Lathi&Zhi Ding, 'Modern Digital and Analog Communication Systems', 5th Edition, Oxford University Press, 2018.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	2	3								3	3	
CO2	3	2	3	3	3			3	3	3		3	3	3	3
CO3	3	2	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	2	3								3	3	
CO5	3	2	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	2	Apply the signal sampling and reconstruction concepts for different waveform coding techniques
	PO2	3	Apply the knowledge to analyse the given problem to design the communication system
	PO3	3	Design the communication system components considering environmental and societal requirements

	PO4	2	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to perform the complex investigations
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	3	Design the communication system components considering industrial and societal requirements
CO2	PO1	3	Apply the different channel coding techniques for various communication systems
	PO2	2	Apply the knowledge to analyse the given error control codes to design the communication system for reliable data transmission
	PO3	3	Design the reliable communication system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing channel coding techniques and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on error control codes
	PO8	3	Apply ethical responsibilities to develop the communication systems implementing different channel codes ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO1	3	Perform the different channel coding techniques by applying basic engineering knowledge
	PSO2	3	Design the reliable communication system modules considering different environmental conditions
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO3	PO1	3	Apply the digital modulation techniques for different communication systems
	PO2	2	Apply the knowledge to analyse the given problem to design the communication system
	PO3	3	Develop the digital communication system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing modulation techniques and identify the problems for further investigations
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on baseband modulation
	PO8	3	Apply ethical principles to compare digital modulation techniques ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO1	3	Compare the various digital modulation techniques by applying basic engineering knowledge
	PSO2	3	Design the communication system components considering telecommunication industrial requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the different pulse shaping concepts for baseband transmission
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the baseband transmission systems
	PO3	3	Develop the baseband communication schemes considering environmental and societal requirements

	PO4	2	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to study the performance of different line codes
	PSO1	3	Measure the power spectral densities of different line codes by applying basic engineering knowledge
	PSO2	3	Develop the baseband communication system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of information theory for different source coding techniques
	PO2	2	Apply the engineering knowledge to analyse the given source coding technique
	PO3	3	Develop the algorithms for various source codes for different channel requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing source coding techniques understanding the limitations of channels
	PO5	3	Apply the relevant simulators to perform the complex investigations on information theory
	PSO1	3	Apply the concepts of information theory for solving complex problems
	PSO2	3	Design the communication system components considering industrial and societal requirements

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 602 - Embedded Systems								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100
Objective(s)	• To understand and program embedded systems using modern embedded processors • To learn the fundamental concept of Embedded network and computing • To understand the architecture of ARM and do programming • To interfaces, peripherals and processors associated with embedded systems • To understand concept of RTOS in Embedded computing							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Interpret the basic design process of embedded system CO2: Illustrate the wired and wireless networking protocols for an embedded application CO3: Examine standard architecture and peripheral subsystem of ARM CO4: Develop programs for 32-bit ARM Processor using ARM development tools CO5: Describe the basic architecture of an operating system and its fundamental operations							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Embedded Computing
Introduction – Characteristics of Embedded computing -Challenges in Embedded computing system design - Embedded system design process – Embedded hardware units and devices in a system – Embedded software in a system – Examples of Embedded system – Classifications of embedded system-Skills required for an embedded system designer. [9]

Embedded Networks
Introduction to Embedded Networks - Distributed embedded architectures – Network protocols: RS485, CAN, USB, Wireless: Wi-Fi and LoRA. Case Study: Automatic chocolate vending machine and digital camera, Elevator controller. [9]

ARM Architecture

Advanced RISC Machine -Architecture Inheritance, ARM Programming Model - 3 and 5 stages Pipeline ARM Organization, ARM Instruction Execution and Implementation - Thumb bit in the CPSR - Thumb programmer's model, Architectural Support for System Development - memory interface, JTAG IEEE1149. [9] **LPC 214x Microcontroller** Introduction, Key Features, Architectural overview, Block diagram, pinning information, Memory map, Interrupt controller, Interrupt sources, System control block functions, Application Information, ARM development tool ,ARM programming. [9] **Real Time Operating Systems** Basic principles of OS – OS Architecture – System calls – Threads, tasks and process – Task states – Kernel and its function – Scheduling: static, dynamic, priority, pre-emptive, round robin, Earliest Deadline First, Rate monotony, First-Come, First-Served (FCFS). Shortest-Job-Next, Multiple-Level Queues Scheduling. [9]
Total Hours: 45

Text book(s):

1	Rajkamal, 'Embedded Systems Architecture: Programming and Design', 2nd Edition, Tata McGraw Hill, 2014.
2	Steve Furber, 'ARM System on chip Architecture', 2nd Edition, Addison Wesley, 2017.

Reference(s):

1	Wayne Wolf, 'Computers as Components: Principles of Embedded Computing System Design', 2nd Edition, Morgan Kaufman Publishers, 2013.
2	David E.Simon, 'An Embedded Software Primer', 3rd Edition, Pearson Education, 2014.
3	Dr K.V.K.K.Prasad, 'Embedded/Real-Time systems: Concepts, Design& Programming', New Edition, Dream Tech Press, 2013.
4	Joseph Yiu, 'The Definitive Guide to the ARM Cortex-M',Elsevier- Newness, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3	3			3	3	3		3	3	3	3
CO3	3	3	3	3	3								3	2	
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3								3	2	

COs	POs/PSOs	Level	Justification
CO1	PO 1	3	Apply the knowledge of engineering specialization interpret with design process to find the solution of complex engineering problems.
	PO 2	3	Literature the various design process to develop the embedded system
	PO 3	3	Design an embedded system to interpret with other process for a specific application by considering societal needs.
	PO 4	3	Investigate social problem and to interpret with development of embedded system to bring solution.
	PSO 1	3	Perform the microprocessor system by applying basic engineering knowledge
	PSO 2	3	Design the microprocessor-based system components considering industrial and societal requirements
CO2	PO 1	3	Apply the knowledge of wired and wireless networking protocol to establish the communicate between ends

	PO 2	3	Formulate the networking connectivity using wired and wireless method to solve the engineering problems.
	PO 3	3	Design and establish the continuous communication between the ends by considering environmental and societal requirements
	PO 4	3	Conduct the detailed literature survey on existing techniques and identify the problems
	PO 5	3	Use the modern simulators to perform the complex problem to investigate the connection establishment
	PO 8	3	Apply ethical responsibilities to develop the communication systems implementing different network protocol ensuring environmental safety
	PO 9	3	Effectively collaborate with interdisciplinary team to develop project meeting with industry standard
	PO 10	3	Communicate effectively through paper presentation and as like other technical events to promote the recent development of wired and wireless system
	PO 12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO 1	3	Perform the different networking techniques by applying basic engineering knowledge
	PSO 2	3	Design the reliable communication system modules considering different environmental conditions
	PSO 3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO3	PO 1	3	Apply the knowledge of 32 bit architecture to create the subsystem for engineering problems.
	PO 2	3	Framing of an embedded system with the support of sub module to find the solution of the social problem.
	PO 3	3	Design and establishment of ARM based system addressing the problem of the public health, safety and societal requirements
	PO 4	3	Literature and reviewing the various processor and identify the possibility compact system development to address the solution of society
	PO 5	3	Use the modern tool to perform the complex problem to test the performance of the modules in a system
	PSO 1	3	Compare the various ARM processor by applying basic engineering knowledge
	PSO 2	3	Design the ARM based system components considering industrial automation requirements
CO4	PO 1	3	Apply the programming language knowledge for 32-bit ARM architecture to develop the system for engineering problems.
	PO 2	3	Identifying the suitable algorithms to perform better way to produce the solution for existing problem.
	PO 3	3	Design and establishment of ARM based program using modern tool usage for providing flexible and compact system.
	PO 4	3	Investigating the possible and better programming flow and conduct experiment to ensure the safety and provide the solution.
	PO 5	3	Use the modern tool to examine each submodule performance for meeting the requirement.
	PO 8	3	Considering ethical responsibilities to develop an embedded systems implementing ensuring environmental safety.
	PO 9	3	Effectively collaborate with interdisciplinary team to develop project meeting with industry standard
	PO 10	3	Communicate effectively through project presentation and as like other technical events to promote the recent development.

	PO 12	3	Develop interest in building more reliable and safety system considering wider technological updates.
	PSO 1	3	Apply the algorithmic knowledge to solve complex engineering problems
	PSO 2	3	Design ARM based system by adopting the suitable algorithm to meet the industrial requirements
	PSO 3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO 1	3	Apply knowledge on operating system architecture for ensuring the better memory management applications.
	PO 2	3	Literature the various process to develop the better operating system
	PO 3	3	Design an operating system and schedule the process to meet specific application by time.
	PO 4	3	Investigate social problem and to interpret with development of embedded system to bring solution.
	PO 5	3	Use the modern tool to examine system performance and memory occupancy for meeting the requirement.
	PSO 1	3	Apply the concepts of operating system for solving complex engineering problems
	PSO 2	3	Design the operating system considering performance and memory bottle neck to suit industrial requirements

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 603 – Machine Learning Techniques</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To enable students to understand different techniques related to Machine Learning
• To understand the machine learning theory and linear models.
• To study about various unsupervised learning techniques and dimensionality reduction techniques.
• To learn the theoretical aspects of graphical model.
• To implement reinforcement learning techniques and its applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Explain the basic concepts of machine learning
CO2: Identify and apply the appropriate machine learning technique for classification, regression and decision making.
CO3: Design and implement solution for clustering and dimensionality problems.
CO4: Describe the inference and learning algorithms for the graphical model.
CO5: Apply reinforcement learning techniques for real life problems.</td></tr>
<tr><td colspan="9">Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.</td></tr>
<tr><td colspan="9">Introduction
Neural Networks - Training a Perceptron - Learning Boolean Functions - Multilayer Perceptrons - Back propagation Algorithm -Training Procedures - Tuning the Network Size - Types of Machine Learning – Supervised and</td></tr>
</table>

unsupervised Learning– theory of generalization – generalization bound – approximation-generalization tradeoff – bias and variance – learning curve. [9]

Linear Models

Linear regression- Ridge regression- Lasso, Bayesian regression- Regression with Basis functions- Logistic regression- Perceptrons- Large margin classification- Kernel methods- Support Vector Machines-hard SVM, soft SVM- Classification and Regression Trees, Radial Basis Functions. [9]

Unsupervised Learning and Dimensionality Reduction

Nearest neighbour models - K means - clustering around medoids - silhouettes - hierarchical clustering - Dimensionality reduction - principle component analysis - linear discriminant analysis- factor Analysis – Independent Component Analysis. [9]

Graphical Model and Ensemble Methods

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution-Bayesian Belief Networks-Markov Random Fields- Hidden Markov Models -Boosting - Adaboost, Gradient Boosting; Bagging - Simple methods, Random Forest. [9]

Reinforcement Learning

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in Health care – applications in robot control. [9]

Total Hours: 45

Text book(s):

1	Ethem Alpaydin, 'Introduction to Machine Learning', 4th Edition, MIT Press, 2020.
2	Tom M Mitchell, 'Machine Learning', 1st Edition, McGraw Hill Education, 2017.

Reference(s):

1	Peter Flach, 'Machine Learning: The art and science of algorithms that make sense of data', Cambridge University Press, 2012
2	K. P. Murphy, 'Machine Learning: A probabilistic perspective', MIT Press, 2012.
3	Christopher M. Bishop , Pattern Recognition and Machine Learning , Springer,2014
4	Stephen Marsland, Machine Learning: An Algorithmic Perspective, 2nd Edition, 2014

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2									3	2	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Fundamental of mathematics and sciences are used in various aspects of machine learning techniques pertains solving complex engineering problems
	PO2	2	Able to identify and analyse engineering problems using machine learning approaches

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	PO3	2	Supervised and unsupervised learning concepts can be used to design and develop solutions for complex engineering problems.
	PO4	2	Supervised learning and unsupervised concepts can be used to design and conduct experiments to provide valid conclusions
	PSO1	3	Various learning approaches acquire skills to design, analyze and develop algorithms and implement those using image processing, machine learning
	PSO2	2	Different machine learning methods helps to design system components and develop products
CO2	PO1	3	Knowledge of various machine learning technique for classification, regression and decision making, dimensionality reduction techniques involves solving complex engineering problems.
	PO2	3	Various aspects of Classification and Regression models, clustering methods in machine learning helps to identify and analyze engineering problems
	PO3	3	Knowledge of Linear Models and Unsupervised Learning can be used to design and develop solutions for complex engineering problems
	PO4	3	Linear Models, Clustering algorithms knowledge can be used to design and conduct experiments to provide valid conclusions.
	PO5	3	Able to use various tools to develop the prediction and modelling system based on application
	PSO1	3	Knowledge of different supervised Learning, regression techniques obtain skills to design, analyse and develop algorithms and implement them using high-level programming languages in machine learning.
	PSO2	3	Different linear regression and SVM classification model techniques concepts contribute skills in computing and design system components and develop products

CO3	PO1	3	Knowledge in mathematics is required for solving complex engineering problems using machine learning technique for decision making, dimensionality reduction techniques
	PO2	3	Principles of mathematics and engineering sciences used in various aspects of clustering methods in machine learning helps to identify and analyse complex engineering problems
	PO3	3	Knowledge of Unsupervised Learning can be used to design and develop solutions for complex engineering problems
	PO4	3	Dimensionality reduction, Clustering algorithms knowledge can be used to design and conduct experiments to provide valid conclusions.
	PO5	3	Developing a prediction and modelling system based on application using various available tools
	PSO1	3	Knowledge of different Unsupervised Learning, dimensionality reduction techniques helps to design, analyse and develop algorithms and implement them using high-level programming languages in machine learning.
	PSO2	3	Different clustering techniques concept contribute skills in computing and design system components and develop products
CO4	PO1	3	Knowledge of Graphical Model and concept of inference and learning algorithms for the Ensemble Methods helps in solving complex engineering problems.
	PO2	3	Principles of mathematics and engineering sciences are used to analyse problems in Graphical Model and Ensemble Methods.
	PO3	3	Knowledge of theoretical foundations Ensemble Methods and Learning task can be used to design and develop solutions for complex engineering problems.
	PO4	3	The inference and learning algorithms for the graphical model concept helps in analysis complex problems and provide valid conclusions
	PSO1	3	Study of Graphical Model and Ensemble Methods working helps to design, analyse and develop algorithms and implement those using programming languages in machine learning.
	PSO2	3	Various Ensemble techniques principles contribute skills to design, analyse, develop the model.
CO5	PO1	3	Knowledge of reinforcement learning algorithms support in solving complex engineering problems.
	PO2	3	Principles of mathematics and engineering sciences are used in various Reinforcement Learning.
	PO3	3	Knowledge of theoretical foundations of Reinforcement Learning, Learning Task can be used to design and develop solutions for complex engineering problems in applications in Health care, robot control.
	PO4	3	Reinforcement Learning concepts, -utility function helps in analysis of performance of solutions to complex problems.
	PSO1	3	Various reinforcement learning approaches acquire skills to design, analyze and develop algorithms and implement those using image processing
	PSO2	3	Reinforcement learning methods to design system components and develop products in automation industry

K.S.Rangasamy College of Technology – Autonomous R 2018

50 MY 014 - Start-ups and Entrepreneurship

Common to all branches

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	0	30	0	100	-	100

Objective(s)

- To provides practical proven tools for transforming an idea into a product or service that creates value for others.
- To build a winning strategy, how to shape a unique value proposition, prepare a business plan
- To impart practical knowledge on business opportunities
- To inculcate the habit of becoming entrepreneur
- To know the financing, growth and new venture & its problems

Course Outcomes

At the end of the course, the students will be able to

CO1: Transform ideas into real products, services and processes, by validating the idea, testing it and turning it into a growing, profitable and sustainable business.

CO2: Identify the major steps and requirements in order to estimate the potential of an innovative idea as the basis of an innovative project.

CO3: Reach creative solutions via an iteration of a virtually endless stream of world-changing Ideas and strategies, integrating feedback, and learning from failures along the way.

CO4: Apply the 10 entrepreneurial tools in creating a business plan for a new innovative venture.

CO5: Apply methods and strategies learned from interviews with startup entrepreneurs and innovators, methods of exit from Business

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Entrepreneurship & Entrepreneur

Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship.

The Entrepreneur*:* Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system. [6]

Business Opportunity Identification and Preparing a Business Plan

Business ideas, methods of generating ideas, and opportunity recognition, Idea Generation Process, Feasibility study, preparing a Business Plan: Meaning and significance of a business plan, components of a business plan. [6]

Innovations

Innovation and Creativity - Introduction, Innovation in Current. Environment, Types of Innovation, School of Innovation, Analysing the Current Business Scenario, Challenges of Innovation, Steps of Innovation Management, Experimentation in Innovation Management, Participation for Innovation, Co-creation for Innovation, Proto typing to Incubation. Blue Ocean Strategy-I, Blue Ocean Strategy-II. Marketing of Innovation, Technology Innovation Process. [6]

Financing and Launching the New Venture

Importance of new venture financing, types of ownership, venture capital, types of debt securities, determining ideal debt-equity mix, and financial institutions and banks.

Launching the New Venture: Choosing the legal form of new venture, protection of intellectual property, and formation of the new venture. [6]

Managing Growth and Rewards in New Venture

Characteristics of high growth new ventures, strategies for growth, and building the new ventures.

Managing Rewards: Exit strategies for Entrepreneurs, Mergers and Acquisition, Succession and exit strategy, managing failures – bankruptcy. [6]

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		Total Hours: 30
Text book(s):		
1	Stephen Key, 'One Simple Idea for Startups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company' 1st Edition, Tata McGraw Hill Company, New Delhi, 2013.	
2	Charles Bamford and Garry Bruton, 'ENTREPRENEURSHIP: The Art, Science, and Process for Success', 2nd Edition, Tata McGraw Hill Company, New Delhi, 2016.	
Reference(s):		
1	Philip Auerswald, 'The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy', Oxford University Press, 2012.	
2	Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, 'Entrepreneurial Finance: Strategy, Valuation, and Deal Structure, Stanford Economics and Finance', 2011.	
3	Edward D. Hess, 'Growing an Entrepreneurial Business: Concepts and Cases', Stanford Business Books, 2011.	
4	Howard Love, 'The Start-Up J Curve: The Six Steps to Entrepreneurial Success', Book Group Press, 2011.	

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	1	3	1	2	1		2	2	2	1	
CO2	2	3	3	2	2		2	2	2		2	2	3		
CO3	3	2	3	1	2				1	3	1	3	3		
CO4	3	3	3	3	3	2	2	1		1	3	3	3		
CO5	3	2	3	3	3			2			3	2	2		

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to fundamentals concepts of Entrepreneurship
	PO2	3	Apply the knowledge to analyse the given problem to economic development
	PO3	3	Develop the agencies in entrepreneurship management for environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	1	Apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations in future of entrepreneurship
	PO6	3	Apply the contextual knowledge to skills required to be an entrepreneur to the professional engineering practice.
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO8	2	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice for preparing business plan
	PO9	1	Function effectively as leader in the entrepreneurial decision process
	PO11	2	Demonstrate knowledge and understanding of the engineering and management principles and apply these to entrepreneurship development
	PO12	2	Recognize the need for entrepreneur and life-long learning in the broadest context of technological change.

	PSO1	2	Solve complex engineering problems by applying engineering knowledge in the field of product development
	PSO2	1	Design system components and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO2	PO1	2	Apply the knowledge to various Business ideas, methods and technologies used in business.
	PO2	3	Apply the knowledge to analyse various opportunity recognition
	PO3	3	Design the components of a business plan considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing business plan identify the problems
	PO5	2	Apply the relevant simulators and software to perform the complex investigations on feasibility study
	PO7	2	Understand the impact of the business ideas in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO8	2	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
	PO9	2	Function effectively as a member or leader in diverse teams, and in multidisciplinary settings
	PO11	2	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
	PO12	2	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
	PSO1	3	Prepare a business plan by applying basic engineering knowledge
CO3	PO1	3	Apply the innovation and creativity for different applications
	PO2	2	Apply the knowledge to analyse the Analysing the Current Business Scenario
	PO3	3	Develop the steps of innovation management considering environmental and societal requirements
	PO4	1	Conduct the detailed literature survey on existing product development and identify the problems for further investigations
	PO5	2	Apply the relevant simulators and software to perform the complex investigations on innovation
	PO9	1	Apply the knowledge of engineering analysis design in the professional engineering practice
	PO10	3	Understand the impact of the professional engineering solutions in innovation in current environment of societal
	PO11	1	Demonstrate knowledge and understanding of the engineering and management principles and apply these to multidisciplinary environments.
	PO12	3	Write effective reports and design document to represent idea
	PSO1	3	Solve complex engineering problems by applying engineering knowledge in the field of Signal/Image processing and Communication
CO4	PO1	3	Apply the knowledge in various types of debt securities
	PO2	3	Apply the knowledge of engineering to analyse the given problem in determining ideal debt-equity mix in financing
	PO3	3	Develop the new venture considering environmental and societal requirements

	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on financing and launching the new venture
	PO6	2	Apply the knowledge of intellectual property in the professional engineering practice
	PO7	2	Understand the impact of choosing the legal form of new venture and privacy of societal and environmental context
	PO8	1	Apply ethical principles and commit to formation of the new venture and norms of the engineering practice
	PO10	1	Communicate effectively on complex engineering activities with the engineering community and formation of the new venture
	PO11	3	Demonstrate knowledge and understanding of the engineering and management principles and apply these to financial institutions and banks.
	PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
	PSO1	3	Measure the factors affecting new venture by applying basic engineering knowledge
CO5	PO1	3	Apply the fundamental concepts psychological and social impact, health concerns related to wearable devices
	PO2	2	Apply the engineering knowledge to analyse the given wire Psychological effects of wearable devices.
	PO3	3	Develop the technology for social implications for different requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing financing techniques understanding the limitations
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for create new ventures
	PO8	2	Apply ethical principles in development of solution with new ventures
	PO11	3	Function effectively in teams and as individual to develop modules and new ventures concepts for design
	PO12	2	Write effective reports and design document to represent idea
	PSO1	2	Apply the concepts of exit strategies for Entrepreneurs for solving complex problems

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 6P1 - Analog and Digital Communication Laboratory								
B.E. Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	4	60	2	60	40	100
Objective(s)	• To obtain a better understanding of the operation of analog and digital modulation schemes • To analyze and test digital communication systems using simulation software as well as laboratory components • To understand error coding and decoding in digital telecommunication system. • To measure the spectrum of filters • To measure the radiation pattern of antenna							

Course Outcomes	**At the end of the course the students will be able to** CO1: Construct and test analog and digital modulation techniques CO2: Demonstrate the various pulse modulation techniques CO3: Generate the line coding and decoding techniques CO4: Develop a program for error control coding using MATLAB CO5: Measure the spectrum of filters and analyze the radiation pattern of RF antenna

LIST OF EXPERIMENTS

1. Amplitude Modulation and Demodulation
2. Frequency Modulation and Demodulation
3. Pulse Modulation (PPM, PWM)
4. Signal sampling and time division multiplexing
5. Simulation of Digital Modulation systems
6. Study and analysis of Line Coding techniques
7. Delta Modulation and Adaptive delta modulation techniques
8. Quadrature phase shift keying modulation and detection
9. Implementation of convolutional codes
10. Spectrum measurement for filters
11. Antenna design and simulation
12. Project design and implementation

The following tools can be used for antenna design and analysis: Ansys HFSS, ADS, CST, Magus, MATLAB, LABVIEW etc…

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge of different modulation techniques to generate AM,FM,Pulse,QPSK waveforms
	PO2	3	Apply the knowledge to analyse the given problem to design various modulation techniques
	PO3	3	Design the analog and digital modulation system components considering environmental and societal requirements
	PO4	3	Design of experiments, analysis and interpretation of data related to analog and digital modulation system
	PO5	3	Apply the relevant simulators to Like MATLAB,SIMULINK,ANSYS to perform the complex investigations
	PSO1	3	Solve complex engineering problems in the field of analog and digital modulation system

	PSO2	3	Design the communication system components considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of different pulse modulation techniques to generate PPM,PWM,DM,ADM waveforms
	PO2	3	Apply the knowledge to analyse various pulse modulation techniques
	PO3	3	Design the pulse modulation system by considering environmental and societal requirements
	PO4	3	Design of experiments, analysis and interpretation of data related to analog and digital pulse modulation system
	PO5	3	Apply the relevant simulators to Like MATLAB,SIMULINK,ANSYS to perform the complex investigations
	PSO1	3	Solve complex engineering problems in the field of analog and digital pulse modulation system
	PSO2	3	Design the pulse modulation system components considering industrial and societal requirements
CO3	PO1	3	Apply the knowledge of different line coding techniques to generate RZ,NRZ, Manchester waveforms
	PO2	3	Apply the knowledge to analyse various line coding techniques
	PO3	3	Design the line coding and decoding system by considering environmental and societal requirements
	PO4	3	Design of experiments, analysis and interpretation of data related to line coding and decodingsystem
	PO5	3	Apply the relevant simulators to Like MATLAB,SIMULINK,ANSYS to perform the complex investigations
	PSO1	3	Solve complex engineering problems in the field of line coding and decoding
	PSO2	3	Design the line coding and decoding system considering industrial and societal requirements
CO4	PO1	3	Apply the knowledge of different error control coding to correct and detect errors
	PO2	3	Apply the knowledge to analyse the given problem to design error control coding scheme
	PO3	3	Design the error control coding by considering environmental and societal requirements
	PO4	3	Design of experiments, analysis and interpretation of data related to cyclic and convolutional codes
	PO8	3	Apply ethical principles and commit to professional ethics in conduct of experiment
	PO9	3	Function effectively as an individual, and as a member or leader in diverse teams in design of experiments
	PO10	3	Communicate effectively on complex engineering activities in conduction of experiments
	PO12	3	To manage projects in in design of experiments in error control coding
	PSO1	3	Solve complex engineering problems in the field of error control coding
	PSO2	3	Design the error control coding schemes considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in conduction of experiment in error control coding
CO5	PO1	3	Apply the knowledge of spectrum of filters to generate LPF,HPF,BPF waveforms
	PO2	3	Apply the knowledge to analyse the given problem to design radiation pattern of RF antenna in HFSS
	PO3	3	Design of RF antenna by considering environmental and societal requirements

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	PO4	3	Design of experiments, analysis and interpretation of data related to RF antenna and filters
	PO5	3	Apply the relevant simulators to Like MATLAB,SIMULINK,ANSYS to perform the complex investigations on RF antenna and filters
	PO6		Design of experiment related to Engineering and society
	PO7		Design of experiment in welfare of societal and environmental contexts
	PO8		Apply ethical principles and commit to professional ethics in conduct of experiment
	PO9		Function effectively as an individual, and as a member or leader in diverse teams in design of experiments
	PO10		Communicate effectively on complex engineering activities in conduction of experiments
	PO12		To manage projects in in design of experiments in RF antenna and filters
	PSO1	3	Apply the concepts of RF antenna and filters for solving complex problems
	PSO2	3	Design the RF antenna and filters components considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in conduction of experiment in RF antenna

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 6P2–Embedded Systems Laboratory</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours / Week</th><th rowspan="2">Total hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>0</td><td>0</td><td>4</td><td>60</td><td>2</td><td>60</td><td>40</td><td>100</td></tr>
<tr><td>Course Objectives</td><td colspan="8">• To familiarize the 8085,8051 and ARM processors architectures
• To give an exposure of assembling language programming and interfacing of various modules
• To use IDE for programming and debugging
• To understand the techniques to interface sensors and I/O circuits and to implement applications using these processors
• To develop microprocessor or microcontroller based small application projects</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Perform arithmetic operations using 8085 & 8051 by developing assembly language programs
CO2: Write, compile, debug, link and execute C program for the given target board
CO3: Developing C code for accessing GPIO for interfacing switched and LEDs
CO4: Design a system for temperature acquisition system
CO5: Analyze the memory requirements and delay for the system by implementing the application</td></tr>
<tr><th colspan="9">LIST OF EXPERIMENTS</th></tr>
</table>

1. Programs for arithmetic operations in 8085 & 8051
2. Basic programs to understand the Keil IDE for 8051
3. Developing an assembly program for accessing GPIO and Timer peripherals
4. Developing C programs for accessing ADC through GPIO, timer peripherals and interrupts
5. Design a setup for a display system to display the data in 7 segment LED and LCD module
6. Design an analog data acquisition system
7. Design a system for an temperature monitoring application
8. Design a system for stepper motor control application along with sensor
9. Design a mini project either in 8051 target board or ARM board

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	3								3	2	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO 1	3	Apply arithmetic knowledge on 8bit controller to find solution for basic engineering problems
	PO 2	3	Review various arithmetic problems which support to the embedded system
	PO 3	3	Design and understand the internal process for a specific task by considering engineering consideration
	PO 4	2	Investigate social problem and find the sub module solution with the help of arithmetic operation
	PO5	3	Use the modern simulators to perform the complex problem to investigate the internal operation.
	PSO 1	3	Perform the 8bit microprocessor arithmetic operation by applying basic engineering knowledge
	PSO 2	2	Design the 8051 & 8085-based system components considering industrial and societal requirements
CO2	PO 1	3	Apply embedded c programming on target board to find solution for basic engineering problems
	PO 2	3	Research compatible target board and debug and link for hardware and software interface which support to the embedded system
	PO 3	3	Design and understand the internal process for a specific task by considering engineering consideration
	PO 4	3	Design of experiment to address the social problem by utilizing various stages of embedded design process
	PO 5	3	Use the modern simulators to perform the complex problem to investigate the internal operation.

	PSO 1	3	Perform various stages of hardware and software interpretation by applying basic engineering knowledge
	PSO 2	3	Design a microprocessor-based product to meet the industrial needs.
CO3	PO 1	3	Apply embedded c programming to interpret input and output peripheral for realizing the result and expect to find solution for basic engineering problems
	PO 2	3	Research suitable GPIO devices and debug for hardware and software interface which support to the embedded system
	PO 3	3	Design and understand the interaction of GPIO for a specific task by considering engineering consideration
	PO 4	3	Design of experiment to address the social problem by utilizing various stages of embedded design process
	PO 5	3	Use the modern simulators to perform the complex problem to investigate the internal operation.
	PO 8	3	Apply ethical responsibilities to develop the embedded systems interfacing suitable peripherals to meet the social safety
	PO 9	3	Effectively collaborate with interdisciplinary team to develop project meeting with industry standard
	PO 10	3	Communicate effectively through project presentation and other technical events to promote the recent development of an embedded system
	PO 12	3	Develop interest in building more reliable system considering wider technological changes
	PSO 1	3	Developing peripheral interaction by applying engineering knowledge
	PSO 2	3	Design system component and develop product to meet the industrial needs
	PSO 3	3	Communicate effectively with proper documentation in various technical events like project presentation by acquiring essential interpersonal skills
CO4	PO 1	3	Apply the knowledge of mathematics and engineering science to convert analog to digital conversion to understand the industry solutions
	PO 2	3	Analyse the world signals and chose proper sensors to conclude the solution for complex engineering problems.
	PO 3	3	Design and develop signal conversion application by engineering consideration
	PO 4	3	Design of experiment to sense the signal and utilizing necessary engineering conversion to achieve solution.
	PO 5	3	Use the modern tool and apply appropriate conversion of analog to digital transformation.
	PO 8	3	Apply ethical responsibilities to develop the conversion method of the engineering practice.
	PO 9	3	Effectively collaborate with interdisciplinary team to develop project meeting with industry standard
	PO 10	3	Communicate effectively through project presentation and other technical events to promote the recent development of an embedded system
	PO 12	3	Develop interest in building more reliable system considering wider technological changes
	PSO 1	3	Compare the various sensing signals requirement by applying basic engineering knowledge
	PSO 2	3	Design a project applying concepts of signal conversion requirement and meet the industrial standard

	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO5	PO 1	3	Apply knowledge on operating system architecture for ensuring the better memory management applications.
	PO 2	3	Literature the various process to develop the better operating system
	PO 3	3	Design an operating system and schedule the process to meet specific application by time.
	PO 4	3	Investigate social problem and to interpret with development of embedded system to bring solution.
	PO 5	3	Use the modern tool to examine system performance and memory occupancy for meeting the requirement.
	PO 8	3	Apply ethical responsibilities to develop a system in engineering practice.
	PO 9	3	Effectively collaborate with interdisciplinary team to develop project meeting with industry standard
	PO 10	3	Communicate effectively through project presentation and other technical events to promote the recent development of an embedded system
	PO 12	3	Develop interest in building more reliable system considering wider technological changes
	PSO 1	3	Apply the concepts of operating system for solving complex engineering problems.
	PSO 2	3	Design the operating system by considering performance and memory bottle neck to suit industrial requirements.
	PSO 3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 6P3–Innovation Project Laboratory								
B.E. Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	4	60	2	60	40	100
Course Objectives	• To engage students in exploring simple but non-trivial problems and support them for working towards a resolution of the problem • To introduce students with current technologies and support them develop applications in various fields • To provide an interdisciplinary approach in project based learning • To promote enquiry and self-directed learning in students • Develop prototypes to bring their ideas into reality							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Develop empathy based, human centered creative ideas to solve problems in the society CO2: Progress in their career with increased knowledge retention and confidence CO3: Combine knowledge and skills from multiple subject areas and transfer the knowledge to develop new solutions CO4: Have environmental awareness and independent decision making capabilities CO5: Tackle challenges in creation, development and deployment of technology based solutions							

Students have to design application circuits/systems using Electronics and communication Domain. Application can be chosen (any four) from the given list but need not be confined to it.

1. Develop proof of concept -Identify a social problem near to your village and develop a real time solution
2. Design and develop a Medical based Application
3. Develop robotics based application
4. Design and develop agriculture based Application
5. Develop Mobile applications with open source frameworks
6. Develop ML based application

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the engineering knowledge to identify the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to formulate the complex engineering problems on literature survey carried out
	PO3	3	Identify solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Identify the solution based on literature survey for societal need
	PO7	3	Identify the solutions based on literature survey for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop empathy based, human centered creative ideas to solve problems in the society
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop innovation products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO2	PO1	3	Apply the engineering knowledge to analyze the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to analyze the complex engineering problems on literature survey carried out
	PO3	3	Analyse solutions on literature survey carried out for complex problems
	PO4	3	Conduct the detailed literature survey on analyzed problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Analyse the solution on literature survey carried out for societal need
	PO7	3	Analyse the solutions on literature survey carried out for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial innovation projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems

	PSO2	3	Design system components and develop innovation products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO3	PO1	3	Apply the engineering knowledge to design the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to design the complex engineering problems on literature survey carried out
	PO3	3	Design innovation projects for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to design the complex problems on problem stated
	PO6	3	Design the solution on literature survey for societal need
	PO7	3	Find the solutions on literature survey for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the engineering knowledge to identify the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to review the complex engineering problems on literature survey carried out
	PO3	3	Develop solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Design the solution on identified problem for societal need
	PO7	3	Design the solutions on identified problem for sustainable development
	PO8	3	Apply ethical principles to identified complex problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO1	3	Design system components and develop products with needs of industry and society
	PSO2	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
	PSO3	3	Apply the engineering knowledge to identify the engineering problems in various domain

CO5	PO1	3	Apply the engineering knowledge to demonstrate the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to demonstrate the complex engineering problems on literature survey carried out
	PO3	3	Design solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to design the complex problems on problem stated
	PO6	3	Demonstrate the solution on identified problem for societal need
	PO7	3	Demonstrate the solutions on identified problem for sustainable development
	PO8	3	Apply ethical principles to designed problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills

K.S.Rangasamy College of Technology - Autonomous Regulation R 2018								
50 TP 0P4 - Career Competency Development IV								
Common to all Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	0	0	2	30	0	100	00	100

Course Objectives	• To help the learners to enrich the advanced written and oral communication skills in the academic and professional contexts • To help the learners to augment their advanced verbal and logical reasoning ability to meet out the employability requirements of the companies • To help the learners to comprehend the advanced level of aptitude skills in the concepts of Geometry • To help the learners to enhance the data interpretation and analytical skills in varied methods. • To help the learners to enrich the technical and programming skills to be focused on better employability, codeathons and hackathons
Course Outcomes	**At the end of the course, the student will be able to** CO1: Examine and correlate the written and oral communication skills in the academic and professional contexts CO2: Predict and discriminate advanced verbal and logical reasoning ability to meet out the employability requirements of the companies CO3: Infer the concepts of advanced level of aptitude skills on Geometry pertaining to competitive exams and company recruitments. CO4: Illustrate the data interpretation and analytical skills in varied methods. CO5: Formulate the technical and programming skills to be focused on better employability, codeathons and hackathons

Unit – 1	Written and Oral Communication – Part 2	Hrs
Self-Introduction – GD - Personal Interview Skills **Practices** on Reading Comprehension Level 2 – Paragraph Writing - Newspaper and Book Review Writing - Skimming and Scanning – Interpretation of Pictorial Representations - Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Editing **Materials:** Instructor Manual, Word power Made Easy Book, News Papers		4
Unit – 2	Verbal & Logical Reasoning – Part 2	8
Analogies – Blood Relations – Seating Arrangements – Syllogism - Statements and Conclusions, Cause and Effect–Deriving Conclusions from Passages –Series Completion (Numbers, Alphabets & Figures) – Analytical Reasoning – Classification – Critical Reasoning **Practices**: Analogies – Blood Relations - Statement &Conclusions **Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit – 3	Quantitative Aptitude - Part – 5	6
Geometry-StraightLine–Triangles–Quadrilaterals–Circles–Co-ordinateGeometry–Cube–Cone – Sphere. **Materials:** Instructor Manual, Aptitude book		
Unit – 4	Data Interpretation and Analysis	6
Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs can be Column Graphs,Bar Graphs,LineCharts,PieChart,GraphsrepresentingArea,VennDiagram&Flow Charts. **Materials:** Instructor Manual, Aptitude Book		
Unit – 5	Technical & Programming Skills – Part 2	6
Core Subject – 4,5,6 **Practices :** Questions from Gate Material **Materials:** Text Book, Gate Material		
	Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions each from Unit 1, 2, 3, 4 & 5 (External Evaluation)	50
2	Evaluation 2 - Oral Communication	GD and HR Interview (External Evaluation by English, MBA Dept.)	30

3	Evaluation 3 – Technical Interview	Internal Evaluation by the Dept. – 3 Core Subjects	20
		Total	100

Reference Books

1. Aggarwal, R.S.'A Modern Approach to Verbal and Non-verbal Reasoning', Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.
2. Abhijit Guha, 'Quantitative Aptitude', TMH, 3rd Edition
3. Objective Instant Arithmetic by M.B. Lal & Goswami Upkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note:

- Instructor can cover the syllabus by Class room activities and Assignments (5Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough Work pages
- Each Assignment has 20 questions from Unit 1,2,3,4,5 and 5 questions from Unit1(Oral Communication) & Unit5(Programs)
- Evaluation has to be conducted as like Lab Examination.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1	1	1	2	1	1	2	3	2	3	1	2	3
CO2	2	1	2	2	1	2	1	1	2	3	3	3	2	2	2
CO3	2	1	2	2	1	1	1	1	2	3	2	3	3	2	2
CO4	2	2	2	2	2	1	1	1	2	3	3	3	3	2	1
CO5	2	2	2	2	2	2	2	2	2	3	2	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Examine and correlate the complex engineering problems for better understanding in academic and professional contexts
	PO2	1	Examine and correlate the literature and understanding the substantiated conclusions
	PO3	1	Examine and correlate solutions for the complex engineering problems in the academic and professional contexts
	PO4	1	Assessing the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	1	Examining the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	2	Examining the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Assess and correlate the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be examined and correlated professionally
	PO9	2	Analyse and correlate the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper analysis
	PO11	2	Correlate the demonstration of knowledge in multidisciplinary environments
	PO12	3	Examine and correlate the broadest situational context of changing technology
	PSO1	1	Assess with academic and professional context to solve the complex engineering problems

	PSO2	2	Examining the design and development of components and products
	PSO3	3	Enriching interpersonal skills and attitude with proper examination and correlation
CO2	PO1	2	Predict the complex engineering problems for better understanding
	PO2	1	Predict the literature and understanding the substantiated conclusions
	PO3	2	Developing solutions for the complex engineering problems with professional prediction
	PO4	2	Predict the synthesis of information after conducting investigations of complex problems
	PO5	1	Predict and model the complex problems with its limitations both academically and professionally
	PO6	2	Predict the assessment of contextual responsibilities
	PO7	1	Professionally and academically predict the demonstration and necessity of sustainable development
	PO8	1	Predict the ethical norms and responsibilities professionally
	PO9	2	Predict the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper prediction
	PO11	3	Predict the demonstration of knowledge in multidisciplinary environments
	PO12	3	Ability to predict in the broadest situational context of changing technology
	PSO1	2	Predict the design and development of components and products
	PSO2	2	Predict of enriching interpersonal skills and attitude
	PSO3	2	Predict the complex engineering problems for better understanding
CO3	PO1	2	Infer the application of engineering knowledge and find solutions to complex engineering problems
	PO2	1	Infer the contingent factors to analyse complex engineering problems
	PO3	2	Infer the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems
	PO5	1	Infer the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	1	Infer the assessed contextual knowledge for professional relevance
	PO7	1	Infer with aptitude the impact of engineering solutions for sustainable development
	PO8	1	Infer the ethical principles and norms of engineering practice
	PO9	2	Making effective presentation skills both as individual and as a member in a team

	PO10	3	Communicating with clarity on engineering problems and report and infer the concepts effectively
	PO11	2	Infer knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to infer and showcase the aptitude in the broadest situational context of changing technology
	PSO1	3	Infer with aptitude to solve the complex engineering problems
	PSO2	2	Design and develop components and products with proper inference and aptitude
	PSO3	2	Enriching interpersonal skills and attitude by showcasing effective inference and aptitude
CO4	PO1	2	Illustrate the complex engineering problems for better understanding in academic and professional contexts
	PO2	2	Exemplify the literature and understanding the substantiated conclusions
	PO3	2	Demonstrate solutions for the complex engineering problems in the academic and professional contexts
	PO4	2	Illustrate the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	2	Exemplify the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	1	Illustrate the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Demonstrate the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be examined professionally
	PO9	2	Illustrate the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper illustration
	PO11	3	Illustrate the demonstration of knowledge in multidisciplinary environments
	PO12	3	Exemplify the broadest situational context of changing technology
	PSO1	3	Assess with academic and professional context to solve the complex engineering problems
	PSO2	2	Examining the design and development of components and products
	PSO3	1	Enriching interpersonal skills and attitude with proper assessment
CO5	PO1	2	Formulate the application of engineering knowledge and find solutions to complex engineering problems
	PO2	2	Devise the contingent factors to analyse complex engineering problems
	PO3	2	Formulate the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems
	PO5	2	Formulate the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities

	PO6	2	Devise the assessed contextual knowledge for professional relevance
	PO7	2	Formulate with aptitude the impact of engineering solutions for sustainable development
	PO8	2	Formulate the ethical principles and norms of engineering practice
	PO9	2	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and devise the concepts effectively
	PO11	2	Devise knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to formulate the aptitude in the broadest situational context of changing technology
	PSO1	3	Formulate to solve the complex engineering problems
	PSO2	3	Design and develop components and products with proper formulation
	PSO3	3	Enriching interpersonal skills and attitude by showcasing effective formulation

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 701 - Computer Networks								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- To describe the functions of the networking standards and wireless standards
- To provide the data communication link considering fundamental concepts of CRC,wired and wireless LAN
- To know the various protocols in each layer of the network model and their standards
- To explain the important aspects of internet applications such as E-mail and multimedia
- Manage a network and propose solutions under network security threats

Course Outcomes

At the end of the course, the students will be able to

CO1: Describe the fundamentals of networks, their types, topologies, networking models and wireless standards
CO2: Explain the various error control protocols and LAN protocols
CO3: Identify the routing mechanisms to fulfil networking requirements
CO4: Describe the various transport protocols and methods to improve the QoS
CO5: Analyze the features and operations of various application layer protocols such as HTTP, DNS and SMTP, Cryptographic algorithms and multimedia

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction
Data Communications –Network Components, Network Criteria, Topologies, Network Types, Protocol Layering, Networking models: OSI model, TCP/IP model, OSI Vs TCP/IP - Wireless standards: Bluetooth, Zigbee (IEEE802.15.4) - Adhoc and Sensor Networks -- Performance factors – Throughput, Bandwidth and Latency, Introduction to Network slicing, software defined networking. [9]

Data Link Layer
Nodes and links, services - Error detection and correction: CRC, check sum - HDLC protocol. Media Access Control (MAC): MAC for wired and wireless Local Area Networks (LAN), Pure and Slotted ALOHA, CSMA, CSMA/CD - IEEE 802.3: Ethernet, Fast Ethernet, Gigabit Ethernet - IEEE 802.11 WiFi MAC protocol, CSMA/CA - IEEE 802.16: WiMAX. [9]

Network layer
Connecting devices: Hubs, Switches, Routers, Gateways - Network Layer services- Packet switching- Network Layer performance – IPv4 addressing: Classful, Classless addressing, Dynamic Host Configuration Protocol – Internet Protocol – IPv4, IPv6, ICMP - IPv6 Addressing - Routing - Unicast Routing algorithms and protocols– Multicast Routing protocols: IGMP- Mobile IP [9]

Transport layer
Transport layer services, UDP, TCP, SCTP - Congestion control: Congestion avoidance (DECbit, RED) - Quality of Service. [9]

Application Layer
Services - Paradigms – Client Server Programming – World Wide Web and HTTP – FTP-DNS- Electronic Mail (SMTP, POP3, IMAP, MIME), Telnet, Network security threats, Cryptography, Security in the Internet: IP Security & Firewalls, Voice Over IP andMultimedia: Streaming stored video/ audio, Real time interactive protocol: RTP, Introduction to data privacy. [9]

Total Hours: 45

Text book(s):

1	Behrouz A Forouzan, ‘Data Communication and Networking’, Tata McGraw-Hill, New Delhi, 2014.
2	Kurose James F and Keith W. Ross, ‘Computer Networking: A Top-Down Approach’, 7th edition, Pearson Education, New Delhi, 2017.

Reference(s):

1	Larry L. Peterson, Bruce S. Davie, ‘Computer Networks: A Systems Approach’, Morgan Kauffmann

	Publishers Inc., 2012.
2	William Stallings, ‘Data and Computer Communication’, Prentice Hall of India, New Delhi, 2014.
3	NatarajVenkataramanan, Ashwin Shriram ,’Data Privacy: Principles and Practice’, CRC press, 2016.
4	S. M. Ahsan Kazmi, Latif U. Khan, Choong Seon Hong, Nguyen H. Tran, ‘Network Slicing for 5G and Beyond Networks’, Springer International Publishing,2020.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	2	
CO2	3	3	3	3									3	2	
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO1	3	Apply the different topologies for different wireless networks
	PO2	3	Apply the knowledge to analyse the given problem to design the different types of networks
	PO3	3	Classify the different Wireless standards considering environmental and societal requirements
	PO4	3	Conduct the experiments, analyse and interpret data from different topologies of a given network.
	PSO1	3	Perform the data communication by applying basic engineering knowledge
	PSO2	2	Study of various wireless standards like Bluetooth and Zigbee and its criteria that satisfy the needs of societal requirements
CO2	PO1	3	Apply the Error detection and correction methods for data effective data communication
	PO2	3	Study of Media Access Control for wired and wireless Local Area Networks and analysing collision principles
	PO3	3	Understand the CSMA techniques for Ethernet and wireless protocols that satisfy societal requirements from which student can develop solutions for complex engineering problems we they go for network domain in industry
	PO4	3	Conduct the detailed literature survey on existing data link layer protocols and identify the problems
	PSO1	3	Perform the different error detection and error correction, CSMA techniques on networks by applying basic engineering knowledge
	PSO2	2	Enumerate and understand the data link layer protocols its constraints that are required for the solving problems in society
CO3	PO1	3	Apply the packet switching technique for reliable communication
	PO2	3	Apply the knowledge of unicast routing and multicast routing algorithms to analyse the given problem
	PO3	3	Describe the shortest path algorithms like distance vector routing and link state routing for effective and efficient data communication through different routers and apply the same for design and develop solutions for complex engineering problems when the students prefer communication and network domain
	PO4	3	Conduct investigations on case study of routing algorithms and search advanced routing algorithms that is applied for adhoc and sensor networks

	PO5	3	Apply the relevant simulators and software to analyse the performance for routing protocols like routing information protocol and open shortest path first protocol
	PO8	3	Understand and study the ethical principles like radiation constraints when routing is applied for a given problem
	PO9	3	Function effectively in teams to develop projects related to network domain
	PO10	3	Communicate effectively with proper documentation and do project presentation.
	PO12	3	Develop interest by acquiring knowledge related to case studies using routing protocols considering wider technological changes
	PSO1	3	Compare the performance parameters of various routing protocols like RIP,OSPF by applying basic engineering knowledge
	PSO2	3	Identify the internetworking components considering telecommunication industrial requirements
	PSO3	3	Communicate effectively with proper documentation and do project presentation as a team by acquiring essential interpersonal skills
CO4	PO1	3	Apply the transport layer protocols for making communication between transport layers providing effective process to process delivery
	PO2	3	Apply the knowledge of engineering to analyse the given network through connectionless and connection oriented protocols
	PO3	3	Understand the traffic shaping technique for providing quality of service to reduce interference such as packet loss, jitter, and latency
	PO4	3	Conduct the detailed literature survey on existing problems related to quality of service and identify the solutions to new problems
	PO5	3	Use the relevant simulators to analyse the performance of leaky bucket and token bucket algorithms
	PSO1	3	Compare the different transport layer protocols by applying basic engineering knowledge
	PSO2	3	Study of resource reservation technique that are needed for society and provide solutions for a given problem
CO5	PO1	3	Apply the engineering knowledge to compare the application layer protocols such as HTTP and FTP
	PO2	3	Apply the engineering knowledge to analyse the given application layer protocols
	PO3	3	Illustrate the algorithms such as cryptography for providing secure end to end communication
	PO4	3	Conduct the detailed literature survey on existing security algorithms and understand the need of data privacy
	PO5	3	Apply the relevant simulators to perform the complex investigations on encryption and decryption
	PO8	3	Apply ethical principles to prepare the documentation to compare application layer protocols such as HTTP, FTP and SMTP.
	PO9	3	Function effectively in teams to develop projects on encryption and decryption via XOR algorithm
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation on networks and do project presentation related to network security.
	PO12	3	Promote interest in acquiring knowledge of more security algorithms considering wider technological changes
	PSO1	3	Apply the concepts of voice over IP and data security for solving complex problems in providing efficient networking
	PSO2	3	Study of products that provide security and data privacy that meet the specific needs of industry and society
	PSO3	3	Communicate effectively with proper documentation and do project presentation as a team by acquiring essential interpersonal skills

K.S.Rangasamy College of Technology – Autonomous R 2018
50 EC 702 - Microwave Engineering

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- To understand the working of Microwave components and analyse them with high frequency parameters.
- To analyse the microwave matching networks.
- To learn the functioning of Microwave sources.
- Tounderstand the concepts of microwave measurements and get familiarized with the methods of measurement
- To know the types of microwave systems and the various applications of microwaves

Course Outcomes

At the end of the course, the students will be able to

CO1: Interpret the basics of Scattering matrix
CO2: Analyse the microwave matching networks
CO3: Examine high power and low power microwave devices
CO4: Describe the working of various microwave measuring instruments
CO5: Discuss microwave application.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Two port Network theory

History of Microwaves, Microwave Frequency bands, Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors. [9]

RF Amplifiers and Matching Networks

Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization Methods, Noise Figure, Constant VSWR, Broadband, High power and Multistage Amplifiers, Impedance matching using discrete components, two component matching Networks, Frequency response and quality factor, Microstrip Line Matching Networks. [9]

Passive and Active Microwave Devices

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, Wave-guide Attenuator, Circulator, Isolator. Microwave Active components: PIN diodes, Gunn Diodes, IMPATT and TRAPATT diodes, Microwave tubes: Klystron-2 Cavity Klystrons, Reflex Klystrons- Limitations and Losses of conventional tubes at Microwave Frequencies, TWT-Slow-Wave structures, Amplification Process, Magnetron-Cylindrical Magnetron. [9]

Microwave Measurements

Microwave Measurements Power, Frequency and impedance measurement at microwave frequency, Network Analyser and measurement of scattering parameters, Spectrum Analyser and measurement of spectrum of a microwave signal, Measurement of Microwave antenna parameters. [9]

Modern Trends in Microwaves Engineering

Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC), Monolithic Microwave IC fabrication, RF MEMS for microwave components, Microwave Imaging. [9]

Total Hours: 45

Text book(s):

1	Samuel Y.Liao, 'Microwave Devices and Circuits', 3rd Edition, Prentice Hall of India, 2008.
2	Annapurna Das and Sisir K. Das, 'Microwave Engineering', 3rd Edition, Tata McGraw-Hill, 2014.

Reference(s):

1	Robert E.Collin, 'Foundations for Microwave Engineering', 2nd Edition, Wiley, Reprint 2009.
2	Mathew M Radmanesh, 'RF and Microwave Electronics', Prentice Hall, 2000.
3	David M.Pozar, 'Microwave Engineering', 4th Edition, John Wiley & Sons, 2014.

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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4	Reinhold Ludwig and Gene Bogdanov, ‘RF Circuit Design: Theory and Applications’, Pearson Education Inc., 2011

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3	3		3	3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the S matrix concepts for different microwave devices
	PO2	3	Apply the knowledge to analyse the given problem to formulate the S matrix
	PO3	3	Apply the microwave devices considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing microwave devices and identify the problems
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	3	Design the microwave system components considering industrial and societal requirements
CO2	PO1	3	Apply the matching system concepts to microwave devices
	PO2	3	Apply the knowledge to analyse the given matching networks to design communication system for microwave devices
	PO3	3	Design the reliable matching network components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing matching network techniques and identify the problems
	PSO1	3	Perform the matching network techniques by applying basic engineering knowledge
	PSO2	3	Design the reliable communication system with matching network considering different environmental conditions
CO3	PO1	3	Apply different methods to analyse power in microwave devices
	PO2	3	Apply the knowledge to analyse the power in the given problem to design microwave devices
	PO3	3	Develop the microwave system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing microwave tubes and identify the problems for further investigations
	PSO1	3	Compare the various microwave diodes by applying basic engineering knowledge
	PSO2	3	Design the microwave system components considering telecommunication industrial requirements
CO4	PO1	3	Apply the different microwave measurement concepts for microwave transmission
	PO2	3	Apply the knowledge of engineering to analyse the given problem to analyse microwave measurements
	PO3	3	Develop the measurement methods considering environmental and societal requirements

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	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Measure the scattering parameters of microwave devices by applying basic engineering knowledge
	PSO2	3	Develop the methods to measure antenna parameters considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of microwave concepts for different applications
	PO2	3	Apply the engineering knowledge to analyse the given microwave applications
	PO3	3	Develop the microwave applications considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing applications understanding the limitations of microwave devices
	PO7	3	Understand the impact of the microwave engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO8	3	Apply ethical responsibilities to develop the microwave components considering the different applications ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable microwave devices considering wider technological changes
	PSO1	3	Apply the concepts of microwave engineering for solving complex problems
	PSO2	3	Design the microwave system components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

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50 EC 703 - Mobile Communication and Networks

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- To describe the mobile radio communication principles and the recent trends adopted in cellular systems
- To investigate different radio propagation models
- To explore various modulation techniques and its performances
- To analyse the different signal processing and multiple access concepts
- To design the different wireless standards and networks

Course Outcomes

At the end of the course, the students will be able to

CO1: Discuss the cellular system design and technical challenges
CO2: Analyse the different radio wave propagation models and fading effects
CO3: Compare the performance of modulation and diversity techniques
CO4: Summarize the principles and applications of wireless systems and standards
CO5: Describe the recent wireless data communication networks

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction

Introduction to wireless communication systems - Modern wireless communication systems: 2G/3G/4G cellular networks - Cellular concept: Frequency reuse - channel assignment - hand off -interference & system capacity – trunking& grade of service - Coverage and capacity improvement - Basics of 5G technology: requirements.
[9]

Mobile Radio Propagation
Free space propagation model - Three basic propagation mechanisms: Reflection - Two-Ray model - Diffraction - Knife-edge diffraction model - Scattering - Log-normal shadowing - Okumara model - Hata model - Log-distance path loss model - Small-scale multipath propagation - Parameters of mobile multipath channels - Types of small scale fading - Rayleigh and Rician distributions. [9]

Modulation Techniques and Signal Processing
Structure of a wireless communication link - Principles of Offset-QPSK - π/4-DQPSK - Minimum Shift Keying - Gaussian Minimum Shift Keying - Error performance in fading channels - Spread Spectrum Modulation –Orthogonal Frequency Division Multiplexing–Review of equalization techniques - Diversity reception - Rake receiver –SDMA - Introduction to MIMO systems. [9]

Wireless Standards
GSM: features - Architecture - Radio subsystems - Traffic channels - call processing - CDMA: features - Architecture - IS 95 Forward and reverse channels - power control - system capacity - WiMax - 4G (LTE). [9]

Modern Wireless Networks

IEEE 802.11a/b/g/n/ac wireless local area networks - 60 GHz millimeter wave gigabit wireless networks - Vehicular wireless networks - Wireless protocols for Internet of Things including Bluetooth, BLE, 802.15.4, Zigbee, LoRA and SigFox. [9]

Total Hours: 45

Text book(s):

1	T.S.Rappaport, 'Wireless Communications: Principles and Practice', 2nd Edition, Pearson Education/Prentice Hall of India, 3rd Indian Reprint, 2009.
2	Erik Dahlman, Stefan Parkvall and Johan Skold, '4G, LTE-Advanced Pro and The Road to 5G', 3rd Edition, Elsevier, 2016.

Reference(s):

1	W.C.Y.Lee, 'Mobile Communications Engineering: Theory and applications', 2nd Edition, McGraw-Hill International, 2009.
2	Martin Sauter,'From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband', Wiley-Blackwell, 2016.
3	Erik Dahlman, Stefan Parkvall and Johan Skold, '5G NR: The Next Generation Wireless Access Technology', 1st Edition, Elsevier, 2018.
4	Eldad Perahia and Robert Stacey, 'Next Generation Wireless LANs: 802.11n and 802.11ac', 2nd Edition, Cambridge University Press, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3		3	3						3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3		3	3	3	3	3		3	3	3	3
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of introduction to wireless Communication Systems
	PO2	3	Apply fundamentals of Engineering the Knowledge to analyse of Modern wireless communication systems
	PO3	3	Design and develop wireless communication components considering environmental and societal requirements

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	PO4	3	Analyse the detailed literature survey on existing systems and identify the problems
	PO6	3	Design and develop wireless communication components considering Safety and societal requirements
	PO7	3	Develop wireless Mobile components considering environmental and societal requirements
	PSO1	3	Apply the fundamentals of Engineering knowledge for understanding of introduction Mobile Communication Systems
	PSO2	3	Design 5G mobile components and develop products that meet the specific needs of industry and society
CO2	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of basic propagation mechanisms in wireless Communication systems
	PO2	3	Apply fundamentals Engineering Knowledge to analyse of reflection, diffraction and scattering in wireless Communication system
	PO3	3	Design and develop modern wireless communication components considering environmental and societal requirements
	PO4	3	Analyse the detailed literature survey on existing wireless communication systems and identify the problems
	PSO1	3	Perform the different radio propagation techniques by applying basic engineering knowledge
	PSO2	3	Design reliable communication system modules that meet the specific needs of industry and society
CO3	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of modulation techniques and signal processing
	PO2	3	Apply the Knowledge to analysis the different modulation techniques and signal processing
	PO3	3	Develop advanced mobile communication system components considering environmental and society requirements
	PO4	3	Research the detailed literature survey on existing advanced mobile communication systems and identify the problems
	PO5	3	Apply the relevant simulators to perform the different modulation technique experiments
	PSO1	3	Compare the wired and wireless communication techniques by applying fundamental Engineering knowledge
	PSO2	3	Design the baseband communication system components considering industrial and societal requirements
CO4	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of basic GSM mechanisms in wireless Communication systems
	PO2	3	Apply fundamentals Engineering Knowledge to analyse of Call processing in wireless Communication system
	PO3	3	Design and develop WiMax-4G(LTE) components considering environmental and societal requirements
	PO4	3	Analyse the detailed literature survey on Cellular networks systems and identify the problems
	PO6	3	Apply radio subsystem knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
	PO7	3	Understand the various wireless standards to give professional engineering solutions in societal and environmental contexts
	PO8	3	Apply ethical principal to compare various cellular techniques ensuring environmental safety
	PO9	3	Lead effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation, Group discussion etc...
	PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
	PSO1	3	Perform the various mobile communication techniques by applying fundamental Engineering knowledge

	PSO2	3	Compare the various wireless Communication systems components considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication
CO5	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of modern wireless networks
	PO2	3	Apply fundamentals Engineering Knowledge to analyse of various IEEE standards in wireless Communication system
	PO3	3	Design and develop vehicle to vehicle communication components considering environmental and societal requirements
	PO4	3	Analyse the detailed literature survey on existing wireless network components and identify the problems
	PSO1	3	Perform the modern wireless networks by applying fundamental Engineering knowledge
	PSO2	3	Design the advanced wireless network components considering industrial and societal requirements

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2018</td></tr>
<tr><td colspan="9">50 AC 001 - Research Skill Development - I</td></tr>
<tr><td colspan="9">Common to All Branches</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total Hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>1</td><td>0</td><td>0</td><td>10</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn about the effective usage of power point presentation
• To prepare presentation with various effects
• To visualize the data in the presentation
• To acquire knowledge about data sources
• To investigate the research articles based on various applications</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Develop presentation with visual effects
CO2: Prepare a presentation with supporting data
CO3: Attain the importance of research and data collection
CO4: Analyze the various sources of research articles
CO5: Interpret the tools and methods in preparing manuscript</td></tr>
<tr><td colspan="9">Note:Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.</td></tr>
<tr><td colspan="9">Preparing a Presentation
Presenting data using Power Point- Power Point preparation and presentation, Design principles for creating effective Power Point slides with visuals displaying data. - Profile, - Problem, and a set of basic Excel charts, use to create a presentation. [3]

Creating effective slides using PowerPoint
Create effective slides using PowerPoint. Tools within Power Point, structure story line, create story boards, identify primary elements of slide design, display data and finalize slide presentation. [2]

Research Designs and Data Sources
Overview of the topics: process of data collection and analysis. Starting with a research question - Review of existing data sources- Survey data collection techniques- Importance of data collection- Basic features affect data analysis when dealing with sample data. Issues of data access and resources for access. [3]

Measurements and Analysis Plan
Importance of well-specified research question and analysis plan: various data collection strategies - Variety of available modes for data collection – review of literature - Tools at hand for simple analysis and interpretation. [2]</td></tr>
<tr><td colspan="9">Total Hours: 10</td></tr>
</table>

Text Book(s):	
1.	Judy Jones Tisdale. Effective Business Presentations. Gulf Coast Books LLC. ISBN-13: 978-0130977359, 2004.
2.	**FraukeKreuter. Framework for Data Collection and Analysis,2018. https://www.coursera.org/learn/data-collection-framework**
Reference(s)	
1.	Kothari, C.R. andGaurav Garg, “Research Methodology: Methods and Techniques”, New Age International Publishers, 2013
2.	Srivastava, T.N. and Rego, S., "Business Research Methodology", Tata McGrawHill Education Pvt. Ltd., Delhi, 2019.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3		3	2				2	3	3			3	1
CO2	3	3	1	2	2		2		2	3	2	1		3	2
CO3	3	3	2	2			2		1	3		1	3	3	
CO4	3	3	3	2		2	1	2		3	2	2	3	2	
CO5	3	3	2	2		2	1		2	3	2	2	3	2	

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO1	3	Apply the knowledge of engineering specialization to find the solution of Research results in manuscript
	PO2	3	Apply the knowledge to analyse the research literature
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems to prepare manuscript
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for create copy rights
	PO9	2	Function effectively as an individual, and as a member or leader in diverse teams in research process
	PO10	3	write effective reports and design documentation, make effective presentations, and give and receive clear instructions
	PO11	3	Demonstrate knowledge and understanding of the engineering and management principles and apply these to prepare manuscript
	PSO2	3	Design system components and develop products that meet the specific needs of industry and society with valid manuscript
	PSO3	1	Develop essential interpersonal skills and attitude needed for developing manuscript
CO2	PO1	3	Apply the knowledge of engineering specialization to prepare manuscript and apply for publications
	PO2	3	Analyze complex engineering problems reaching substantiated conclusions in research process
	PO3	1	Design solutions for complex engineering problems in preparation of manuscript
	PO4	2	Use research-based knowledge and research methods including design of experiments before apply the manuscript for publications
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for create copy rights
	PO7	2	Understand the impact of the professional engineering solutions in societal and environmental issues in dealing with research process

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	PO9	2	Function effectively as an individual, and as a member or leader in diverse teams in research process
	PO10	3	Write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
	PO11	2	Demonstrate knowledge and understanding of the engineering and management principles and apply these to develop manuscript
	PO12	1	Have some contribution in engage in independent and life-long learning of research process
	PSO2	3	Design system components and develop products that meet the specific needs of industry and society with valid manuscript
	PSO3	2	Develop essential interpersonal skills and attitude needed for developing manuscript
CO3	PO1	3	Apply the knowledge of engineering specialization to find new idea to create copy rights
	PO2	3	Analyze research literature, and complex engineering problems to create copy rights
	PO3	2	Design new solutions for environmental and societal requirements to create copy rights
	PO4	2	Analysis and interpretation of data, and synthesis of the information to provide valid conclusions
	PO7	2	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams to filing patent
	PO10	3	write effective reports and design documentation, make effective presentations, and give and receive clear instructions for successful copy rights
	PO12	2	ability to engage in independent and life-long learning
	PSO1	3	Solve complex engineering problems in creating copy rights
	PSO2	3	Design system components and develop products to produce IPR
CO4	PO1	3	Apply the knowledge of engineering specialization to find new idea to filing patent and copy rights
	PO2	3	Analyze research literature, and complex engineering problems to create copy rights
	PO3	3	Design new solutions for environmental and societal requirements create copy rights
	PO4	2	Analysis and interpretation of data, and synthesis of the information to provide valid conclusions
	PO6	2	For filing patent aapply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO8	2	Apply ethical principles in developing copy right and filing patent
	PO10	3	write effective reports and design documentation, make effective presentations, and give and receive clear instructions for successful copy rights
	PO11	2	understanding of the engineering and management principles in filing patent
	PO12	2	ability to engage in independent and life-long learning to develop innovations and filing patent
	PSO1	3	Solve complex engineering problems to produce IPR
	PSO2	2	Design system components and develop products to produce IPR
CO5	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of developing mobile applications
	PO2	3	Apply the knowledge to analyse theresults of mobile applications
	PO3	2	Design solutions for environmental and societal requirements by developing new mobile applications

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	PO4	2	Analysis and interpretation of data, and synthesis of the information to provide valid conclusions
	PO6	2	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues to develop and test new mobile applications
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental contexts to develop and test new mobile applications
	PO9	2	Function effectively as an individual, and as a member or leader in diverse teams,in developing and testing of applications
	PO10	3	write effective reports and design documentation, make effective presentations, and give and receive clear instructions for successful copy rights
	PO11	2	Need adequate skill of Project management and finance in development of applications
	PO12	2	Product development should have ability to engage in independent and life-long learning
	PSO1	3	Solve complex engineering problems in development of applications
	PSO2	2	Design system components and develop products related to mobile applications

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC 7P1 - Communication and Networks Laboratory								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	60	40	100
Objective(s)	• To analyse the characteristics of microwave devices. • To learn the measurement of radiation pattern and impedance measurement • To learn error detection/error correction techniques • To analyse the performance of wired/ wireless networks • To implement the routing and cryptographic algorithms							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyse the characteristics of microwave devices. CO2: Measure the radiation pattern and impedance of horn antenna CO3: Implement the error detection/error correction techniques CO4: Simulate and analyse the performance of wired/ wireless networks CO5: Implement the routing and cryptographic algorithms							

LIST OF EXPERIMENTS

1. S parameter measurement for microwave components
2. Frequency and wavelength measurement
3. Power measurement for directional coupler
4. Radiation pattern measurement of microwave antennas
5. Study the characteristics of microwave sources
6. VSWR and impedance measurement.
7. Simulation of network topologies
8. Implementation of error detection/error correction techniques
9. Apply various application tools and analyse the performance of wired/wireless network using Qualnet
10. Implementation of IP Addressing Scheme
11. Implementation of routing algorithms
12. Implementation of Cryptographic algorithms

Note: The following tools can be used for networks simulation – NS2, Qualnet
virtual lab for computer networks
http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3			3	3	3		3	3	3	3
CO2	3	3	3	3	3			3	3	3		3	3	3	3
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to study characteristics of microwave devices
	PO2	3	Analyse the characteristics of different microwave devices
	PO3	3	Design the microwave devices considering environmental and societal requirements
	PO4	3	Conduct the experiments, analyze and interpret of data from different characteristics of microwave devices
	PO5	3	Apply the modern simulators to design and analyse the waveguides used in microwave devices
	PO8	3	Apply ethical principles on designing microwave devices ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like project presentations based on the concepts learnt.
	PO12	3	Develop interest in designing devices considering advanced technological changes
	PSO1	3	Analyse the different characteristics by applying basic engineering knowledge
	PSO2	3	Design the different microwave devices considering different environmental conditions and satisfying the needs of the society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation, project presentation and so on as a team by acquiring essential interpersonal skills
CO2	PO1	3	Apply the knowledge Measure the radiation pattern and impedance of horn antenna
	PO2	3	Identify different antennas to measure radiation pattern and impedance
	PO3	3	Develop the reliable antennas considering environmental and societal requirements
	PO5	3	Apply the relevant software to measure the radiation pattern to perform the complex investigations
	PO4	3	Conduct the detailed literature survey on different antennas and identify the problems based radiation and impedance
	PO8	3	Apply ethical principles to measure radiation pattern and impedance measurement
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation on networks and do project presentation.

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	PO12	3	Develop interest in designing antennas considering advanced technological changes
	PSO1	3	Analyse the different radiation pattern by applying basic engineering knowledge and observing parameters
	PSO2	3	Develop the efficient antennas that meet the specific needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like project presentation as a team by acquiring essential interpersonal skills
CO3	PO1	3	Apply the error detection techniques for reliable communication
	PO2	3	Apply the knowledge to analyse the given problem to design the various network topologies for different types of networks
	PO3	3	Develop the error correction techniques for reliable data communication of different networks considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing error detection and correction techniques and identify the problems for further investigations
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on algorithms like CRC and checksum
	PO8	3	Apply ethical principles on developing algorithms of error detection and correction ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like project presentations based on the concepts learnt.
	PO12	3	Develop interest in building more algorithms like hamming code considering wider technological changes
	PSO1	3	Compare the various error detection/correction protocols by applying basic engineering knowledge
	PSO2	3	Design the components to make error control mechanism considering telecommunication industrial requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation, project presentation and so on as a team by acquiring essential interpersonal skills
CO4	PO1	3	Apply the knowledge of engineering fundamentals for making communication wired/wireless networks
	PO2	3	Apply the knowledge of engineering to analyse the given network in different topologies
	PO3	3	Develop the implement different IP addressing schemes considering societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to study the performance of different traffic shaping techniques
	PO8	3	Apply ethical principles for implementing IPV4/IPV6 addressing techniques ensuring societal safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation on networks and do project presentation.
	PO12	3	Develop interest in building more routing protocols considering wider technological changes

	PSO1	3	Compare the different unicast routing protocols by applying basic engineering knowledge and observing parameters
	PSO2	3	Develop the efficient networks with proper routing mechanism considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like project presentation as a team by acquiring essential interpersonal skills
CO5	PO1	3	Apply the fundamental concepts of cryptography
	PO2	3	Apply the engineering knowledge to analyse the given application layer protocols
	PO3	3	Develop the algorithms for providing secure communication
	PO4	3	Conduct the detailed literature survey on existing security algorithms and understand the need of data security
	PO5	3	Apply the relevant simulators to perform the complex investigations on encryption and decryption
	PO8	3	Apply ethical principles to compare various routing protocols and cryptographic algorithms
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation on networks and do project presentation.
	PO12	3	Develop interest in building more security algorithms considering wider technological changes
	PSO1	3	Apply the concepts of encryption and decryption for solving complex problems in providing effective networking
	PSO2	3	Develop the security algorithms that meet the specific needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation, project presentation and so on as a team by acquiring essential interpersonal skills

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC 7P2 - Project Work - Phase I</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>0</td><td>0</td><td>4</td><td>60</td><td>2</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To help the students apply their academic knowledge and technical skills in a specific domain
• To facilitate the students to identify , formulate and solve engineering problems
• To help the students design a system , component or process to meet the desired needs within realistic constraints
• To work and communicate efficiently in multidisciplinary terms
• To develop an understanding of professional and ethical responsibility in students</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Identify engineering problems in their domain of interest and carry out literature review in the chosen technical area
CO2: Analyse and identify an appropriate technique to solve the problem.
CO3: Design engineering solution , do experimentation / simulation / programming / fabrication/ collect and interpret data utilizing a systems approach
CO4: Communicate effectively in oral and written forms
CO5: Demonstrate the knowledge, skills and attitudes of a professional engineer as an individual and member of a team</td></tr>
<tr><td colspan="9">• A committee is constituted with the project coordinator, project guide and HOD/Senior professor in the department</td></tr>
</table>

- Three reviews have to be conducted by the committee
- Problem should be selected by every batch of students
- Students must do a literature survey collecting a minimum of 1 survey paper and 2 technical papers related to their work
- Report has to be prepared by the students as per the format
- Preliminary implementation can be done if possible Internal evaluation has to be done based on the three reviews for 100 marks

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the engineering knowledge to identify the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to formulate the complex engineering problems on literature survey carried out
	PO3	3	Identify solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Identify the solution based on literature survey for societal need
	PO7	3	Identify the solutions based on literature survey for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO2	PO1	3	Apply the engineering knowledge to analyze the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to analyze the complex engineering problems on literature survey carried out
	PO3	3	Analyse solutions on literature survey carried out for complex problems

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	PO4	3	Conduct the detailed literature survey on analyzed problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Analyse the solution on literature survey carried out for societal need
	PO7	3	Analyse the solutions on literature survey carried out for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO3	PO1	3	Apply the engineering knowledge to design the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to design the complex engineering problems on literature survey carried out
	PO3	3	Design solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to design the complex problems on problem stated
	PO6	3	Design the solution on literature survey for societal need
	PO7	3	Find the solutions on literature survey for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the engineering knowledge to identify the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to review the complex engineering problems on literature survey carried out
	PO3	3	Develop solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects

	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Design the solution on identified problem for societal need
	PO7	3	Design the solutions on identified problem for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO1	3	Design system components and develop products with needs of industry and society
	PSO2	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
	PSO3	3	Apply the engineering knowledge to identify the engineering problems in various domain
CO5	PO1	3	Apply the engineering knowledge to demonstrate the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to demonstrate the complex engineering problems on literature survey carried out
	PO3	3	Design solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to design the complex problems on problem stated
	PO6	3	Demonstrate the solution on identified problem for societal need
	PO7	3	Demonstrate the solutions on identified problem for sustainable development
	PO8	3	Apply ethical principles to designed problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills

K.S.Rangasamy College of Technology - Autonomous Regulation R 2018									
50 TP 0P5 - Career Competency Development V									
Common to all Branches									
Semester	Hours/Week			Total hrs	Credit	Maximum Marks			
	L	T	P		C	CA	ES	Total	
VII	0	0	2	30	0	100	00	100	

Course Objectives	• To help the learners to practice the written and oral communication skills in the academic and professional contexts • To help the learners to practice the verbal and logical reasoning ability to meet out the requirements of both competitive exams and companies • To help the learners to practice effectively the aptitude modules for company based recruitments and competitive exams • To help the learners to practice effectively the data interpretation and analysis modules for company based recruitments and competitive exams To help the learners to hone the technical and programming skills for better employability
Course Outcomes	**At the end of the course, the student will be able to** CO1: Reinforce the written and oral communication skills in the academic and professional contexts CO2: Discriminate and assess the verbal and logical reasoning ability to meet out the employability requirements of the companies CO3: Relate the aptitude modules for company based recruitments and competitive exams effectively CO4: Compare and illustrate the data interpretation and analysis modules effectively for company based recruitments and competitive exams CO5: Formulate and integrate the technical and programming skills to be focused on better employability and code contests.

Unit–1	**Written and Oral Communication**	
Self-Introduction–GD–HRInterviewSkills–CorporateProfileReview-PracticesonCompanyBasedQuestions and Competitive Exams **Materials:** Instructor Manual		6
Unit–2	**Verbal & Logical Reasoning**	
Practice son Company Based Questions and Competitive Exams **Materials:** Instructor Manual		6
Unit–3	**Quantitative Aptitude**	
Practiceson Company Based Questions and Competitive Exams **Materials:** Instructor Manual		6
Unit–4	**Data Interpretation and Analysis**	
Practiceson Company Based Questions and Competitive Exams **Materials:** Instructor Manual		6
Unit–5	**Programming &Technical Skills–Part3**	
Data Structure – Arrays–Linked List–Stack–Queues –Tree–Graph. Practiceson Algorithms and Objective Type Questions. **Materials:** Instructor Manual		6
	Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions each from Unit 1, 2, 3, 4 & 5 (External Evaluation)	50
2	Evaluation 2 - Oral Communication	GD and HR Interview (External Evaluation by English, MBA Dept.)	30
3	Evaluation 3 – Technical Interview	Internal Evaluation by the Dept. – 3 Core Subjects	20
		Total	100

Reference Books

1. Aggarwal, R.S.'A Modern Approach to Verbal and Non-verbal Reasoning', Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.
2. Abhijit Guha, 'Quantitative Aptitude', TMH, 3rd Edition
3. Objective Instant Arithmetic by M.B. Lal & Goswami Upkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note:

- Instructor can cover the syllabus by Class room activities and Assignments (5Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough Work pages
- Each Assignment has 20 questions from Unit 1,2,3,4,5 and 5 questions from Unit1(Oral Communication) & Unit5(Algorithms)
- Evaluation has to be conducted as like Lab Examination.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1	1	1	2	1	1	2	3	2	3	1	2	3
CO2	2	1	2	2	1	2	1	1	2	3	3	3	2	2	2
CO3	2	1	2	2	1	1	1	1	2	3	2	3	3	2	2
CO4	2	2	2	2	2	1	1	1	2	3	3	3	3	2	1
CO5	2	2	2	2	2	2	2	2	2	3	2	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	1	Reinforce the complex engineering problems for better understanding in academic and professional contexts
	PO2	1	Reinforce the literature and understanding the substantiated conclusions
	PO3	1	Strengthen solutions for the complex engineering problems in the academic and professional contexts
	PO4	1	Emphasize the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	1	Emphasize the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	2	Reinforce the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Highlight the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be examined and correlated professionally
	PO9	2	Reinforce the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper reinforcement
	PO11	2	Reinforce the demonstration of knowledge in multidisciplinary environments
	PO12	3	Emphasize the broadest situational context of changing technology
	PSO1	1	Emphasize with academic and professional context to solve the complex engineering problems

	PSO2	2	Reinforce the design and development of components and products
	PSO3	3	Enriching interpersonal skills and attitude with proper reinforcements
CO2	PO1	2	Assess the complex engineering problems for better understanding in academic and professional contexts
	PO2	1	Assess the literature and understanding the substantiated conclusions
	PO3	2	Assess solutions for the complex engineering problems in the academic and professional contexts
	PO4	2	Assessing the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	1	Assess the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	2	Assess the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Assess the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be examined professionally
	PO9	2	Analyse the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper analysis
	PO11	3	Assess of the demonstration of knowledge in multidisciplinary environments
	PO12	3	Examine the broadest situational context of changing technology
	PSO1	2	Assess with academic and professional context to solve the complex engineering problems
	PSO2	2	Examining the design and development of components and products
	PSO3	2	Enriching interpersonal skills and attitude with proper assessment
CO3	PO1	2	Relate the complex engineering problems for better understanding in academic and professional contexts
	PO2	1	Correlate the literature and understanding the substantiated conclusions
	PO3	2	Relate solutions for the complex engineering problems in the academic and professional contexts
	PO4	2	Relate the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	1	Relate the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	1	Correlate the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Correlate the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be correlated professionally
	PO9	2	Relate the functions effectively both as individual and as a member in diverse teams

	PO10	3	Communicating effectively on complex engineering activities with proper correlation
	PO11	2	Illustrate the demonstration of knowledge in multidisciplinary environments
	PO12	3	Correlate the broadest situational context of changing technology
	PSO1	3	Relate with academic and professional context to solve the complex engineering problems
	PSO2	2	Correlating the design and development of components and products
	PSO3	2	Enriching interpersonal skills and attitude with proper correlation
CO4	PO1	2	Illustrate the complex engineering problems for better understanding in academic and professional contexts
	PO2	2	Exemplify the literature and understanding the substantiated conclusions
	PO3	2	Demonstrate solutions for the complex engineering problems in the academic and professional contexts
	PO4	2	Illustrate the synthesis of information after conducting investigations of complex problems in academic and professional contexts
	PO5	2	Exemplify the prediction and modelling of complex problems with its limitations both academically and professionally
	PO6	1	Illustrate the assessment of contextual responsibilities both in academic and professional contexts
	PO7	1	Demonstrate the demonstration and necessity of sustainable development to be examined
	PO8	1	The ethical norms and responsibilities to be examined professionally
	PO9	2	Illustrate the functions effectively both as individual and as a member in diverse teams
	PO10	3	Communicating effectively on complex engineering activities with proper illustration
	PO11	3	Illustrate the demonstration of knowledge in multidisciplinary environments
	PO12	3	Exemplify the broadest situational context of changing technology
	PSO1	3	Assess with academic and professional context to solve the complex engineering problems
	PSO2	2	Examining the design and development of components and products
	PSO3	1	Enriching interpersonal skills and attitude with proper assessment
CO5	PO1	2	Formulate and integrate the application of engineering knowledge and find solutions to complex engineering problems
	PO2	2	Devise and integrate the contingent factors to analyse complex engineering problems

	PO3	2	Formulate and integrate the concepts of aptitude in the designing of solutions to complex engineering problems
	PO4	2	Showcase the aptitude of synthesising of information to arrive valid conclusions to the complex engineering problems
	PO5	2	Formulate and integrate the concepts and develop the attitude for applying appropriate techniques and tools for the prediction of complex engineering activities
	PO6	2	Devise and integrate the assessed contextual knowledge for professional relevance
	PO7	2	Formulate and integrate with aptitude the impact of engineering solutions for sustainable development
	PO8	2	Formulate the ethical principles and norms of engineering practice
	PO9	3	Making effective presentation skills both as individual and as a member in a team
	PO10	3	Communicating with clarity on engineering problems and report and devise the concepts effectively
	PO11	2	Devise knowledge on projects in diverse multi-disciplinary ambience with effective inference
	PO12	3	Ability to formulate the aptitude in the broadest situational context of changing technology
	PSO1	3	Formulate and integrate to solve the complex engineering problems
	PSO2	3	Design and develop components and products with proper formulation
	PSO3	3	Enriching interpersonal skills and attitude by showcasing effective formulation

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2018</th></tr>
<tr><th colspan="9">50 AC 002 - Research Skill Development -II</th></tr>
<tr><th colspan="9">Common to All Branches</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VIII</td><td>1</td><td>0</td><td>0</td><td>15</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To identify the ethics in preparing research paper
• To organize manuscript for submission
• To attain knowledge for filing Patent
• To apply for copy right
• To develop and deploy Mobile App. in play store</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Prepare a manuscript for journal publication.
CO2: Apply the manuscript for publication
CO3: Interpret the process of obtaining copyright and patent
CO4:Analyze the various provisions to share the application
CO5:Create and publish the mobile application in the digital store</td></tr>
<tr><td colspan="9">Note: Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.</td></tr>
<tr><td colspan="9">Preparation of Manuscript
Data necessary before writing a paper: the context in which the scientist is publishing. Learning and identification of research community - advantages of scientific journal publication and manuscript preparation - ethical values in publishing. [3]</td></tr>
</table>

Writing the paper
Writing research paper - structure of the paper - usage of bibliographical tools - abstract preparation and to do a peer review for the abstract of the others, as in real academic life. Plagiarism of the prepared manuscript. [2]

Copyright

Copyright law in India-Meaning of copyright-Classes of works for copyright protection -Ownership of Copyright-Assignment of copyright-Intellectual Property Rights (IPR) of Computer Software-Copyright Infringements-Procedure for registration [2]

Patents

Patent System In India -Types of Patent Applications-patentable invention - Not patentable-Appropriate office for filing -Documents required Publication and Examination of Patent Applications -Grant of Patent-Infringement of Patents -E-filing of Patent applications. [3]

Deploying Mobile App. in play store
Introduction to Application Stores – Play Store, App Store, Microsoft Store, Creating App – Android, iOS, UWP, Defining Manifest, Certifying App, Create Store Listing, Sharing Screenshots, Sharing App Credentials for Testing. [5]

Total Hours: 15

Text Book(s):

1.	Mathis Plapp. How to Write and Publish a Scientific Paper (Project-Centered Course). https://www.coursera.org /learn/how-to-write-a-scientific-paper#instructors
2.	Rajkumar S. Adukia ,Handbook On Intellectual Property Rights In India,2007
3	Dr. M. Kantha Babu ,"Text book on Intellectual Property Rights",2019.

Reference(s)

1.	Kothari, C.R. andGaurav Garg, "Research Methodology: Methods and Techniques", New Age International Publishers, 2013
2.	Srivastava, T.N. and Rego, S., "Business Research Methodology", Tata McGrawHill Education Pvt. Ltd., Delhi, 2019.
3.	https://support.google.com/googleplay/android-developer/answer/9859152
4.	https://developer.apple.com/ios/submit/
5.	https://docs.microsoft.com/en-us/windows/uwp/publish/app-submissions

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3				3		2	3	1		3	1
CO2	3	3	3	3			1	2	2	2	2	1		3	2
CO3	3	3	2	2	2		2	2	1	2	1	1	3	3	
CO4	3	3	3		3	2	2		2		2	2	3	2	
CO5	3	3	3		3	2	2		2		2	2	3	2	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge of engineering specialization to find the solution of Research results in manuscript

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	PO2	3	Apply the knowledge to analyse the research literature
	PO3	3	Design solutions for environmental and societal requirements with the help of research
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems to prepare manuscript
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice for preparing manuscript
	PO10	2	write effective reports and design documentation, make effective presentations, and give and receive clear instructions
	PO11	3	Demonstrate knowledge and understanding of the engineering and management principles and apply these to prepare manuscript
	PO12	1	To engage in independent and life-long learning in the broadest context of technological change in prepare of manuscript
	PSO2	3	Design system components and develop products that meet the specific needs of industry and society with valid manuscript
	PSO3	1	Develop essential interpersonal skills and attitude needed for developing manuscript
CO2	PO1	3	Apply the knowledge of engineering specialization to prepare manuscript and apply for publications
	PO2	3	analyze complex engineering problems reaching substantiated conclusions in research process
	PO3	3	Design solutions for complex engineering problems in preparation of manuscript
	PO4	3	Use research-based knowledge and research methods including design of experiments before apply the manuscript for publications
	PO7	1	Understand the impact of the professional engineering solutions in societal and environmental issues in dealing with research process
	PO8	2	Apply ethical principles in development of manuscript
	PO9	2	Function effectively as an individual, and as a member or leader in diverse teams in research process
	PO10	2	write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
	PO11	2	Demonstrate knowledge and understanding of the engineering and management principles and apply these to develop manuscript
	PO12	1	Have some contribution in engage in independent and life-long learning of research process
	PSO2	3	Design system components and develop products that meet the specific needs of industry and society with valid manuscript
	PSO3	2	Develop essential interpersonal skills and attitude needed for developing manuscript
CO3	PO1	3	Apply the knowledge of engineering specialization to find new idea to create copy rights
	PO2	3	Analyze research literature, and complex engineering problems to create copy rights
	PO3	2	Design new solutions for environmental and societal requirements to create copy rights
	PO4	2	Analysis and interpretation of data, and synthesis of the information to provide valid conclusions
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for create copy rights
	PO7	2	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO8	2	Apply ethical principles in developing copy right and filing patent
	PO9	1	Function effectively as an individual, and as a member or leader in diverse teams to filing patent
	PO10	2	write effective reports and design documentation, make effective presentations, and give and receive clear instructions for successful copy rights

	PO11	1	understanding of the engineering and management principles in creating copy rights
	PO12	1	ability to engage in independent and life-long learning
	PSO1	3	Solve complex engineering problems in creating copy rights
	PSO2	3	Design system components and develop products to produce IPR
CO4	PO1	3	Apply the knowledge of engineering specialization to find new idea to filing patent and copy rights
	PO2	3	Analyze research literature, and complex engineering problems to create copy rights
	PO3	3	Design new solutions for environmental and societal requirements create copy rights
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools applied for filing patent
	PO6	2	For filing patent apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues
	PO7	2	Understand the impact of the professional engineering solutions in societal and environmental contexts
	PO9	2	Function effectively as an individual, and as a member or leader in diverse teams to filing patent
	PO11	2	understanding of the engineering and management principles in filing patent
	PO12	2	ability to engage in independent and life-long learning to develop innovations and filing patent
	PSO1	3	Solve complex engineering problems to produce IPR
	PSO2	2	Design system components and develop products to produce IPR
CO5	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of developing mobile applications
	PO2	3	Apply the knowledge to analyse the results of mobile applications
	PO3	3	Design solutions for environmental and societal requirements by developing new mobile applications
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools to develop and test new mobile applications
	PO6	2	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues to develop and test new mobile applications
	PO7	2	Understand the impact of the professional engineering solutions in societal and environmental contexts to develop and test new mobile applications
	PO9	2	Function effectively as an individual, and as a member or leader in diverse teams,in developing and testing of applications
	PO11	2	Neeed adequate skill of Project management and finance in development of applications
	PO12	2	Product development should have ability to engage in independent and life-long learning
	PSO1	3	Solve complex engineering problems in development of applications
	PSO2	2	Design system components and develop products related to mobile applications

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2018</th></tr>
<tr><th colspan="9">50 EC 8P1 - Project Work - Phase II</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
</table>

VIII	0	0	16	240	8	50	50	100
Objective(s)	• To help the students apply their academic knowledge and technical skills in a specific domain • Foster collaborative learning skills • Habituated to critical thinking and use problem solving skills • Develop self-directed inquiry and life-long skills • To enhance the communication skills of the students by providing opportunities to discuss in groups and to present their observations, findings and report in formal reviews both in oral and written format							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Identify engineering problems in their domain of interest and carry out literature review in the chosen technical area CO2: Analyse and identify an appropriate technique to solve the problem. CO3: Design engineering solution , do experimentation / simulation / programming / fabrication/ collect and interpret data utilizing a systems approach CO4: Communicate effectively in oral and written forms CO5: Demonstrate the knowledge, skills and attitudes of a professional engineer as an individual and member of a team							

- A committee is constituted with the project coordinator, project guide and HOD/Senior professor in the department.
- Three reviews have to be conducted by the committee
- Each review has to be evaluated for 100 marks.
- Attendanceiscompulsoryforallreviews.Ifastudentfailstoattendreviewforsome valid reason, one or more chance may be given.
- A senior professor from other departments may be included in the committee for final review.
- The report should be submitted as per the format by the students.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the engineering knowledge to identify the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to formulate the complex engineering problems on literature survey carried out
	PO3	3	Identify solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Identify the solution based on literature survey for societal need
	PO7	3	Identify the solutions based on literature survey for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety

	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO2	PO1	3	Apply the engineering knowledge to analyze the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to analyze the complex engineering problems on literature survey carried out
	PO3	3	Analyse solutions on literature survey carried out for complex problems
	PO4	3	Conduct the detailed literature survey on analyzed problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Analyse the solution on literature survey carried out for societal need
	PO7	3	Analyse the solutions on literature survey carried out for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO3	PO1	3	Apply the engineering knowledge to design the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to design the complex engineering problems on literature survey carried out
	PO3	3	Design solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to design the complex problems on problem stated
	PO6	3	Design the solution on literature survey for societal need
	PO7	3	Find the solutions on literature survey for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects

	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the engineering knowledge to identify the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to review the complex engineering problems on literature survey carried out
	PO3	3	Develop solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to perform the complex problems on problem stated
	PO6	3	Design the solution on identified problem for societal need
	PO7	3	Design the solutions on identified problem for sustainable development
	PO8	3	Apply ethical principles to identified problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PO12	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO1	3	Design system components and develop products with needs of industry and society
	PSO2	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills
	PSO3	3	Apply the engineering knowledge to identify the engineering problems in various domain
CO5	PO1	3	Apply the engineering knowledge to demonstrate the engineering problems in various domain
	PO2	3	Apply the engineering knowledge to demonstrate the complex engineering problems on literature survey carried out
	PO3	3	Design solutions for identified complex problems
	PO4	3	Conduct the detailed literature survey on identified problems and provide conclusions for outcome of projects
	PO5	3	Use the modern engineering tools to design the complex problems on problem stated
	PO6	3	Demonstrate the solution on identified problem for societal need
	PO7	3	Demonstrate the solutions on identified problem for sustainable development
	PO8	3	Apply ethical principles to designed problem for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like journal, conference etc.
	PO11	3	Develop interest in building more reliable real time application circuits considering wider technological changes

	PO12	3	Develop interest in building more reliable real time application circuits considering wider technological changes
	PSO1	3	Apply the concepts of engineering knowledge for solving complex problems
	PSO2	3	Design system components and develop products with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like journal, conference paper presentation etc. by acquiring essential interpersonal skills

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50 EC E11 - Biomedical Electronics

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100

Objective(s)	• To study the principles of bioelectric signals, methods of recording various bio-potentials and biosensors • To discuss the measurement of bio-chemical and non-electrical parameters • To learn about various assist devices used in medical field • To study the principle of physical medicine and bio telemetry • To learn the latest trends in biomedical instrumentation
Course Outcomes	**At the end of the course, the students will be able to** CO1: Learn the fundamentals of bioelectric signals, bio potential electrodes and biosensors CO2: Evaluate the measurement of bio-chemical and non-electrical parameters CO3: Outline the operation of assist devices CO4: Discuss the types of physical medicine, bio-telemetry and their applications CO5: Discuss the recent trends in medical instrumentation

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Electro-Physiology, Biopotential Recording and Bio sensors
Origin of Biopotentials; biopotential electrodes; biological amplifiers; ECG, EEG, EMG – lead systems and recording methods, typical waveforms and signal characteristics. Bio sensors – Need of sensors, working principle of bio sensor, types of biosensors and their applications. [9]

Bio-Chemical and Non Electrical Parameter Measurements
pH, pO2, pCO2,pHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure measurement, temperature measurement, pulse measurement, Blood cell counters. [9]

Assist Devices
Cardiac pacemakers, DC Defibrillators, Dialyser, Heart-Lung machine, Audiometer, Lithotripsy. [9]

Physical Medicine and Bio-Telemetry
Diathermies – Short-wave, ultrasonic and microwave type and their applications, Surgical diathermy, Bio-telemetry - principles, frequency selection and types – single channel and multi-channel telemetry, radio pill, electrical safety.
[9]

Recent Trends In Medical Instrumentation
Thermograph, Endoscopy unit, Laser in medicine, Cryogenic application, Introduction to telemedicine, Case study: Handheld devices such as Infrared thermometer, pulse oximeter, blood glucose meter, blood pressure monitor, ECG monitor, nebulizer, body sensors. [9]

Total Hours: 45

Text book(s):

1	John G.Webster, 'Medical Instrumentation Application and Design', 4th Edition, Wiley India (Pvt) Ltd., 2015.
2	Leslie Cromwell, 'Biomedical instrumentation and measurement', 2nd Edition, Prentice Hall, 2015.

Reference(s):

1	Khandpur, R.S. 'Handbook of Biomedical Instrumentation', 2nd Edition, McGraw-Hill, 2015.
2	Joseph.J, Carr and John M.Brown, 'Introduction to Biomedical Equipment Technology', 4th Edition, Pearson Education, 2009.
3	Myer Kutz, 'Standard Handbook of Biomedical Engineering and Design', Volume 1, McGraw Hill Publisher, 2009.

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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4	Michael M. Domach, 'Introduction to Biomedical Engineering', 2nd Edition, Pearson Education India, 2015.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2									3	3	
CO2	3	3	3	2									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the fundamentals concepts of bioelectric signal in bio medical electronics
	PO2	3	Apply the knowledge to analyse the given problem to design the bio system
	PO3	3	Design the Bio communication system components considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	3	Design the bio system components considering industrial and societal requirements
CO2	PO1	3	Apply the different measurement techniques for finding bio-chemical and non-electrical parameters.
	PO2	3	Apply the knowledge to analyse the measurement techniques for finding bio-chemical and non-electrical parameters.
	PO3	3	Design the reliable Bio system components considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing non electric parameter for identify the problems
	PSO1	3	Perform the different measurement of bio-chemical and non-electrical parameters by applying basic engineering knowledge
	PSO2	3	Design the reliable Bio system modules considering different environmental conditions
CO3	PO1	3	Apply the different techniques for design of assist devices
	PO2	3	Apply the knowledge to analyse the given problem to design assist device.
	PO3	3	Develop the Bio electronic system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing working techniques of assist devices and identify the problems for further investigations
	PSO1	3	Compare the various techniques of working operation of assist device by applying basic engineering knowledge
	PSO2	3	Design the bio system components considering telecommunication industrial requirements
CO4	PO1	3	Apply the basic concept in bio-telemetry and their applications in baseband transmission

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	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the baseband transmission bio systems
	PO3	3	Develop the bio system schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Measure the power spectral densities of different modulation of telemetry by applying basic engineering knowledge
	PSO2	3	Develop the baseband bio communication system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of information theory for trends in medical instrumentation.
	PO2	3	Apply the engineering knowledge to analyse the recent trends in medical instrumentation
	PO3	3	Develop the algorithms for various recent trends in medical instrumentation
	PO4	3	Conduct the detailed literature survey of recent trends in medical instrumentation
	PO5	3	Apply the relevant simulators to perform the complex investigations on information theory
	PO8	3	Apply ethical principles to compare telemetry modulation techniques ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable bio communication system considering wider technological changes
	PSO1	3	Apply the concepts of information theory for solving complex problems
	PSO2	3	Design the bio communication system components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

<table>
<tr><th colspan="10">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="10">50 EC E12– Consumer Electronics</th></tr>
<tr><th colspan="10">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td>Total</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>hrs</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn the working principles of audio system.
• To study the principle of Television
• To become familiar with mobile phone operating system
• To study the working principle of home and office system
• To become familiar with Product safety and liability issues</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Describe the working principles of basic audio system
CO2: Explain the functions of various broadcasting systems</td></tr>
</table>

	CO3: Describe the mobile phone architecture CO4: Explain the operating principles of home Appliances CO5: Discuss the safety issues and safety standards of electronic systems

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Audio System

Microphones, Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid range, multi-speaker system, baffles and enclosures- Digital sound recording on disc-DTS-Dolby systems-CD system- Introduction to Blue ray technology-Hi-Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers. [9]

Television

Principles of Television: - TV standards- Scanning- Video Bandwidth - Composite Video signal- TV Camera:- Principle & working of Vidicon TV Camera - Monochrome picture tube— Block diagram and Working principle of B&W TV Transmitter and TV Receiver - colour television display tube- Delta gun-Precision- in- line picture tube-HD TV systems-LCD, LED, PLASMA Systems. Block diagram and working principle of cable TV and DTH, set top box. [9]

Pervasive Devices

Mobile Phone: Elements – Mobile Information Architecture - Mobile Phone Design – Types of mobile operating system- Android Overview-The Stack – Android User Interface – Preferences, the File System, the Options Menu and Intents. [9]

Home and Office Systems

Alexa and cortana Device, Digital camera system, Microwave oven, Washing machine, Air Conditioners Refrigerators, Construction and working principles of Inkjet Printer, Laser Printer- RFID-Ultrasonic remote transmitter, IR remote-control transmitter. [9]

Compliance

Product safety and liability issues- standards related to electrical safety and standards related to fire hazards, e.g., UL and VDE- EMI/EMC requirements and design techniques for compliance - ESD, RF interference and immunity- line current harmonics and mains voltage surge-case study. [9]

Total Hours: 45

Text book(s):

1	Bali S.P, ‘Consumer Electronics’, Pearson Education, 2018.
2	Gupta R.G. ‘Audio Video Systems’, 2nd Edition, McGraw-Hill, 2017.

Reference(s):

1	R.R Gulati, ‘Monochrome & Color Television’, 2nd Edition, New Age international, 2017.
2	R.R Gulati, ‘Complete Satellite & Cable Television’, Revised Edition, New Age international, 2017.
3	K. Blair, Benson ‘Audio Engineering Hand book’, McGraw-Hill, 2017.
4	Brian Fling, ‘Mobile Design & Development’, 1st Edition, O’Reilly, 2016.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	2	
CO2	3	3	3	3									3	2	
CO3	3	3	3	3		3	3						3	3	
CO4	3	3	3	3				3	3	3		3	3	3	3
CO5	3	3	3	3				3					3	2	

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply Basic principles to design basic audio system
	PO2	3	Apply the knowledge to analyse the given problem to design the audio system
	PO3	3	Design the audio system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Performthe signal processing by applying basic engineering knowledge
	PSO2	2	Design the audio system components considering industrial and societal requirements
CO2	PO1	3	Apply the Basic principles to find of various broadcasting systems
	PO2	3	Apply the knowledge to analyse the Basic principles to design basic audio system
	PO3	3	Design the functions of various broadcasting systems considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on various broadcasting systems and identify the problems
	PSO1	3	Perform the different usage of basic principles by applying basic engineering knowledge
	PSO2	2	Design the reliable basic audio system modules considering different environmental conditions
CO3	PO1	3	Apply the digital techniques for mobile phone architecture
	PO2	3	Apply the knowledge to analyse the given problem to design mobile phone architecture
	PO3	3	Develop the mobile phone architecture components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing design techniques and identify the problems for further investigations
	PO6	3	Apply the relevant simulators and software to perform the complex investigations on mobile phone architecture
	PO7	3	Apply ethical principles to mobile phone architecture techniques ensuring environmental safety
	PSO1	3	Compare the various digital techniques by applying basic engineering knowledge
	PSO2	3	Design the mobile phone architecture considering Digital electronics industrial requirements
CO4	PO1	3	Apply the different techniques for operating principles of home Appliances
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design home Appliances.
	PO3	3	Develop the home Appliances schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO8	3	Apply ethical principles to compare home Appliances ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable digital home Appliances techniques considering wider technological changes
	PSO1	3	Measure the analysis of home Appliances . by applying basic engineering knowledge
	PSO2	3	Develop the home Appliances components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the fundamental concepts of safety issues and safety standards of electronic systems
	PO2	3	Apply the engineering knowledge to analyse the safety issues and safety standards of electronic systems

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	PO3	3	Develop the algorithms for analysis of safety issues and safety standards of electronic systems
	PO4	3	Conduct the detailed literature survey on safety issues and safety standards of electronic systems
	PO8	3	Apply ethical principles to compare safety issues and safety standards of electronic systems ensuring environmental safety
	PSO1	3	Apply analysis of safety issues and safety standards of electronic systems for solving complex problems
	PSO2	2	Design safety issues and safety standards of electronic systems considering industrial and societal requirements

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E13 - Nano Electronics								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100

Objective(s)	• To understand the fundamentals of Quantum Mechanics • To learn simple Harmonic Oscillators and their approximations • To study Systems with two and many Degrees of Freedom • To study the concepts of Statistical Mechanics • To know the applications of Nano electronics
Course Outcomes	**At the end of the course, the students will be able to** CO1: Derive solutions using Schrodinger wave equation and quantum mechanics CO2: Describe the function of quantum LC circuit and find the approximation values of Simple Harmonic Oscillators CO3: Describe the quantization in Electromagnetic field and density of various states CO4: Discuss the concept of statistical mechanics and microscopic systems CO5: Analyse the role of gaseous interaction with nano electric materials and mechanical properties of carbon nano materials

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Quantum Mechanics

Particles, waves, probability amplitudes, Schrodinger equation, wave packets solutions, operators, expectation values, Eigen functions, piecewise constant potentials. [9]

Simple Harmonic Oscillators and Approximations

SHM Operators, SHM wave packet solutions, Quantum LC circuit, WKB approximations, variational methods. [9]

Systems with Two and Many Degrees of Freedom

Two level systems with static and dynamic coupling, problems in more than one dimensions, electromagnetic field quantization, density of states. [9]

Statistical Mechanics

Basic concepts, microscopic, quantum systems in equilibrium, statistical models applied to metals and semiconductors. [9]

Applications

Hydrogen and Helium atoms, electronic states, Atomic force microscope, Nuclear Magnetic Resonance, carbon nanotube properties and applications. [9]

Total Hours: 45

Text book(s):

1	Hagelstein, Peter L., Stephen D. Senturia, and Terry P. Orlando, ‘Introduction to Applied Quantum and Statistical Physics’, Wiley, 2004.
2	Rainer Waser, ‘Nanoelectronics and Information Technology’, 3rd Edition, Wiley-VCH, 2012.

Reference(s):

1	Michael A. Nielsen and Isaac L. Chuang, 'Quantum Computation and Quantum Information', 10th Edition, Cambridge University Press, 2015.
2	Neil Gershenfeld, 'The Physics of Information Technology', Cambridge University Press, 2011.
3	Adrian M.Ionesu and Kaustav Banerjee, 'Emerging Nanoelectronics: Life with and after CMOS', Vol I, II and III, Kluwer Academic Publishers, 2005.
4	Mitin V V , Kochelap V A and Stroscl0 M A 'Introduction to Nanoelectronics', Cambridge University Press,2012

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2									3	2	
CO2	3	3	3										3	2	
CO3	3	3	3	3									3	2	
CO4	3	3	3										3	2	
CO5	3	3	3	3									3	2	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the quantum mechanic concepts for different particles and waves
	PO2	3	Apply the knowledge to analyse the given problem to eigen functions and potentials
	PO3	3	Apply the solutions to Schrodinger wave equation, wave packets considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing concepts in quantum mechanics and identify the problems
	PSO1	3	Find solutions to the quantum mechanics by applying basic engineering knowledge
	PSO2	2	Develop the system using quantum mechanics and Schrodinger wave equation considering industrial and societal requirements
CO2	PO1	3	Apply the approximation concepts to simple harmonic oscillators
	PO2	3	Apply the knowledge to analyse the given SHM operators, wave packet solutions to design harmonic oscillators
	PO3	3	Design the reliable quantum LC circuit considering environmental and societal requirements
	PSO1	3	Apply different approximations in simple harmonic oscillators by applying basic engineering knowledge
	PSO2	2	Design the reliable approximation computing with the help variational methods considering different environmental conditions
CO3	PO1	3	Apply different methods to analyse problems with more than one dimension syatems
	PO2	3	Apply the knowledge to analyse electromagnetic field quantization in the given problem with degrees of freedom

	PO3	3	Develop the two level systems with static and dynamic coupling considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on systems with two and many degrees of freedom and identify the problems for further investigations
	PSO1	3	Compare the degrees of freedom in various dimensions by applying basic engineering knowledge
	PSO2	2	Analyse the density of states and electromagnetic field quantization considering nano electronics industrial requirements
CO4	PO1	3	Apply the basic concepts for statistical mechanics
	PO2	3	Apply the knowledge of engineering to analyse the given problem in quantum systems in equilibrium
	PO3	3	Develop the different statistical models considering environmental and societal requirements
	PSO1	3	Develop the quantum systems in equilibrium by applying basic engineering knowledge
	PSO2	2	Develop the statistical models applied to metals and semiconductors considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of nanoelectronics for different applications
	PO2	3	Apply the engineering knowledge to analyse the given nanoelectronics applications
	PO3	3	Develop the different applications considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing applications understanding the limitations of Nuclear Magnetic Resonance, carbon nanotube properties
	PSO1	3	Apply the concepts of Hydrogen and Helium atoms for solving complex problems
	PSO2	2	Design the nanoelectronics devices considering industrial and societal requirements

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E14 - Measurements and Instrumentation								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100
Objective(s)	• To gain knowledge about different types analog and digital measurement techniques of circuit components and electrical quantities • To introduces principle of basic operation of analog and digital measuring instruments • To develop the basic knowledge in the areas of several domestic applications of measuring instruments • To gain insight knowledge on different types of transducers and their usages • To learn the function of Data Acquisition and its instrumentation							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Identify errors in different types of electrical measurements CO2: Determination of capacitance and inductance measurement Using AC bridges CO3: Explanation of Digital Measurement Concepts CO4: Design of signal generator and their measurements system CO5: Design of Sensor for various application							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Electrical Measurements

Standards of Measurement & Errors – Accuracy and precision types Statistical analysis, analog indicating instruments: MC,MI instruments: Voltmeter- Ammeter- Wattmeter- Multimeter and Energy meter. [9]

Measurement of Resistance, Inductance and Capacitance

Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement. [9]

Digital Instruments

Electronic voltmeter- Multimeter- Wattmeter- Energy meter, Time- Frequency- phase angle measurements using CRO, Spectrum analyzer, Digital counter- frequency meter-virtual instruments [9]

Signal generators

Function generators- pulse and square wave generators- Frequency Synthesizer [9]

Transducers

Classification & selection of transducers- inductive & capacitive transducers- piezoelectric and Hall-effect transducers- encoder, thermisters, thermocouples, potentiometer, photo-diodes & photo-transistors, strain gauges, signal conditioning and telemetry, basic concepts of smart sensors and application, Data Acquisition Systems. Interfacing of transducers, Multiplexing, Data loggers, Computer controlled Instrumentation [9]

Total Hours : 45

Text book(s):

1	Albert D.Helfrick and William D.Cooper, 'Modern Electronic Instrumentation and Measurement Techniques', Pearson / Prentice Hall of India, 2016.
2	Ernest O. Doebelin, 'Measurement Systems-Application and Design', 7th Edition, Tata McGraw-Hill, 2019.

Reference(s):

1	Jones, B.E., 'Instrumentation Measurement and Feedback', Tata McGraw-Hill, 1986.
2	Golding, E.W., 'Electrical Measurement and Measuring Instruments', 3rd Edition, SirIssac Pitman and Sons, 1960.
3	Buckingham, H. and Price, E.N., 'Principles of Electrical Measurements', 1961.
4	A.K.Sawhney, 'A Course in Electrical and Electronic Measurements and Instrumentation', 19th Revised Edition, Dhanpatrai& co, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	2	
CO2	3	3	3	3									3	2	
CO3	3	3	3	3									3	2	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the concepts for Identify different errors
	PO2	3	Apply the knowledge to analyse the errors in electrical measurements
	PO3	3	Design the system components considering environmental and societal requirements

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	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	2	Design the communication system components considering industrial and societal requirements
CO2	PO1	3	Apply the different techniques for Determination of capacitance and inductance measurement Using AC bridges
	PO2	3	Apply the knowledge to analyse the given Determination of capacitance and inductance measurement
	PO3	3	Design the reliable system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing capacitance and inductance measurement and identify the problems
	PSO1	3	Perform the different capacitance and inductance measurement techniques by applying basic engineering knowledge
	PSO2	2	Design the reliable communication system modules considering different environmental conditions
CO3	PO1	3	Apply the Digital Measurement Concepts techniques for different communication systems
	PO2	3	Apply the Digital Measurement Concepts techniques to design the communication system
	PO3	3	Develop the Digital Measurement components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing modulation techniques and identify the problems for further investigations
	PSO1	3	Compare the various Digital Measurement component by applying basic engineering knowledge
	PSO2	2	Design the communication system components considering telecommunication industrial requirements
CO4	PO1	3	Apply the concepts in different signal generator and their measurements system for baseband transmission
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design signal generator and their measurements
	PO3	3	Develop the signal generator and their measurements system considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Measure the power spectral densities of different signal generator applying basic engineering knowledge
	PSO2	3	Develop the different signal generator system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of Design of Sensor for various application
	PO2	3	Apply the engineering knowledge to analyse the Design of Sensor for various application
	PO3	3	Develop the algorithms for various Design of Sensor requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing Sensor requirements
	PO5	3	Apply the relevant simulators to perform the complex investigations on information theory
	PSO1	3	Apply the concepts of Design for Sensor in various application
	PSO2	3	Design the Sensor for various application

B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100
Objective(s)	• To understand the basics concepts of EMI • To understand the coupling principles. • To study the EMI Sources and Problems • To understand Measurement technique for emission and immunity • To understand Solution methods in PCB							
Course Outcomes	CO1: Define the concepts of an EMI free system CO2: Gather the different types of EMI coupling methods CO3: Summarize the different EMI Control Techniques CO4: Examine the EMI Measurements and Standards CO5: Implement the high speed Printed Circuit board with minimum interference							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

EMI/EMC concepts
EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards. [9]

EMI Coupling Principles
Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling, cross talk; Field to cable coupling; Power mains and Power supply coupling. [9]

EMI Control Techniques
Shielding Material-Shielding integrity at discontinuities, Filtering- Characteristics of Filters Impedance and Lumped element filters-Telephone line filter, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC- Cable shielded grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets. [9]

EMI Measurements and Standards
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; EMI Test Receiver and spectrum analyser, Transient EMI test wave Simulators; Basic Standards, Product Standards, National and International EMI Standardizing -CISPR, FCC, IEC, EN; Military standards-MIL461E/462. EN Emission and Susceptibility standards and Specifications. [9]

EMC Design of PCBs
PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models. [9]

Total Hours : 45

Text book(s):

1	V.P.Kodali, 'Engineering EMC Principles, Measurements and Technologies', 2nd Edition, IEEE Press, Newyork, 2010.
2	Clayton R.Paul,' Introduction to Electromagnetic Compatibility', John Wiley Publications, 2nd Edition, 2010.

Reference(s):

1	Henry W.Ott, 'Noise Reduction Techniques in Electronics Systems', Wiley Inter Science Publication John Wiley and Sons New York, 2011.
2	David A Weston, 'Electromagnetic Compatibility, Method, Analysis, Circuits and Measurements', 3rd Edition CRC Publication, 2016.
3	Christos Christopoulos, 'Principles and Techniques of Electromagnetic Compatibility', 2nd Edition, CRC Publication, 2018.
4	Bemhard Keiser, 'Principles of Electromagnetic Compatibility', Artech house, Norwood, 2008.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3		
CO2	3	3	3	3									3	3	
CO3	3	3	3	3		3	3						3	3	
CO4	3	3	3	3		3	3						3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO 1	3	Apply the EMI free concepts in engineering complex system
	PO 2	3	Identify EMI free system for complex engineering problems reaching substantiated conclusions
	PO 3	3	Develop EMI free system with appropriate consideration for the public health and safety
	PO 4	3	Analyse and interpretation of data to investigate the EMI free solution
	PSO 1	3	Solve complex engineering problems by applying engineering knowledge in the field of signals.
CO2	PO 1	3	Apply types of EMI coupling methods concepts in engineering complex system
	PO 2	3	Formulate EMI coupling system for complex engineering problems reaching substantiated conclusions.
	PO 3	3	Develop EMI coupling system with appropriate consideration for the public health and safety
	PO 4	3	Analyse and interpretation of data to investigate the EMI coupling system to meet industry expectation
	PSO 1	3	Solve complex engineering problems by applying engineering knowledge in the field of signals.
	PSO 2	3	Design EMI coupling components and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO3	PO 1	3	Apply EMI controlling technique in engineering complex system
	PO 2	3	Review various EMI control techniques to conclude the substantiated conclusion.
	PO 3	3	Develop EMI controlling techniques with appropriate consideration for the public health and safety
	PO 4	3	Interpretation of data for controlling the EMI signal to meet industry expectation
	PO 6	3	Apply controlling technique and contextual knowledge to assess societal, health, safety.
	PO 7	3	Understand engineering solutions in societal and environmental contexts for sustainable development of EMI system
	PSO 1	3	Solve complex engineering problems by applying engineering knowledge in the field of signals.
	PSO 2	3	Design system components and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO4	PO 1	3	Apply EMI measurement techniques in engineering complex system
	PO 2	3	Identify EMI measurement techniques for complex engineering problems to reach substantiated conclusions.
	PO 3	3	Design solution for EMI measuring techniques to ensure the public health and safety
	PO 4	3	Interpretation of EMI measuring data to meet industry expectation
	PO 6	3	Apply measuring technique and contextual knowledge to assess societal, health, safety.
	PO 7	3	Understand engineering solutions in societal and environmental contexts for sustainable development of EMI measuring

	PSO 1	3	Solve complex engineering problems by applying engineering knowledge in the field of signals.
	PSO 2	3	Design measuring technique that meet the specific needs of industry and society in Electronics and Communication Engineering
CO5	PO 1	3	Apply high speed PCB board with minimum inference implementation techniques in engineering complex system
	PO 2	3	Analyse high speed PCB board to implement and meet the industrial requirement.
	PO 3	3	Design solution for high-speed PCB board to implement and ensure the public health and safety
	PO 4	3	Conduct experiment of high-speed PCB board to meet industry expectation
	PSO 1	3	Solve complex engineering problems by applying engineering knowledge in the field of signals.
	PSO 2	3	Design high speed PCB board that meet the specific needs of industry and society in Electronics and Communication Engineering.

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50 EC E16 - Automotive Electronics

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100

Objective(s)

- To understand the concepts of Automotive Electronics and its evolution and trends
- To acquire knowledge in the vehicle sensors, ignition and injection systems in the field of Automobiles.
- To create a knowledge to the students to understand and create various electronics control of Automotive Systems.
- To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software.
- To understand the principles of comfort, safety systems and advanced vehicle technologies of automobiles.

Course Outcomes

At the end of the course, the students will be able to

CO1: Obtain an overview of automotive components, subsystems and design cycles.
CO2: Interface automotive sensors and actuators with microcontrollers
CO3: Develop, simulate and integrate control algorithms for ECUs with hardware
CO4: Interpret the lighting system and its types.
CO5: Illustrate communication protocols and safety systems employed in today's automotive industry

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Microcomputer

Buses, memory, timing, CPU registers; Microprocessor architecture: Initialization, operation codes, program counter, branch and jump instructions, subroutine. Analog to digital converters and Digital to analog converters, sampling, polling and interrupts, digital filters, lookup table. [9]

Sensors and Actuators

Classification of sensors, sensor for speed, Pressure sensors: Manifold Absolute Pressure sensor, knock sensor, Temperature sensors: Coolant and Exhaust gas temperature, Exhaust Oxygen level sensor, Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor. [9]

Electronic Engine Controls

Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics – engine control module and power train control module. [9]

Lighting System

Insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and

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preventive methods. Horn, wiper system and trafficator fuses, cables, connectors and selection. Multiplexing and demultiplexing, Immurements cluster and tell-tales. [9]

Future Automotive Electronic Systems

Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control. [9]

Total Hours : 45

Text Book(s):

1	Robert Bosch, 'Bosch Automotive Electrics and Automotive Electronics: Systems and Components, Networking and Hybrid Drive', Springer Vieweg ,Plochingen, Germany, 2014.
2	William B Ribbens, 'Understnading Automotive Electronics- An Engineering Persepective', the Boulevard, Langford Lane, Kidlington, Oxford, 2017.

Reference(s):

1	FulepTimea,'Design Methods of Safety-Critical Electronic Automotive Systems', 2010
2	Barry Holembeak, 'Automotive Electricity and Electronics', Delmar Publishers, Clifton Park, USA, 2010.
3	James D Halderman, 'Automotive Electricity and Electronics', Prentice Hall, USA, 2013.
4	Manish K Patel, 'The 8051 Microcontroller Based Embedded Systems', McGraw Hill, ISBN: 978-93-329-0125-4, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2									3	2	
CO2	3	2	3	3									3	3	
CO3	3	2	3	3									3	2	
CO4	3	2	3										3	2	
CO5	3	2	3	3									3		

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of microcomputer
	PO2	2	Analyse the concepts of different types of microprocessor architecture
	PO3	3	Design and develop analog to digital and digital to analog converters
	PO4	2	Analyse the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the program counter by applying fundamental Engineering knowledge
	PSO2	2	Design the various digital components and considering industrial and societal requirements
CO2	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Sensors and Actuators concepts
	PO2	2	Review the concepts of classification of sensors
	PO3	3	Develop the various types of sensors for needs of societal and environmental considerations
	PO4	3	Conduct the detailed literature survey on existing sensors and identify the problems
	PSO1	3	Analyse the various sensors, applying fundamental Engineering knowledge
	PSO2	3	Design the various sensors and actuators and considering industrial and societal requirements
CO3	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Electronic

			engine control concepts
	PO2	2	Apply the Concept of an electronic engine control system in automotive electronics models
	PO3	3	Develop the different scheme of fuel injection and considering environmental and society requirements
	PO4	3	Research the detailed literature survey on existing fuel injection systems and identify the problems
	PSO1	3	Compare the engine control module and power train control module by applying fundamental Engineering knowledge
	PSO2	2	Design the engine control module and power train control module considering automobile requirements
CO4	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Lighting system concepts
	PO2	2	Analyse the concepts of LED lighting system in automobile requirements
	PO3	3	Design and develop square law detector in Amplitude demodulation
	PSO1	3	Perform the various noise modulation techniques by applying fundamental Engineering knowledge
	PSO2	2	Compare the various noise analogy Communication systems components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamentals of Engineering knowledge for understanding of Radio receivers concepts
	PO2	2	Analyse the concepts of AM and FM radios
	PO3	3	Develop AM and FM radio model scheme considering environmental and society requirements
	PO4	3	Analyse the detailed literature survey on existing AM and FM radio systems and identify the problems
	PSO1	3	Perform the various noise modulation techniques by applying fundamental Engineering knowledge

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50 IT E18 – Programming in Java

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100

Objective(s)

- To understand the concepts of object oriented Programming to develop applications.
- To develop programs using the packages, interfaces, exceptions and threads.
- To develop applications using I/O streams and serialization.
- To develop programs using Collection APIs.
- To analyze and develop the JDBC technology with real world problems.

Course Outcomes

At the end of the course, the students will be able to

CO1: Design classes, objects with data Abstraction, Polymorphism and inheritance concepts.
CO2: Prompt the package, interface, String handling classes and observe predefined and user defined Exception handling.
CO3: Analyze the importance of lang package and I/O file system.
CO4: Compose the functionalities of collections framework classes and interfaces.
CO5: Apply the database concepts with JDBC connectivity.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction An overview of Java, Arrays, Methods, Object oriented java programming - Classes and Objects, Inheritance and Polymorphism, Wrapper Class, Abstraction [9] **Java Concepts** Packages and Interfaces, Exception handling, Multithreaded programming, String Handling [9] **I/O Streams** Introduction to Lang package, I/O packages – File, The stream classes, The byte streams, The character streams, Serialization, Externalizable. [9] **Collection Framework** The Collection Interfaces, The Collection Classes and Interfaces, using an Iterator, Working with Maps, The Legacy Classes and Interfaces, String Tokenizer. [9] **Java Database Connectivity** Java Database Programming-Introduction, Relational Database Systems, DML, DDL, DCL and TCL, JDBC, Statement, Prepared Statement. [9]
Total Hours : 45

Text book(s):	
1	Herbert Schildt, 'Java : The complete Reference', Comprehensive coverage of the Java language, Oracle press, 10th Edition, Publisher : McGraw-Hill, 2017.
2	Y.Daniel Liang 'Introduction to Java Programming', Comprehensive Version, 10th Edition, Pearson Education, 2015 [JDBC only].
Reference(s):	
1	'Advanced programming in JAVA', Prentice Hall of India Private Limited NIIT, 2003.
2	Pratik Patel and Karlmoss, 'Java Data base programming with JDBC', 2nd Edition, Dream Tech Press, 2000.
3	Bert Bates and Kathy Sierra, 'Head First Java', 2nd Edition, O'Reilly's, 2009.
4	Online Resources : https://www.tutorialspoint.com, https://www.javatpoint.com, https://www.journaldev.com, https://beginnersbook.com

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	2								3	3	2
CO2	3	3	3	3	2								3	3	2
CO3	3	3	3	3	2								3	3	2
CO4	3	3	3	3	2								3	3	2
CO5	3	3	3	3	2								3	3	2

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
	PO3	3	Design solutions for complex engineering problems and design system

			components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
	PSO1	3	Develop suitable IT infrastructure in diverse domains through acquired foundation skills and knowledge
	PSO2	3	Apply necessary tools and methodologies to design and develop software products
	PSO3	2	Create a zest for innovative career path through value-based software courses and entrepreneurial skills resulting in competent IT solution providers
CO2	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
	PO3	3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
	PSO1	3	Develop suitable IT infrastructure in diverse domains through acquired foundation skills and knowledge
	PSO2	3	Apply necessary tools and methodologies to design and develop software products
	PSO3	2	Create a zest for innovative career path through value-based software courses and entrepreneurial skills resulting in competent IT solution providers
CO3	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
	PO3	3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
	PSO1	3	Develop suitable IT infrastructure in diverse domains through acquired foundation skills and knowledge
	PSO2	3	Apply necessary tools and methodologies to design and develop software products
	PSO3	2	Create a zest for innovative career path through value-based software courses and entrepreneurial skills resulting in competent IT solution providers
CO4	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an

			engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
	PO3	3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
	PSO1	3	Develop suitable IT infrastructure in diverse domains through acquired foundation skills and knowledge
	PSO2	3	Apply necessary tools and methodologies to design and develop software products
	PSO3	2	Create a zest for innovative career path through value-based software courses and entrepreneurial skills resulting in competent IT solution providers
CO5	PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
	PO3	3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
	PSO1	3	Develop suitable IT infrastructure in diverse domains through acquired foundation skills and knowledge
	PSO2	3	Apply necessary tools and methodologies to design and develop software products
	PSO3	2	Create a zest for innovative career path through value-based software courses and entrepreneurial skills resulting in competent IT solution providers

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50 EC E21 – Digital Image Processing								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• To become familiar with digital image fundamentals • To get exposed to simple image enhancement techniques in Spatial and Frequency domain. • To learn concepts of degradation function and restoration techniques. • To study the image segmentation and representation techniques. • To become familiar with image compression and recognition methods
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the fundamentals of Digital image CO2: Discuss image enhancement techniques in spatial domain CO3: Analyse image restoration through various filters CO4: Explain the concepts of segmentation and boundary extraction CO5: Discuss the algorithms for lossy and lossless compression

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Digital Image Fundamentals and Transforms
Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – Discrete Cosine Transform, Haar, Color image fundamentals - RGB, HSI models. [9]

Image Enhancement
Basic gray level transformations – Histogram equalization – Histogram matching –spatial filtering – smoothing spatial filters – sharpening spatial filters- Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement. [9]

Restoration
Model of the image degradation / Restoration process- mean filters – order – statistics filters- Adaptive filters – Inverse filtering – minimum mean square error filtering – constrained least squares filtering – Geometric mean filter – geometric transformations. [9]

Image Segmentation and Representation
Edge detection – Thresholding – Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors – Regional descriptors –Simple descriptors- Texture Image Segmentation Based on Color. [9]

Image Compression
Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding - DPCM.
Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization. [9]

Total Hours : 45

Text book(s):

1	Rafael C Gonzalez, Richard E. Woods, ‘Digital Image Processing’, 4th Edition, Pearson Education, 2018.
2	A.K. Jain, ‘Fundamentals of Digital Image Processing’, New Edition, Prentice Hall of India, 2016.

Reference(s):

1	Rafael C Gonzalez, Richard E. Woods, ‘Digital Image Processing’, Prentice Hall, 3rd Edition, 2016.
2	William K. Pratt, ‘Digital Image Processing‘, John Wiley, New York, 2016
3	D.E. Dudgeon and RM. Mersereau, ‘Multidimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 2016.
4	Yao Wang, JoernOstermann, and Ya-Qin Zhang ,’ Video Processing and Communications’, Prentice Hall, 2016.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO1	3	3	3	3	3								3	2	
CO2	3	3	3	3	3			3	3	3		3	3	2	3
CO3	3	3	3	3	3								3	2	
CO4	3	3	3	3	3								3	2	
CO5	3	3	3	3	3								3	2	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply Basic principles to find fundamentals of Digital image
	PO2	3	Apply the knowledge to analyse the given problem todesign the digital image processing systems
	PO3	3	Design the Digital system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systemsand identify the problems
	PO5	3	Apply the relevant simulators to perform the complex investigations
	PSO1	3	Performthe Image processing by applying basic engineering knowledge
	PSO2	2	Design the Digital Image components considering industrial and societal requirements
CO2	PO1	3	Discuss image enhancement techniques in spatial domain
	PO2	3	Apply the knowledge to analyse image enhancement techniques in spatial domain
	PO3	3	Design the image enhancement techniques in spatial domain considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing image enhancement techniques in spatial domain
	PO8	3	Apply ethical principles to compare image enhancement techniques in spatial domain ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manageindustrial projects
	PO10	3	Communicate effectively with proper documentation invarious technical events like project presentation etc.
	PO12	3	Develop interest in building more reliable image enhancement techniques in spatial domain techniques considering wider technological changes
	PSO1	3	Performthe Image processing by applying basic engineering knowledge
	PSO2	2	Design the Digital Image components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation invarious technical events like paper presentation etc. by acquiring essential interpersonal skills
CO3	PO1	3	Apply Basic principles to Analyse image restoration through various filters
	PO2	3	Apply the knowledge to analyse the given problem todesign the digital image processing systems
	PO3	3	Design the Digital system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systemsand identify the problems
	PO5	3	Apply the relevant simulators to perform the complex investigations
	PSO1	3	Performthe Image processing by applying basic engineering knowledge
	PSO2	2	Design the Digital Image components considering industrial and societal requirements
CO4	PO1	3	Apply the different techniques for the concepts of segmentation and boundary extraction

	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the concepts of segmentation and boundary extraction.
	PO3	3	Develop the Digital systems schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systemsand identify the problems
	PO5	3	Apply the relevant simulators to study the performance ofdifferent techniques
	PSO1	3	Measure the analysis of concepts of segmentation and boundary extraction by applying basic engineering knowledge
	PSO2	2	Develop the digital Image processing system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of algorithms for lossy and lossless compression
	PO2	2	Apply the engineering knowledge to analyse the Deign and verify concepts of the algorithms for lossy and lossless compression
	PO3	3	Develop the algorithms for analysis of the algorithms for lossy and lossless compression
	PO4	3	Conduct the detailed literature survey on analysis of algorithms for lossy and lossless compression
	PO5	3	Apply the relevant simulators to perform the analysis the algorithms for lossy and lossless compression
	PSO1	3	Apply analysis of the algorithms for lossy and lossless compression for solving complex problems
	PSO2	2	Design the digital image processing system components considering industrial and societal requirements

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50 EC E22 - ARM Architecture and Programming

BE-Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)

- To understand the architecture of ARM processor
- To learn the ARM programming & Thumb programming models
- To understand the design aspects of I/O and Memory Interfacing circuits
- To learn, design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware
- To learn integer and floating point ARM architecture

Course Outcomes

At the end of the course, the students will be able to

CO1: Describe the features of ARM architecture and instruction set

CO2: Describe theprogrammer's model of ARM processor and create and test assembly level programming

CO3: Analyze and understand ARM programming using high level languages

CO4: Analyze the function of memory Management of ARM

CO5: Analyze floating point processor architecture and its architectural support for higher level language

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

ARM Architecture and Instruction Set

ARM Design Philosophy, Registers, PSR, Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions. [9]

ARM Programming Model

Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Interrupts, Software Interrupt Instructions, Exception handling.

[9]

ARM Programming using High Level Language

Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops. [9]

Memory Management

Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Content Switch. [9]

Integer and Floating Point Arithmetic on ARM: Double precision Integer Multiplication, Division, Square roots, Endian Reversal and Bit Operations, Random Number Generation, DSP on ARM – FIR filters, IIR filters. [9]

Total Hours : 45

Text book(s):

1	Andrew N. Sloss, D. Symes, C.Wright, 'ARM System Developer's Guide, Designing and optimizing Systems Software', Reprint, Elsevier,2010.
2	Steve Furber, 'ARM System on chip Architecture', 2nd Edition, Addison Wesley, 2017.

Reference(s):

1	David Seal, 'ARM Architecture Reference Manual', 2nd Edition, Addison-Wesley, 2012.
2	Wayne Wolf, 'Computers as Components: Principles of Embedded Computing System Design', Morgan Kaufman Publishers, 2013.
3	Frank Vahid and TonyGivargi, 'Embedded System Design: A Unified Hardware/Software Introduction', 3rd Edition, John Wiley & Sons, 2012.
4	Joseph Yiu , 'The Definitive Guide to the ARM Cortex-M', Elsevier- Newness, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	2	
CO2	3	3	3	3	3								3	2	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO 1	3	Apply the knowledge of ARM architecture fundamentals to the solution of complex engineering problems
	PO 2	3	Identifying the engineering problems and supported by the ARM module to find the solution of the engineering problem.
	PO 3	3	Design and establishment of ARM based system addressing the problem of the public health, safety and societal requirements
	PO 4	3	Literature and reviewing the ARM instruction set to perform the system in better way to obtain the result.
	PO 5	3	Use the modern tool to test the perform of ARM modules for system development.
	PSO 1	3	Compare the various ARM processor by applying basic engineering knowledge
	PSO 2	2	Design the ARM based system components considering industrial automation requirements
CO2	PO 1	3	Apply ARM programmer mode to develop the system for engineering problems.
	PO 2	3	Identifying the suitable algorithms to perform better way to produce the solution for existing problem.
	PO 3	3	Develop ARM based system with suitable test assembly level programming for the complex engineering problem

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	PO 4	3	Literature and reviewing the assemble programming to perform the system and meet the industry expectation.
	PO 5	3	Use the modern tool to examine each submodule performance for meeting the requirement.
	PSO 1	3	Apply the low-level programming algorithmic knowledge to solve complex engineering problems
	PSO 2	2	Understand the ARM programmer model-based system components considering industrial automation requirements
CO3	PO 1	3	Apply the high level programming language knowledge in ARM programmer model to develop the system for engineering problems.
	PO 2	3	Identifying the suitable algorithms to perform better way to produce the solution for existing problem.
	PO 3	3	Develop ARM based system with suitable test high level programming for the complex engineering problem
	PO 4	3	Literature and reviewing the assemble programming to perform the system and meet the industry expectation.
	PO 5	3	Use the modern tool to examine flow of high-level programming flow in terms of performance to meeting the requirement.
	PSO 1	3	Apply the high-level algorithmic knowledge to solve complex engineering problems
	PSO 2	3	Understand the high-level ARM program to develop model-based system components considering industrial automation requirements
CO4	PO 1	3	Apply the knowledge of memory hierarchy to develop the system for engineering problems.
	PO 2	3	Analyse the memory utilization better to produce the solution for existing problem.
	PO 3	3	Design and establishment of ARM memory usage in effective way of system development to reach industry needs.
	PO 4	3	Investigating the possible and better programming flow and conduct experiment to ensure the safety and provide the solution.
	PO 5	3	Use the modern tool to examine memory performance to ensure the perfect utilization.
	PSO 1	3	Apply memory management knowledge to solve complex engineering problems
	PSO 2	3	Design a system with fast performance by considering industrial real-time automation requirements.
CO5	PO 1	3	Apply ARM floating point modal to develop the system for engineering problems.
	PO 2	3	Literature the various architecture to develop the better ARM based system.
	PO 3	3	Design an system with higher level language to meet specific application.
	PO 4	3	Investigate social problem and to interpret with development of higher-level language programming support floating system to bring solution.
	PO 5	3	Use the modern tool to examine system performance of floating-point architecture to meet the requirement of industry.
	PSO 1	3	Apply the concepts of floating-point architecture for solving complex engineering problems
	PSO 2	3	Design system of floating-point processor performance that meet industry needs.

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC E23 – Robotics</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn the fundamentals of Robots
• To make the student familiar with the basic concepts, Kinematics and Dynamics of Robots
• To enhance the knowledge about Actuators, Drive systems and Sensors
• To Learn the concept for a practical Robot Design Process
• To broaden the importance of artificial personality of a Robot</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">CO1: Enumerate the Fundamentals of Robots
CO2: Differentiate Kinematics and Dynamics of Robots</td></tr>
</table>

	CO3: Explain the Actuators, Drive systems and Sensors CO4: Describe the concept for a practical Robot Design process. CO5: Explain the Artificial Personality of a Robot

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Fundamentals of Robots

What is a Robot? Classification of Robots, Advantages and disadvantages of Robots, Robot Components, Robot Degrees of Freedom, Robots Joints, Robot coordinates, Robots reference frames, Programming modes, Robot Characteristics, Robot Workspace, Robot Languages, Robot Applications. [9]

Kinematics and Dynamics of Robots

Robots as Mechanisms, Conventions, Matrix representation, Homogeneous transformation matrices, Representation of Transformations, Inverse of transformation matrices, Forward and Inverse kinematics of Robots, Forward and Inverse kinematic equations: Position, Orientation, D-H representation of forward kinematic equations of Robots, Dynamic equations for multiple DOF robots, Static force analysis of Robots. [9]

Actuators, Drive systems and Sensors

Characteristics of actuating systems, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Microprocessor control of electric motors, Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors Force and pressure sensors, Torque sensors, Microswitches, Visible light and IR sensors, Touch and tactile sensors, Proximity sensors, Range finders. [9]

A concept for a practical Robot Design process

A systems engineering-based approach to robotics, state the problem using use cases, solving problems with storyboards, decompose use cases and storyboards into requirements, the basics of image recognition, Artificial neural networks, image processing for robots, robot arm machine-learning approaches, The LeNet framework: Training, Testing and Deployment. [9]

Robot an Artificial Personality

Transaction-based conversation, designing a chatbot, Natural language processing, Monte Carlo modeling, an emotion state machine, playing the emotion game, creating a model of Human behavior, Integrating artificial personality in to Robot, The OODA loop. [9]

Total Hours : 45

Reference(s):

1	Saeed B Niku, 'Introduction to Robotics, Analysis, Control, Applications', 3rd Edition, Wiley Publisher 2019.
2	Francis X Govers, 'Artificial Intelligence for Robotics', Packt, 2018.

Reference book(s):

1	MikellP.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, 'Industrial Robotics Technology, Programming and Applications', McGraw Hill Book Company, 2018.
2	Fu K.S. Gonzaleaz R.C. and Lee C.S.G., 'Robotics Control Sensing, Vision and Intelligence', McGraw Hill International Editions, 2017.
3	Deb, S.R., 'Robotics Technology and flexible automation', 2nd Edition, Tata Mc-Graw Hill, 2017.
4	Peter Mckinnon, 'Robotics', 3rd Edition, Robotics Mastery, 2018.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2									3	3	
CO2	3	3	2	2									3	3	
CO3	3	3	2	2									3	3	
CO4	3	3	3	3				3	3	3		3	3	3	3
CO5	3	3	2	2									3	3	

COs	POs/PSOs	Level	Justification

CO1	PO1	3	Apply the knowledge of Fundamentals of Robots in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the advantages and disadvantages of Robots.
	PO3	2	Design solutions for Robot characteristics for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	2	Design solutions for Robot Applications that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PSO1	3	Solve complex Robot workspaces by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design Robot components and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO2	PO1	3	Apply the knowledge of Robots Kinematics in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the representation of Robots.
	PO3	2	Design solutions for Robot kinematic equations for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	2	Design solutions for static force analysis of Robots that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PSO1	3	Solve complex Robot Kinematics by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design Robot Dynamics and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO3	PO1	3	Apply the knowledge of Robots Actuators in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the drive systems of Robots.
	PO3	2	Design solutions for Robot sensors for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	2	Design solutions for Microprocessor control of electric motors that control a robot that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PSO1	3	Solve complex Robot drive systems by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design Robot sensors and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO4	PO1	3	Apply the knowledge of system engineering-based approach to robotics in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the storyboards of Robots.
	PO3	3	Design solutions for Robot artificial neural network for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Design solutions machine learning approaches of a robot that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the robot image recognition.
	PO9	3	Training testing and deployment of Robot AI to Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
	PO10	3	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give

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			and receive clear instructions in robot use cases.
	PO12	3	
	PSO1	3	Solve complex Robot story boards by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Solve complex image processing for Robots drive by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for training, testing and deployment.
CO5	PO1	3	Apply the knowledge of natural language processing approach to robotics in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the emotion game of Robots.
	PO3	2	Design solutions for Robot monte carlo modeling for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	2	Design solutions for integrating artificial personality of a robot that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
	PSO1	3	Solve complex natural language processing for Robots drive by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for artificial personality of a robot.

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E24 - Error Correcting Codes								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100
Objective(s)	• Apply the knowledge of finite field arithmetic to analyse error correcting codes. • Apply the encoder and decoder algorithms in the digital communication systems. • Analyse efficient encoder and decoder algorithms for convolutional codes. • Explore efficient design methods and iterative decoding techniques for high capacity codes. • Explain the importance of modern coding techniques in the design of digital communication systems.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the principles and algorithms of cyclic codes CO2: Illustrate the principles and algorithms of convolutional codes CO3: Illustrate the principles and algorithms of trellis codes and block coded modulation CO4: Describe and design the error correcting codes using turbo codes and explain the decoding algorithms CO5: Describe the algorithms of space time code and its encoding and decoding techniques							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Finite field arithmetic and cyclic codes

Review of modern algebra- construction of Galois field-basic properties of Galois field- Computations using Galois field arithmetic-Linear block codes-Syndrome and error detection-minimum distance of a block code-error detection and error correcting capabilities-standard array and syndrome decoding- Cyclic codes- generator and parity check matrices-encoding of cyclic codes- syndrome computation and error detection – decoding of cyclic codes.

[9]

Convolutional-codes

Convolutional codes- Encoding of convolutional codes – Structural and distance properties of convolutional codes- Viterbi decoding algorithm- Maximum Likelihood decoding -Recursive Maximum Likelihood decoding algorithm - ZJ Sequential decoding algorithm - Fano Sequential decoding algorithm- Performance characteristics of sequential decoding- code construction for sequential decoding [9]

Trellis code and block coded modulation

Trellis coded Modulation - TCM code construction -TCM performance analysis- Rotationally Invariant TCM-Multidimensional TCM-Distance concepts of Block coded modulation-multilevel block modulation codes-multistage decoding of multilevel BCM codes-Concatenated coded modulation-product coded modulation-multilevel coded modulation for unequal error protection. [9]

Turbo-code

Turbo codes- distance properties, performance analysis and design of turbo codes- Iterative decoding of Turbo codes- MAP decoding algorithm - Max log MAP decoding algorithm - Optimum decoding of turbo codes. [9]

Space time code

MIMO channel-Narrowband MIMO channel-Diversity performance with maximal ration combining- Space-time block codes- Alamouti code- performance calculation-real orthogonal designs-encoding and decoding based on orthogonal designs – complex orthogonal designs-Space-time trellis codes. [9]

Total Hours : 45

Text book(s):

1	S.Lin&D.J.Costello, 'Error Control Coding ',2nd Edition, Pearson, 2005.
2	T.K.Moon, 'Error Correction Coding: Mathematical Methods and Algorithms', Wiley, 2009.

Reference(s):

1	C.B.Schlegel&L.C.Perez, 'Trellis and Turbo Coding', 2nd Edition, Wiley& Sons Ltd, 2015.
2	B.Vucetic&J.yuan, 'Space-Time Coding', Wiley& Sons Ltd, 2003.
3	R.Johannaesson&K.S.Zigangirov, 'Fundamentals of Convolutional Coding', Wiley-IEEE Press, 2015.
4	Ron M.Roth , 'Introduction to Coding Theory', Cambridge University Press, 2006.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3			3	3	3		3	3	3	3
CO3	3	3	2	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	2	3	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of Galois field
	PO2	3	Apply the knowledge to analyze the given problem to design of Linear block codes
	PO3	3	Design the error detection and error correcting capabilities
	PO4	3	Use Syndrome computation and error detection and cyclic codes
	PO 5	3	Design cyclic codes generator and decoding of cyclic codes
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge in design of satellite communication and its applications
	PSO2	3	Design the different satellite launching methods considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of Convolutional codes and sequential coding
	PO2	3	Apply likelihood decoding sequential decoding algorithm
	PO3	3	Design the Viterbi decoding algorithm and recursive maximum likelihood decoding
	PO4	3	Use research-based knowledge analysis and interpretation of sequential coding
	PO8	3	Apply the concepts of rotational variant TCM and multidimensional TCM

	PO9	3	Apply the effective Function of Trellis Code Modulation
	PO10	3	Design the multistage decoding of multilevel BCM Codes
	PO 12	3	ability to engage in independent and life-long learning in the coded modulation in communications
	PSO1	3	Solve complex Engineering problem by applying basic distance properties of convolutional codes
	PSO2	3	Design the encoding of convolutional codes and structural encoding codes
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in designing blockmodulatuion codes
CO3	PO1	3	Apply different types of trellis ode and block code modulation
	PO2	3	Apply the knowledge to analyze TCM code construction
	PO3	2	Develop the performance analysis of TCM
	PO4	3	analysis and interpretation of distance concepts of Block coded modulation
	PSO1	3	Compare the various multilevel coded modulation
	PSO2	3	Design the concatenated coded modulation and product coded modulation
CO4	PO1	3	Apply the basic fundamentals and distance properties of turbo codes
	PO2	3	Apply the knowledge to analyze the performance and design of turbo codes
	PO3	3	Design the iterative decoding of turbo codes
	PO4	3	Use research-based knowledge analysis and interpretation of MAP coding algorithm
	PSO1	3	Solve complex Engineering problem by applying optimum decoding concepts of turbo codes
	PSO2	3	Design the multiple access MAP decoding algorithm
CO5	PO1	3	Apply the fundamental concepts of space time codes
	PO2	3	Apply the engineering knowledge to analyze the space time block codes
	PO3	2	Design the performance calculation and and real orthogonal designs
	PO4	3	Use research-based knowledge analysis and interpretation of space time trellis codes
	PO8	3	Apply the concepts space time block codes and its performance
	PO9	3	Apply the encoding and decoding based on orthogonal designs
	PO10	3	Design the space time trellis codes
	PO12	3	ability to engage in independent and life-long learning in the space time codes
	PSO1	3	Apply the concepts of space time codes and complex orthogonal designs for solving complex problems
	PSO2	3	Develop the orthogonal designs of encoding and decoding considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in designing blockmodulatuion codes

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E25- Mixed Signal Design								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100
Objective(s)	• To know the types of filters for VLSI circuits. • To explain the different techniques of ADC and DAC for mixed signal circuits. • To explain the different techniques of DAC for mixed signal circuits. • To explain sigma delta converter for mixed signal circuits. • To understand the design methodologies and EDA tools for mixed signal VLSI circuits.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Examine the concept of different filter for VLSI circuit design CO2: Explain the function of continuous time filter in MOS technology for mixed signal circuits CO3: Discuss DAC and ADC techniques for data conversions using CMOS technologies CO4: Describe the concept of sigma delta converter method for VLSI circuits CO5: Illustrate the basic syntax and extension logic used for HDL in analog and mixed signals							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Active Filters and Switched Capacitor Filters
Switched capacitor filters: Switched capacitor resistors - amplifiers – comparators - sample & hold circuits – Integrator-Biquad. [9]

Continuous Time Filters
Introduction to Gm - C filters - bipolar transconductors - CMOS Transconductors using Triode transistors, active transistors – BiCMOStransconductors – MOSFET C Filters - Tuning Circuitry - Dynamic range performance - Elementary transconductor building block- First and second order filters. [9]

Digital to Analog & Analog to Digital Converters
Non-idealities in the DAC - Types of DAC's: Current switched, Resistive, Charge redistribution (capacitive), Hybrid, segmented DAC's - Techniques for improving linearity - Analog to Digital Converters: quantization errors - non-idealities - types of ADC's: Flash, two step, pipelined, successive approximation, folding ADC's. [9]

Sigma Delta Converters
Over sampled converters - over sampling without noise & with noise - implementation imperfections - first order modulator - decimation filters - second order modulator - sigma delta DAC & ADC's. [9]

Analog and Mixed Signal Extensions to HDL
Introduction - Language design objectives - Theory of differential algebraic equations - the 1076 .1 Language - Tolerance groups - Conservative systems - Time and the simulation cycle - A/D and D/A Interaction - Quiescent Point - Frequency domain modeling and examples-analog extensions to Verilog: Introduction - data types – Expressions – Signals- Analog behavior –Hierarchical Structures –Mixed signal Interaction. [9]

Total Hours : 45

Text book(s):

1	David A Johns and Ken Martin, 'Analog Integrated Circuit Design', John Wiley and Sons, 2016.
2	Rudy van de Plassche, 'Integrated Analog-to-Digital and Digital-to-Analog Converters', Kluwer, 2014.

Reference(s):

1	Antoniou, 'Digital Filters Analysis and Design', Tata McGraw Hill, 2010.
2	Behzad Razavi. 'Design of Analog CMOS Integrated Circuits', 2012
3	Michael D.Ciletti, 'Advanced Digital Design with the Verilog HDL', 2nd Edition, Pearson Education, 2011
4	Tony Chan Carusone, David Johns, and Kenneth Martin, 'Analog Integrated Circuit Design', 2nd Edition, McGraw Hill, 2011

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	2	
CO2	3	3	3	2									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	2				3	3	3		3	3	3	3
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to design different filter for VLSI circuit design.
	PO2	3	Apply the knowledge to solve the complex engineering problems in different filter design for VLSI circuit
	PO3	3	Design filter for VLSI circuit for identified complex problems
	PO4	3	Conduct the detailed literature survey on filter for VLSI circuit design and identify the problems

	PSO1	3	Apply the concepts of filter in VLSI circuit design for solving complex problems
	PSO2	2	Design filter for VLSI circuit components with needs of industry and society
CO2	PO1	3	Apply knowledge to continuous time filter in MOS technology for mixed signal circuits
	PO2	3	Apply the knowledge to given complex problems in continuous time filter for mixed signal circuits
	PO3	3	Design continuous time filter for mixed signal circuits
	PO4	2	Conduct the detailed literature survey on continuous time filter for mixed signal circuits and identify the problems
	PSO1	3	Apply the concepts of continuous time filter in mixed signal VLSI circuitsfor solving complex problems
	PSO2	3	Design continuous time filter in VLSI system components with needs of industry and society
CO3	PO1	3	Apply the knowledge to discuss DAC and ADC techniques for data conversions using CMOS technologies
	PO2	3	Apply the knowledge to given complex problems on DAC and ADC techniques for data conversions using CMOS technologies
	PO3	3	Design DAC and ADC techniques for data conversions for given complex problems
	PO4	3	Conduct the detailed literature survey on DAC and ADC techniques for data conversions in VLSI domain and identify the problems
	PSO1	3	Apply the concepts of various DAC and ADC techniques in VLSI domain for solving complex problems
	PSO2	3	Design DAC and ADC techniques for data conversions in VLSI system with needs of industry and society
CO4	PO1	3	Apply the knowledge to describe the concept of sigma delta converter methods for VLSI circuits
	PO2	3	Apply the knowledge toanaylse the complex engineering problems in sigma delta converter methods for VLSI circuits
	PO3	3	Design sigma delta converter using CMOS technologies for identified complex problems
	PO4	2	Conduct the detailed literature survey on sigma delta converter and identify the problems
	PO8	3	Apply ethical principles to compare various sigma delta converters in VLSI domain for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable sigma delta converters for VLSI circuits considering wider technological changes
	PSO1	3	Apply the concepts of sigma delta converter for solving complex problems
	PSO2	3	Design sigma delta converters for VLSI system components with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the knowledge to illustrate the basic syntax and extension logic used for HDL in analog and mixed signals
	PO2	3	Apply the knowledge to design the complex engineering problems in analog and mixed signals using HDL
	PO3	3	Design analog and mixed signals using HDL for identified complex problems
	PO4	3	Conduct the detailed literature survey on analog and mixed signals and identify the problems
	PSO1	3	Apply the concepts of analog and mixed signals using HDL for solving complex problems

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	PSO2	3	Design analog and mixed signal circuits using HDL for VLSI circuit components with needs of industry and society

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E26 – RFID and Biometrics								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• To understand the principle of RFID technology • To learn the principles of communication and operating modes in RFID • To learn the basics of biometrics and issues in biometric security • To discuss about various biometric equipment technology • To discuss about biometric standards and applications
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the fundamentals of RFID and its applications. CO2: Elaborate the communication concepts, operating modes in RFID and general operating problems in data transmission. CO3: Discuss the key biometric process and accuracy in biometric systems. CO4: Describe the basic concepts, algorithms, strength and weakness of finger- scan and facial- scan technologies. CO5: Examine the operation, strength and weakness of iris-scan and voice-scan technologies and biometric standards

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to RFID
Definitions and Vocabulary, History, Frequencies and their Classification, RFID vs. Barcodes, Fundamentals of RFID - RFID Tags and Readers, Passive Transponders, Passive RFID Coupling, Active Transponder, Semi-passive Transponders, Middleware, Radio Frequency (or Contact less) Identification and its range of applications [9]

Communication and Operating Modes in RFID
Contact less Communication Concepts, Elements of RFID, Energy Transfer and Communication Modes, Forward Link and Return Link, Data Communications, Principle of Communication, Concept of Operating Modes, General Operating modes, Problems in Data Transmission, Problems Relating to ‘Long Distance’ RFID Systems. [9]

Introduction to Biometrics
Over view of bio metrics - Benefits of biometric security – Verification and identification and enrollment – Basic working of biometric matching – Accuracy – False match rate – False non-match rate – Failure to enroll rate – Derived metrics – Layered biometric solutions. Biometric system security, Ethical issues in biometric security. [9]

Finger Scan and Facial Scan
Finger scan, Features, Components, Operation (steps), Competing Finger Scan technologies, Strength and weakness. Types of algorithms used for interpretation. Facial Scan, Features, Components, Operation (steps), Competing Facial Scan technologies – Strength and weakness. [9]

Iris Scan, Voice Scan
Features, Components, Operation (steps), Competing iris scan and voice scan technologies – Strength and weakness. Biometrics Application, Biometric Solution Matrix, Bio privacy, Comparison of privacy factor in different biometrics technologies, Designing privacy sympathetic biometric systems. Biometric standards - (BioAPI, BAPI), Biometric middleware. [9]

Total Hours : 45

Text book(s):

1	Samir Nanavati, Michael Thieme, Raj Nanavati, ‘Biometrics - Identity Verification in a Networked World’, Wiley India Pvt. Ltd., 2011.
2	Dominique Paret, ‘RFID at Ultra and Super High Frequencies: Theory and Application’, Wiley Publications, 2010.

Reference(s):

1	Paul Reid, ‘Biometrics for Network Security’, 2nd Reprint, Pearson Education, 2009.

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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2	Albert Lozano-Nieto, 'RFID Design Fundamentals and Applications', CRC Press, 2011.
3	James Wayman, Anil K.Jain, ArunA.Ross, Karthik Nandakumar, 'Introduction to Biometrics', Springer, 2011.
4	Shimon K.Modi, 'Biometrics in Identity Management: Concepts to Applications', Artech House, 2011.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2									3	3	
CO2	3	3	2	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	2	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the fundamentals for designing RFID Tags and Readers
	PO2	3	Apply the knowledge to analyse the Passive Transponders
	PO3	3	Design the communication system components considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	3	Design the communication system components considering industrial and societal requirements
CO2	PO1	3	Apply the different Energy Transfer and Communication Modesto design the communication system for reliable data transmission
	PO2	3	Apply the knowledge to analyse the Principle of Communication, Concept of Operating Modes codes to design the communication system for reliable data transmission
	PO3	2	Design the reliable communication system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on General Operating mode techniques and identify the problems
	PSO1	3	Perform the different Problems in Data Transmission techniques by applying basic engineering knowledge
	PSO2	3	Design the reliable communication system modules considering different environmental conditions
CO3	PO1	3	Apply the Benefits of biometric security for different communication systems
	PO2	3	Apply the knowledge to analyse the given problem to design the communication system
	PO3	3	Develop the Verification and identification and enrolment communication system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing techniques and identify the problems for further investigations
	PSO1	3	Compare the various Biometric system security techniques by applying basic engineering knowledge
	PSO2	3	Design the communication system components considering telecommunication industrial requirements
CO4	PO1	3	Apply the different Finger scan concepts for baseband transmission
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the baseband transmission systems

	PO3	3	Develop the Finger scan, Features, Components schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to study the performance of different scan
	PSO1	3	Measure the power spectral densities of different biometrics by applying basic engineering knowledge
	PSO2	3	Develop the baseband communication system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of information theory for different source coding techniques
	PO2	3	Apply the engineering knowledge to analyse the given source coding technique
	PO3	3	Develop the algorithms for various source codes for different channel requirements considering different environmental factors
	PO4	2	Conduct the detailed literature survey on existing source coding techniques understanding the limitations of channels
	PO5	3	Apply the relevant simulators to perform the complex investigations on information theory
	PO8	3	Apply ethical responsibilities to develop the different strength and weakness of iris-scan and voice-scan technologies biometric standards
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO1	3	Apply the concepts of information theory for solving complex problems
	PSO2	3	Design the communication system components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC E27 - Antennas and Propagation</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td>Total</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>hrs</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn the fundamental parameters of antenna and radiated filed components.
• To design and characterize antenna arrays.
• To learn about special types of antennas like broad band antennas, Microstrip antenna and MEMS antenna.
• To understand the propagation mechanisms for radio waves in atmosphere.
• To understand the principles of selection of antennas for modern wireless communication application.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Describe the various parameters of antenna and formulate the radiation fields by infinitesimal dipole antenna and half wave dipole antenna.
CO2: Design and analyse the different types of antenna arrays and their radiation patterns.
CO3: Design broad band antennas, frequency independent antennas and microwave antennas.
CO4: Describe the concepts of radio wave propagation.
CO5: Describe the various types of antennas for Modern Wireless Application.</td></tr>
<tr><td colspan="9">Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.</td></tr>
</table>

Antenna Fundamentals

Types of antennas-Radiation mechanism-single wire, two wire, current distribution on thin wire- Antenna parameters-radiation pattern, beam solid angle, radiation intensity, radiation power density, directivity and gain, effective aperture, efficiency, polarization, bandwidth, beam width, antenna impedance - FRIIS transmission formula.

Radiated field components- Infinitesimal dipole and half wave dipole antenna. [9]

Design of Arrays

Antenna Arrays- Linear array- array of two point sources–N-element linear array-Broad side array, End fire array-pattern multiplication. Non-uniform excitation-Binominal array. [9]

Design of Antennas

Wire Antennas- long wire, V-Antenna, Rhombic antenna, Helical antenna, Yagi-Uda antenna. Frequency independent antenna - spiral and log periodic antenna. Aperture antennas - Horn antenna, Parabolic reflector antenna, Microstrip antenna. MEMS antenna. [9]

Wave Propagation

Propagation in free space - Modes of propagation- Ground wave Propagation, Space wave propagation-Tropospheric propagation- structure of ionosphere- Sky wave Propagation-Refractive index of the ionosphere - Critical frequency- Maximum Usable Frequency - Duct propagation. [9]

Antennas for Modern Wireless Communication

Antennas for Terrestrial mobile communication - mobile handsets and base stations. Antennas for Satellite Communication- MSAT briefcase terminal and vehicle mounted antennas, VSAT and DBS TV antennas. Antenna for Radar systems. Adaptive antenna, RFID antenna, Ultra wideband antenna, Terahertz antenna. [9]

Total Hours : 45

Text book(s):

1	K.D.Prasad, 'Antenna and Wave Propagation', 3rd Edition, Satya Prakasham, 2016.
2	John D. Kraus Ronald J.Marhefka, and Ahmed S.Khan, 'Antennas and Wave propagation', 5th Edition, McGraw-Hill, 2017.

Reference(s):

1	Constantine A. Balanis, 'Antenna Theory: Analysis and Design', 4th Edition, John Wiley & Sons, 2016.
2	Simon.R.Saunders, 'Antennas and Propagation for Wireless Communication', 2nd Edition, John Wiley, 2007.
3	J.D.Kraus, 'Antenna for all Applications', 4th Edition, TMH, 2010.
4	Warren L.Stutzman Gray A.Thiele, 'Antenna theory and Design', 3rd Edition, Wiley, 2012.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2									3	3	
CO2	3	3	3	3	2								3	3	
CO3	3	3	3	3	2								3	3	
CO4	3	3	3	2									3	2	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the various parameters for antennas
	PO2	3	Apply the knowledge to analyse the various parameters to design the antennas
	PO3	3	Design the radiated field components by various antennas considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on existing antennas and identify the

			problems
	PSO1	3	Measure the different parameters of antennas by applying basic engineering knowledge
	PSO2	3	Design the antenna components considering industrial and societal requirements
CO2	PO1	3	Apply the antenna arrays for different types of antennas
	PO2	3	Apply the knowledge to analyse the given problem to design antenna arrays
	PO3	3	Design the different antenna arrays considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing antenna arrays and identify the problems for further investigations
	PO5	2	Use the relevant simulators to perform the complex investigations on antenna arrays
	PSO1	3	Perform the different antenna arrays by applying basic engineering knowledge
	PSO2	3	Design the antenna arrays that meet the given specification for considering industrial and societal requirements
CO3	PO1	3	Apply the fundamental concepts of antennas for broad band and microwave antennas
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design broad band and microwave antennas
	PO3	3	Develop the various types of antennas considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing different antennas and identify the problems
	PO5	2	Apply the relevant simulators and software to perform the complex investigations on different antennas
	PSO1	3	Compare the various antennas by applying basic engineering knowledge
	PSO2	3	Design the different types of antennas considering industrial and societal requirements
CO4	PO1	3	Apply radio wave propagation concepts for antennas in free space
	PO2	3	Apply the knowledge to analyse the given problem to design the antennas
	PO3	3	Develop the antenna components considering environmental and societal requirements
	PO4	2	Conduct the detailed literature survey on antennas wave propagation and identify the problems for further investigations
	PSO1	3	Compare the various modes of propagation by applying basic engineering knowledge
	PSO2	2	Design the antenna components for considering industrial and societal requirements
CO5	PO1	3	Apply the antenna fundamental concepts for modern wireless communication
	PO2	3	Apply the knowledge to analyse the given problem to design various wireless antennas
	PO3	3	Design the modern wireless communication antennas considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing wireless antennas and identify the problems
	PO8	3	Apply ethical responsibilities to develop modern wireless communication antennas ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable various antennas considering wider technological changes
	PSO1	3	Compare the various modern wireless communication antennas by applying basic engineering knowledge

	PSO2	3	Design the wireless antennas considering different environmental conditions
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E31 - Neural Networks								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3	50	50	100
Objective(s)	• To enable students to understand conceptual knowledge of neural networks. • To familiarize the architectures of neural network. • To learn the theoretical and practical aspects of single layer feed forward networks. • To understand the essentials of artificial neural networks with multilayer feed forward networks. • To implement back propagation algorithm for training feed forward neural network							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain the human neuron function and neural network learning rules CO2: Characterize neural network terminologies, learning methods and early network algorithms CO3: Identify and apply the appropriate training algorithm in classification model for decision making. CO4: Describe the inference of multilayer feed forward network along with learning factors. CO5: Apply back propagation algorithm and learn the effect of tuning parameters on neural networks.							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Fundamental Concepts of Neural Network

Introduction- Biological Neuron- McCulloch-Pitts Neuron Model- Feed forward Network-Feedback Network-Neural processing- supervised and unsupervised learning- Neural network learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning rule, Widrow-Hoff learning rule.

Practical:

Generate AND, NOTBoolean function using McCulloch-Pitts neural net by a MATLAB program.
Understanding the concept of Perceptron learning rule &Hebbian Learning Rule.

[12]

Essentials of Artificial Neural Network

Basic building blocks of Artificial Neural Network (ANN) - ANN Terminologies: Weights, Activation functions, Sigmoidal Functions, Bias and Threshold – Characteristics of neural networks- Learning methods - Taxonomy of neural network architectures- Early neural network architectures and algorithms – Rosenblatt's Perceptron. ADALINE network, Application domains.

Practical:

Write a MATLAB program to generate Logistic, Hyperbolic tangent and Identity activation functions in neural networks.

[12]

Single layer Feedforward Networks

Classification model, features and decision regions – Discriminant functions- Minimum distance classification Nonparametric training concept- Training Algorithms: Discrete and continuous perceptron networks.

Practical: Implementation of AND, OR, NOT logic gate using single layer perceptron.

[12]

Multilayer Feedforward Networks

Linearly nonseparable pattern classification- Delta learning rule- Feedforward recall and error back propagation training- Learning factors: Initial weights, Cumulative weight adjustment versus incremental updating- Steepness of activation function, Learning constant, Network architectures versus data representation, Hidden neurons-Classifying and expert layered networks .

Practical: Implementation of XOR logic gate using Multilayer perceptron.

[12]

Backpropagation Networks

Architecture of a Backpropagation Network (BPN) - Backpropagation learning-Effect of tuning parameters of the backpropagation neural network- Selection of various parameters in BPN-Research directions.

Practical:

Implementation of XOR logic gate using RBFN, Error back Propagation. [12]

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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Total Hours : 30+30(Practical) =60	
Text book(s):	
1	Jacek M.Zurada, 'Introduction of Artificial Neural Systems', Jaico Publishing House, 2006.
2	Laurene Fausett, 'Fundamentals of Neural Networks', Pearson Education, 2008.
Reference(s):	
1	SundaramoorthyRajasekaran; G A Vijayalakshmi Pai, 'Neural networks, fuzzy systems and evolutionary algorithms: synthesis and applications', PHI Learning Private Limited, 2017.
2	S N Sivanandam, S Sumathi, 'Introduction to neural networks using MATLAB 6.0', Tata McGraw-Hill Education, 2010.
3	Simon Haykin, 'Neural Networks- A comprehensive foundation', Prentice-Hall of India, 2008.
4	Aggarwal, Charu C, 'Neural Networks and Deep Learning-A Textbook', Springer International Publishing, 2018.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Fundamental of mathematics and sciences engineering are applied in various aspects of neural network techniques
	PO2	3	Principles of mathematics and engineering sciences are used in many aspects of neural network learning rule approaches
	PO3	3	Using the knowledge of supervised learning and unsupervised concepts, solutions for complex engineering problems are designed and developed
	PO4	3	Neural network learning models knowledge is used to design and conduct experiments to provide valid conclusions
	PO5	3	A knowledge in the problem solving methods will help to choose the best method to solve a problem Usage of tools like MATLAB/Python programming helps to understand how to design the performance analyzer
	PSO1	3	Various learning approaches Acquire skills to design, analyze and develop algorithms and implement those using image processing
	PSO2	3	Different supervised and unsupervised learning methods helps to design network models
CO2	PO1	3	Knowledge of classifier ANN models applications helps in solving complex engineering problems.
	PO2	3	Principles of mathematics and engineering sciences are used in linear and nonlinear activation functions, different neural network architectures and algorithms
	PO3	3	Knowledge of theoretical foundations of Artificial Neural network can be used to design and develop solutions for complex engineering problems
	PO4	3	Understanding the activation functions and the network architectures, helps in analyzing and interpreting the quality of network models.
	PO5	3	Use various ANN architectures and algorithms to conduct experiments in real life

			problems to provide valid conclusions
	PSO1	3	Knowledge of different learning methods and early network algorithms obtain skills to design, analyse and develop algorithms and implement in image processing
	PSO2	3	Different Neural network learning rules concept contribute in computing and design model for specific needs of industry and society
CO3	PO1	3	Knowledge of appropriate training algorithm in classification model for decision making techniques involves solving complex engineering problems.
	PO2	3	Principles of mathematics and engineering sciences are used in various aspects of classifier models
	PO3	3	Knowledge of theoretical foundations of classifier models and concept learning networks can be used to design and develop solutions for complex engineering problems.
	PO4	3	Various classifier models, Training Algorithms knowledge is used to design and conduct experiments to provide valid conclusions
	PO5	3	Understanding the various learning techniques for Classification model, features and decision regions helps in analyzing research based works
	PSO1	3	Theoretical foundations of Multilayer Feed forward Networks to identify better classifier Acquire skills to design, analyse and develop algorithms and implement them using high-level programming languages
	PSO2	3	Study of Multilayer Feed forward Networks technique that are needed for society and provide solutions for a given problem
CO4	PO1	3	Knowledge of Feedforward recall and error back propagation training s involves solving complex engineering problems
	PO2	3	Apply the knowledge of engineering to analyse the Learning factors in Multilayer Feed forward Networks
	PO3	3	Multilayer Feed forward Networks algorithms is used to design and develop solutions for complex engineering problems
	PO4	3	Conduct the detailed literature survey on research based issues in Multilayer Feed forward Networks and identify the problems
	PO5	3	Developing a prediction and modelling system based on application using various available tools
	PO8	3	Apply ethical principles to design Multilayer Feed forward Networks for ensuring environmental safety
	PO9	3	Function effectively in teams to develop projects related to image processing domain
	PO10	3	Communicate effectively with proper documentation and do project presentation.
	PO12	3	Develop interest by acquiring knowledge related to case studies using Multilayer Feed forward Networks considering wider technological changes for lifelong learning and the continued upgrading of technical knowledge
	PSO1	3	Apply the concepts of Multilayer Feed forward Networks for solving complex problems in image processing/ communication filed
	PSO2	3	Study of Multilayer Feed forward Networks that are needed for society and provide solutions for a given problem
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Knowledge of Backpropagation Networks algorithm involves solving complex engineering problems
	PO2	3	Apply the knowledge of engineering to analyse the Selection of various parameters in BPN
	PO3	3	Backpropagation learning method is used to design and develop solutions for complex engineering problems
	PO4	3	Conduct the detailed literature survey on Research directions in Backpropagation Networks and identify the problems
	PO5	3	Developing a prediction and modelling system based on application using various available tools
	PSO1	3	Apply the concepts of Backpropagation Network for solving complex problems in image processing/ communication filed
	PSO2	3	Study of Backpropagation Network that are needed for society and provide solutions for a given problem

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E32 - High Performance RISC Processor								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3	50	50	100

Objective(s)

- To acquire the basic knowledge on 16, 32 bit Advanced Microprocessors
- To describe each module in MSP430, working out to the on-chip peripherals and use low power features of MSP430 to develop embedded solutions
- To acquire knowledge on free scale processor architecture and peripheral interfacings
- To develop the basic programs for MSP430 and Freescale microprocessors
- To introduce the features in recent mobile processor

Course Outcomes

At the end of the course, the students will be able to

CO1: Illustrate the concepts of MSP430 functionalities and apply knowledge of I/O module to develop simple programs

CO2: Learning the various inbuilt modules of MSP 430 peripheral interface and applications.

CO3: Describe the architecture of Free-scale 32 bit Processor and internal modules of processor to develop a system

CO4: Develop an Assembly program for free-scale cold fire processor for a specific application

CO5: Learning new generation of mobile architectures and Compare and contrast various features of mobile processors

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

MSP430 RISC CPU Architecture
Introduction, Functional block diagram, Memory map, Architecture, Addressing modes, Instruction set Functions, Interrupts, Digital I/O –Digital Input and Output, Parallel ports, Mixed signal systems.
Practical: Programming examples using MSP430 Microcontroller**.** [12]

MSP430 Peripheral Interface
Timer – Watchdog Timer, Clock System, Resets, Comparator, Op-Amp. Case study – Algorithm Execution comparison between Microchip PIC24F16KA and the TI MSP430F2252, Home automation application, Biomedical application.
Practical: Interfacing program like DAC, I2C, SPI using MSP430 Microcontroller [12]

Free-Scale Cold Fire 32 bit processor core
Introduction to Cold Fire Core - User, Supervisor, EMAC and Interrupt Programming Models, Addressing modes, Exception processing sequence, Exception Vector Table, Interrupt Controller, Reset Controller Module, Clock Module, System Control Module.
Practical: Chip Configuration Module Programming with S12X processor. [12]

Free-Scale Cold Fire 32 Bit Processor Peripherals and Programming
Analog to Digital Converters, Universal Asynchronous Transmitter Receiver, Timer Unit, Queued Serial Peripheral Interface, Fast Ethernet controller, Tools and Software.
Practical: C programming examples with Code Warrior tools and Run control Devices. [12]

Recent Mobile Processor
Evolution of Processor Architecture in Mobile Phones, Benefits of Multiple CPU Cores in Mobile Devices, Processors for Mobile Applications, features and comparison – Dual Core, Quad Core, Octa Core and hexa Core processor.
Practical: Programming Languages for Mobile App Development. [12]

Total Hours : 30+30(Practical) =60

Text book(s):

1	John H. Davies, 'MSP430 Microcontroller Basics', 2nd Edition, Elsevier Science & Technology, 2015.
2	MunirBannoura, Rudan Bettelheim and Richard Soja, 'ColdFire Microprocessors & Microcontrollers', AMT Publishing, 2007.

Rev.No. 3 / w.e.f. 13/02/2022
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Approved in Academic Council Meeting held on 23/02/2022

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Reference(s):	
1	‘ColdFire Family Programmer’s Reference Manual’, Free scale Semiconductors, 2011.
2	Barry.B.Brey, ‘The Intel Microprocessors Architecture, Programming and Interfacing’, PHI, 2009.
3	Valvano, ‘Embedded Microcomputer Systems’, Thomson Asia Pvt Ltd. reprint, 2010.
4	Gene .H.Miller, ‘Micro Computer Engineering’, Pearson Education, 2003.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply knowledge of I/O module to develop simple programs
	PO2	3	Apply the knowledge to analyse the Memory map, Addressing modes and Interrupts in MSP430 RISC
	PO3	3	Design each module in MSP430 and use low power features of MSP430 to develop embedded solutions.
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to perform the complex investigations
	PSO1	3	Perform the Mixed signal systems by applying basic engineering knowledge
	PSO2	3	Design the Mixed signal systems components considering industrial and societal requirements
CO2	PO1	3	Apply the MSP430 Peripheral Interface for various Embedded systems
	PO2	3	Design working out to the on-chip peripherals and use low power features of MSP430 to develop embedded solutions.
	PO3	3	Design the reliable Embedded systems components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on case study like Algorithm Execution comparison between Microchip PIC24F16KA and the TI MSP430F2252 and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on Home automation application, Biomedical application
	PSO1	3	Perform the different MSP430 Peripheral Interface by applying basic engineering knowledge
	PSO2	3	Design the reliable Embedded systems modules considering different environmental conditions
CO3	PO1	3	Apply the Cold Fire Core for different Embedded systems
	PO2	3	To Apply knowledge on free scale processor architecture and peripheral interfacings
	PO3	3	Design the basic programs for MSP430 and Freescale microprocessors components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing Free-Scale Cold Fire 32 bit processor core and identify the problems for further investigations

	PO5	3	Apply the relevant simulators and software to perform the complex investigations on Chip Configuration.
	PSO1	3	Compare the various S12X processor by applying basic engineering knowledge
	PSO2	3	Design the Embedded system components considering telecommunication industrial requirements
CO4	PO1	3	Apply the Free-Scale Cold Fire 32 Bit Processor Peripherals and Programming in Embedded systems.
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the Run control Devices.
	PO3	3	Develop the C programming examples with Code Warrior tools and Run control Devices.
	PO4	3	Conduct the detailed literature survey on existing systems tools and software and identify the problems
	PO5	3	Apply the relevant simulators to study the performance improvement of Free-Scale Cold Fire 32 Bit Processor Peripherals and Programming.
	PSO1	3	Queued Serial Peripheral Interface by applying Free-Scale Cold Fire 32 Bit Processor.
	PSO2	3	Develop the Free-Scale Cold Fire 32 Bit Processor Peripherals and Programming using Embedded systems system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of Evolution of Processor Architecture in Mobile Phones.
	PO2	3	Apply the engineering knowledge to analyse the Recent Mobile Processor.
	PO3	3	Develop the algorithms for various source codes for different channel requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing source coding techniques understanding the limitations of channels
	PO5	3	Apply the fundamental concepts of Evolution of Core Processor.
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	PO9	3	Apply the engineering knowledge to analyse the multidisciplinary Technology.
	PO10	3	Communicate effectively on complex engineering activities with the engineering mobile phone technology.
	PSO1	3	Applying engineering knowledge in the field of Signal/Image processing using Mobile Communication.
	PSO2	3	Design system components and development prototype.
	PSO3	3	Develop essential interpersonal skills various processor level and apply the prototype as patent.

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="9">50 EC E33 - Optical Communication</th></tr>
<tr><th colspan="9">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>2</td><td>0</td><td>2</td><td>60</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn the basic elements of optical fiber transmission link, fiber modes, configurations and structures
• To enhance the knowledge on signal degradation in optical fibers
• To facilitate the knowledge about fiber optic sources and coupling techniques
• To provide knowledge about the operation of fiber optic receivers and parameters measurement</td></tr>
</table>

	• To enrich the idea of optical fiber networks such as SONET/SDH and optical components
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain the basic concepts of optical communication CO2: Analyze the different kind of losses& signal degradation in optical waveguides CO3: Explain about the optical sources and coupling techniques CO4: Explain the fiber optic receiver operation and parametric measurement techniques CO5: Describe the basic concepts of different optical components and optical networks

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Optical Fibers
Evolution of fiber optic system, Element of an Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations– Single Mode Fibers – Graded Index fiber structure, Fiber fabrication techniques.
Practical: Analog transmission characteristics of fiber optic link [12]

Signal Degradation in Optical Fibers
Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers – Intermodal dispersion– Pulse Broadening in GI fibers , Design Optimization of SM fibers.
Practical: Attenuation and numerical aperture measurement in optical fibers [12]

Fiber Optical Sources and Coupling
Optical sources- LEDs and LASER diodes: structures, characteristics and quantum efficiency, Modulators using LEDs and LASER diodes, Power launching and coupling, Fiber Alignment, Fiber -to- Fiber joints, Fiber Splicing.
Practical::PI characteristics of LED and LASER diodes [12]

Fiber Optical Receivers and Measurements
PIN and APD - structure and working principles, noise in detectors, Optical receivers operation, Ideal photo receiver and quantum limit of detection. Fiber optic measurements –attenuation, dispersion,refractive index profile and cut- off wave length
Practical: Gain characteristics of APD and photodiode [12]

Optical Networks and Components
SONET and WDM optical networks , optical couplers, filters, isolators, switches, multiplexers and amplifiers
Practical: Study of WDM using simulator

[12]

Total Hours : 30+30(Practical) =60

Text book(s):

1	Gerd Kaiser, 'Optical Fiber Communications', 5thEdition, Tata McGraw Hill Publishers, 2013.
2	John M. Senior, 'Optical Fiber Communication', 3rdEdition, Pearson Education, 2009.

Reference(s):

1	Govind P. Agarval, 'Fiber-Optic Communication Systems', 4th Edition, John Wiley & Sons, 2010.
2	Rajiv Ramasamy and Kumar. N. Sivarajan, Galen H. Sasaki, 'Optical networks-A practical perspective', 3rd Edition, Morgan Kauffman, 2010.
3	Ramaswami, Sivarajan and Sasaki 'Optical Networks', Morgan Kaufmann, 2009.
4	Vivekanand Mishra and Sunita P.Ugate, 'Fiber – optic Communication', Wiley India, 2013

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	

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CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of optics to solve complex problems in various fibers
	PO2	3	Apply the knowledge to analyse the given problem to design the optical communication system
	PO3	3	Understand the working of optical system components considering environmental and societal requirements
	PO4	3	Identify and analyse the problems involved in the optical communication system
	PO5	3	Apply the relevant simulators to perform the complex investigations
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge
	PSO2	3	Design the fiber optic components by considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of optical signal degradation to analyze different kind of losses
	PO2	3	Apply the knowledge to analyse the effect of dispersion and noise
	PO3	3	Understand the working of communication system components considering environmental and societal requirements
	PO4	3	Identify and analyse the problems involved in the existing fiber Refractive index profile design
	PO5	3	Use the relevant simulators to perform the complex investigations on fiber losses
	PSO1	3	Perform the loss measurement by applying basic engineering knowledge
	PSO2	3	Design the reliable communication system modules considering different environmental conditions
CO3	PO1	3	Apply the optical sources concepts in various applications
	PO2	3	Apply the knowledge to analyse the given problem to design the LED
	PO3	3	Understand the working of LED and coupling components considering environmental and societal requirements
	PO4	3	Identify and analyse the problems involved in the existing optical sources and provide a valid solution
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on characteristics of LED
	PSO1	3	Compare the various LED techniques by applying basic engineering knowledge
	PSO2	3	Design the Optical source components considering telecommunication industrial requirements
CO4	PO1	3	Apply the different optical detector concepts for better SNR
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the optical receiver
	PO3	3	Understand the principle of the optical detection considering environmental and societal requirements
	PO4	3	Identify and analyse the problems involved in the existing receiver system and provide a valid solution
	PO5	3	Apply the relevant simulators to study the performance of different optical detection characteristics
	PSO1	3	Analyze the various noise performance by applying basic engineering knowledge
	PSO2	3	Develop the optical measurement system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of optical components and optical networks
	PO2	3	Apply the engineering knowledge to analyse the performance of optical networks and components
	PO3	3	Understand the working of optical system components that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Identify and analyse the problems in the operation of optical amplifiers and provide a valid solution existing
	PO5	3	Apply the relevant simulators to perform the complex investigations on WDM

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			characteristics
	PO8	3	Apply ethical responsibilities in developing the communication systems implementing SONETS in telephone systems
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations
	PO12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO1	3	Apply the concepts of optical amplifier, switches, filters for solving complex problems
	PSO2	3	Design the WDM,SONET components considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork involved in development of products

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50 EC E34 - Radar and Navigational Aids

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3	50	50	100

Objective(s)

- To understand the basic concepts, types of radars and antennas,
- To learn the concepts of MTI and pulse Doppler Radar
- To understand the principles of antennas and propagation in radar system
- To understand principles of navigation, in addition to approach and landing aids as related to navigation
- To learn the basics of Satellite Navigation and GPS

Course Outcomes

At the end of the course, the students will be able to

CO1: Explain the different types of radar.
CO2: Describe theconcept of MTI and doppler radar.
CO3: Analyze the detectioncriteriaofradar signal.
CO4: Explaintheprinciplesofradionavigation and different types of landing system.
CO5: Explain the concepts of satellite navigation systems

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Range Equation and Types of Radar
Basic Radar, Radar equation, Block diagram, Radar frequencies. Types of Radar: CW, Doppler, MTI, FMCW, Pulsed, Tracking Radar.
Practical: Design of end to end radar system using MATLAB
[12]

MTI and Pulse Doppler Radar
Introduction to Doppler and MTI Radar- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector – Pulse Doppler Radar- Automatic Tracking with Surveillance Radars (ADT).
Practical: Design of Doppler Radar system using MATLAB
[12]

Detection of Radar Signals in Noise and Antennas
Detection of radar signals in Noise and clutter, detection criteria and detectors, Matched filter response to delayed Doppler shifted signals, Types of Antennas: Parabolic, Cassegrain and Electronically steered phased array antennas.
Practical: Design a Patch Antenna using Ansys HFSS
[12]

Radio Navigation and Landing Aids

General principles, NDB, ADF, DME, Hyperbolic Navigation DECCA, OMEGA, LORAN, Mechanics of Landing: Microwave Landing System. **Practical:**Develop an CDMA based communication model using MATLAB [12] **Satellite Navigation System** Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment -Ground Controlled Approach System - Microwave Landing System(MLS). Inertial Navigation - Principles of Operation - Navigation Over the Earth– Components of an Inertial Navigation System -The Transit System - Navstar Global Positioning System (GPS). **Practical:**DevelopanGPS receiver simulation model using MATLAB [12]
Total Hours : 30+30(Practical) =60

Text book(s):	
1	M.I.Skolnik, 'Introduction to Radar Systems', Tata McGraw Hill, 2nd Edition, 2007.
2	Myron Kyton and W.R.Fried, 'Avionics Navigation Systems', 2nd Edition, John Wiley & Sons, 1997.
Reference(s):	
1	Nagaraja, 'Elements of Electronic Navigation', Tata McGraw Hill, 2nd Edition, 2001.
2	Albert Helfrick. D, 'Principles of Avionics', Avionics communications Inc., 9th Edition, 2015.
3	Nathansan, 'Radar design principles-Signal processing and environment', PHI, 2nd Edition, 2007.
4	Hofmann-Wellenhof, Hlichlinegger and J.Collins, 'GPS Theory and Practice', 5th Edition, Springer International Edition, 2012.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO1	3	Apply the engineering knowledge to classify the different types of Radars
	PO2	3	Apply the knowledge to analyse the given problem using Radar equation
	PO3	3	Develop the coding schemes in the Radar technologies for environmental and societal requirements
	PO4	3	Analysis the performance for different Radars
	PO5	3	Apply modern technology tools to complex engineering activities radar system using MATLAB.
	PSO1	3	Perform the Range tracking is carried out using timing control unit
	PSO2	3	Design a product of Radar to meet the specific needs of industry and society
CO2	PO1	3	Apply the Doppler filters can be implemented either as hardware by resonance filters
	PO2	3	To build the mathematical model of radar processing
	PO3	3	Design the in a modern radar, detection and tracking can be automatically processed the data
	PO4	3	Conduct the detailed literature survey on existing Radar concepts in coverage and capacity improvement and identify the problems

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	PO5	3	Apply modern tools in a radar system uses corrected coefficients to compensate for pulses
	PSO1	3	Perform the microcell zone concepts by applying basic radar knowledge
	PSO2	3	Design the radar for considering different environmental conditions
CO3	PO1	3	Apply the multiple access techniques Detection of radar signals in Noise and clutter, detection criteria and detectors
	PO2	3	Apply the knowledge Doppler shifted signals to analyse the given problem to design the single input
	PO3	3	Design a Antenna using Ansys HFSS with appropriate consideration for the public
	PO4	3	Conduct the detailed survey and identify the problems for further development in Antenna
	PO5	3	Use the modern tools to work with Antenna
	PSO1	3	Compare the various Radar perform the complex investigations on multiple by applying basic engineering knowledge
	PSO2	3	Design the spatial division multiple access devices considering Antennas industrial requirements
CO4	PO1	3	Apply the General principles of Radio Navigation method
	PO2	3	Apply the knowledge of engineering to analyse the given problem in Mechanics of Landing
	PO3	3	design system components or processes that meet the specified needs Landing Aids.
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems signals of radar
	PO5	3	Apply the knowledge of free space Navigation system design in the professionalengineering practice
	PSO1	3	Measure the factors affecting free space Navigation by applying basic engineering knowledge
	PSO2	3	Develop the Radar system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of Satellite Navigation System and its application
	PO2	3	Apply the engineering knowledge to analyse the given Distance Measuring Equipment
	PO3	3	Develop the algorithms for various source codes for different channel requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing Radar Frequency Energy Harvesting techniques understanding the limitations
	PO5	3	Apply the knowledge of Global Positioning System design in the professionalengineering practice
	PO8	3	Understand the impact of solutions in societal and environmental contexts in networks
	PO9	3	Apply ethical principles in development of solution with Navigation Over the Earth
	PO10	3	Write effective reports and design document to represent idea
	PSO1	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
	PSO2	3	Design a project applying Navigation System
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E35 - VLSI Testing and Verification								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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VII	2	0	2	60	3	50	50	100

Objective(s)	• To know the various types of faults in digital circuits • To learn the concepts of fault modeling • To acquire knowledge in test vectors generation for combinational and sequential circuits • To know the test generation concepts in DFT, BIST • To study the concepts in fault diagnosis
Course Outcomes	**At the end of the course, the students will be able to** CO1: Examine the various concepts of testing and methods of fault model in VLSI circuits. CO2: Analyze test generation of various algorithms for digital circuits. CO3: Describe the various techniques for testability CO4: Discuss the various types of architecture and test algorithm for BIST. CO5: Design the self-checking circuit for fault diagnosis of VLSI circuits.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Testing and Fault Modeling
Introduction to testing – Faults in Digital Circuits – Modeling of faults – Logical Fault Models –Fault detection – Fault Location – Fault dominance – Logic simulation – Types of simulation – Delay models.
Practical: Design Fault Injection and modeling Technique for Digital HDL Models
[12]

Test Generation
Test generation for combinational logic circuits – Testable combinational logic circuit design – Test generation for sequential circuits.
Practical: Design efficient test generation method for digital circuits using HDL
[12]

Design for Testability
Design for Testability – Ad-hoc design – generic scan based design –– system level DFT approaches.
Practical: Design various DFT approaches using HDL.
[12]

Self – Test and Test Algorithms
Built-In self Test – test pattern generation for BIST – Circular BIST – BIST Architectures – Testable Memory Design – Test Algorithms.
Practical: Develop self-test algorithm of BIST for digital systems using HDL
[12]

Fault Diagnosis
Logical Level Diagnosis – Diagnosis by UUT reduction – Fault Diagnosis for Combinational Circuits – Self-checking design.
Practical: Implement self-checking logic for digital systems using HDL
[12]

Total Hours : 30+30(Practical) =60

Text book(s):

1	M.Abramovici, M.A.Breuer and A.D. Friedman, 'Digital systems testing and Testable Design', Jaico Publishing House, 2013.
2	P.K. Lala, 'Digital Circuit Testing and Testability', Academic Press, 2012.

Reference(s):

1	M.L.Bushnell and V.D.Agrawal, 'Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits', Springer US, 2013.
2	A.L.Crouch, 'Design-For-Test For Digital IC's And Embedded Core Systems', Pearson Education, 2012.
3	N. Jha& S.D. Gupta, 'Testing of Digital Systems', Cambridge, 2003.
4	W. W. Wen, 'VLSI Test Principles and Architectures Design for Testability', Morgan Kaufmann Publishers, 2006.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to examine the various concepts of testing and methods of fault model.
	PO2	3	Apply the testing methods to solve the complex engineering problems in fault models in VLSI circuits
	PO3	3	Design fault models in VLSI circuits for identified complex problems
	PO4	3	Conduct the detailed literature survey on fault models in VLSI circuits and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on fault models in VLSI circuits
	PSO1	3	Apply the concepts of fault models in VLSI circuits for solving complex problems
	PSO2	3	Design fault models in VLSI components with needs of industry and society
CO2	PO1	3	Apply knowledge to generate test vector using various algorithm for digital circuits
	PO2	3	Apply the knowledge to given complex problems in test generation algorithms
	PO3	3	Design test generation algorithms for VLSI circuits
	PO4	3	Conduct the detailed literature survey on test generation algorithms in VLSI circuits and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on test generation algorithms in VLSI circuits
	PSO1	3	Apply the concepts of test generation algorithms in VLSI circuits for solving complex problems
	PSO2	3	Design test generation algorithms in VLSI system components with needs of industry and society
CO3	PO1	3	Apply the knowledge to describe the various techniques for testability.
	PO2	3	Apply the knowledge to given complex problems on various techniques for testability
	PO3	3	Design various DFT approaches for given complex problems
	PO4	3	Conduct the detailed literature survey on various DFT approaches in VLSI domain and identify the problems
	PO5	3	Apply the modern engineering tools to perform the complex problems survey on various DFT approaches in VLSI domain
	PO8	3	Apply ethical principles to compare various DFT approaches in VLSI domain for ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable testing VLSI circuits considering wider

			technological changes
	PSO1	3	Apply the concepts of various DFT approaches in VLSI domain for solving complex problems
	PSO2	3	Design testability component in VLSI system with needs of industry and society
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the knowledge to discuss the various types of architecture and test algorithm for BIST
	PO2	3	Apply the knowledge toanaylse the complex engineering problems in BIST architecture and test algorithm
	PO3	3	Design BIST architecture and test algorithm for identified complex problems
	PO4	3	Conduct the detailed literature survey on BIST architecture and test algorithm and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on BIST architecture and test algorithm
	PSO1	3	Apply the concepts of BIST architecture and test algorithm for solving complex problems
	PSO2	3	Design BIST architecture and test algorithm for VLSI system components with needs of industry and society
CO5	PO1	3	Apply the knowledge to design self-checking circuit for fault diagnosis in VLSI circuits
	PO2	3	Apply the knowledge to design the complex engineering problems in fault diagnosis logic for VLSI circuits
	PO3	3	Design fault diagnosis logic for VLSI circuits for identified complex problems
	PO4	3	Conduct the detailed literature survey on fault diagnosis logic for VLSI circuits and identify the problems
	PO5	3	Use the modern engineering tools to perform the complex problems survey on fault diagnosis logic for VLSI circuits
	PSO1	3	Apply the concepts of fault diagnosis logic for solving complex problems
	PSO2	3	Design fault diagnosis logic for VLSI circuit components with needs of industry and society

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E36 - Adaptive Signal Processing								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3	50	50	100
Objective(s)	• To understand the concepts of stationary and non-stationary random signals and characterization of discrete-time random processes. • To explain Non parametric and parametric methods for power spectrum estimation. • To design optimum filters such as Wiener and Kalman filters. • To design adaptive filtering techniques using LMS and RLS algorithm and understand the applications of adaptive filters. • To learn the concepts of Wavelet transform and Filter banks							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain the mathematical description and signal modelling of discrete time random processes. CO2: Apply various techniques for estimating the power spectrum of a stationary random process. CO3: Develop the Lattice filter structure and optimum filters CO4: Design, implementation and analysis of various adaptive filters and application of adaptive filters.							

	CO5: Discuss the concepts of CWT and develop the two channel filter bank.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Discrete time random processes
Introduction- Random processes-Definitions-Ensemble Averages-Stationary processes- Auto covariance and Autocorrelation matrices-Properties- Ergodicity- White noise- Weiner Khitchine relation- Power spectral density – Filtering random processes- Spectral Factorization Theorem- Special types of random processes – ARMA, AR, MA Processes
Practical : Power spectral density using square magnitude and autocorrelation method

[12]

Power Spectrum Estimation
Bias and Consistency of estimators- Non-Parametric methods Periodogram - Performance of the Periodogram-Modified periodogram- Barlett'smethod- Welch's method-Blackman-Tukey Approach- Performance comparisons - Parametric methods - AR, MA, ARMA spectrum estimation using YuleWalker method- The Levinson-Durbin recursion- Development of the Recursion-The Levinson recursion algorithm for solving Toeplitz system of equations.
Practical : Estimate the PSD of a noisy signal using periodogram and modified periodogram.

[12]

OptimumFilters
Lattice filter-FIR Lattice Filter-IIR Lattice Filter-Forward and backward covariance method-Burg's method-Wiener filtering-FIR Wiener filter-Filtering, Linear Prediction- IIR Wiener filter-Causal and NoncausalIIRWienerfilter-Discrete Kalmanfilter.
Practical : Application of optimum filters (Wiener and Kalman filters)

[12]

Adaptive Filters
Introduction-FIR Adaptive filters - Newton's steepest descent method - Widrow Hoff LMS Adaptive algorithm - Convergence - Normalized LMS- Applications - Noise cancellation - Channel equalization – Echo cancellation-Adaptive Recursive Filters - RLS adaptive algorithm
Practical : Adaptive Filter for noise cancellation in Sinusoidal signal and System Identification using Adaptive filter

[12]

Continuous Wavelet transform and Filter banks
Wavelet basis– STFT-Discrete STFT-Continuous time Wavelet Transform (CWT)– .Multi-Resolution Analysis (MRA) - Construction of Wavelets-Construction of Orthonormal Wavelets- Orthonormal scaling functions--Two channel perfect reconstruction filter bank
Practical : Time-Frequency Analysis with the Continuous Wavelet Transform and Signal Reconstruction from Continuous Wavelet Transform Coefficients.

[12]

Total Hours : 30+30(Practical) =60

Text book(s):

1	Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling', John Wiley and Sons Inc., New York, 2008.
2	Jaideva C Goswami and Andrew K Chan, 'Fundamentals of Wavelets–Theory, Algorithms and Applications', JohnWiley&Sons, Inc., Singapore, 2011.

Reference(s):

1	Alan V Oppenheim, Ronald W Schafer, 'Discrete Time Signal Processing', Pearson Education India, 3^{rd} Edition, 2014.
2	John G. Proakis, Dimitris G. Manolakis, 'Digital Signal Processing: Principles, Algorithms and Applications', Pearson Education, 4^{th} Edition,2014.
3	Simon Haykin, 'Adaptive Filter Theory', Pearson, 5^{th} Edition, 2013.
4	Steven M.Kay,' Modern Spectrum Estimation: Theory And Application', Prentice Hall PTR, 1999.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3			3	3	3		3	3	3	3
CO5	3	3	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the mathematical concepts and signal modeling for discrete time random processes
	PO2	3	Apply the knowledge to analyse the various parameters to design signal modeling
	PO3	3	Develop the signal modeling for discrete time signal processing considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing signal modeling and identify the problems
	PO5	3	Apply the relevant simulators to perform the complex investigations on discrete time random processes
	PSO1	3	Perform the discrete time signal processing by applying basic engineering knowledge
	PSO2	3	Develop the discrete time random processes considering industrial and societal requirements
CO2	PO1	3	Apply the different techniques for estimating the power spectrum of a random process
	PO2	3	Apply the knowledge to analyse the given problem to estimate the power spectrum
	PO3	3	Develop the spectrum estimation algorithm for a random process considering environmental requirements
	PO4	3	Conduct the detailed literature survey on existing spectrum estimation and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on power spectrum estimation
	PSO1	3	Compare different power spectrum estimation methods by applying basic engineering knowledge
	PSO2	3	Design the signal processing algorithms for considering industrial and societal requirements
CO3	PO1	3	Apply the digital filters concepts for lattice and optimum filters
	PO2	3	Apply the engineering knowledge to analyse the given problem to design optimum filters for linear prediction
	PO3	3	Develop the various optimum filters considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing optimum linear filters and identify the problems
	PO5	3	Apply the relevant simulators and software to perform the complex investigations

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			on optimum filters
	PSO1	3	Compare the various optimum digital filters by applying basic engineering knowledge
	PSO2	3	Design the optimum digital filters considering industrial and societal requirements
CO4	PO1	3	Apply different methods for adaptive filters
	PO2	3	Apply the engineering knowledge to analyse the given problem to design the adaptive filters
	PO3	3	Develop the adaptive filtering algorithms considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on different adaptive filter algorithms and identify the problems for further investigations
	PO5	3	Apply the relevant simulators to perform the complex investigations on adaptive filters
	PO8	3	Apply ethical responsibilities to develop adaptive filter algorithms ensuring industrial safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
PO4	PO12	3	Develop more reliable different adaptive filters considering industrial requirements
	PSO1	3	Perform the various adaptive algorithm by applying basic engineering knowledge
	PSO2	3	Develop the signal processing algorithmsfor considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the continuous time wavelet transform for signal processing
	PO2	3	Apply the knowledge to analyse the given problem to design filter banks
	PO3	3	Develop the signal processing algorithms considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing transforms and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on wavelet transform
	PSO1	3	Perform the wavelet transform by applying basic engineering knowledge
	PSO2	3	Developthe signal processing algorithms considering industrial conditions

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E37 - Principles of Medical Imaging								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3	50	50	100
Objective(s)	• To understand the basic principles of medical imaging. • To learn mathematical preliminaries for image reconstruction. • To understand the concepts of various imaging modalities • To analyse the image quality and contrast agents • To discuss the concept of MRI							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Outline the fundamentals of medical imaging and radiography techniques CO2: Outline the concepts of two, three dimensional and iterative image reconstruction from projections CO3: Discuss the principles of fluoroscopy, computed tomography and analyse the image quality							

	CO4: Illustrate the fundamentals of magnetic resonance and contrast agents in MRI CO5: Discuss the principles of ultrasound imaging

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Basics of Medical Imaging
Introduction to medical imaging techniques - Single crystal scintillation camera - Principles of scintillation camera operation - Multiple crystal scintillation camera- Solid state camera - Rectilinear scanner- Emission computed Tomography - Radiography: Digital Radiography
Practical: Implement the various preprocessing stages and filters for the acquired camera images. [12]

Mathematical Preliminaries and Image Reconstruction
Image reconstruction from projections in two dimensions - Mathematical preliminaries for two and three dimensional image reconstructions- Two dimensional projection reconstruction - Iterative reconstruction techniques- Fourier reconstruction
Practical: Develop and implement imaging algorithms for image reconstruction [12]

Fluoroscopy, CT and Image Quality
Digital fluoroscopy - Automatic brightness control, cine fluorography - Principles of computed tomographic imaging - Reconstruction algorithms – Scan motions- X-ray sources – Collimation, X ray detectors, Viewing system, Patient dose, Quality control - Influences on image quality: Unsharpness –Contrast - Image noise, Image distortion - Artifacts.
Practical: Implementnoise removal algorithm that enhances image quality. [12]

Magnetic Resonance Imaging
Fundamentals of magnetic resonance – Overview: magnetic resonance as a probe of the body - Pulse sequences - spatial encoding of magnetic resonance imaging signal - Motion suppression techniques - Contrast Agents - tissue contrast in MRI.
Practical: Apply transforms to the MR signals and find the main determinants of contrast in MRI signals [12]

Ultrasound Imaging
Introduction to ultrasound: Presentation modes -Time required obtaining images - System components, signaling processing - dynamic range – Ultrasound image artifacts - Quality control, Origin of Doppler shift - Limitations of Doppler systems.
Practical: Develop imaging algorithms to eliminate artifacts in ultrasound image to improve image quality [12]

Total Hours : 30+30(Practical) =60

Text book(s):

1	William R. Hendee, and E. Russell Ritenour, ‘Medical Imaging Physics’, A John Wiley & sons, Inc., Publication, 4th Edition, 2003.(Units I,III,IV,V)
2	Zang-Hee Cho, Joie P. Jones and Manbir Singh, ‘Foundations of Medical Imaging’, John Wiley and sons Inc., 2017.(Units II &V)

Reference(s):

1	Avinash C. Kak, and Malcolm Slaney, ‘Principles of Computerized Tomographic Imaging’, IEEE Press, New York, 2001.
2	Mostafa Analoui, Joseph D. Bronzino, and Donald R. Peterson ‘Medical Imaging Principles and Practices’, 1st Edition, CRC Press, 2012.
3	Michael Chappell, ‘Principles of Medical Imaging for Engineers’, Springer, 2019.
4	K. Kirk Shung, Michael Smith, and Benjamin M.W. Tsui, ‘Principles of Medical Imaging’, Academic Press, 2012.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3			3	3	3		3	3	3	3
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3								3	3	

CO5	3	3	3	3	3								3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic principle concepts for different medical Imaging
	PO2	3	Apply the knowledge to analyse the given problem to design the system
	PO3	3	Design the system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to perform the complex investigations
	PO8	3	Apply ethical responsibilities to develop the systems implementing different codes ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO1	3	Perform the signal image processing by applying basic engineering knowledge
	PSO2	3	Design the system components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO2	PO1	3	Apply the different coding techniques for image processing systems
	PO2	3	Apply the knowledge to analyse the different coding to design the system for reliable transmission
	PO3	3	Design the reliable image processing system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing coding techniques and identify the problems
	PO5	3	Use the relevant simulators to perform the complex investigations on medical imaging
	PSO1	3	Perform the different coding techniques by applying basic engineering knowledge
	PSO2	3	Design the reliable communication system modules considering different environmental conditions
CO3	PO1	3	Apply the different concepts of various imaging modalities techniques for image processing systems
	PO2	3	Apply the knowledge to analyse the given problem to design the image processing system
	PO3	3	Develop the image processing system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing modulation techniques and identify the problems for further investigations
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on imaging modalities techniques
	PSO1	3	Compare the various imaging modalitiestechniques by applying basic engineering knowledge
	PSO2	3	Design the image processing system components considering telecommunication industrial requirements
CO4	PO1	3	Apply different techniques to analyse the image quality and contrast agents
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the baseband transmission systems

	PO3	3	Develop the image processing system schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators to study the performance of different codes
	PSO1	3	Measure the power spectral densities of different codes by applying basic engineering knowledge
	PSO2	3	Develop the image processing system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of information theory for MRI image
	PO2	2	Apply the engineering knowledge to analyse the given source coding technique
	PO3	3	Develop the algorithms for various codes for MRI requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing source coding techniques understanding the limitations of MRI
	PO5	3	Apply the relevant simulators to perform the complex investigations on MRI
	PSO1	3	Apply the concepts of MRI image for solving complex problems
	PSO2	3	Design Image processing system components considering industrial and societal requirements

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E41 – Artificial Intelligence								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- To enable students to understand the various characteristics of Intelligent agents and search strategies in AI
- To familiarize different searching techniques.
- To study various logical representations of artificial intelligence.
- To learn to represent knowledge in solving AI problems and apply planning and reasoning algorithms.
- To acquire knowledge on uncertain knowledge representation and various learning techniques.

Course Outcomes

At the end of the course, the students will be able to

CO1: Develop solutions for problems using various Artificial Intelligence concepts.
CO2: Use appropriate search algorithms for any AI problem
CO3: Represent a problem using first order and predicate logic
CO4: Provide the apt planning and reasoning algorithms to solve a given problem
CO5: Use appropriate learning algorithms for solving real life problems

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Fundamentals of Artificial Intelligence

Introduction–Definition – History of AI - Intelligence, Knowledge, and Human artifice -Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems- Searching for solutions -Un-informed search strategies –Avoiding repeated states -Searching with partial information. [9]

Informed Searching Techniques

Informed search and exploration -Informed search strategies -Heuristic function -Local search algorithms and optimistic problems –Constraint Satisfaction Problems (CSP) -Backtracking search -Structure of problems -Adversarial Search -Games -Optimal decisions in games -Alpha -Beta Pruning. [9]

Logical Reasoning

Logical agents: Knowledge-based agents – The Wumpus world. Logic – Propositional logic: A very simple logic-Propositional theorem proving. First order logic: Representation – Syntax and semantics of first order logic – Using first order logic-Inference in first order logic: Propositional versus first order inference– Unification and lifting – Forward chaining – Backward chaining – Resolution. [9]

Planning and Decision Making

Classical Planning: Definition – Algorithms for planning as state space search- Planning graphs – Other classical planning approaches. Making simple Decisions-Combining beliefs and desires under Uncertainty-Utility theory-Utility functions-Multi attribute utility functions-Decision networks- The value of information-Decision theoretic expert systems. [9]

Learning

Quantifying uncertainty: Acting under uncertainty - Probability basics – Bayes' Rule and its use. Probabilistic reasoning: Representing knowledge in uncertain domain- The semantics of Bayesian networks. Forms of learning - Supervised learning - Learning decision trees. Reinforcement Learning: Passive Learning – Active Learning – Learning an Action-Value function using Q Learning. [9]

Total Hours : 45

Text book(s):

1	Stuart Russell and Peter Norvig, 'Artificial Intelligence –A Modern Approach', 3rd Edition, Pearson Education, 2016.
2	Deepak Khemani, 'Artificial Intelligence', Tata McGraw Hill Education, 2013.

Reference(s):

1	Kevin Night and Elaine Rich, Nair B., ‘Artificial Intelligence (SIE)’, 3rd Edition, McGraw Hill,2008.
2	Dan W. Patterson, ‘Introduction to AI and ES’, 3rd Edition, Pearson Education, 2007.
3	Peter Jackson, ‘Introduction to Expert Systems’, 3rd Edition, Pearson Education, 2007.
4	Nils J. Nilsson, ‘Artificial Intelligence: A new Synthesis’, Harcourt Asia Pvt. Ltd., 2000.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge of Fundamentals of Artificial Intelligence in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Problem-Solving Approach to Typical AI problems.
	PO3	3	Design solutions for Knowledge and Human artifice for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PSO1	3	Solve complex Problem-Solving Approach to Typical AI problems by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design Un-informed search strategies and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO2	PO1	3	Apply the knowledge of Informed Searching Techniques in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Optimal decisions in games.
	PO3	3	Design solutions for Constraint Satisfaction Problems for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions optimistic problems.
	PSO1	3	Solve complex Informed Searching Techniques by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design and develop Optimal decisions in games products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO3	PO1	3	Apply the Logical Reasoning in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Wumpus world. Logic.
	PO3	3	Design solutions for Unification and lifting for the public health and safety, and the

			cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for Backward chaining.
	PSO1	3	Solve complex Logical Reasoning by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design and develop Unification and lifting products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO4	PO1	3	Apply the knowledge of Planning and Decision Making in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Algorithms for planning as state space search.
	PO3	3	Design solutions for Utility theory for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for Classical Planning.
	PSO1	3	Solve complex Planning and Decision Making by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Solve complex desires under Uncertainty by applying engineering knowledge in the field of Signal/Image processing and Communication.
CO5	PO1	3	Apply the knowledge of Learning in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Quantifying uncertainty.
	PO3	3	Design solutions for Q Learning for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for Supervised learning.
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice for Learning.
	PO9	3	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings for Quantifying uncertainty.
	PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change in Learning.
	PSO1	3	Solve complex Learning by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for Quantifying uncertainty.
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for Supervised learning.

K.S.Rangasamy College of Technology – Autonomous R 2018									
50 EC E42 – Real Time System Design									
B.E. Electronics and Communication Engineering									
Semester	Hours / Week			Total hrs	Credit	Maximum Marks			
	L	T	P		C	CA	ES	Total	

VII	3	0	0	45	3	50	50	100

Objective(s)	• To learn real time systems and requirements • To understand the performance analysis techniques. • To explore the state machine concepts • To understand the storage management concepts • To learn protection and security concepts
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the principles of real time systems. CO2: Illustrate the concept of performance analysis techniques and requirements of real time systems. CO3: Observe the state machine concepts and execution time prediction. CO4: Summarize the storage management concepts. CO5: Illustrate the concept of protection and security in operating systems.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Hardware for Real Time Systems
Basic processor architecture - memory technologies - architectural advancements - peripheral interfacing-standard microcontrollers-custom microcontrollers-distributed real time architectures. [9]

Requirements and performance analysis techniques
Requirements engineering for real time systems – formal methods in system specification – semiformal methods in system specification – real time performance analysis – applications of queuing theory – Input/output performance - analysis of memory requirements. [9]

State machines and execution time prediction
Systems of state machines: Communicating real time state machines- state charts. Execution time prediction: Approaches and issues – program analysis with timing schema – prediction by optimization – system interferences and architectural complexities. [9]

Storage management
File concept-access methods-directory and disk structure-File system mounting-File sharing-Protection – File system structure and implementation-directory implementation-Allocation methods-Free space management-Efficiency and performance-Disk structure and attachment-Disk scheduling-Disk management- swap space management. [9]

Protection and security
Goal of protection-principles of protection-Domain of protection-Implementation of access matrix-Access control-Revocation of access rights-capability based systems-Language based protection- The security problem-program threats-System and network threats-Cryptography as a security tool-User authentication-Implementing security defenses-computer security classifications. [9]

Total Hours : 45

Text book(s):

1	Philip A.Laplante, Seppo J. ovaska, ‘Real Time Systems Design and Analysis’, |IEEE Press, 4th edition, 2012.
2	Alan C.Shaw, ‘Real Time Systems and Software’, John Wiley & Sons, 2001.

Reference(s):

1	Allen Burns, Andy Wellings, ‘Real Time Systems and programming Languages’, Pearson Education, 2009.
2	C.M. Krishna, Kang G. Shin, ‘Real-Time Systems’, Tata McGraw-Hill education, 2010.
3	Stuart Bennett, ‘Real Time Computer Control’, Pearson, 2003.
4	Qing Li, Caroline Yao, ‘Real Time Concepts for Embedded Systems’, CRC Press, 2003.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	

CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply knowledge of memory technology to develop memory extended systems.
	PO2	3	Apply the knowledge to analyse the - peripheral interfacing in Hardware for Real Time Systems.
	PO3	3	Design each module in Real time system and use low power features of custom microcontrollers develop embedded solutions.
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the distributed real time architectures by applying basic engineering knowledge
	PSO2	3	Design the standard microcontrollers components considering industrial and societal requirements
CO2	PO1	3	Apply the applications of queuing theory for various Embedded systems
	PO2	3	Design working out to the real time systems and use low power features memory requirements embedded solutions.
	PO3	3	Design the formal methods in system specification Embedded systems components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on case study like Requirements and performance analysis techniques and identify the problems
	PSO1	3	Perform the real time analysis applying basic engineering knowledge
	PSO2	3	Design the reliable Embedded systems modules considering different environmental conditions
CO3	PO1	3	Apply the Communicating real time state machines-different Embedded systems
	PO2	3	To Apply knowledge on state machine for execution of time prediction.
	PO3	3	Design the Systems of state machines considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on prediction by optimization identify the problems for further investigations
	PSO1	3	Compare the program analysis with timing schema by applying basic engineering knowledge
	PSO2	3	Design the Embedded system components considering requirements system interferences and architectural complexities
CO4	PO1	3	Implement File system structure in Storage management.
	PO2	3	Apply the knowledge of engineering allocation methods-Free space management.
	PO3	3	Develop the C programming examples with Disk scheduling.
	PO4	3	Conduct the detailed literature survey on existing systems tools and software and identify the problems
	PSO1	3	Applying engineering knowledge in the field of Signal/Image processing using Real time system design.
	PSO2	3	Develop the Real time system design and Programming using Embedded systems system components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts Goal of protection principles of protection Domain of protection.
	PO2	3	Apply the engineering knowledge to analyse the Recent Protection and security Technology.

	PO3	3	Develop the algorithms for various source codes for different Protection and security requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing source coding techniques understanding the limitations of channels
	PO5	3	Apply the fundamental concepts of Evolution of computer security classifications.
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	PO9	3	Apply the engineering knowledge to analyse the multidisciplinary Technology.
	PO10	3	Communicate effectively on complex engineering activities with the engineering Protection and security .
	PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change in Learning.
	PSO1	3	Applying engineering knowledge in the field of Signal/Image processing using Protection and security .
	PSO2	3	Design system components and development prototype.
	PSO3	3	Develop essential interpersonal skills various processor level and apply the prototype as patent.

K.S.Rangasamy College of Technology – Autonomous R 2018

50 EC E43 – Optoelectronic Devices

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- To know the basics of solid state physics and understand the nature and characteristics of light.
- To understand the operation of different display devices and their applications.
- To learn the principle of optical detection mechanism in different detection devices.
- To understand different light modulation techniques and optical switching.
- To study the opto electronic integrated circuits in transmitters and receivers

Course Outcomes

At the end of the course, the students will be able to

CO1: Explain the concept of light wave theory and solid state physics
CO2: Explain the operation of various display devices
CO3: Explain the working principle of optical detection devices
CO4: Explain the working principle of optical modulators and switches
CO5: Explain about optoelectronic integrated circuits and guided wave devices

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Elements of Light and Solid State Physics

Wave nature of light, Polarization, Interference, Diffraction, Quantum mechanics and band theory, Band structure and carrier effective masses, Scattering and carrier mobilities, Semiconductors statistics, Carrier recombination.[9]

Display Devices and Lasers

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of lasers, laser applications. [9]

Optical Detection Devices

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Junction Photo diodes, High speed diodes, Metal-Semiconductor-Metal (MSM) diodes, Solar Cells, CCD sensors. [9]

Optoelectronic Modulators and Switches Introduction, Analog and Digital Modulation, Electro-optic modulators, Quantum confined Stark effect in quantum well semiconductors, Electro-absorption modulators, electro-refraction devices .Optical, Switching and Logic Devices. [9] **Optoelectronic Integrated Circuits** Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices. [9]
Total Hours : 45

Text book(s):

1	Pallab Bhattacharya 'Semiconductor Opto Electronic Devices', Prentice Hall of India Pvt., Ltd., New Delhi,2nd Edition, 2017.
2	Jasprit Singh, 'Opto Electronics – As Introduction to Materials and Devices', McGraw-Hill International Edition, 1998.

Reference(s):

1	S C Gupta, 'Opto Electronic Devices and Systems', Prentice Hall of India, 2005.
2	J. Wilson and J.Haukes, 'Opto Electronics – An Introduction', Prentice Hall, 1995.
3	Tamir T. Grifel and Henry L. Bertoni, 'Guided wave opto-electronics: Device characterization, analysis and design', Plenium Press, 1995.
4	Bandyopathay, 'Optical communication and networks', PHI, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3				3	3	3		3	3	3	3
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of light wave theory and solid state physics for solving complex problems in various fibers
	PO2	3	Apply the knowledge to analyze the given problem in the area of light wave theory
	PO3	3	Understand the working of opto electronic system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Solve complex Engineering problems in solid state physics by applying basic engineering knowledge
	PSO2	3	Abe to design the opto electronic system considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of optics to analyze different kind of display devices
	PO2	3	Apply the knowledge to analyze the effect of Luminescence in various display devices
	PO3	3	Understand the working reliable display components considering environmental and societal requirements

	PO4	3	Conduct the detailed literature survey on existing display devices
	PSO1	3	Analyze the LASER diode types by applying basic engineering knowledge
	PSO2	3	Abe to design the reliable display devices considering different environmental conditions
CO3	PO1	3	Apply the Photo detector concepts in various applications
	PO2	3	Apply the knowledge to analyse the given problem to design the Photo detectors
	PO3	3	Understand the working of Photo detectors by considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing Solar Cells, CCD sensors and identify the problems for further investigations
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on characteristics of Photo detectors
	PO8	3	Apply ethical responsibilities to develop the communication systems implementing Analog and Digital Modulation
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations related to photodetectors
	PO12	3	Develop interest in building more reliable communication system considering wider technological changes
	PSO1	3	Compare the various Photo detectors techniques by applying basic engineering knowledge
	PSO2	3	Abe to design the Photo detectors considering telecommunication industrial requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Analyze the different Optoelectronic Modulators concepts
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design the Optoelectronic Modulators
	PO3	3	Understand the working of the Optoelectronic Modulators schemes considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Abe to analyze the various Optoelectronic Modulators characteristics by applying basic engineering knowledge
	PSO2	3	Abe to develop the Optical Switching components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of Optoelectronic Integrated Circuits
	PO2	3	Apply the engineering knowledge to analyse the performance of Optoelectronic Integrated Circuits
	PO3	3	Understand the working of Optoelectronic Integrated Circuits that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Identify and analyse the problems involved in the Optoelectronic Integrated Circuits
	PSO1	3	Apply the concepts of Optoelectronic Integrated Circuits for solving complex problems
	PSO2	3	Abe to understand the design of hybrid and Monolithic Integration for industrial and societal requirements

B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)	• Overview of satellite systems in relation to other terrestrial systems. • Study of satellite orbits and launching. • Study of earth segment and space segment components. • Study of satellite access by various users and coding methods. • Study of various applications in satellite communication
Course Outcomes	**At the end of the course, the students will be able to** CO1: Learn basic concepts of satellite communication systems and coordinate systems for launchingsatellite. CO2: Acquireknowledgeaboutgeostationaryorbitsandvariousblocksofspacesegment. CO3: DesignofEarthstationandspacelinkingsatellitesystem. CO4: Explain how analog and digital technologies are used for satellite communication networks with codingschemes. CO5: Explain the applications of satellitecommunication

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Overview of Satellite Systems, Orbits and Launching Methods
Introduction – Frequency Allocations for Satellite Services – Intelsat – U.S.Domsats – Polar Orbiting Satellites – Problems – Kepler's Law –Definitions of Terms for Earth-orbiting Satellites – Orbital Elements – Apogee and Perigee Heights – Orbital Perturbations –Inclined Orbits – Calendars – Universal Time – Julian Dates – Sidereal Time – The Orbital Plane – The Geocentric-Equatorial Coordinate System – Earth Station Referred to the IJK Frame – The Top centric-Horizon Co-ordinate System – The Sub-satellite Point – Predicting Satellite Position. [9]

Geostationary Orbit & Space Segment
Introduction – Antenna Look Angels – The Polar Mount Antenna – Limits of Visibility – Near Geostationary Orbits – Earth Eclipse of Satellite – Sun Transit Outage – Launching Orbits – Problems – Power Supply – Attitude Control – Spinning Satellite Stabilization – Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders – Wideband Receiver – Input Demultiplexer – Power Amplifier – Antenna Subsystem – Morelos – Anik-E – Advanced Tiros-N Spacecraft [9]

Earth Segment & Space Link
Introduction – Receive-Only Home TV Systems – Master Antenna TV System – Community Antenna TV System – Transmit-Receive Earth Stations – Problems – Equivalent Isotropic Radiated Power – Transmission Losses – Free-Space Transmission – Feeder Losses – Antenna Misalignment Losses – Fixed Atmospheric and Ionospheric Losses – Link Power Budget Equation – System Noise – Carrier-to-Noise Ratio – Uplink – Saturation Flux Density – Input Back Off – The Earth Station HPA – Downlink – Output Back off – Satellite TWTA Output – Effects of Rain –Combined Uplink and Downlink C/N Ratio. [9]

Satellite Accessand coding methods
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption, Coding Schemes. [9]

Satellite Applications
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH)[9]

Total Hours : 45

Text book(s):	
1	Dennis Roddy, 'Satellite Communications', McGraw-Hill Publication, 4thEdition, 2006.
2	Timothy Pratt , Charles Bostian& Jeremy Allmuti, 'Satellite Communications', John Willy & Sons (Asia) Pvt. Ltd. 3rd Edition, 2019.

Reference(s):	
1	Wilbur L. Pritchars Henri G. SuyderHond Robert A.Nelson, 'Satellite Communication Systems Engineering', Pearson Education Ltd., 2nd Edition, 2003.
2	M.Richharia, 'Satellite Communication Systems (Design Principles)', Macmillan Press Ltd., 2nd Edition 2017.
3	K.N. Raja Rao, 'Fundamentals of Satellite Communications', PHI, 2004

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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4	D.C Agarwal , 'Satellite Communication', Khanna Publications, Mc.Graw Hill, 5th Edition, 2008

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3				3	3	3		3	3	3	3
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of frequency allocation Satellite Services and its orbiting satellites
	PO2	3	Apply the knowledge to analyze the given problem to design of Apogee and Perigee and its orbital plane
	PO3	3	Design the orbits and launching methods that meet the specified needs
	PO4	3	Use research-based knowledge analysis and interpretation of data in Geocentric-Equatorial Coordinate System
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge in design of satellite communication and its applications
	PSO2	3	Design the different satellite launching methods considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of Geostationary Orbit and its applications
	PO2	3	Apply the knowledge of geostationary orbits and its automation
	PO3	3	Design the different Satellite Stabilization by considering environmental and societal requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of various Satellite transponders
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge in design of various Geostationary Orbit
	PSO2	3	Design the various Satellite transponders by considering different environmental conditions
CO3	PO1	3	Apply the various TV Systems and applications
	PO2	3	Apply the knowledge to analyze the various space inking systems
	PO3	3	Develop the Transmit-Receive Earth Stations considering environmental and societal requirements
	PO4	3	analysis and interpretation of data and identify the problems for further investigations of inking systems
	PO8	3	Apply the ethical principles and commit to professional ethics to uplink and downlink the data through satellite
	PO9	3	Function effectively as a member of leader to launch the satellite systems
	PO10	3	Communicate effectively on complex engineering activities like uplink and downlink the data.
	PSO1	3	Compare the various the space inking by applying basic engineering knowledge
	PSO2	3	Design the uplink and downlink the data through satellite in a shortest way to meet the defenses requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in designing different Antenna TV systems

CO4	PO1	3	Apply the basic fundamentals of modulation and multiplexing methods and its applications
	PO2	3	Apply the knowledge to analyze the digital transmission systems
	PO3	3	Design the different multiple access in considering environmental and societal security requirements
	PO4	3	Use research-based knowledge analysis and interpretation of spread spectrum communication
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge and coding methods
	PSO2	3	Design the multiple access to industrial and societal security requirements
CO5	PO1	3	Apply the fundamental concepts to satellite navigational systems and its applications
	PO2	3	Apply the engineering knowledge to analyze mobile satellite services used in satellite systems
	PO3	3	Design GPS position and location principles that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Use research-based knowledge analysis and interpretation of direct broadcast satellite systems
	PSO1	3	Apply the concepts of different satellite application for solving complex problems
	PSO2	3	Develop GPS Position location principles with considering industrial and societal requirements

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50 EC E45 - VLSI Signal Processing

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- Introduce techniques for altering the existing DSP structures to suit VLSI implementations.
- Learn the various transformations include retiming folding and unfolding.
- Understand various fast convolution techniques.
- Introduce the algorithmic and numerical strength reduction methods for performance improvement
- Understand low power processors for signal processing and wireless applications

Course Outcomes

At the end of the course, the students will be able to

CO1: Learn the basics of DSP systems and process of pipelining, retiming
CO2: Analysis of digital filters using folding and unfolding for critical path reduction
CO3: Describe the techniques of fast convolution algorithm
CO4: Analyze the Power Reduction techniques in filters
CO5: Analyze the power Estimation techniques in VLSI signal processing

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to DSP
Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms.Iteration Bound–data flow graph representations, loopbound and iteration bound, Longest path Matrix algorithm.
Pipelining and Parallel Processing: Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power.
Retiming: Introduction – Definitions and Properties – Solving System of Inequalities – Retiming Techniques. [9]

Folding and Unfolding
Folding: Introduction -Folding Transform – Register minimization Techniques – Register minimization in folded architectures – folding of multirate systems Unfolding: Introduction – An Algorithm for Unfolding – Properties of Unfolding – critical Path, Unfolding and Retiming – Applications of Unfolding. [9]

Fast Convolution

Introduction – Cook-Toom Algorithm – Winogard algorithm – Iterated Convolution – Cyclic Convolution – Design of Fast Convolution algorithm by Inspection. [9] **Algorithmic Strength Reduction in Filters and Transforms** Introduction, Parallel FIR filters, Two-parallel and three-parallel low-complexity FIR filters, 3-parallel fast FIR filter, Parallel filter algorithms from linear convolutions, Discrete Cosine Transform and Inverse DCT. [9] **Low Power Design** Scaling Vs Power Consumption –Power Analysis, Power Reduction techniques –Power Estimation Approaches Programmable DSP: Evaluation of Programmable Digital Signal Processors, DSP Processors for Mobile and Wireless Communications, Processors for Multimedia Signal Processing. [9]
Total Hours : 45

Text book(s):	
1	KeshabKParhi, 'VLSI Digital Signal Processing Systems Design and Implementation', Wiley - Inter science, 2008.
2	Kaushik Roy and Sharat C. Prasad, 'Low-Power CMOS VLSI Circuit Design', Wiley- Interscience, 2000.
Reference(s):	
1	S.Y. Kuang, H.J. White house, T. Kailath, 'VLSI and Modern Signal Processing', Prentice Hall of India Private Ltd., 2013.
2	Uwe Meyer Baese, 'Digital Signal Processing with Field Programmable Gate Arrays', Springer, 2014.
3	Chandrakasan, R. Brodersen , 'CMOS Low Power Digital Design', Kluwer Academic Publications. 1995..
4	Christian Piguet, 'Low-power CMOS circuits: technology, logic design and CAD tools', CRC Press, Taylor & Francis Group, 2006.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3				3	3	3		3	3	3	3
CO5	3	3	3	3									3	3	

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO1	3	Apply the basic fundamentals of signal processing for solving complex problems in DSP algorithms
	PO2	3	Apply the knowledge to analyze the given problem in the area of pipelining
	PO3	3	Understand iteration bound and dataflow graphs considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing siganal processing systems and identify the problems
	PSO1	3	Solve complex Engineering problems in iteration bound by applying basic engineering knowledge
	PSO2	3	Able to develop the methods to find iteration and loop bound considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of filters to analyze folding and unfolding
	PO2	3	Apply the knowledge to analyze the register minimization techniques

	PO3	3	Understand the folding of multi-rate systems considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on unfolding and retiming
	PSO1	3	Analyze the folding and unfolding by applying basic engineering knowledge
	PSO2	3	Able to develop the solution for critical path in folding and unfolding considering different environmental conditions
CO3	PO1	3	Apply the fundamental concepts for fast convolution algorithm
	PO2	3	Apply the knowledge to analyze the given problem to design system using cook-toom and winograd algorithm
	PO3	3	Understand the different convolution types by considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on iterated convolution and cyclic convolution and identify the problems for further investigations
	PSO1	3	Compare the various algorithms by applying basic engineering knowledge
	PSO2	3	Able to design the fast convolution techniques considering telecommunication industrial requirements
CO4	PO1	3	Apply the fundamental concepts to reduce the power consumption in ICs
	PO2	3	Apply the knowledge of engineering to analyze the given problem to design low power FIR filters.
	PO3	3	Understand the complexity parallel FIR filters considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO8	3	Apply ethical responsibilities to develop the VLSI signal processing systems implementing Discrete Cosine Transform and Inverse DCT.
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Create effective reports and design documentation, make effective paper presentations related to VLSI signal processing
	PO12	3	Develop interest in building more reliable VLSI signal processing system considering wider advanced technological changes
	PSO1	3	Able to analyze the various Algorithmic Strength Reduction in Filters by applying basic engineering knowledge
	PSO2	3	Able to develop the parallel low-complexity FIR filters and fast FIR filters considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the fundamental concepts power analysis and power estimation approaches in Integrated Circuits
	PO2	3	Apply the engineering knowledge to analyze the performance of VLSI signal processors.
	PO3	3	Understand the working of signal processing applications that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Identify and analyze the problems involved in the Evaluation of Programmable Digital Signal Processors
	PSO1	3	Apply the concepts of power Reduction techniques for solving complex problems
	PSO2	3	Able to understand the design of DSP Processors for Mobile and Wireless Communications for industrial and societal requirements

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)

- To study basic concepts of processing speech and audio signals
- To study and analyse various M-band filter-banks for audio coding
- To understand audio coding based on transform coders
- To study time and frequency domain speech processing methods
- To understand the predictive analysis of speech.

Course Outcomes

At the end of the course, the students will be able to

CO1: Describe and Analyse the modeling of speechsignal and audio signal

CO2: Explain the concepts and transform techniques of filter banks in speech and audio processing

CO3: Describe various audio coding and transform coders

CO4: Analyse the time domain and frequency domain methods for speech processing

CO5: Explain the predicitive analysis of speech using various methods.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Mechanics of Speech and Audio

Introduction - Review of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Absolute Threshold of Hearing- Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Non- simultaneous Masking - Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality. [9]

Time-Frequency Analysis: Filter Banks and Transforms

Introduction - Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters - Tree-Structured QMF and CQF M-band Banks - Cosine Modulated 'Pseudo QMF' M-band Banks -Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Pre-echo Control Strategies. [9]

Audio Coding and Transform Coders

Lossless Audio Coding – Lossy Audio Coding - ISO-MPEG-1A, 2A, 2A-Advaned, 4A Audio Coding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder –Brandenburg - Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding –Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization -MDCT with Vector Quantization. [9]

Time and Frequency Domain Methods for Speech Processing

Time domain parameters of Speech signal – Methods for extracting the parameters :Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods Homomorphic Speech Analysis: Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders. [9]

Predictive Analysis of Speech

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method– Covariance method – Solution of LPC equations – Cholesky method – Durbin"s Recursive algorithm– Lattice formation and solutions–Comparison of different methods–Application of LPC parameters– Pitch detection using LPC parameters – Formant analysis – VELP – CELP. [9]

Total Hours : 45

Text book(s):

1	B.Gold and N.Morgan, 'Speech and Audio Signal: Processing: Processing and Perception of Speech and Music', Wiley and Sons, 2nd Edition, 2011.
2	L. R. Rabiner and R.W. Schafer, 'Digital Processing of Speech Signals', Pearson Education, Delhi, India, 2004.

Reference(s):

1	Mark Kahrs, Karlheinz Brandenburg, Kluwer Applications of Digital Signal Processing to Audio and Acoustics, Kluwer AcademicPublishers,1998.
2	Udo Zölzer, 'Digital Audio Signal Processing', 2ndEdition A John Wiley&sonsLtd, 2ndEdition , 2008

3	Thomas F Quatieri, ‘Discrete-Time Speech Signal Processing – Principles and Practice’, Pearson Education, 2004.
4	Claudio Becchetti and Lucio PrinaRicotti, ‘Speech Recognition’, John Wiley and Sons, 1999.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3				3	3	3		3	3	3	3
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO1	3	Apply the mathematical concepts and Mechanics of Speech and Audio
	PO2	3	Apply the knowledge to analyse the modeling of speech signal and audio signal
	PO3	3	Develop the speech modeling for considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing speech modeling and identify the problems
	PSO1	3	Perform the speech processing by applying basic engineering knowledge
	PSO2	3	Develop the speech processing Mechanics for considering industrial and societal requirements
CO2	PO1	3	Apply the concepts and transform techniques of filter banks
	PO2	3	Apply the knowledge to analyse the Filter Banks and Transforms
	PO3	3	Develop the Time-Frequency Analysis for a Filter Banks
	PO4	3	Conduct the detailed literature survey on filter banks in speech and audio processing
	PSO1	3	Compare different Filter Banks and Transforms estimation methods by applying basic engineering knowledge
	PSO2	3	Design the Filter Banks for considering industrial and societal requirements
CO3	PO1	3	Apply the various audio coding and transforms concepts
	PO2	3	Apply the engineering knowledge to analyse the audio coding and transform coders
	PO3	3	Develop the various audio coding and transform coders considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on various audio coding and transform coders and identify the problems
	PSO1	3	Compare the various audio coder and transform coder by applying basic engineering knowledge
	PSO2	3	Design the audio coder and transform coder considering industrial and societal requirements
CO4	PO1	3	Apply time domain and frequency domain for speech processing
	PO2	3	Apply the engineering knowledge to analyse the time domain and frequency domain approach

	PO3	3	Develop the time and frequency domain algorithms considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on time domain and frequency domain methods for speech processing
	PO8	3	Apply ethical responsibilities to Time and Frequency Domain Methods and ensuring industrial safety
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO12	3	Develop more reliable time domain and frequency domain methods for considering industrial requirements
	PSO1	3	Perform the various time domain and frequency domain methods by applying basic engineering knowledge
	PSO2	3	Develop the time domain and frequency domain algorithms for considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO5	PO1	3	Apply the predicitive analysis for speech and audio processing
	PO2	3	Apply the knowledge to analyse Linear Prediction problem
	PO3	3	Develop the predicitive speech processing algorithms considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing Linear Prediction and identify the problems
	PSO1	3	Perform the Linear Prediction problem by applying basic engineering knowledge
	PSO2	3	Develop the speech Prediction algorithms considering industrial conditions

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E47 – High Speed Networks								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To familiarize High Speed Networks • To learn different wireless LAN network technologies and its application • To learn the concept about asynchronous transfer mode • To know techniques involved to support real-time traffic and congestion control • To know the QoS and role of support protocols in Highspeed networks							
Course Outcomes	**At the end of the course, the students will be able to :** CO1: Discuss the concept of ISDN and frame relay in high speed network CO2: Describe the architecture of high speed WLAN technologies CO3: Illustrate the concepts of asynchronous transfer mode CO4: Explain the effect of congestion control and traffic management in data transmission CO5: Describe the architecture of integrated services and differentiated services, support Protocols							

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

High Speed Networks

Introduction to High Speed networks, ISDN: Conceptual view – Standards – Transmission structure – B-ISDN standards and services, protocol architecture - Frame Relay: Frame mode protocol architecture – Call control – LAPF – Frame Relay Congestion Control. [9]

High Speed LANs

Introduction – WLAN technologies: applications, requirements – IEEE 802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee. [9]

Asynchronous Transfer Mode

Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories – AAL - Traffic and Congestion control in ATM - Requirements - Attributes - Traffic Management Frame work, Traffic Control – ABR traffic Management - ABR rate control, RM cell formats, ABR Capacity allocations. [9]

TCP Congestion Control and Traffic Management

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks- The Need for Flow and Error Control – Link Control Mechanisms – ARQ Performance – TCP Flow Control – TCP Congestion Control – Performance of TCP Over ATM. [9]

QoS and Support Protocols in IP Networks

Integrated Services: Architecture – Approach, Components, Services – Queuing Discipline : FQ, PS, BRFQ, GPS, WFQ – Random Early Detection – Differentiated Services- Resource Reservation : RSVP – Multi protocol Label Switching – Real Time Transport Protocol. [9]

Total Hours : 45

Text book(s):

1	William Stallings, 'ISDN and Broadband ISDN with Frame Relay and ATM', 4th Edition, PHI, 2004. (Unit I)
2	William Stallings, 'High Speed Networks and Internet', Pearson Education, 2002. (Unit III,IV,V)

Reference(s):

1	Jochen Schiller,' Mobile Communications', 2nd Edition, Pearson Education 2012. (Unit II)
2	Warland, PravinVaraiya, 'High Performance Communication Networks', Jean Harcourt Asia, 2001.
3	IrvanPepelnjk, Jim Guichard and Jeff Apcar, 'MPLS and VPN Architecture', Cisco Press, Volume 1 and 2, 2003.
4	Anurag Kumar, D.Manjunath, Joy kuri, 'Wireless Networking', 1st Edition, Elsevier, 2011.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3				3	3	3		3	3	3	3
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge in identifying the appropriate channel access techniques for both wired and wireless high speed networks
	PO2	3	Apply the knowledge to analyse the given problem to design the different types of networks
	PO3	3	Classify the different Wireless standards considering environmental and societal requirements
	PO4	3	Conduct the experiments, analyse and interpret data from different bandwidth channels of a given network.
	PSO1	3	Calculate the high speed network performance by applying basic engineering knowledge in communication filed

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	PSO2	3	Study of various wireless standards like B-ISDN , Frame Relay and its criteria that satisfy the needs of societal requirements
CO2	PO1	3	Apply the Ad hoc networks and WLAN technologies for data effective data communication
	PO2	3	Study of protocol architecture such as 802.11b, 802.11a – Hiper LAN , wireless Local Area Networks and analysing collision principles
	PO3	3	Understand the WLAN technologies for wireless protocols that satisfy societal requirements from which student can develop solutions for complex engineering problems we they go for network domain in industry
	PO4	3	Conduct the detailed literature survey on existing WLAN technologies based data link layer protocols and identify the problems
	PSO1	3	Perform the Ad hoc networks, WLAN techniques on networks by applying basic engineering knowledge
	PSO2	3	Enumerate and understand the WPAN IEEE 802.15.4, Zigbee protocols its constraints that are required for the solving problems in society
CO3	PO1	3	Apply the transport layer protocols for making communication between transport layers providing effective process to process delivery
	PO2	3	Apply the knowledge of engineering to analyse the given network through connectionless and connection oriented protocols
	PO3	3	Understand the traffic management and control techniques for providing quality of service to reduce interference
	PO4	3	Conduct the detailed literature survey on existing problems related to quality of service and identify the solutions to new problems
	PSO1	3	Compare the different transport layer protocols by applying basic engineering knowledge
	PSO2	3	Study of TCP and ATM Congestion Control technique that are needed for society and provide solutions
CO4	PO1	3	Apply the knowledge in Integrated Services for making better network performance
	PO2	3	Apply the knowledge of engineering to analyse the QoS in network through various Queuing Discipline methods
	PO3	3	Develop solution in IP network for improving the QoS Services such as packet loss, jitter, and latency
	PO4	3	Understand the TCP functions and the network factors, helps in analyzing and interpreting the quality of networks
	PO5	3	Use the relevant simulators to analyse the performance of QoS using various algorithms like leaky bucket and token bucket,RED
	PO8	3	Understand and study the ethical principles like radiation constraints when routing is applied for a given problem
	PO9	3	Function effectively in teams to develop projects related to network domain
	PO10	3	Communicate effectively with proper documentation and do project presentation.
	PO12	3	Develop interest by acquiring knowledge related to case studies using routing protocols considering wider technological changes
	PSO1	3	Compare the different support protocols for QoS in IP Networks by applying basic engineering knowledge
	PSO2	3	Study of resource reservation technique that are needed for society and provide solutions for a given problem
	PSO3	3	Communicate effectively with proper documentation and do project presentation as a team by acquiring essential interpersonal skills
CO5	PO1	3	Apply the engineering knowledge in network management for high speed networks
	PO2	3	Apply the engineering knowledge to analyse the Network management using various method
	PO3	3	Knowledge of Network Management and Application can be used to design and develop solutions for complex engineering problems
	PO4	3	Conduct the detailed literature survey on High-Speed Networking for Multimedia Applications to provide valid conclusions
	PSO1	3	Apply the concepts of voice over IP and data security for solving complex problems in providing efficient networking
	PSO2	3	Study of products that provide security and data privacy that meet the specific

			needs of industry and society

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E51 - Deep Learning								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100

Objective(s)	• To make the student familiar with the overview of Machine Learning • To enhance the knowledge about Deep Feed Froward Networks for Deep Learning • To enhance the knowledge about Regularization for Deep Learning • To broaden the importance of CNN algorithms in Deep Learning • To broaden the importance of RNN algorithms in Deep Learning
Course Outcomes	**At the end of the course, the students will be able to** CO1: Recall the concepts of machine learning algorithms to solve simple problems CO2: Solve simple problems using the concepts of deep neural networks CO3: Describe the different regularization methods for Deep learning CO4: Explain the knowledge of CNN models and apply in computer vision CO5: Explain the RNN models and apply in Natural Language Processing

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Overview of Machine Learning
Learning Algorithms – Capacity, Overfitting and Underfitting – Hyper parameters and Validation Sets – Estimators, Bias and Variance – Bayesian Estimates – Maximum Likelihood Estimation – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Stochastic Gradient Descent – Building a Machine Learning Algorithm – Challenges Motivating Deep Learning. [9]

Deep Feed forward Networks
Example: Learning XOR – Gradient-Based Learning – Hidden Units – Architecture Design – Back-Propagation and Other Differentiation Algorithms – Random or Unsupervised Features. [9]

Regularization for Deep Learning
Parameter Norm Penalties – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Parameter Sharing – Bagging and Other Ensemble Methods – Dropout – Adversarial Training. [9]

Convolutional Networks
The Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs Efficient Convolution Algorithms. **Applications:** Computer Vision. [9]

Sequence Modeling
Recurrent and Recursive Nets: Recurrent Neural Networks – Bidirectional RNNs – Encoder-Decoder Sequence-to-Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – The Long Short-Term Memory and other Gated RNNs. **Applications:** Natural Language Processing. [9]

Total Hours : 45

Text book(s):

1	Ian Goodfellow, YoshuaBengio, and Aaron Courvill, ‘Deep Learning’, MIT Press, USA, 2016.
2	Josh Patterson and Adam Gibson, ‘Deep Learning – A Practitioner’s Approach’, 1st Edition, O’Reilly Series, August-2017.

Reference(s):

1	Indra den Bakker, ‘Python Deep Learning Cookbook’, 1st Edition, Packt Publishing, 2017.
2	Michael Nielsen, ‘Neural Networks and Deep Learning’, Determination Press, 2015.
3	Eugene Charniak, ’Introduction to Deep Learning’, The MIT Press, –2019.
4	Michelucci, Umberto, ‘Applied Deep Learning, A Case-Based Approach to Understanding Deep Neural Networks’, Apress , 2018.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3				3	3	3		3	3	3	3
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the Machine Learning knowledge in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Problem-Solving Approach to Building a Machine Learning Algorithm.
	PO3	3	Design solutions for Deep Learning in the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use machine learning algorithms including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PSO1	3	Solve complex Problem-Solving Approach to machine learning algorithms by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design machine learning algorithms and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO2	PO1	3	Apply the Deep Feed forward Network Techniques in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Architecture Design.
	PO3	3	Design solutions for Differentiation Algorithms for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide Random or Unsupervised Features.
	PSO1	3	Solve complex Deep Feed forward Network by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design and develop Architecture that meet the specific needs of industry and society in Electronics and Communication Engineering
CO3	PO1	3	Apply the Regularization for Deep Learning in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Dataset Augmentation.
	PO3	3	Design solutions for Noise Robustness for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid Bagging and Other Ensemble Methods.
	PSO1	3	Solve complex Regularization for Deep Learning by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design and develop Parameter Norm Penalties that meet the specific needs of industry and society in Electronics and Communication Engineering
CO4	PO1	3	Apply the knowledge of Convolutional Networks in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Algorithms for Computer Vision.
	PO3	3	Design solutions for Convolution Algorithms for the public health and safety, and the

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			cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for Variants of the Basic Convolution Function.
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice for Learning in Computer Vision.
	PO9	3	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings for Quantifying uncertainty in the Convolution Operation.
	PO10	3	Communicate effectively on complex engineering activities and make effective presentations, and give and receive clear instructions for Efficient Convolution Algorithms.
	PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change in Learning computer vision.
	PSO1	3	Solve complex Planning in Convolutional Networks and Decision Making by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Solve complex desires of Computer Vision by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for Efficient Convolution Algorithms.
CO5	PO1	3	Apply the knowledge of Sequence Modeling in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Quantifying uncertainty in Recurrent and Recursive Nets.
	PO3	3	Design solutions for Natural Language Processing for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for Deep Recurrent Networks.
	PSO1	3	Solve complex Sequence Modeling by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for Natural Language Processing.

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E52 - Micro Electro Mechanical Systems								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100
Objective(s)	• To introduce and provide a broad view of MEMS and micro systems. • To familiarize with the fundamentals of MEMS products, materials for microsystems • To learn the microsystem fabrication process • To know the various MEMS-specific design issues and constraints • To learn the applications of microsensors and microactuators							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Discuss the basic principles of MEMS sensors and actuators. CO2: Describe the various materials used for MEMS products. CO3: Familiarize with the fabrication process of MEMS devices. CO4: Explain the design consideration, issues and constraints of basic MEMS sensors and							

	actuators. CO5: Describe the diverse applications of MEMS sensors.

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction

Overview – MEMS and micro system products – Microsystems and Microelectronics – Working Principle of Microsystems – Micro actuation techniques. [12]

Practical: Designing a tilt sensor

Materials for Microsystems

Substrate and wafer – single crystal silicon wafer formation – ideal substrates – Mechanical properties – silicon compounds – SiO_2, SiC, $Si_3N_4$and polycrystalline silicon – Silicon piezo resistors – Gallium arsenide - quartz – Piezoelectric crystals - polymers. [12]

Practical: Vibration sensing usingPiezoelectric

Micro System Fabrication Process

Photolithography – Ion implantation – Diffusion – oxidation – CVD – physical vapor deposition- Deposition by epitaxy – etching process. [12]

Practical: Fabricating a MEMS Heater

Micro System Design

Design considerations- Process design- mask layout design – Design constraints – Selection of Materials – Manufacturing Process - Signal transduction – packaging – Application of Micro system in automotive industry – Biomedical – Aerospace – telecommunication. [12]

Practical: Demonstrating working of 3 axis accelerometer

Micro Sensors

Introduction – Microsensors – Biomedical sensors – Pressure sensors – Thermal Sensors – Chemical sensors – Optical sensors – Microactuation – MEMS with actuators.

Practical: Demonstrating working of pressure sensor [12]

Total Hours : 30+30(Practical) =60

Text book(s):

1	Tai-Ran Hus, 'MEMS & Microsystems Design, Manufacture and Nanoscale engineering', John Wiley & Sons, 2013.
2	Julian W.Gardner, Vijay K.Varadan, Osama O.Awadel Karim, 'Microsensors MEMS and Smart Devices', John Wiley & sons, 2011.

Reference(s):

1	Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2	Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3	James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
4	Thomas M.Adams and Richard A.Layton, 'Introduction MEMS, Fabrication and Application,' Springer, 2010.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO 1	3	Apply the principles of MEMS sensors and actuators application

	PO 2	3	Analyze engineering problems and ways to solve using MEMS sensors
	PO 3	3	Design the process to solve the societal problems with MEMS sensors and actuators
	PO 4	3	Research and analyze the data to design solution using actuators
	PSO 1	3	Compare the various MEMS techniques and actuators by applying basic engineering knowledge
	PSO 2	3	Design system components using MEMS sensors and develop solutions that meet specific needs
CO2	PO 1	3	Apply the knowledge of various materials used for MEMS products
	PO 2	3	Analyzes the problem that can be controlled using MEMS products
	PO 3	3	Development of solution designed using various materials for MEMS products
	PO 4	3	Conduct the detailed survey on various materials used for MEMS products and identify the problems for further investigations
	PSO 1	3	Compare the various materials and apply basic engineering knowledge to find solution
	PSO 2	3	Design a project with the materials used for MEMS products
CO3	PO 1	3	Apply the process of fabrication of MEMS products
	PO 2	3	Analyzes the process and applying in problem solving
	PO 3	3	Development of MEMS products by fabricating own devices
	PO 4	3	Conduct the detailed survey on process involved in fabrication of MEMS devices
	PSO 1	3	Compare the various fabrication process applying basic engineering knowledge
	PSO 2	3	Design a project with MEMS sensors to solve societal problems
CO4	PO 1	3	Apply the knowledge to create a solution for a real time application using MEMS sensors
	PO 2	3	Analyzes design consideration, issues and constraints of basic MEMS sensors and actuators.
	PO 3	3	Development of MEMS sensors and design to solve real filed problem
	PO 4	3	Conduct the detailed survey on different issues and constraints in problems for further investigations
	PSO 1	3	Compare the various MEMS sensors and actuators to solve complex engineering problems
	PSO 2	3	Design a project applying MEMS sensors and actuators
CO5	PO 1	3	Apply the knowledge of diverse applications of MEMS sensors to develop solutions
	PO 2	3	Analyzes diverse applications of MEMS sensors in various fields
	PO 3	3	Development of MEMS sensors for application
	PO 4	3	Conduct the detailed survey of MSME sensors in application field
	PO 8	3	Apply ethical principles in development of solution using MEMS sensors
	PO 9	3	Function effectively in teams and as individual to apply MEMS sensors in solution designs
	PO 10	3	Writeeffective reports and design document to represent idea
	PO 12	3	Develop interest to learn further techniques and implement the idea in societal problems
	PSO 1	3	Compare the various fields of application of MEMS sensors
	PSO 2	3	Design a project applying MEMS sensors
	PSO 3	3	Develop interpersonal skills and attitude needed for ethicalleadership teamwork

K.S.Rangasamy College of Technology – Autonomous R 2018				
50 EC E53 - Wireless Sensor Networks				
B.E. Electronics and Communication Engineering				
Semester	Hours / Week	Total	Credit	Maximum Marks

	L	T	P	hrs	C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100

Objective(s)	• To understand the concepts of wireless sensor networks • To understand the architecture for WSN and design WSN to analyse its performance • To understand the layer approach in sensor networks • To establish the new infrastructure model. • To have an exposure to mote programming platforms and tools
Course Outcomes	CO1: Examine the basics of Wireless Sensor Networks and its design principles CO2: Learn the architecture and placement strategies of Sensors CO3: Apply the knowledge to identify appropriate layer protocols with the suitable routing algorithm based on the network and user requirement CO4: Describe the establishment of the networking infrastructure CO5: Build basic modules and be familiar with the OS used in Wireless Sensor Networks

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction of Wireless Sensor Networks

Challenges for wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture, Hardware components, Energy consumption of sensor nodes, Network architecture, Sensor network scenarios, Design principles. [9]

Architectures

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. [9]

Networking Sensors

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing. [9]

Infrastructure Establishment

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control. [9]

Sensor Network Platforms and Tools

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming. Case Studies. [9]

Total Hours : 45

Text book(s):

1	Holger Karl & Andreas Willig, ‘Protocols And Architectures for Wireless Sensor Networks’, John Wiley, 2007.
2	Feng Zhao & Leonidas J. Guibas, ‘Wireless Sensor Networks- An Information Processing Approach’, Elsevier, 2007

Reference(s):

1	Sitharama Iyengar S, Nandan Parmeshwaran, Balkrishnan N and Chuka D, ‘Fundaments of Sensor Network Programming, Applications and Technology’, John Wiley & Sons, 2011.
2	Fei Hu and Xiaojun Cao, ‘Wireless Sensor Networks Principles and Practice’, CRC Press, 2010.
3	Kazem Sohraby, Daniel Minoli, &TaiebZnati, ‘Wireless Sensor Networks-Technology, Protocols, And Applications’, John Wiley, 2007.
4	Anna Hac, ‘Wireless Sensor Network Designs’, John Wiley, 2017.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	

CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of Wireless Sensor Networks to the solution for solving complex problems in ciphers
	PO2	3	Apply the knowledge to analyse the given problem to design of Wireless Sensor Networks
	PO3	3	Design theWireless Sensor Networks components that meet the specified needs
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of Wireless Sensor Networks applications
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge indesign of Wireless Sensor Networks applications
	PSO2	3	Design the different Wireless Sensor Networks applications considering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of Sensors in various applications
	PO2	3	Apply the knowledge of Sensors in industry and automation
	PO3	3	Design the different Sensors by considering environmental and societal requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of various Sensors
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge indesign of various Sensors
	PSO2	3	Design the various Sensors by considering different environmental conditions
CO3	PO1	3	Apply the routing algorithm in various wireless sensor network applications
	PO2	3	Apply the knowledge to analyse the given problem in routing algorithm related to cost and hop count
	PO3	3	Develop the routing algorithm considering environmental and societal requirements
	PO4	3	analysis and interpretation of data and identify the problems for further investigations in routing algorithm
	PSO1	3	Compare the various routing algorithm by applying basic engineering knowledge
	PSO2	3	Design the of shortest path cost effective algorithm considering the IT industrial requirements
CO4	PO1	3	Apply the basic fundamentals of establishment of the networking infrastructureto the solution for solving complex problems in wireless sensor networks applications
	PO2	3	Apply the knowledge to analyse the given problem to establishment of the network infrastructure
	PO3	3	Design the network infrastructure in considering environmental and societal security requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of network infrastructure
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge in building network infrastructure

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	PSO2	3	Design the network infrastructure considering industrial and societal security requirements
CO5	PO1	3	Apply the fundamental concepts to develop OS used in Wireless Sensor Networks
	PO2	3	Apply the engineering knowledge to analyse OS used in Wireless Sensor Networks
	PO3	3	Design operating for system wireless sensor network that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Use research-based knowledge analysis and interpretation of data in developing operating system
	PO8	3	Apply ethical responsibilities to develop the communication systems implementing operating system wireless sensor network
	PO9	3	Function effectively in teams to develop and manage industrial sensorprojects
	PO10	3	Develop interest in building more reliable communication system considering wider technological changes in development of operating system
	PO12	3	life-long learning in the broadest context of technological change in development of operating system
	PSO1	3	Apply the concepts of wireless sensor networks for solving complex problems in developing operating system
	PSO2	3	Develop OS and related sensor components with considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in designing operating system for WSN

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 EC E54 - Wavelets and Its Applications								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100

Objective(s)	• To introduce the fundamentals concepts of wavelet transforms. • To study about multi resolution and discrete wavelet transform • To understand the design of wavelet system • To learn the fundamentals of wavelet families • To learn the applications of different wavelets
Course Outcomes	**At the end of the course, the students will be able to** CO1: Outline the fundamentals of wavelets CO2: Develop the multi resolution formulation of wavelet systems and filter banks CO3: Discuss about wavelet system design CO4: Analyse the properties and applications of wavelet families CO5: Discuss about images and signal based wavelet applications

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Wavelets

Introduction to Multirate signal processing- Decimation and Interpolation, Quadrature Mirror Filters, Subband coding, Limitations of Fourier transform, Short time Fourier transform and its drawbacks, Continuous Wavelet transform, Time frequency representation, Wavelet System and its characteristics, Orthogonal and Orthonormal functions and function space [9]

Multi resolution Concept and Discrete Wavelet Transform

Multi resolution formulation of wavelet systems- signal spaces, scaling function, wavelet function and its properties, Multi resolution analysis, Haar scaling and wavelet function, Filter banks-Analysis and Synthesis, 1D and 2D Discrete wavelet transform, Wavelet Packets, Tree structured filter bank, Multichannel filter bank, Undecimated wavelet transform. [9]

Wavelet System Design
Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Daubechies orthogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets. [9]

Wavelet Families
Continuous Wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Meyer wavelets. Orthogonal wavelets- Properties of Haar wavelets, Daubechies wavelets, Symlets, Coiflets and Discrete Meyer wavelets. Properties of Biorthogonal wavelets, Applications of wavelet families. [9]

Wavelet Applications
Denoising of Signals and Images, Image enhancement, Edge detection, Image Fusion, Image compression, Wavelet based feature extraction, Analysis of phonocardiogram signals, Analysis of EEG signals, Speech enhancement for hearing aids. [9]

Total Hours : 45

Text book(s):

1	C.Sidney Burrus, Ramesh A.Gopinath and Haitao Guo, 'Introduction to Wavelets and Wavelet Transform', Prentice Hall, 2005.
2	G.Strang and T.Nguyen, 'Wavelet and Filter Banks', Wesley and Cambridge Press, 1996.

Reference(s):

1	MetinAkay, 'Time Frequency and Wavelets in Biomedical Signal Processing', Wiley-IEEE Press, 1997.
2	P.P.Vaidyanathan, 'Multi rate Systems and Filter Banks', Pearson, 2006.
3	Raguveer M Rao and Ajith S. Bopardikar, 'Wavelet Transforms – Introduction to Theory and Applications', Addison Wesley, 2001.
4	M.Vetterli and J. Kovacevic, 'Wavelets and Sub Band Coding', Prentice Hall, 1995.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply basic concepts of wavelets
	PO2	3	Apply the knowledge to analyse the given problem to design the the fundamentals of wavelets
	PO3	3	Design the fundamentals of wavelets components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Performthe signal processing by applying basic engineering knowledge
	PSO2	3	Design the fundamentals of wavelets components considering industrial and societal requirements
CO2	PO1	3	Apply the Basic principles of multi resolution formulation of wavelet systems and filter banks
	PO2		Apply the knowledge to analyse the Basic principles to design wavelet systems

		3	and filter banks
	PO3	3	Design the functions of various wavelet systems and filter banks techniques considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on various wavelet systems and filter banks and identify the problems
	PSO1	3	Perform the different usage of basic principles by applying basic engineering knowledge
	PSO2	3	Design the reliable wavelet systems and filter banks modules considering different environmental conditions
CO3	PO1	3	Apply the digital techniques for wavelet system design
	PO2	3	Apply the knowledge to analyse the given problem wavelet system design
	PO3	3	Develop the wavelet system design components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing design techniques and identify the problems for further investigations
	PSO1	3	Compare the various digital techniques by applying basic engineering knowledge
	PSO2	3	Design the wavelet system design considering Digital electronics industrial requirements
CO4	PO1	3	Apply the different techniques for operating the properties and applications of wavelet families
	PO2	3	Apply the knowledge of engineering to analyse the given problem to the properties and applications of wavelet families
	PO3	3	Develop the properties and applications of wavelet families considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Measure the analysis of the properties and applications of wavelet families by applying basic engineering knowledge
	PSO2	3	Develop the properties and applications of wavelet families considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of images and signal based wavelet applications
	PO2	3	Apply the engineering knowledge to analyse the concepts of images and signal based wavelet applications
	PO3	3	Develop the algorithms for analysis the concepts of images and signal based wavelet applications
	PO4	3	Conduct the detailed literature survey the concepts of images and signal based wavelet applications
	PO8	3	Apply ethical principles to w images and signal based wavelet applications ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manageindustrial projects
	PO10	3	Communicate effectively with proper documentation invarious technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable images and signal based wavelet applications techniques considering wider technological changes
	PSO1	3	Apply analysis the concepts of images and signal based wavelet applications and its application for solvingcomplex problems
	PSO2	3	Design the concepts of images and signal based wavelet applications and its application consideringindustrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation invarious technical events like paper presentation etc. by acquiring essential interpersonal skills

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<table>
<tr><th colspan="10">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="10">50 EC E55 – Green Communication</th></tr>
<tr><th colspan="10">B.E. Electronics and Communication Engineering</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VIII</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To learn the fundamentals of green communication and modulation techniques.
• To familiarize different concepts and basic principles of energy conservation techniques
• To expose to the concepts of energy harvesting systems
• To help the learners to design a future architecture for green communication and networking
• To give exposure to implement green communication by overcoming technical challenges and in measurement of energy gain for future opportunities</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Describe the energy harvesting techniques and modulation schemes
CO2: Illustrate the energy conservation and energy optimization techniques
CO3: Analyse the design issues in EM energy harvesting schemes and energy scavenging techniques
CO4: Explain the mixed signal and low power techniques and its comparison
CO5: Analyse energy consumption of WSN</td></tr>
</table>

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Green Communication Fundamentals

Fundamental tradeoffs on the design of green radio networks: Insight from Shannon's capacity formula - impact of practical constraints - algorithms for energy harvesting wireless networks: Energy harvesting technologies - PHY and MAC layer optimization for energy harvesting wireless networks –Green modulation and coding schemes in energy-constrained wireless networks. [9]

Energy Conservation on Various Applications

QoE-Based Energy Conservation for VoIP-Applications in WLAN, Minimum Energy Multi-criteria Relay Selection in Mobile Ad Hoc Networks; Energy Optimization Techniques for Wireless Sensor Networks. [9]

Energy Harvesting Systems

Design Issues in EM Energy Harvesting Systems, Energy Scavenging for Magnetically Coupled Communication Devices-Case study. [9]

Techniques on Energy Harvesting Systems

Mixed-Signal- Low-Power Techniques in Energy-Harvesting Systems- Toward Modeling Support for Low-Power and Harvesting Wireless Sensors for Realistic Simulation of Intelligent Energy-Aware Middleware. [9]

Energy Harvesting and Management on WSNs

Energy Consumption Profile for Energy Harvested WSNs, Radio Frequency Energy Harvesting and Management for Wireless SensorNetworks. [9]

Total Hours : 45

Text book(s):

1	H. Venkataraman, Gabriel-miroMuntean, 'Green Mobile Devices and Networks: Energy Optimization and Scavenging Techniques', CRC Press, 2012.
2	Ekram Hossain, Vijay K. Bhargava, Gerhard P. Fettweis, 'Green Radio Communication Networks', Cambridge University Press, 2012.

Reference(s):

1	Jinsong Wu, Sundeep Rangan ,Honggang Zhang , 'Green Communications: Theoretical Fundamentals, Algorithms and Applications', CRC Press ,2012.
2	F. Richard Yu, Xi Zhang, Victor C.M. Leung, 'Green Communications and Networking', CRC Press, 2012
3	BhuvanUnhelkar, 'Green IT Strategies and Applications: Using Environmental Intelligence', CRC Press, 2011.
4	Mohammad S. Obaidat, AlaganAnpalagan and Isaac Woungang, 'Handbook of Green Information and Communication Systems', Academic Press, 2012.

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3				3	3	3		3	3	3	3
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the engineering knowledge to analyse Shannon's capacity formula in radio networks
	PO2	3	Apply the engineering knowledge to analyse energy harvesting technologies
	PO3	3	Develop the coding schemes in the energy constrained wireless networks for environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO8	3	Apply ethical principles to compare various wireless networks with respect to impact of practical constraints
	PO9	3	Function effectively in teams to develop and manage industrial projects
	PO10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc
	PO12	3	Develop interest in building more reliable green communication networks considering wider technological change
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	3	Design the communication system components considering industrial and societal requirements
	PSO3	3	Communicate effectively with proper documentation in various technical events like paper presentation etc. by acquiring essential interpersonal skills
CO2	PO1	3	Apply the different energy conservation techniques for various applications
	PO2	3	Apply the knowledge to analyse minimum energy multi criteria relay selection in networks
	PO3	3	Design the reliable wireless communication system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing channel coding techniques in energy optimization and identify the problems
	PSO1	3	Perform the different energy conservation by applying basic engineering knowledge
	PSO2	3	Design the energy optimization techniques for wireless sensor networks considering different environmental conditions
CO3	PO1	3	Apply the energy management techniques for different harvesting systems

	PO2	3	Apply the knowledge to analyse the given energy management problem to design the energy harvesting systems
	PO3	3	Develop the energy harvesting systems components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing energy management techniques and identify the problems for further investigations
	PSO1	3	Compare the various harvesting systems techniques by applying basic engineering knowledge
	PSO2	3	Design the magnetically coupled communication devices considering telecommunication industrial requirements
CO4	PO1	3	Apply the different low power techniques in energy harvesting systems
	PO2	3	Apply the knowledge of engineering to analyse the given problem to design low power techniques in energy harvesting systems
	PO3	3	Develop low power techniques in energy harvesting systems considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Measure the power of different harvesting systems by applying basic engineering knowledge
	PSO2	3	Develop the harvesting wireless sensors for realistic simulation of intelligent energy considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of Energy Consumption theory for different Harvested wire sensor networks
	PO2	3	Apply the engineering knowledge to analyse the given wire sensor network
	PO3	3	Develop the algorithms for various source codes for different channel requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing Radio Frequency Energy Harvesting techniques understanding the limitations
	PSO1	3	Apply the concepts of energy harvesting and management for solving complex problems
	PSO2	3	Design the low power Wireless Sensor Network components considering industrial and societal requirements

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50 EC E56 - Multimedia Communication								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• To introduce the concept of multimedia system • To outline the formal procedure for digital audio video processing • To introduce the concept of text and image compression • To outline the concept of VOIP Technology • To introduce the concept of multimedia networking							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain the basic concepts of multimedia system and its application							

	CO2: Discuss about audio compression and video compression techniques CO3: Explain about text and image compression CO4: Discuss about VOIP architecture and challenges CO5: Describe the concepts of multimedia networking and its application

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to Multimedia Systems

Components of multimedia system. Desirable features. Applications of multimedia systems. Introduction to different types. Multimedia storage device. [9]

Audio and Video Compression

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perceptual coding Video compression –principles-H.261-H.263-MPEG 1, 2, and 4. [9]

Text and Image Compression

Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding–source encoding-text compression –static Huffman coding dynamic coding –Lempel ziv-welsh Compression-image compression- Still image coding-JPEG. Discrete cosine Transform. Sequential and Progressive DCT based encoding algorithms-Discrete wavelet transform coding and embedded image coding algorithms.

[9]

VOIP Technology

Basics of IP transport, VoIPchallenges, H.323/ SIP –Network Architecture, Protocols,Call establishment and release, VoIP and SS7, Quality of Service-CODEC Methods-VOIP applicability. [9]

Multimedia Networking

Multimedia networking -Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP. [9]

Total Hours : 45

Text book(s):

1	Fred Halshall, ‘Multimedia communication -Applications, Networks, Protocols and Standards’, Pearson Education, 2017
2	KR.Rao,Z S Bojkovic, D A Milovanovic, ‘Multimedia Communication Systems: Techniques, Standards, and Networks’, Pearson Education, 2017.

Reference(s):

1	Mark Nelson, ‘Data Compression Book’, BPB Publication, 2017.
2	Yao Wang, JoernOstermann, and Ya-Qin Zhang, ’Video Processing and Communications’, Prentice Hall, 2016.
3	Kurose and W.Ross, ‘Computer Networking a Top Down Approach’, Pearson Education, 2016.
4	Mihaela van der Schaar. and Philip Chou, ‘Multimedia over IP and Wireless Networks: Compression, Networking, and Systems’, Academic Press, 2017.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3				3	3	3		3	3	3	3
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply basic concepts of multimedia system and its application
	PO2	3	Apply the knowledge to analyse the given problem todesign the multimedia system
	PO3	3	Design the multimedia system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systemsand identify the problems
	PSO1	3	Performthe signal processing by applying basic engineering knowledge
	PSO2	3	Design the multimedia system components considering industrial and societal requirements
CO2	PO1	3	Apply the Basic principles to find audio compression and video compression techniques
	PO2	3	Apply the knowledge to analyse the Basic principles to design basic audio compression and video compression techniques
	PO3	3	Design the functions of various audio compression and video compression techniques considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on various audio compression and video compression techniques and identify the problems
	PSO1	3	Perform the different usage of basic principles by applying basic engineering knowledge
	PSO2	3	Design the reliable audio compression and video compression modules considering different environmental conditions
CO3	PO1	3	Apply the digital techniques for text and image compression
	PO2	3	Apply the knowledge to analyse the given problem to text and image compression
	PO3	3	Develop the text and image compression components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing design techniques and identify the problems for further investigations
	PO8	3	Apply ethical principles to compare text and image compression ensuring environmental safety
	PO9	3	Function effectively in teams to develop and manageindustrial projects
	PO10	3	Communicate effectively with proper documentation invarious technical events like paper presentation etc.
	PO12	3	Develop interest in building more reliable text and image compression techniques considering wider technological changes
	PSO1	3	Compare the various digital techniques byapplying basic engineering knowledge
	PSO2	3	Design the text and image compression considering Digital electronics industrial requirements
	PSO3	3	Communicate effectively with proper documentation invarious technical events like paper presentation etc. by acquiring essential interpersonal skills
CO4	PO1	3	Apply the different techniques for operating principles of VOIP architecture and challenges
	PO2	3	Apply the knowledge of engineering to analyse the given problem to VOIP architecture and challenges.
	PO3	3	Develop the VOIP architecture and challenges considering environmental and

			societal requirements
	PO4	3	Conduct the detailed literature survey on existing systemsand identify the problems
	PSO1	3	Measure the analysis of VOIP architecture and challenges. by applying basic engineering knowledge
	PSO2	3	Develop VOIP architecture and challenges components considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of multimedia networking and its application
	PO2	3	Apply the engineering knowledge to analyse the concepts of multimedia networking and its application
	PO3	3	Develop the algorithms for analysis the concepts of multimedia networking and its application
	PO4	3	Conduct the detailed literature survey the concepts of multimedia networking and its application
	PSO1	3	Apply analysis the concepts of multimedia networking and its application for solving complex problems
	PSO2	3	Design the concepts of multimedia networking and its application considering industrial and societal requirements

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50 EC E57 - Cryptography and Network Security

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100

Objective(s)

- To know concepts of modern symmetric key ciphers and number theory
- To learn the basics of symmetric key encipherment and its algorithm
- To learn the basics of Asymmetric key encipherment and its algorithm
- To understand the principles of integrity, Authentication, hash functions and digital signature
- To understand the security concepts in System Security and wireless network security protocols

Course Outcomes

At the end of the course, the students will be able to

CO1: Explain the concepts of Ciphers and different Galois fields.

CO2: Describe the modern block ciphers and modern stream ciphers and its Encryption Standards

CO3: Evaluate the mathematics of cryptography, Primarily Testing, Factorization and design different Asymmetric key Encipherment algorithms.

CO4: Analyze the concepts of message integrity, message authentication, digital signature and key management schemes

CO5: Examine the security applications like System Security and wireless network security protocols

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Number Theoretic and Algebraic Algorithms

Introduction- Integer Arithmetic, Modular Arithmetic – matrices – Linear congruence - Substitution ciphers – Transposition ciphers – Algebraic structure – GF(2) field. [9]

Modern Symmetric Key Ciphers

Modern block ciphers – Modern stream ciphers – DES – AES – Multiple uses of modern block ciphers and stream cipher. [9]

Asymmetric Key Encipherment

Primarily Testing – Factorization – Chinese Remainder Theorem – Quadratic congruence – Exponentiation & Logarithm – RSA Rabin – Elgamal – Elliptic curve cryptography [9]

Message Authentication and Integrity

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509 [9]

System Security and Network security protocols

System Security: Intruders – Malicious software – viruses – Firewalls. Network security protocols**:** VPN**,** SNMPv3**,** IPSecurity- Transport Level Security-Electronic Mail Security -Wireless LAN Security (WEP,WPA,WPA2,WPA3) [9]

Total Hours : 45

Text book(s):

1	Behrouz A. Ferouzan, ‘Cryptography & Network Security’, Tata McGraw Hill, 3rd Edition, 2015.
2	W.Stallings, ‘Cryptography & Network Security: Principles and Practice’, Prentice Hall of India, 8th Edition, 2019.

Reference(s):

1	Douglas R.Stlinson,, ‘Cryptography Theory and Practice’, CRC Press series on Discrete Mathematics and its application, 4th Edition, 2019
2	Charlie Kaufman, Radia Perlman, Mike Speciner, ‘Network Security Private Communication in a Public World’, Pearson Education, 2nd Edition, 2016.
3	Douglas R Simson, ‘Cryptography – Theory and practice’,1st Edition, CRC Press, 1995.
4	Aaron E. Earle, ‘Wireless Security Handbook’, Auerbach publications, Taylor & Francis Group, 2006.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3				3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of cryptographyto the solution for solving complex problems in ciphers
	PO2	3	Apply the knowledge to analyse the given problem to design of ciphers
	PO3	3	Design the ciphers considering environmental and societal requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of different Galois fields
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge indesign of different Galois fields
	PSO2	3	Design thedifferent Galois fields and cipherconsidering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of Encryption Standards in network security
	PO2	3	Apply the knowledge of block and stream ciphers to analyse network security performance
	PO3	3	Design the AES/DES algorithm by considering environmental and societal requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of AES/DES algorithm
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge indesign of AES/DES algorithm

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	PSO2	3	Design the network security algorithm by considering different environmental conditions
CO3	PO1	3	Apply the Factorization and design in various applications
	PO2	3	Apply the knowledge to analyse the given problem in Factorization and design
	PO3	3	Develop the cryptography model using Factorization and design considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing source techniques and identify the problems for further investigations
	PSO1	3	Compare the various theorem and algorithm by applying basic engineering knowledge
	PSO2	3	Design the RSA algorithm considering the IT industrial requirements
CO4	PO1	3	Apply the basic fundamentals of Integrity,authenticationto the solution for solving complex problems in wireless networks
	PO2	3	Apply the knowledge to analyse the given problem to design of digital signature
	PO3	3	Design the Integrity,authentication algorithm in considering environmental and societal security requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of Integrity,authentication algorithm
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge inIntegrity,authentication algorithm
	PSO2	3	Design the digital signatureconsidering industrial and societal security requirements
CO5	PO1	3	Apply the fundamental concepts of wireless network security to analyze WIFI
	PO2	3	Apply the engineering knowledge to analyse the WIFI QoS parameter in wireless networks security
	PO3	3	Design wireless networks security that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Use research-based knowledge analysis and interpretation of data in wireless networks security
	PO8	3	Apply ethical responsibilities to develop the communication systems implementing wireless networks security
	PO9	3	Function effectively in teams to develop and manage industrial WIFIprojects
	PO10	3	Develop interest in building more reliable communication system considering wider technological changes in WIFI
	PO12	3	life-long learning in the broadest context of technological change in firewall and security
	PSO1	3	Apply the concepts of wireless networks for solving complex problems in developing WIFI
	PSO2	3	Develop WIFI wireless networks security componentswith considering industrial and societal requirements
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork in designing SystemSecurity and wireless network security

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50 EC L01 – Internet of Things

Open Elective – Common to All Branches

Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**	45	**C**	**CA**	**ES**	**Total**
	3	0	0		3	50	50	100

Objective(s)	• To understand the IoT concept and its impact • To recognize various tools and platforms for implementing IoT • To understand the need and potential of data analytics • To identify the business opportunity and market potential for IoT products • To develop products / modules based on IoT
Course Outcome(s)	**At the end of the course, the students will be able to :** CO1: Explain the concepts of IoT and recognize the problems in society and industry CO2: Describe the architecture of IoT in various levels based on customer requirements CO3: Discuss the hardware and software platforms for IoT and develop an IoT product CO4: Describe the role and implementation of data analytics in IoT CO5: Outline the basics of Entrepreneurship and IPR

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction to IoT

Definitions of IoT – History of IoT – Necessity of IoT – Characteristics of IoT – IoT Challenges and Issues – Application examples

Activity: Identifying problem statement[-1] – Customer and Market Survey[-1]–Product Design approach [5]

IoT Architecture

IoT Architecture: Node, Gateway, Network infrastructure and Cloud server –Components of IoT: Control Unit, Sensors and Actuators, Communication and Power Source

Activity: IoT Product Vision and Mission[-1] – Identifying target customer for an IoT product[-2] – Lean canvas [10]

IoT Development Hardwares

IoT Hardware Considerations – IoT programming Considerations – Open source hardware platforms , Designing of Proprietary Hardware – IoT Cloud services – Communication Hardware and Protocols

Activity: Developing working model of IoT product [-2] [15]

IoT Data Analytics

Introduction and need of analytics – Big Data Analytics – Artificial Intelligence and Machine learning – Challenges in data analytics – Database Management – Data Security – Open Source tools for Data analytics

Activity: Demonstration of IoT product[-2] – Results and discussion [-1] [8]

Entrepreneurship IN IoT[-1]

Introduction – Ethics in Entrepreneurship - Lean canvas – Business canvas - Business model - Business Finance Planning – Startups - Intellectual property rights: Copyrights, Trade mark, Patent [7]

[-1] – Class will be handled by visiting faculty

[-2] – Project activity by students

Total Hours: 45

Text book(s):

1	Adrian McEwen, 'Designing the Internet of Things', Wiley, 2013
2	Andrew Minteer, 'Analytics for the Internet of Things (IoT)', Packt Publishing Limited, 2017

Reference(s);

1	Cuno P fister, 'Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects)', Maker Media, 1stEdition, 2011
2	Prof.SudipMisra, 'Introduction to Internet of Things', NPTEL Course
3	Prof. Nandan Sudarsanam and Prof. B. Ravindran, 'Introduction to Data Analytics', NPTEL Course
4	Muthu Singaram, 'Entrepreneurship: A Hands On Guide To Starting Your Business', 2018

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3		3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3			3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3		3	3	3	3	3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO 1	3	Apply the knowledge of IoT to the solution of complex engineering problems
	PO 2	3	Analyze engineering problems in the society solved with IOT application
	PO 3	3	Research and investigate the challenges to design a IoT solution
	PO 4	3	Design a solution with IoT that meet the needs for society
	PO 5	3	Understand to apply techniques of IoT to create the model
	PO 6	3	Apply conceptual knowledge of IoT for problem solving
	PO 7	3	Understand the problem in the society and come out with a sustainable solution
	PO 8	3	Apply ethical principles and professional responsibilities in IoTproduct
	PO 9	3	Function effectively in teams to develop and manage IoT based solution
	PO 10	3	Make communications withthe engineering community to comprehend and write reports and design documentation effectively
	PO 11	3	Develop ethics in project and manage principles in concluding solutions
	PO 12	3	Develop interest in further learning and get deep into the IoT technology
	PSO 1	3	Compare the various IoT techniques by applying basic engineering knowledge
	PSO 2	3	Develop product that meet the needs of society with IoT
	PSO 3	3	Develop interpersonal skills and attitude needed for ethicalleadership teamwork
CO2	PO 1	3	Apply the knowledge of different IoT techniques based on customer requirements
	PO 2	3	Analyzes the problem that can be solved by IoT solution architecture
	PO 3	3	Development of solution with the architecture of IoT in various levels based on customer requirements
	PO 4	3	Conduct the detailed survey on IoT techniques and identify the problems for further investigations
	PO 5	3	Apply modern technology tools to complex engineering activities
	PO 6	3	Apply the conceptual knowledge of IOT architecture based on the customer requirement
	PO 8	3	Apply ethical principles in development of solution

			witharchitecture of IoT based on customer requirements
	PO 9	3	Function effectively in teams to develop and manage projects
	PO 10	3	Write effective reports and design document to represent idea
	PO 11	3	With the learnt IOT architecture demonstrate the project concept
	PO 12	3	Develop interest to learn further technology and implement the idea in societal problems
	PSO 1	3	Compare the IOT techniques by applying basic engineering knowledge
	PSO 2	3	Design a product with the developed IOT architecture
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO3	PO 1	3	Apply the knowledge of IOT in hardware and software
	PO 2	3	Analyzes the problem to work in hardware and software using IOT
	PO 3	3	Develop a solution to solve the problem in hardware and software using IOT
	PO 4	3	Conduct the detailed survey on the hardware and software platforms for IoT
	PO 5	3	Use the modern platforms of the hardware and software for IoT
	PO 6	3	Apply the conceptual knowledge of the hardware and software platforms for IoT in problem solving
	PO 7	3	Understand the impact of solutions in societal and environmental contexts in IOT
	PO 8	3	Apply ethical principles in development of the platforms for IoT
	PO 9	3	Function effectively in teams and as individual to develop and manage problems
	PO 10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO 11	3	With the learnt IOT platforms demonstrate the project concept
	PO 12	3	Develop interest to learn further platforms and implement the idea in societal problems
	PSO 1	3	Compare the various platforms by applying basic engineering knowledge
	PSO 2	3	Design a project with the developed platforms for IOT
	PSO 3	3	Develop interpersonal skills and attitude needed for ethicalleadership teamwork
CO4	PO 1	3	Apply the knowledge of data analytics in IOT to create a solution for a real time application
	PO 2	3	Analyzes IOT concepts for design and develop design with the techniques
	PO 3	3	Development of concept of data analytics in IOT to solve problem
	PO 4	3	Conduct the detailed survey on data analytics and identify the problems for further investigations
	PO 5	3	Apply IOT concepts for design complex engineering activities with an understanding
	PO 8	3	Apply ethical principles in development of solution
	PO 9	3	Function effectively in teams and as individual to develop solution
	PO 10	3	Write effective reports and design document to represent ideas of data analytics
	PO 11	3	Develop interest in project and manage principles in concluding solutions
	PO 12	3	Develop interest to learn further techniques and implement the idea in societal problems
	PSO 1	3	Compare the various data analytics echniquesby applying basic

			engineering knowledge
	PSO 2	3	Design a project applying IOT concepts for design and development of solution
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO5	PO 1	3	Apply the knowledge of concepts learnt in entrepreneurship
	PO 2	3	Analyzes concepts and design solution with the technology
	PO 3	3	Development of concept of Entrepreneurship and IPRto solve real filed problem
	PO 4	3	Conduct the detailed survey and identify the problems for further development in entrepreneurship
	PO 5	3	Apply the modern tools in the field of entrepreneurship and IPR
	PO 6	3	Apply the knowledge to proceed IPR in professional engineering
	PO 8	3	Apply ethical principles in development of solution in entrepreneurship and IPR
	PO 9	3	Function effectively in teams and as individual to develop product
	PO 10	3	Write effective reports and design document to represent idea like paper presentation
	PO 11	3	Develop interest in project and manage principles in concluding solutions
	PO 12	3	Develop interest to learn further techniques and apply IPR
	PSO 1	3	Compare the various entrepreneurship ideas and apply basic engineering knowledge
	PSO 2	3	Design a project and develop further for entrepreneurship and IPR
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork

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50 EC L02 –Wearable Devices

Open Elective – Common to All Branches

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	50	50	100

Objective(s)

- To learn the field of wearable devices and applications
- To study the various components and their properties used for wearable devices
- To learn the advanced and emerging technologies related to wearable device
- To discuss the product development and design factors in wearable device
- To explore the security issues, privacy concerns, psychological effects, and social impact, health issues related to wearable devices

Course Outcomes

At the end of the course, the students will be able to

CO1: Discuss the history, current devices used as wearables and their applications
CO2: Describe the key functions and basic principles of various components and technologies used in wearable devices
CO3: Analyze the development process and design considerations in wearable products
CO4: Review security and privacy issues in wearable technology
CO5: Explore the psychological and social impact, health concerns related to wearable devices

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction
Introduction to wearable technology, Brief history, wearables we know today, Applications of wearable Technology. [9]

Components and Technologies

Introduction, Components and Technologies: Microcontrollers and microprocessors, Operating systems, Sensors, Wireless connectivity unit, Battery technology, Displays and other user interface elements, Microphones and speakers, Artificial intelligence, Machine learning, Data mining, Virtual and augmented reality, Voice recognition.[9]

Product Development and Design Considerations

Introduction, Product development process – Engineering analysis, Prototyping, Testing and validation, Production. Design considerations- Various factors and requirements – Operational, Power packaging and material, Maintenance. [9]

Security Issues and Privacy Concerns

Introduction, Security and privacy issues in wearable technology, Potential solutions, Product case examples. [9]

Psychological and Social Impact, Health Concern

Psychological effects of wearables, Social implications, Technology acceptance factors, Electromagnetic radiation, Specific absorption rate, Thermal effects, Cancer, Fertility, Vision and sleep disorder, Pain and discomfort, Electromagnetic intolerance and other risks. [9]

Total Hours: 45

Text book(s):

1.	HaiderRaad, 'The Wearable Technology Handbook', United Scholars Publication, 2017.
2.	Hang,Yuan-Ting, 'Wearable Medical Sensors and Systems', Springer, 2013

Reference(s):

1.	http://www.medgadget.com
2.	https://www.wareable.com
3.	https://www.wearable-technologies.com/
4.	Sandeep K.S. Gupta,Tridib Mukherjee, Krishna Kumar Venkatasubramanian, 'Body Area Networks Safety, Security, and Sustainability,' Cambridge University Press, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	2	3	3						3	3	
CO4	3	3	3	3	3	3	3						3	3	
CO5	3	3	3	3		3	3						3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the fundamentals concepts of wearable technology in current devices used as wearable's and their applications
	PO2	3	Apply the knowledge to analyse the given problem to wearable technology
	PO3	3	Develop the coding schemes in the wearable technology for environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the different measurement of wearable devices parameters by applying basic engineering knowledge
	PSO2	3	Design the wearable devices considering industrial and societal

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			requirements
CO2	PO1	3	Apply the knowledge to various components and technologies used in wearable devices.
	PO2	3	Apply the knowledge to analyse various components and their properties used for wearable devices.
	PO3	3	Design the artificial intelligence system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing Voice recognition identify the problems
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on machine learning
	PSO1	3	Perform the machine learning concepts by applying basic engineering knowledge
	PSO2	3	Design the Components for considering different environmental conditions
CO3	PO1	3	Apply the Product development process for wearable devices
	PO2	3	Apply the knowledge to analyse the given problem to product and design factors in wearable device
	PO3	3	Develop the various components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing product development and identify the problems for further investigations
	PO5	2	Apply the relevant simulators and software to perform the complex investigations on product development
	PO6	3	Apply the knowledge of engineering analysis design in the professional engineering practice
	PO7	3	Understand the impact of the professional engineering solutions in prototyping of societal and environmental context
	PSO1	3	Compare the various perform the complex investigations on packaging and material by applying basic engineering knowledge
	PSO2	3	Design the Product considering telecommunication industrial requirements
CO4	PO1	3	Apply the knowledge in Security and privacy issues in wearable technology
	PO2	3	Apply the knowledge of engineering to analyse the given problem in Security and privacy issues in wearable technology
	PO3	3	Develop the Product considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on product development
	PO6	3	Apply the knowledge of security and privacy design in the professional engineering practice
	PO7	3	Understand the impact of the professional engineering solutions in security and privacy of societal and environmental context
	PSO1	3	Measure the factors affecting Potential solutions by applying basic engineering knowledge
	PSO2	3	Develop the simulation of security and privacy issues in wearable technology industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts psychological and social impact, health concerns related to wearable devices
	PO2	3	Apply the engineering knowledge to analyse the given wearable device psychological effects
	PO3	3	Develop the technology for social implications for different requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing electromagnetic radiation analysing techniques understanding the limitations

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	PO6	3	Apply the knowledge of thermal effects design in the professional engineering practice
	PO7	3	Understand the impact of solutions in societal and environmental contexts in networks
	PSO1	3	Apply the concepts of absorption rate for solving complex problems
	PSO2	3	Design the low absorption rate components considering industrial and societal requirements

K.S.Rangasamy College of Technology - Autonomous R 2018								
50 EC L03 – Next Generation Wireless Networks								
Open Elective – Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	50	50	100

Objective(s)

- To study about advanced wireless networks, LTE, 4G/5G and Evolutions from LTE to LTEA.
- To study about wireless IP architecture, Packet Data Protocol and LTE network architecture
- To study about adaptive link layer, hybrid ARQ and graphs routing protocol.
- To study about mobility management, cellular network, and micro cellular networks
- To understand the different QoS techniques in wireless networks

Course Outcomes

At the end of the course, the students will be able to

CO1: Illustrate the principles of latest 4G/5G networks and LTE
CO2: Explain the wireless IP architecture and LTE network architecture
CO3: Describe the adaptive link layer and network layer graphs and protocol
CO4: Discuss about the mobility management and cellular networks
CO5: Analyze the QoS parameter in Next Generation Wireless Networks

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction
Introduction to 1G/2G/3G/4G/5G Terminology - Evolution of Public Mobile Services -Motivation for IP Based Wireless Networks -Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G/5G Advanced Features and Roadmap Evolutions from LTE to LTEA - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with Small World Properties. [9]

Wireless IP Network Architectures
3GPP Packet Data Networks - Network Architecture - Packet Data Protocol (PDP) Context -Configuring PDP Addresses on Mobile Stations - Accessing IP Networks through PS Domain – LTE network Architecture - Roaming Architecture- Protocol Architecture- Bearer Establishment Procedure -Inter-Working with other RATs. [9]

Adaptive Link and Network Layer
Link Layer Capacity of Adaptive Air Interfaces-Adaptive Transmission in Ad Hoc Networks - Adaptive Hybrid ARQ Schemes for Wireless Links-Stochastic Learning Link Layer Protocol - Infrared Link Access Protocol-Graphs and Routing Protocols-Graph Theory-Routing with Topology Aggregation-Network and Aggregation Models. [9]

Mobility Management
Cellular Networks-Cellular Systems with Prioritized Handoff-Cell Residing Time Distribution-Mobility Prediction in Pico- and Micro-Cellular Networks. [9]

Quality of Service
QoS Challenges in Wireless IP Networks - QoS in 3GPP - QoS Architecture, Management and Classes -QoS Attributes - Management of End-to-End IP QoS - EPS Bearers and QoS in LTE networks. [9]

Total Hours: 45

Text book(s):

1	Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, ‘Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach’, John Wiley & Sons, 2014.

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2	Jyh-Cheng Chen and Tao Zhang, 'IP-Based Next-Generation Wireless Networks Systems, Architectures, and Protocols', John Wiley & Sons, Inc. Publication, 2006.
Reference(s):	
1	Minoru Etoh, 'Next Generation Mobile Systems 3G and Beyond,' Wiley Publications, 2005.
2	StefaniaSesia, IssamToufik and Matthew Baker, 'LTE – The UMTS Long Term Evolution From Theory to Practice', John Wiley & Sons, Inc. Publication, 2nd Edition, 2011.
3	SavoGlisic, 'Advanced wireless networks-technology and business models', 3rd Edition, John Wiley & Sons, Ltd, 2016
4	SavoGlisic, 'Advanced Wireless Networks-4G Technologies', John Wiley & Sons, Ltd, 2006.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3									3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the basic fundamentals of 1G to 5G networks to the solution for solving complex problems in wireless networks
	PO2	3	Apply the knowledge to analyse the given problem to design 4G/5G networks
	PO3	3	Design the 4G/5G networks and LTE components considering environmental and societal requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of 4G/5G networks
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge in design of 4G/5G networks
	PSO2	3	Design the 4G/5G networksconsidering industrial and societal requirements
CO2	PO1	3	Apply the knowledge of wireless IP architecture in network configuration
	PO2	3	Apply the knowledge of LTE network architecture to analyse network performance
	PO3	3	Design the LTE network components considering environmental and societal requirements
	PO4	3	Use research-based knowledge in design of LTE networks
	PSO1	3	Perform the LTE network design by applying basic engineering knowledge
	PSO2	3	Design the LTE network modules by considering different environmental conditions
CO3	PO1	3	Apply the adaptive link layer and network layer concepts in various applications
	PO2	3	Apply the knowledge to analyse the given problem to design the routing protocols
	PO3	3	Develop the routing protocols considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing source techniques and identify the problems for further investigations
	PSO1	3	Compare the routing protocol algorithm techniques by applying basic

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			engineering knowledge
	PSO2	3	Design therouting protocol algorithm considering the IT industrial requirements
CO4	PO1	3	Apply the basic fundamentals of cellular networks to the solution for solving complex problems in wireless networks
	PO2	3	Apply the knowledge to analyse the given problem to design cellular networks
	PO3	3	Design the cellular networksconsidering environmental and societal requirements
	PO4	3	Use research-based knowledge analysis and interpretation of data in design of cellular networks
	PSO1	3	Solve complex Engineering problem by applying basic engineering knowledge in mobility management
	PSO2	3	Design the cellular networks considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of wireless networks to analyze QoS parameter
	PO2	3	Apply the engineering knowledge to analyse the QoS parameter in wireless networks
	PO3	3	Design wireless networks that meet the specified needs with appropriate consideration for the public health and safety.
	PO4	3	Use research-based knowledge analysis and interpretation of data in QoS parameter
	PSO1	3	Apply the concepts of wireless networks for solving complex problems in developing QoS parameter
	PSO2	3	Develop wireless networks components with good QoS parameterby considering industrial and societal requirements

K.S.Rangasamy College of Technology - Autonomous R 2018								
50 EC L04 – Microprocessor and Microcontroller								
Open Elective – Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	50	50	100
Objective(s)	• To introduce the architecture and programming of 8085 microprocessors • To interfacing of peripheral devices with 8085 microprocessors • To introduce the architecture, programming of 8051 micro controller • Interfacing an peripheral device with the 8051 microcontroller • To explore the applications using microcontroller 8051							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the concept of 8 bit microprocessor and develop the assembly language program using 8085 microprocessor. CO2: Interface and configure the peripheral IC's with 8085 microprocessor. CO3: Describe the operation of 8051 microcontroller and develop the assembly language program using 8051 microcontroller. CO4: Do interfacing design of peripherals like I/O, A/D, D/A, timer etc. CO5: Develop the 8051 microcontroller based system for various applications.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.								
8085 Microprocessor 8085 Internal Architecture - Addressing modes - Instruction set - Assembly language Programming- Machine cycles with states and timing diagram Interrupts - Interfacing memory and I/O devices. [9] **Peripherals Interfacing**								

Programmable Peripheral Interface (PPI 8255) - Programmable Interval Timer (PIT 8253) -8259 Programmable Interrupt Controller -Keyboard & display controller (8279) - Interfacing serial I /O (8251) - ADC/DAC interfacing. [9]

8051 Microcontroller

8051 Architecture- Memory organization-Addressing modes -Instruction set - Microcontroller hardware - I/O pins and ports - Assembly language programming- I/O port programming. [9]

8051 Peripheral and its Programming

Interrupts -Counters and Timers- Timer and counter programming - Serial Communication - Interrupt programming, ADC, DAC and sensor interfacing. [9]

8051 Applications

LCD and Keyboard Interfacing - RTC Interfacing and programming- Stepper motor and DC motor interfacing. Case study: Temperature monitoring system, Turbine monitoring system, traffic light control, washing machine control, Automotive applications, Closed loop process control. [9]

Total Hours: 45

Text book(s):

1	Ramesh S Gaonkar, 'Microprocessor Architecture, Programming and application with 8085', 6th Edition, Penram International Publishing, 2015.
2	Mohamed Ali Mazidi, Janice GillispieMazidi, Rolin Mc Kinlay, 'The 8051 Microcontroller and Embedded Systems: Using Assembly and C', 2nd Edition, Pearson Education, 2011.

Reference(s):

1	Krishna Kant, 'Microprocessors and microcontrollers Architecture, Programming and System design 8085, 8086, 8051, 8096', 3rd Reprint, Prentice Hall of India, 2014.
2	Soumitra Kumar Mandal, 'Microprocessors and Microcontrollers Architecture, Programming and Interfacing using 8085, 8086 and 8051', 6th Reprint, McGraw Hill, 2012.
3	A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 12th Reprint, 2009.
4	NPTEL video lectures by M. Krishna Kumar, IISc.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3	3			3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the knowledge to understand functions of 8 bit microprocessor
	PO2	3	Analyze engineering problems where microprocessors are used
	PO3	3	Research and investigate the problem to design real time solution
	PO4	3	Design a solution using assembly level language of microprocessor that meet the needs for society

	PO5	3	Use the modern tools to work with microprocessors and microcontrollers
	PSO1	3	Compare the various functionality of each block in a microprocessor applying basic engineering knowledge
	PSO2	3	Develop the product that meets the need of society
CO2	PO1	3	Apply the knowledge of microprocessor to configure the peripheral IC's with 8085 microprocessor
	PO2	3	Analyzes the working of microprocessor with peripheral and demonstrate
	PO3	3	Development of solution for problems by interfacing peripherals with microprocessor in various modes
	PO4	3	Conduct the detailed survey on real time problems and identify the solutions for investigations
	PO5	3	Apply modern technology tools to interrupts, stack in a microprocessor and interfacing of peripheral devices
	PSO1	3	Compare the ADC and DAC interfacing techniques by applying basic engineering knowledge
	PSO2	3	Design a product with microprocessor to meet the specific needs of industry and society
CO3	PO1	3	Apply the knowledge to understand functions of 8 bit microprocessor
	PO2	3	Analyzes the problem of programming in microcontrollers
	PO3	3	Develop a solution to solve the problem in programming proficiency using the various addressing modes
	PO4	3	Conduct the detailed survey on the programming proficiency of microcontrollers
	PO5	3	Use the modern tools to work with 8051 microcontrollers
	PSO1	3	Compare the various addressing modes of microcontroller by applying basic engineering knowledge
	PSO2	3	Design a product using 8051 microcontrollers using advanced technology
CO4	PO1	3	Apply the knowledge of interfacing design of peripherals like I/O, A/D, D/A, timer, external communication, etc.
	PO2	3	Analyzes interfacing design and develop peripherals like I/O, A/D, D/A, timer
	PO3	3	Develop interfacing design to meet the specific needs of the environment
	PO4	3	Conduct the detailed investigation on interfacing design and problems faced
	PO5	3	Apply modern tools to design of peripherals like I/O, external communication
	PSO1	3	Compare the various interfacing techniques and apply them in engineering
	PSO2	3	Design a project with I/O, A/D, D/A, timer, external communication
CO5	PO1	3	Apply the knowledge of accessing the peripherals LCD and keyboard interfacing
	PO2	3	Analyzes concepts of RTC interfacing and programming
	PO3	3	Develop the solution for complex engineering problems temperature and monitoring using 8051 microcontroller
	PO4	3	Conduct the detailed survey and identify the problems for further development in applications of microcontrollers
	PO5	3	Apply the modern tools in the field of microcontroller programming to develop solutions

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	PO8	3	Apply ethical principles in development of solution in microcontroller applications
	PO9	3	Function effectively in teams and as individual to develop solution
	PO10	3	Write effective reports and design document to represent idea
	PO12	3	Develop interest to learn further application and learning C programming for microcontrollers
	PSO1	3	Compare the various application in 8051microcontrollers and assembly level programming and apply them in developing a solution
	PSO2	3	Design a project and develop the applications using 8051 microcontroller
	PSO3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork

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50 EC L05 - 5G Technology

Open Elective – Common to All Branches

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	50	50	100

Objective(s)	• To equip the participants with fundamental understanding of the key requirements, key capabilities and usage scenarios of 5G and the key innovations behind it. • To guide the participants to identify the various opportunities offered by 5G. • To provide awareness about the issues and challenges for 5G deployment. • Understand the free space optical networks for 5G. • Learn the different 5G applications and its security.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Recall the basic concepts of Wireless communication. CO2: Illustrate the cellular concepts of 5G mobile Communication. CO3: Contrast the concepts of different multiple access techniques and MIMO techniques. CO4: Illustrate the free space optical networks of 5G technology. CO5: Outline the concepts of 5G Application and Security

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Introduction
General communication systems, main classification of signals, Frequency and wavelength, Bandwidth ,half duplex and full duplex, transmission lines, MODEM, Multiplexing , Electromagnetic spectrum, Evaluation of mobile technologies 1G to 4G. [9]

Cellular concepts
Introduction, Frequency reuse-system architecture - hand off -interference & system capacity –reflection-diffraction-scattering-fading- Coverage and capacity improvement: cell splitting-sectoring-repeaters-microcell zone concepts. [9]

Multiple Access Techniques
Introduction to multiple access -Techniques: FDMA, TDMA, CDMA, SDMA, packet radio, Introduction to SIMO and MIMO systems, non-orthogonal multiple accesses (NOMA). [9]

Free space optical networks
The Role of FSO in the network – factors affecting FSO – line of sight (LOS), Introduction to Laser Satellite Communications, LIFI technology, Optical Filters, Couplers, Amplifiers, Switches, Antennas, Interconnecting Equipments. [9]

5G Applications
High speed mobile network, Device-to-device (D2D), vehicle to vehicle communication (V2V), vehicle to infrastructure communication (V2I), Smart home, Smart cities, Industrial IOT, Security and surveillance. [9]

Practices

- Simulation of multiple access techniques

Total Hours : 45

Text book(s):

1	Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock, 'Millimeter Wave Wireless Communications', Prentice Hall Communications.
2	Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, - 5G Mobile Communications, Springer, 2017.

Reference(s):

1	W.C.Y.Lee, 'Mobile Communications Engineering: Theory and applications', 2nd Edition, McGraw-Hill International, 2009.
2	David Tse and Pramod Viswanath, 'Fundamentals of Wireless Communication', Cambridge university press, 2005.
3	Van Nee.R and Ramji Prasad, 'OFDM for wireless multimedia Communication', Artech house, 2000.
4	Martin Sauter, 'From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband', Wiley-Blackwell, 2016.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3	3								3	3	
CO4	3	3	3	3		3	3						3	3	
CO5	3	3	3	3		3	3	3	3	3		3	3	3	3

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the engineering knowledge to classify the different signals in communication systems
	PO2	3	Apply the knowledge to analyse the given problem to design the communication system
	PO3	3	Develop the coding schemes in the mobile technologies for environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PSO1	3	Perform the signal processing by applying basic engineering knowledge
	PSO2	3	Design the communication system components considering industrial and societal requirements
CO2	PO1	3	Apply the cellular concepts techniques for various applications
	PO2	3	Apply the knowledge to analyse frequency reuse in communication systems.
	PO3	3	Design the reliable wireless communication system components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing cellular concepts in coverage and capacity improvement and identify the problems
	PSO1	3	Perform the microcell zone concepts by applying basic engineering

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			knowledge
	PSO2	3	Design the 5G mobile communication for considering different environmental conditions
CO3	PO1	3	Apply the multiple access techniques for mobile communication systems
	PO2	3	Apply the knowledge to analyse the given problem to design the single input multi output and multi input multi output systems
	PO3	3	Develop the multiple access techniques systems components considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing multiple access techniques and identify the problems for further investigations
	PO5	3	Apply the relevant simulators and software to perform the complex investigations on multiple access techniques
	PSO1	3	Compare the various perform the complex investigations on multiple by applying basic engineering knowledge
	PSO2	3	Design the spatial division multiple access devices considering telecommunication industrial requirements
CO4	PO1	3	Apply the free space optical communication technology in telecommunication systems
	PO2	3	Apply the knowledge of engineering to analyse the given problem in satellite communications
	PO3	3	Develop free space optical communication in optical networks considering environmental and societal requirements
	PO4	3	Conduct the detailed literature survey on existing systems and identify the problems
	PO6	3	Apply the knowledge of free space optical communication design in the professional engineering practice
	PO7	3	Understand the impact of the professional engineering solutions in free space optical communication of societal and environmental context
	PSO1	3	Measure the factors affecting free space optical communication by applying basic engineering knowledge
	PSO2	3	Develop the Free space optical networks for realistic simulation of 5G technology considering industrial and societal requirements
CO5	PO1	3	Apply the fundamental concepts of High speed mobile network in 5G networks and its application
	PO2	3	Apply the engineering knowledge to analyse the given wire sensor network
	PO3	3	Develop the algorithms for various source codes for different channel requirements considering different environmental factors
	PO4	3	Conduct the detailed literature survey on existing Radio Frequency Energy Harvesting techniques understanding the limitations
	PO6	3	Apply the knowledge of High speed mobile network design in the professional engineering practice
	PO7	3	Understand the impact of solutions in societal and environmental contexts in networks
	PO8	3	Apply ethical principles in development of solution with 5G Applications
	PO9	3	Function effectively in teams and as individual to develop modules and 5G concepts for design
	PO10	3	Write effective reports and design document to represent idea
	PO12	3	Develop interest to learn further techniques and implement the Smart home, Smart cities idea in societal problems
	PSO1	3	Apply the concepts of energy harvesting and management for solving complex problems
	PSO2	3	Design the low power Wireless Sensor Network components considering industrial and societal requirements
	PSO3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork

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<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2018</td></tr>
<tr><td colspan="9">50 EC L06 - Mobile Robotics</td></tr>
<tr><td colspan="9">Open Elective – Common to All Branches</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td></td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">• To broaden the importance of Robot Locomotion
• To learn the knowledge of mobile Robot kinematics and dynamics
• To broaden the importance of GPS and sensors
• To enhance the knowledge about Localization, Planning and Navigation
• To make the student design, fabricate, motion planning, and control of intelligent mobile robotic systems</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">At the end of the course, the students will be able to
CO1: Discuss about the Robot Locomotion
CO2: Differentiate theKinematics and the Dynamics of Mobile Robots
CO3: Illustrate the Sensors and GPS
CO4: Describe about the Localization and Planning of Robots
CO5: Summarize the knowledge on Navigation</td></tr>
</table>

Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.

Robot locomotion
Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, controllability. [9]

Mobile robot kinematics and dynamics
Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots. [9]

Perception
Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning system (GPS), Doppler effect-based sensors, vision-based sensors, uncertainty in sensing, filtering. [9]

Localization
Odometric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon systems. [9]

Introduction to planning and navigation
path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP). [9]

practice:
1. Development of Embedded Programming for Motion Control using Fire Bird – V robot
2. Development of Embedded Programming for Velocity Control using Fire Bird – V Robot
3. Development of Embedded Programming for obstacle avoidance using Fire Bird – V robot

Total Hours : 45

Text book(s):

1	R.Siegwart,I.R. Nourbakhsh, ‘Introduction to Autonomous Mobile Robots’,TheMITPress,2017.
2	PeterCorke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tractsin Advanced Robotics,2018.

Reference(s):

1	S.M.LaValle, ‘Planning Algorithms’, Cambridge University Press,2016.(Available online http://planning.cs.uiuc.edu/)
2	Thrun,S.,Burgard,W.,andFox,D.,Probabilistic Robotics. MIT Press,Cambridge, MA,2017.

Rev.No. 3 / w.e.f. 13/02/2022
Passed in BoS Meeting held on 12/02/2022
Approved in Academic Council Meeting held on 23/02/2022

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3	Melgar,E.R.,Diez,C.C., Arduino and Kinect Projects: Design,Build, Blow Their Minds,2016.
4	H.Choset, K.M.Lynch,S. Hutchinson, G. Kantor,W. Burgard,L.E.Kavraki, and S.Thrun, Principles of Robot Motion: Theory, Algorithms and Implementations,PHILtd.,2017.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3	3								3	3	
CO3	3	3	3	3	3			3	3	3		3	3	3	3
CO4	3	3	3	3	3								3	3	
CO5	3	3	3	3									3	3	

COs	POs/PSOs	Level	Justification
CO1	PO1	3	Apply the Robot locomotion in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Problem-Solving Approach to Building wheeled robots.
	PO3	3	Design solutions for legged robots in the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use Robot locomotion including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PSO1	3	Solve complex Problem-Solving Approach to Robot locomotion by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design hopping robots and develop products that meet the specific needs of industry and society in Electronics and Communication Engineering
CO2	PO1	3	Apply the Mobile robot kinematics and dynamics in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Forward and inverse kinematics.
	PO3	3	Design solutions for holonomic and nonholonomic constraints for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide dynamics simulation of mobile robots.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations of kinematic models
	PSO1	3	Solve complex Mobile robot kinematics and dynamics by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design and develop mobile robots that meet the specific needs of industry and society in Electronics and Communication Engineering
CO3	PO1	3	Apply the Perception in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the sensors for mobile robots.

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	PO3	3	Design solutions for vision-based sensors for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide uncertainty in sensing.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations of performance measures of sensors
	PO8	3	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice for Learning in vision-based sensors.
	PO9	3	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings for Quantifying uncertainty in sensing.
	PO10	3	Communicate effectively on complex engineering activities and make effective presentations, and give and receive clear instructions passive/active sensors.
	PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change in global positioning system (GPS) based sensors.
	PSO1	3	Solve complex Regularization for Perception by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Design and develop vision-based sensors that meet the specific needs of industry and society in Electronics and Communication Engineering
	PSO3	3	Develop essential interpersonal skills and attitude needed for ethical leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for uncertainty in sensing and filtering.
CO4	PO1	3	Apply the knowledge of Localization in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Algorithms for positioning beacon systems.
	PO3	3	Design solutions for probabilistic mapping for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for Variants of the Odometric position estimation.
	PO5	3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding the Bayesian localization
	PSO1	3	Solve complex Planning in Localization and Decision Making by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Solve complex desires of localization by applying engineering knowledge in the field of Signal/Image processing and Communication.
CO5	PO1	3	Apply the knowledge of planning and navigation in an engineering specialization to the solution of complex engineering problems.
	PO2	3	Identify, formulate, review research literature, and analyze the Quantifying uncertainty in path planning algorithms.
	PO3	3	Design solutions for Markov Decision Processes for the public health and safety, and the cultural, societal, and environmental considerations.
	PO4	3	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for probabilistic roadmaps.
	PSO1	3	Solve complex planning and navigation by applying engineering knowledge in the field of Signal/Image processing and Communication.
	PSO2	3	Develop essential interpersonal skills and attitude needed for ethical

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			leadership and teamwork such as effective listening and communication, presentation, team building and assertiveness for path planning algorithms.

K.S.Rangasamy College of Technology - Autonomous R 2018								
50 EC SE01- Long Range (LoRa) Wireless Communication for IoT Applications								
Special Elective- B.E. Electronics and Communication Engineering								
Semester	Hours			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	30	0	30	60	3	50	50	100
Objective(s)	• To understand the IoT architecture. • To Know the LoRaWAN Specifications. • To establishment near and far network communication with minimal power. • Provision of a hardware and software infrastructure enabling the development, discovery, and orchestration of applications and services. • To configure LoRaWAN Gateway based on application Interface with Sensor Integration.							
Course Outcomes	**At the end of the course, the students will be able to :** CO1: Discuss the basics of IoT architecture and LoRaWAN CO2: Compare the different modulation techniques and key parameters of LoRaWAN CO3: Describe the network and application server for LoRaWAN integration CO4: Apply LoRaWAN concepts for design and development of modules in real filed applications CO5: Analyse the minimal power requirement and security of LoRA and apply it for short and long range communication							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for the questions in the examinations shall not depend on the number of hours indicated.								
Internet of Things Introduction to Internet of Things (IoT) - IoT architecture – IoT End Devices – IoT Gateway – Wireless IoT Network Protocols: Bluetooth Classic – Bluetooth Low Energy - Wifi - Zigbee – Z-Wave - 6LoWPAN – NB-IoT – SigFox – Neul - LoRaWAN – Advantages and Features of LoRaWAN [8] **LoRaWAN Specifications** Introduction to LoRa – Introduction to LoRaWAN – Difference between LoRa and LoRaWAN – LoRaWAN architecture - LoRaWAN Classes – Class A, Class B and Class C Devices – **Hands on:** LoRaWAN Gateway Configuration, LoRa GPS Node with LoRaWAN network server [12] **Modulation Techniques and Key Parameters** Frequency Shift Keying (FSK) - Chirp Spread Spectrum (CSS) – Spreading Factors – Payload Size – Data Rate - LoRaWAN Regional parameters – IN865-867 – Frequency Range – Bandwidth – Security – LoRaWAN Encryption **Hands on:** Basic Examples for Arduino based LoRaWAN Wireless Modules, Sensor Integration with Arduino based LoRaWAN Wireless Modules, Uplink & Downlink data in Arduino based LoRaWAN Wireless Modules [13] **Network and Application Server** Introduction to Network Server – Introduction to Application Server - End Device Types and States – Activation of ABP End Devices – Activation of OTAA End Devices – Received Signal Strength Indicator (RSSI) – Signal to Noise Ratio (SNR) – Open Source LoRaWAN Server Integration **Hands on:** LoRaWAN Network Server and Application Server Configuration, Integration of Application End Point with LoRaWAN network server [13] **LoRaWAN Real Field Applications** Smart Agriculture – Smart Cities – Smart Environment – Smart HealthCare – Smart Homes & Buildings – Smart Industrial Control – Smart Metering – Smart Supply Chain & Logistics – Asset tracking [14]								
Total Hours: 60								
Text Book(s):								

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1	Anita Geholt, Ravindra Kumar Sharma, Rajesh Singh, Kamal Kumar sharma,' LoRa and IoT Networks for Applications in Industry 4.0', Nova Science Publishers, 2020.
2	Pradeeka Seneviratne, 'Beginning LoRa Radio Networks with Ardunio', Apress, 2019.
Reference(s) :	
1	LoRa Alliance Technical Committee, 'LoRaWAN™ Backend Interfaces 1.0 Specification', 2017.
2	LoRa Alliance Technical Committee Regional Parameters Workgroup, 'LoRaWAN 1.1 Regional Parameters', 2018.
3	LoRa Alliance Technical Committee, 'LoRaWAN™ 1.1 Specification', 2017.
4	https://www.semtech.com/lora/lora-applications

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3			3	3	3	3	3	3	3	3
CO2	3	3	3	3	3			3	3	3	3	3	3	3	3
CO3	3	3	3	3	3		3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

COs	**POs/PSOs**	**Level**	**Justification**
CO1	PO 1	3	Apply the knowledge of IoT architecture to create a customized LoRA architecture based on application
	PO 2	3	Analyze engineering problems using IOT architecture and LoRaWAN
	PO 3	3	Design the process to solve the societal problems with the concept learnt
	PO 4	3	Research and analyze the data to design solution using IoT Gateway
	PO 5	3	Understand to apply techniques of IoT and LoRaWAN to create the model
	PO 8	3	Apply ethical principles and professional responsibilities in LoRaWAN problem solving
	PO 9	3	Function effectively in teams to develop and manage architectural problems in IoT
	PO 10	3	Make communications effective to work with documents and presentations with IoT
	PO 11	3	Develop interest in project and manage principles in concluding solutions
	PO 12	3	Develop interest in further learning and get deep into the IoT technology
	PSO 1	3	Compare the various IoT architecture techniques by applying basic engineering knowledge
	PSO 2	3	Develop product that meet the needs of society with LoRaWAN
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO2	PO 1	3	Apply the knowledge of different modulation techniques based on application
	PO 2	3	Analyzes the problem that can be controlled by various key parameters of LoRaWAN
	PO 3	3	Development of different modulations to design solution to a problem
	PO 4	3	Conduct the detailed survey on modulation techniques and identify the problems for further investigations
	PO 5	3	Use the modern tools of LoRaWAN parameters to design solutions
	PO 8	3	Apply ethical principles in development of solution with modulation techniques
	PO 9	3	Function effectively in teams to develop and manage LoRaWAN projects
	PO 10	3	Write effective reports and design document to represent idea
	PO 11	3	With the learnt different modulation technique demonstrate the project concept

	PO 12	3	Develop interest to learn further parameters and implement the idea in societal problems
	PSO 1	3	Compare the various modulation techniques by applying basic engineering knowledge
	PSO 2	3	Design a project with the developed parameters of LoRaWAN
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO3	PO 1	3	Apply the knowledge to integrate two different servers
	PO 2	3	Analyzes network and application server for LoRaWAN integration
	PO 3	3	Development of networks and server to design solution to a problem
	PO 4	3	Conduct the detailed survey on network techniques and integration of LoRaWAN
	PO 5	3	Use the modern tools of LoRaWAN to integrate networks and server to design solutions
	PO 7	3	Understand the impact of solutions in societal and environmental contexts in networks
	PO 8	3	Apply ethical principles in development of solution with application server for LoRaWAN integration
	PO 9	3	Function effectively in teams and as individual to develop and manage LoRaWAN integration
	PO 10	3	Communicate effectively with proper documentation in various technical events like paper presentation etc.
	PO 11	3	With the learnt integration technique of LoRaWAN demonstrate the project concept
	PO 12	3	Develop interest to learn further techniques and implement the idea in societal problems
	PSO 1	3	Compare the various networking techniques by applying basic engineering knowledge
	PSO 2	3	Design a project with the developed parameters of server integration
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork
CO4	PO 1	3	Apply the knowledge to create a solution for a real time application
	PO 2	3	Analyzes LoRaWAN concepts for designand develop design with the techniques
	PO 3	3	Development of concept of LoRaWAN design to solve real filed problem
	PO 4	3	Conduct the detailed survey on different modules and identify the problems for further investigations
	PO 5	3	Apply LoRaWAN concepts for design complex engineering activitieswith an understanding
	PO 6	3	Apply the knowledge of LoRaWAN design in professional engineering practice.
	PO 7	3	Understand the impact of solutions in societal and environmental contexts in LoRaWAN design concepts
	PO 8	3	Apply ethical principles in development of solution with development of modules
	PO 9	3	Function effectively in teams and as individual to develop modules and LoRaWAN concepts for design
	PO 10	3	Write effective reports and design document to represent idea
	PO 11	3	Develop interest in project and manage principles in concluding solutions
	PO 12	3	Develop interest to learn further techniques and implement the idea in societal problems
	PSO 1	3	Compare the various modules and LoRaWAN by applying basic engineering knowledge
	PSO 2	3	Design a project applying LoRaWAN concepts for design and development of modules
	PSO 3	3	Develop interpersonal skills and attitude needed for ethicalleadership teamwork
CO5	PO 1	3	Apply the knowledge to estimate the power requirement and security issues

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	PO 2	3	Analyzes power requirement concepts and security of LoRA with the techniques
	PO 3	3	Development of concept of minimal power requirement to solve real filed problem
	PO 4	3	Conduct the detailed survey of security of LoRA and identify the problems for further investigations
	PO 5	3	Apply concept of security of LoRA and apply it for short and long range communication
	PO 6	3	Apply the knowledge of minimal power requirement and security of LoRA and in professional engineering practice
	PO 7	3	Understand the impact of solutions in societal and environmental contexts in minimal power requirement and security of LoRA
	PO 8	3	Apply ethical principles in development of solution in short and long range communication
	PO 9	3	Function effectively in teams and as individual to apply it for short and long range communication
	PO 10	3	Write effective reports and design document to represent idea
	PO 11	3	Develop interest in project and manage principles in concluding solutions
	PO 12	3	Develop interest to learn further techniques and implement the idea in societal problems
	PSO 1	3	Compare the various minimal power requirement by applying basic engineering knowledge
	PSO 2	3	Design a project applying concepts of minimal power requirement and security of LoRA
	PSO 3	3	Develop interpersonal skills and attitude needed for ethical leadership teamwork

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