K.S.Rangasamy College of Technology

(Autonomous)

Curriculum & Syllabus

of

Electronics and Communication Engineering Department

(For the batch admitted in 2022 – 2023)

R 2022

Courses Accredited by NBA, Accredited by NAAC with 'A++' Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.

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

Department of Electronics and Communication Engineering

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.

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Tiruchengode - 637 215.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	I	60 EN 001	Professional English I								2	3	3	2	3
		60 MA 001	Matrices and Calculus	3	3	2.8	2.4	2.4							2
		60 PH 003	Physics for Electrical Engineering	3	2.8	2.8	2.6	2.4	2.6	2.4	1.75	2	1.6	2	2.4
		60 ME 002	Engineering Graphics	3	2.6	3	3	3	1	1	1		3	1.4	3
		60 CS 001	C Programming	3	3	3		3				2	2		2
		60 MY 001	Environmental Studies and Climate Change	2.8	2.8	3	2.8	2.75	2.6	3	3	2.2	2.2	1.8	2.8
		60 CS 0P1	C Programming Laboratory	3	3	3		3				2	2		2
		60 ME 0P1	Fabrication and Reverse Engineering Laboratory	3	2.6	2.8	1.6	3	2	2	2.2	3	2	1.6	3
	II	60 EN 002	Professional English II								2	3	3	2	3
		60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	3	3	2.6	2.4	2.6							2
		60 CH 003	Chemistry for Electronic Engineering	3	3	2.8	2.8	2.6	2.8	2.8	2.2	3	2.6	3	3
		60 ME 005	Foundation of Mechanical Engineering	3	3	3	3	3	2	2	2				3
		60 EC 201	Electronic Devices	3	3	2.6	2.6	2.6			3	3	3		3
		60 GE 001	Heritage of Tamils / தமிழர் மரபு							3	3		2		3
		60 CP 0P2	Engineering Physics and Chemistry Laboratory	3	2.8	3	2.8	2.2	2.6	2.8	2.4	2	2.2	2.2	2.4
		60 EC 2P1	Electronic Devices Laboratory	3	3	3	3	2.6	3	3		2.4	3		3
		60 CG 0P1	Career Skill Development – I								2	3	3	2	3
II	III	60 MA 009	Linear Algebra and Numerical Methods	3	3	3	3	2							2
		60 CS 002	Data Structures and Algorithms	3	3	2	2.6	2	2	2	2.4	2.6	2		2
		60 EC 301	Electronic Circuits	3	2.8	2.6	2.2	3			3	3	3		3
		60 EC 302	Circuit Analysis	3	3	3	3	2.6							2
		60 EC 303	Digital System Design	2.8	2.8	3	2.4	2.8			3	3	3		

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Approved in Academic Council Meeting held on 23/12/2023

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

		60 MY 002	Universal Human Values						3	3	3	2.8	3	2	3
		60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்							3	3		2		3
		60 EC 3P1	Analog and Digital Electronics Laboratory	3	3	2	2.7	2	2	2	3	2.6	2		2
		60 CS 0P2	Data Structures and Algorithms Laboratory	3	3	2	3	2	2	2	3	3	2		2
		60 CG 0P2	Career Skill Development – II								2	3	3	2	3
		60 CG 0P6	Internship												
	IV	60 MA 016	Probability and Inferential Statistics	3	3	3	3	2							2
		60 EC 401	Signals and Systems	3	3	2.8	2.8	2			3	3			3
		60 EC 402	Linear Integrated Circuits	2.6	2.8	3	3	3			3	3	3		3
		60 EC 403	Electromagnetic Waves	3	3	3	2.8		3	3					
		60 EC 404	Analog Communication	3	3	3	3	2.8	3			3	3		3
		60 EC L1*	Open Elective I												
		60 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	3	3	3	3	3	2.8		3	3	3		3
		60 EC 4P2	Electronic Design Project Laboratory	3	3	3	3	3	3		3	3	3	3	3
		60 CG 0P3	Career Skill Development – III	2.6	2.6	2.6	2.8		2.4				2	3	3
		60 CG 0P6	Internship												
III	V	60 EC 501	Control Systems Engineering	3	3	3	3	2	3		3	3			3
		60 EC 502	VLSI and Chip Design	3	3	3	3	3		3	3	3	3		3
		60 EC 503	Digital Signal Processing	3	3	2.6	2.4	2.6							2
		60 EC 504	Microprocessors and Microcontrollers	3	3	2.8	3				3	3	3		3
		60 EC E1*	Elective I												
		60 EC L2*	Open Elective II												
		60 MY 003	Startup and Entrepreneurship	2.8	2.6	3.0	2.4	2.2	2.5	1.7	1.8	1.3	2.0	2.2	2.4
		60 EC 5P1	Microcontrollers and VLSI Laboratory	3	3	3	3	3			3	3	3		3
		60 EC 5P2	Communication and Signal Processing Laboratory	3	3	3	3	3			3	3	3	3	3
		60 CG 0P4	Career Skill Development – IV								2	3	3	2	3
		60 CG 0P6	Internship												
	VI	60 EC 601	Embedded systems	3	3	2.6	2.4	2.6							2
		60 EC 602	Digital Communication	2.6	1.8	2.8	1.6	1.4	2.4	2	1.4	2.2	1.8	2.6	1.4
		60 EC 603	Mobile Communication and Networks	3	3	3	3	3	3	3	3	3	3		3
		60 EC 604	Machine Learning Techniques	3	2.8	2.8	2.8	3							
		60 EC E2*	Elective II												
		60 EC L3*	Open Elective III												
		60 EC 6P1	Innovative Engineering Laboratory	3	3	3	3	3	3	3	3	3	3	3	3
		60 EC 6P2	Embedded systems Laboratory	3	3	3	3	3			3	3	3	3	3
		60 EC 6P3	Mini project	3	3	3	3	3	3	3	3	3	3	3	3
		60 CG 0P5	Comprehension Test	3	3	2	2					1	2	2	3
		60 CG 0P6	Internship												

K.S. RANGASAMY COLLEGE OF TECHNOLOGY

Credit Distribution for B.E (ECE) Programme – 2022 –2023 Batch

S.No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	2	2	-	-	-	-	3	-	7	4.32
2.	BS	7	9	4	4	-	-	-	-	24	14.81
3.	ES	11	3	5	-	-	-	-	-	19	11.73
4.	PC	-	5	12	15	18	16	8	-	74	45.68
5.	PE	-	-	-		3	3	6	3	15	9.26

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Approved in Academic Council Meeting held on 23/12/2023

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

6.	OE	-	-	-	3	3	3	-	-	9	5.56
7.	CG	-	-	-	2	-	2	2	8	14	8.64
8.	MC	MC I	-	MC II	-	MC III	-	-	-	-	-
9.	AC	-	-	-	-	-	-	AC I	AC II	-	-
10.	GE	-	GE I	GE II	-	-	-	-	-	-	-
Total		**20**	**19**	**21**	**24**	**24**	**24**	**19**	**11**	**162**	**100**

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
CG - CAREER GUIDANCE COURSES
MC - MANDATORY COURSES
AC - AUDIT COURSES
GE - GENERAL ELECTIVE COURSES

- Open Electives are courses offered by different departments that do not have any prerequisites and could be of interest to students of any branch.

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EN 001	Professional English I	HS	3	1	0	2	2	Basic knowledge of reading and writing in English
2.	60 EN 002	Professional English II	HS	3	1	0	2	2	Basic knowledge of reading and writing in English and should have completed Professional English I.
3.	60 HS 002	Engineering Economics and Financial Accounting	HS	3	3	0	0	3	NIL
4.	60 AB 001	National Cadet Corps (Air wing)	HS	4	2	0	2	3	NIL
5.	60 AB 002	National Cadet Corps (Army Wing)	HS	4	2	0	2	3	NIL

BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 MA 001	Matrices and Calculus	BS	4	3	1	0	4	NIL
2.	60 PH 003	Physics for Electrical Engineering	BS	3	3	0	0	3	NIL
3.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	4	3	1	0	4	NIL
4.	60 CH 003	Chemistry for Electronic Engineering	BS	3	3	0	0	3	NIL
5.	60 CP 0P2	Engineering Physics and Chemistry Laboratory	BS	4	0	0	4	2	NIL
6.	60 MA 009	Linear Algebra and Numerical Methods	BS	4	3	1	0	4	NIL
7.	60 MA 016	Probability and Inferential Statistics	BS	4	3	1	0	4	NIL

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4	NIL
2.	60 CS 001	C Programming	ES	3	3	0	0	3	NIL
3.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2	NIL
4.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2	NIL
5.	60 ME 005	Foundation of Mechanical Engineering	ES	3	3	0	0	3	NIL
6.	60 CS 002	Data Structures and Algorithms	ES	3	3	0	0	3	NIL
7.	60 CS 0P2	Data Structures and Algorithms Laboratory	ES	4	0	0	4	2	Programming knowledge in C language

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC 201	Electronic Devices	PC	3	3	0	0	3	NIL
2.	60 EC 2P1	Electronic Devices Laboratory	PC	4	0	0	4	2	NIL
3.	60 EC 301	Electronic Circuits	PC	3	3	0	0	3	Electronic Devices
4.	60 EC 302	Circuit Analysis	PC	5	2	1	2	4	NIL
5.	60 EC 303	Digital System Design	PC	3	2	1	0	3	NIL
6.	60 EC 3P1	Analog and Digital Electronics Laboratory	PC	4	0	0	4	2	Electronic Devices Laboratory
7.	60 EC 401	Signals and Systems	PC	3	2	1	0	3	Integrals, Partial Differential Equations and Laplace transform.
8.	60 EC 402	Linear Integrated Circuits	PC	3	3	0	0	3	Electronic Circuits
9.	60 EC 403	Electromagnetic Waves	PC	4	3	1	0	4	NIL
10.	60 EC 404	Analog Communication	PC	4	2	0	2	3	Signals and Systems
11.	60 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	PC	4	0	0	4	2	Electronic Circuits
12.	60 EC 501	Control Systems Engineering	PC	4	3	1	0	4	Integrals, Partial Differential Equations and Laplace Transform and Signals and Systems
13.	60 EC 502	VLSI and Chip Design	PC	3	3	0	0	3	NIL
14.	60 EC 503	Digital Signal Processing	PC	4	3	1	0	4	Signals and Systems
15.	60 EC 504	Microprocessors and Microcontrollers	PC	3	3	0	0	3	NIL
16.	60 EC 5P1	Microcontrollers and VLSI Laboratory	PC	4	0	0	4	2	NIL
17.	60 EC 5P2	Communication and Signal Processing Laboratory	PC	4	0	0	4	2	NIL
18.	60 EC 601	Embedded systems	PC	3	3	0	0	3	Microprocessors and Microcontrollers, Basics of C Programming
19.	60 EC 602	Digital Communication	PC	5	2	1	2	4	Analog Communication
20.	60 EC 603	Mobile Communication and Networks	PC	3	3	0	0	3	Digital Communication
21.	60 EC 604	Machine Learning Techniques	PC	5	3	0	2	4	Neural Networks, Programming Language - Python, MATLAB.
22.	60 EC 6P2	Embedded systems Laboratory	PC	4	0	0	4	2	NIL
23.	60 EC 701	Antennas and Microwave Engineering	PC	3	3	0	0	3	Signals and Systems
24.	60 EC 702	Computer Networks	PC	3	3	0	0	3	NIL
25.	60 EC 7P1	RF and Networks Laboratory	PC	4	0	0	4	2	Digital Communication, Computer Networks

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

PROFESSIONAL ELECTIVES (PE)

SEMESTER V, ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC E11	Wearable Devices	PE	4	2	0	2	3	NIL
2.	60 EC E12	IoT Hardware	PE	4	2	0	2	3	Electronic devices and circuits, Basics of C Programming
3.	60 EC E13	Radar Technologies	PE	4	2	0	2	3	Electromagnetic Fields
4.	60 EC E14	Optical Communication and Networks	PE	4	2	0	2	3	Electromagnetic Fields
5.	60 EC E15	Consumer Electronics	PE	4	2	0	2	3	Basic knowledge of Electrical and Electronics Engineering
6.	60 EC E16	Foundations of Data Science	PE	4	2	0	2	3	NIL

SEMESTER VI, ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC E21	Human Assist Devices	PE	3	3	0	0	3	NIL
2.	60 EC E22	IoT Product Development	PE	4	2	0	2	3	Electronic devices and circuits, Basics of C Programming, IoT Hardware
3.	60 EC E23	Avionics Systems	PE	3	3	0	0	3	NIL
4.	60 EC E24	Optoelectronic Devices	PE	3	3	0	0	3	Electronic Devices
5.	60 EC E25	Wireless Broad Band Networks	PE	3	3	0	0	3	Computer Networks, Wireless Communication
6.	60 EC E26	Digital Image Processing	PE	3	3	0	0	3	Basic knowledge of Electrical and Electronics Engineering

SEMESTER VII, ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC E31	Medical Imaging Systems	PE	3	3	0	0	3	NIL
2.	60 EC E32	IoT Based System Design	PE	3	3	0	0	3	NIL
3.	60 EC E33	Satellite Communication	PE	3	3	0	0	3	Analog Communication
4.	60 EC E34	5G/6G Communication Networks	PE	3	3	0	0	3	Digital Communication
5.	60 EC E35	Wireless Sensor Network Design	PE	3	3	0	0	3	NIL
6.	60 EC E36	Artificial Intelligence	PE	3	3	0	0	3	Neural Networks

SEMESTER VII, ELECTIVE IV

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC E41	Brain Computer Interface and Applications	PE	3	3	0	0	3	NIL
2.	60 EC E42	Industrial IoT and Industry 4.0	PE	3	3	0	0	3	IoT
3.	60EC E43	Remote Sensing	PE	3	3	0	0	3	NIL
4.	60 EC E44	Software Defined Networks	PE	3	3	0	0	3	5G/6G Communication Networks
5.	60 EC E45	VLSI Testing and Verification	PE	3	3	0	0	3	CMOS VLSI Design
6.	60 EC E46	Computer Vision: Algorithms and Applications	PE	3	3	0	0	3	Artificial Intelligence

SEMESTER VIII, ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC E51	Body Area Networks	PE	3	3	0	0	3	NIL
2.	60 EC E52	Rocketry and Space Mechanics	PE	3	3	0	0	3	NIL
3.	60 EC E53	Advanced Wireless Communication Techniques	PE	3	3	0	0	3	Mobile Communication and Networks
4.	60 EC E54	Biomedical Instrumentation	PE	3	3	0	0	3	NIL
5.	60 EC E55	Micro Electro Mechanical Systems	PE	3	3	0	0	3	NIL
6.	60 EC E56	Deep Learning	PE	3	3	0	0	3	Machine Learning Techniques

SEMESTER VII & SEMESTER VIII, AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 AC 001	Research Methodology– I	AC	1	1	0	0	0	NIL
2.	60 AC 002	Research Methodology– II	AC	1	1	0	0	0	NIL

MANDATORY COURSES (MC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0	NIL
2.	60 MY 002	Universal Human Values	MC	3	3	0	0	3	NIL
3.	60 MY 003	Start-up and Entrepreneurship	MC	2	2	0	0	0	Basic knowledge of reading and writing in English.

GENERAL ELECTIVE COURSES (GE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 GE 001	Heritage of Tamils / தமிழர் மரபு	GE	1	1	0	0	1	NIL
2.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	GE	1	1	0	0	1	NIL

OPEN ELECTIVES I / II / III (OE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EC L01	Internet of Things	OE	4	2	0	2	3	Microprocessors and

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

									Microcontrollers, Basics of C Programming
2.	60 EC L02	Wearable Devices	OE	3	3	0	0	3	NIL
3.	60 EC L03	Pattern Recognition and Machine Learning	OE	3	3	0	0	3	Probability and Random processes
4.	60 EC L04	Next Generation Wireless Networks	OE	3	3	0	0	3	NIL
5.	60 EC L05	Microprocessor and Microcontroller	OE	3	3	0	0	3	NIL
6.	60 EC L06	5G Communications and MIMO	OE	3	3	0	0	3	NIL
7.	60 EC L07	Mobile Robotics	OE	3	3	0	0	3	Robotics

CAREER GUIDANCE COURSES (CG)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 CG 0P1	Career Skill Development – I	CG	2	0	0	2	1	Basic knowledge of reading and writing in English
2.	60 CG 0P2	Career Skill Development – II	CG	2	0	0	2	1	Basic knowledge of reading and writing in English
3.	60 CG 0P3	Career Skill Development – III	CG	2	0	0	2	1	Basic knowledge of Arithmetic and Logical Reasoning
4.	60 CG 0P4	Career Skill Development – IV	CG	2	0	0	2	1	Basic knowledge of Arithmetic and Logical Reasoning
5.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1	Fundamental knowledge in all core subjects.
6.	60 EC 4P2	Electronic Design Project Laboratory	CG	4	0	0	4	2	Analog and Digital Electronics Laboratory
7.	60 EC 6P1	Innovative Engineering Laboratory	CG	4	0	0	4	2	NIL
8.	60 EC 6P3	Mini project	CG	2	0	0	2	1	NIL
9.	60 EC 7P2	Project work - I	CG	4	0	0	4	2	-
10.	60 EC 8P1	Project work - II	CG	16	0	0	16	8	-
11.	60 CG 0P6	Internship	CG	0	0	0	0	1\2\3	-

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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(An Autonomous Institution affiliated to Anna University)

COURSES OF STUDY

(For the candidates admitted from 2022-2023 onwards)

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		Induction Programme	-	-	-	-	-	**0**
THEORY								
1.	60 EN 001	Professional English I	HS	3	1	0	2	2
2.	60 MA 001	Matrices and Calculus	BS	4	3	1	0	4
3.	60 PH 003	Physics for Electrical Engineering	BS	3	3	0	0	3
4.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4
5.	60 CS 001	C Programming	ES	3	3	0	0	3
6.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0
PRACTICALS								
7.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2
8.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2
			Total	29	14	1	14	20

I to VII semester

NCC% - Course can be waived with 3 credits in VII semester or offered as extra credits

NSS/NSO/YRC/RRC/Fine Arts% 3 credits is not accounted for CGPA

Career Skill Development (CSD)* - additional credit is offered not accounted for CGPA.

I to VIII semester

Internship$ 3 additional credits not accounted for CGPA is offered based on the Internship duration

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EN 002	Professional English II	HS	3	1	0	2	2
2.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	4	3	1	0	4
3.	60 CH 003	Chemistry for Electronic Engineering	BS	3	3	0	0	3
4.	60 ME 005	Foundation of Mechanical Engineering	ES	3	3	0	0	3
5.	60 EC 201	Electronic Devices	PC	3	3	0	0	3
6.	60 GE 001	Heritage of Tamils / தமிழர் மரபு	GE	1	1	0	0	1&
PRACTICALS								
7.	60 CP 0P2	Engineering Physics and Chemistry Laboratory	BS	4	0	0	4	2
8.	60 EC 2P1	Electronic Devices Laboratory	PC	4	0	0	4	2

Passed in BoS Meeting held on 18/11/2023

Approved in Academic Council Meeting held on 23/12/2023

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

9.	60 CG 0P1	Career Skill Development – I	CG	2	0	0	2	1*
Total				**27**	**14**	**1**	**12**	**19**

Heritage of Tamils[&] additional 1 credit is offered and not account for CGPA.

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 MA 009	Linear Algebra and Numerical Methods	BS	4	3	1	0	4
2.	60 CS 002	Data Structures and Algorithms	ES	3	3	0	0	3
3.	60 EC 301	Electronic Circuits	PC	3	3	0	0	3
4.	60 EC 302	Circuit Analysis	PC	5	2	1	2	4
5.	60 EC 303	Digital System Design	PC	3	2	1	0	3
6.	60 MY 002	Universal Human Values	MC	3	3	0	0	3[#]
7.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	GE	1	1	0	0	1[&]
PRACTICALS								
8.	60 EC 3P1	Analog and Digital Electronics Laboratory	PC	4	0	0	4	2
9.	60 CS 0P2	Data Structures and Algorithms Laboratory	ES	4	0	0	4	2
10.	60 CG 0P2	Career Skill Development – II	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship	CG	0	0	0	0	1\2 \3[$]
Total				**32**	**17**	**3**	**12**	**21**

- Tamils and Technology[&] additional1 credit is offered and not account for CGPA.
- UHV[#] additional 3 credit is offered and not accounted for CGPA

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 MA 016	Probability and Inferential Statistics	BS	4	3	1	0	4
2.	60 EC 401	Signals and Systems	PC	3	2	1	0	3
3.	60 EC 402	Linear Integrated Circuits	PC	3	3	0	0	3
4.	60 EC 403	Electromagnetic Waves	PC	4	3	1	0	4
5.	60 EC 404	Analog Communication	PC	4	2	0	2	3
6.	60 EC L1*	Open Elective I	OE	3	3	0	0	3
PRACTICALS								
7.	60 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	PC	4	0	0	4	2
8.	60 EC 4P2	Electronic Design Project Laboratory	CG	4	0	0	4	2
9.	60 CG 0P3	Career Skill Development – III	CG	2	0	0	2	1*

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

10.	60 CG 0P6	Internship	CG	0	0	0	0	1\2 \3$
			Total	**31**	**16**	**3**	**12**	**24**

SEMESTER V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EC 501	Control Systems Engineering	PC	4	3	1	0	4
2.	60 EC 502	VLSI and Chip Design	PC	3	3	0	0	3
3.	60 EC 503	Digital Signal Processing	PC	4	3	1	0	4
4.	60 EC 504	Microprocessors and Microcontrollers	PC	3	3	0	0	3
5.	60 EC E1*	Elective I	PE	4	2	0	2	3
6.	60 EC L2*	Open Elective II	OE	3	3	0	0	3
7.	60 MY 003	Startup and Entrepreneurship	MC	2	2	0	0	0
PRACTICALS								
8.	60 EC 5P1	Microcontrollers and VLSI Laboratory	PC	4	0	0	4	2
9.	60 EC 5P2	Communication and Signal Processing Laboratory	PC	4	0	0	4	2
10.	60 CG 0P4	Career Skill Development – IV	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship	CG	0	0	0	0	1\2 \3$
			Total	**33**	**19**	**2**	**12**	**24**

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EC 601	Embedded systems	PC	3	3	0	0	3
2.	60 EC 602	Digital Communication	PC	5	2	1	2	4
3.	60 EC 603	Mobile Communication and Networks	PC	3	3	0	0	3
4.	60 EC 604	Machine Learning Techniques	PC	5	3	0	2	4
5.	60 EC E2*	Elective II	PE	3	3	0	0	3
6.	60 EC L3*	Open Elective III	OE	3	3	0	0	3
PRACTICALS								
7.	60 EC 6P1	Innovative Engineering Laboratory	CG	4	0	0	4	2
8.	60 EC 6P2	Embedded systems Laboratory	PC	4	0	0	4	2
9.	60 EC 6P3	Mini project	CG	2	0	0	2	1&
10.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship	CG	-	-	-	-	1\2 \3$

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Total	**34**	**17**	**1**	**16**	**24**

Comprehension Test* - one additional credit is offered and not accounted for CGPA calculation.
Mini project[&] - 1 additional credit is offered and not accounted for CGPA calculation

SEMESTER VII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 HS 002	Engineering Economics and Financial Accounting	HS	3	3	0	0	3
2.	60 EC 701	Antennas and Microwave Engineering	PC	3	3	0	0	3
3.	60 EC 702	Computer Networks	PC	3	3	0	0	3
4.	60 EC E3*	Elective III	PE	3	3	0	0	3
5.	60 EC E4*	Elective IV	PE	3	3	0	0	3
6.	60 AB 00*	NCC\NSS\NSO\YRC\RRC\Yoga\Fine Arts	HS	4	2	0	2	3[%]
7.	60 AC 001	Research Methodology– I	AC	1	1	0	0	0
PRACTICALS								
8.	60 EC 7P1	RF and Networks Laboratory	PC	4	0	0	4	2
9.	60 EC 7P2	Project Work - I	CG	4	0	0	4	2
10.	60 CG 0P6	Internship	CG	0	0	0	0	1\2 \3[$]
Total				**24**	**16**	**0**	**8**	**19**

NCC[%] - Course can be waived with 3 credits in VII semester or offered as extra 3 credits.
NSS/NSO/YRC/RRC/Fine Arts[%] 3 extra credits not accounted for CGPA

SEMESTER VIII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EC E5*	Elective V	PE	3	3	0	0	3
2.	60 AC 002	Research Methodology– II	AC	1	1	0	0	0
PRACTICALS								
3.	60 EC 8P1	Project Work - II	CG	16	0	0	16	8
4.	60 CG 0P6	Internship	CG	0	0	0	0	1\2 \3[$]
Total				**20**	**4**	**0**	**16**	**11**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 162

Note: HS-Humanities and Social Sciences including Management Courses, BS-Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, GE-General Elective Courses, OE-Open Elective Courses, CG-Career Guidance Courses, MC-Mandatory Courses

L: Lecture
Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

T: Tutorial
P: Practical

Note:
1 Hour Lecture is equivalent to 1 credit
2 Hours Tutorial is equivalent to 1 credit
2 Hours Practical is equivalent to 1 credit

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN BOARD OF STUDIES
Department of ECE
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Tiruchengode - 637 215.

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
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B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
(For the candidates admitted from 2022-2023 onwards)

FIRSTSEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 EN 001	Professional English I	2	40	60	100	45	100
2.	60 MA 001	Matrices and Calculus	2	40	60	100	45	100
3.	60 PH 003	Physics for Electrical Engineering	2	40	60	100	45	100
4.	60 CS 001	C Programming	2	40	60	100	45	100
5.	60 MY 001	Environmental Studies and Climate Change	2	100	00	100	00	100
6.	60 ME 002	Engineering Graphics	2	50	50	100	45	100
PRACTICAL								
7.	60 CS 0P1	C Programming Laboratory	3	60	40	100	45	100
8.	60 ME 0P1	Fabrication and Reverse EngineeringLaboratory	3	60	40	100	45	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

SECOND SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 EN 002	Professional English II	2	40	60	100	45	100
2.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	2	40	60	100	45	100
3.	60 CH 003	Chemistry For Electronic Engineering	2	40	60	100	45	100
4.	60 ME 005	Foundation of Mechanical Engineering	2	40	60	100	45	100
5.	60 EC 201	Electronic Devices	2	40	60	100	45	100
6.	60 GE 001	Heritage of Tamils / தமிழர்மரபு	1	100	00	100	00	100
PRACTICAL								
7.	60 CP 0P2	Engineering Physics and Chemistry Laboratory	3	60	40	100	45	100
8.	60 EC 2P1	Electronic Devices Laboratory	3	60	40	100	45	100
9.	60 CG 0P1	Career Skill Development – I	1	100	00	100	00	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

THIRD SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 MA 009	Linear Algebra and Numerical Methods	2	40	60	100	45	100
2.	60 CS 002	Data Structures and Algorithms	2	40	60	100	45	100
3.	60 EC 301	Electronic Circuits	2	40	60	100	45	100
4.	60 EC 303	Digital System Design	2	40	60	100	45	100
5.	60 MY 002	Universal Human Values	2	100	-	100	-	100
6.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	1	100	-	100	-	100
THEORY CUM PRACTICAL								
7.	60 EC 302	Circuit Analysis	2	50	50	100	45	100
PRACTICAL								
8.	60 EC 3P1	Analog and Digital Electronics Laboratory	3	60	40	100	45	100
9.	60 CS 0P2	Data Structures and Algorithms Laboratory	3	60	40	100	45	100
10.	60 CG 0P2	Career Skill Development – II	1	100	00	100	00	100
11.	60 CG 0P6	Internship	-	100	-	100	-	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

FOURTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 MA 016	Probability and Inferential Statistics	2	40	60	100	45	100
2.	60 EC 401	Signals and Systems	2	40	60	100	45	100
3.	60 EC 402	Linear Integrated Circuits	2	40	60	100	45	100
4.	60 EC 403	Electromagnetic Waves	2	40	60	100	45	100
5.	60 EC L1*	Open Elective I	2	40	60	100	45	100
THEORY CUM PRACTICAL								
6.	60 EC 404	Analog Communication	2	50	50	100	45	100
PRACTICAL								
7.	60 EC 4P1	Linear Integrated Circuits and Electromagnetics Laboratory	3	60	40	100	45	100
8.	60 EC 4P2	Electronic Design Project Laboratory	3	60	40	100	45	100
9.	60 CG 0P3	Career Skill Development – III	1	100	00	100	00	100
10.	60 CG 0P6	Internship	-	100	-	100	-	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

FIFTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 EC 501	Control Systems Engineering	2	40	60	100	45	100
2.	60 EC 502	VLSI and Chip Design	2	40	60	100	45	100
3.	60 EC 503	Digital Signal Processing	2	40	60	100	45	100
4.	60 EC 504	Microprocessors and Microcontrollers	2	40	60	100	45	100
5.	60 EC L2*	Open Elective II	2	40	60	100	45	100
6.	60 MY 003	Startup and Entrepreneurship	2	100	-	100	-	100
7.								
THEORY CUM PRACTICAL								
8.	60 EC E1*	Elective I	2	50	50	100	45	100
PRACTICAL								
9.	60 EC 5P1	Microcontrollers and VLSI Laboratory	3	60	40	100	45	100
10.	60 EC 5P2	Communication and Signal Processing Laboratory	3	60	40	100	45	100
11.	60 CG 0P4	Career Skill Development – IV	1	100	00	100	00	100
12.	60 CG 0P6	Internship	-	100	-	100	-	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

SIXTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 EC 601	Embedded systems	2	40	60	100	45	100
2.	60 EC 603	Mobile Communication and Networks	2	40	60	100	45	100
3.	60 EC E2*	Elective II	2	40	60	100	45	100
4.	60 EC L3*	Open Elective III	2	40	60	100	45	100
THEORY CUM PRACTICAL								
5.	60 EC 602	Digital Communication	2	50	50	100	45	100
6.	60 EC 604	Machine Learning Techniques	2	50	50	100	45	100
PRACTICAL								
7.	60 EC 6P1	Innovative Engineering Laboratory	3	60	40	100	45	100
8.	60 EC 6P2	Embedded systems Laboratory	3	60	40	100	45	100
9.	60 EC 6P3	Mini project	3	100	00	100	00	100
10.	60 CG 0P5	Comprehension Test	1	100	00	100	00	100
11.	60 CG 0P6	Internship	-	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will puta process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for the award of terminal examination marks.

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 EN 001	PROFESSIONAL ENGLISH I

Category	L	T	P	Credit
HS	1	0	2	2

Objective

- 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

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Listen and comprehend complex academic texts	Understand
CO2	Read and infer the denotative and connotative meanings of technical texts	Analyze
CO3	Write definitions, descriptions, narrations, and essays on various topics	Apply
CO4	Speak fluently and accurately in formal and informal communicative contexts	Apply
CO5	Express their opinions effectively in both oral and written medium of communication	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								2	3	3	2	3	2	2	3
CO2								2	3	3	2	3	2	2	3
CO3								2	3	3	2	3	2	2	3
CO4								2	3	3	2	3	2	2	3
CO5								2	3	3	2	3	2	2	3
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	10
Apply (Ap)	20	20	40
Analyse (An)	30	30	50
Create (Cr)	0	0	0

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EN 001 - Professional English I								
Common to All Branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	1	0	2	30	2	40	60	100

Introduction to Fundamentals of Communication* **Listening:** General information-specific details-conversation: introduction to classmates – audio / video (formal & informal). **Speaking:** Self Introduction; Introducing a friend; conversation - politeness strategies. **Reading:** Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing:** Writing letters – informal and formal – basics and format orientation **Language Focus:** Present Tenses; word formation (affixes); synonyms, antonyms and contranyms, and phrasal verbs; abbreviations & acronyms (as used in technical contexts).	[6]
Narration and Summation* **Listening:** Podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities. **Speaking:** Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews. **Reading:** Biographies, travelogues, newspaper reports, excerpts from literature, and travel & technical blogs. **Writing:** Paragraph writing, short report on an event (field trip etc.). **Language Focus:** Past tenses and prepositions; One-word substitution.	[6]
Description of a process / product* **Listening:** Listen to a product and process descriptions; advertisements about products or services **Speaking:** Picture description; giving instruction to use the product; presenting a product. **Reading:** Advertisements, gadget reviews and user manuals. **Writing:** Definitions; instructions; and product /process description. **Language Focus:** Imperatives; comparative adjectives; future tenses. Homonyms; and Homophones, discourse markers (connectives & sequence words)	[6]
Classification and Recommendations * **Listening:** TED Talks; scientific lectures; and educational videos. **Speaking:**Small Talk; Mini presentations **Reading:** Newspaper articles and Journal reports **Writing:** Note-making / Note-taking; recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode) **Language Focus:** Articles; Pronouns -Possessive & Relative pronouns; ; subject-verb agreement; collocations	[6]
Expression* **Listening:** Debates/ discussions; different viewpoints on an issue; and panel discussions. **Speaking:** Group discussions, debates & role plays. **Reading:** Editorials; and opinion blogs. **Writing:** Essay Writing (Descriptive or narrative). **Language Focus:** Punctuation; Compound Nouns; simple, compound & complex sentences. cause& effect expressions.	[6]
Total hours	**30**

Text book(s):	
1.	'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020
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,

Passed in BoS Meeting held on 18/11/2023

Approved in Academic Council Meeting held on 23/12/2023

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

	New York, 2005
2.	Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003
3.	Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, 'A Course Book on Technical English'Scitech Publications (India) Pvt. Ltd. 2020

*** SDG- 04- Quality Education**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Introduction to Fundamentals of Communication**	
1.1	Listening for general information and Specific details	1
1.2	Self-introduction	1
1.3	Narrating personal experiences	1
1.4	Reading relevant to technical contexts and emails	1
1.5	Writing letters – informal	1
1.6	Writing letters – formal	1
1.7	Present Tenses	1
1.8	synonyms, antonyms and contranyms, and affixes	1
1.9	phrasal verbs; abbreviations & acronyms	1
2	**Narration and Summation**	
2.1	Listening to podcasts, documentaries and interviews with celebrities	1
2.2	Narrating personal experiences	1
2.3	Summarizing of documentaries	1
2.4	Reading travelogues, and excerpts from literature	1
2.5	Paragraph writing	1
2.6	Short report on an event (field trip etc.).	1
2.7	Past tenses	1
2.8	Prepositions	1
2.9	One-word substitution	1
3	**Description of a process / product**	
3.1	Listen to a product and process descriptions	1
3.2	Picture description	1
3.3	Giving instruction to use the product	1
3.4	Reading Advertisements, gadget reviews and user manuals	1
3.5	Writing Definitions and instructions	1
3.6	Future Tenses	1
3.7	Homonyms and Homophones	1
3.8	Imperatives	1
3.9	comparative adjectives, and discourse markers	1
4	**Classification and Recommendations**	

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Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

4.1	Listening to TED Talksand educational videos	2
4.2	Listening to scientific lectures	1
4.3	Small Talk and mini presentations	2
4.4	Reading newspaper articles and journal reports	2
4.5	Note-making / Note-taking	1
4.6	Recommendations	1
4.7	Transferring information from non-verbal	1
4.8	Articles and Pronouns	2
4.9	Subject-verb agreement and collocations	
5	**Expression**	
5.1	Listening to debates and panel discussions	1
5.2	Group discussions	2
5.3	Role plays	1
5.4	Reading editorials and opinion blogs	1
5.5	Essay Writing (Descriptive or narrative)	1
5.6	Punctuation and cause & effect expressions.	1
5.7	Compound Nouns	1
5.8	Simple, compound & complex sentences	1
	Total	**60**

Course Designers

1. Dr.A.Palaniappan -palaniappan@ksrct.ac.in

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60 MA 001	MATRICES AND CALCULUS

Category	L	T	P	Credit
BS	3	1	0	4

Objective

- To familiarize the students with basic concepts in Cayley-Hamilton theorem and orthogonal transformation.
- To get exposed to the fundamentals of differential calculus in various methods.
- To acquire skills to understand the concepts involved in Jacobians and maxima and minima.
- To solve various linear differential equations and method of variation of parameters.
- To learn various techniques and methods in solving definite and indefinite integrals.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply Cayley-Hamilton theorem and reduce the quadratic form into canonical form.	Remember, Apply, Evaluate
CO2	Apply differential calculus in solving various Engineering problems.	Remember, Understand, Apply
CO3	Analyze Jacobian methods and constrained maxima and minima of the functions	Remember, Understand, Analyze
CO4	Apply various methods in solving the differential equations	Remember, Apply
CO5	Evaluate definite and indefinite integrals using different techniques.	Remember, Apply, Evaluate

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3							2		3
CO2	3	3	2	2	3							2		3
CO3	3	3	3	2	3							2		3
CO4	3	3	3	3	3							2		3
CO5	3	3	3	2	3							2		3
3 - Strong;2 - Medium;1 - Some														

Assessment Pattern

Bloom'sCategory	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		

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Tiruchengode - 637 215.

Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	30	20	40	40
Analyze (An)	0	20	20	20
Evaluate (Ev)	10	0	20	20
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

60 MA 001 - Matrices and Calculus

Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT, AI&DS, AI&ML

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100

Matrices Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors –Cayley-Hamilton theorem-Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by an Orthogonal transformation - Nature of quadratic form – Applications: Stretching of an elastic membrane.	[9]
Differentiation Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) – Successive Differentiation-Leibnitz's theorem- **Applications: Maxima and Minimaof functions of one variable*.**	[9]
Functions of Several Variables Partial differentiation – Homogeneous functions and Euler's theorem – Jacobians – Taylor's series for functions of two variables – **Applications: 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 of the form $e^{\alpha x}, sin\,\alpha\, x, cos\,\alpha\, x,\ x^n, n > 0,$ - Differential equations with variable coefficients: Cauchy's and Legendre's form of linear equations – Method of variation of parameters.	[9]
Integration Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centers of mass.	[9]
Hands on: 1. Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank. 2. Solution of system of linear equations. 3. Computation of Eigen values and Eigen vectors of a Matrix. 4. Finding ordinary and partial derivatives. 5. Solving first and second order ordinary differential equations. 6. Computing Maxima and Minima of a function of one variable. 7. Computing Maxima and Minima of a function of two variables.	
Total Hours: 45 + 15(Tutorial)	**60**

Text book(s):

1.	Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.

Reference(s):

1.	Kreyszig Erwin, "Advanced Engineering Mathematics", 10thEdition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.

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Tiruchengode - 637 215.

2.	Kandasamy P, Thilagavathy K and Gunavathy K, “Engineering Mathematics - I”, S.Chand& Company Ltd, New Delhi, 2017
3.	Bali N P and Manish Goyal,” A text book of Engineering Mathematics”,10th Edition, Laxmi Publications (P) Ltd, 2016.
4.	“Matrix Analysis with Applications” Dr Gupta S K and DrSanjeev Kumar and Prof. Somnath Roy “Matrix Solvers”, NPTEL Online Video Courses.

***SDG: 4 – Quality Education**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Matrices**	
1.1	Characteristic equation	1
1.2	Eigen values and Eigen vectors of a real matrix vectors	1
1.3	Properties of Eigen values and Eigen vectors	1
1.4	Cayley-Hamilton theorem	1
1.5	Tutorial	2
1.6	Orthogonal transformation of a symmetric matrix to diagonal form	1
1.7	Reduction of quadratic form to canonical form by Orthogonal transformation	1
1.8	Nature of quadratic form	1
1.9	Applications : Stretching of an elastic membrane	1
1.10	Tutorial	2
2	**Differentiation**	
2.1	Representation of functions	1
2.2	Limit of a function and Continuity	1
2.3	Differentiation rules (sum, product, quotient, chain rules)	1
2.4	Successive differentiation	1
2.5	Tutorial	2
2.6	Leibnitz’s theorem	1
2.7	Maxima and minima of functions two variables	1
2.8	Lagrange Multipliers	1
2.9	Applications : Maxima and Minima of functions of one variable	1
2.10	Tutorial	2
3	**Functions of Several Variables**	
3.1	Partial differentiation	1
3.2	Homogeneous functions and Euler’s theorem	1
3.3	Jacobians	1
3.4	Tutorial	2
3.5	Taylor’s series for functions of two variables	1
3.6	Maxima and minima of functions of two variables	1
3.7	Constrained maxima and minima	1
3.8	Lagrange’s Method of Undetermined Multipliers.	2

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3.9	Tutorial	2
4	**Differential Equations**	
4.1	Linear differential equations of second and higher order with constant co-efficient	1
4.2	R.H.S is of the form $e^{\alpha x}, sin\,\alpha\, x, cos\,\alpha\, x,\ x^n, n > 0$	1
4.3	R.H.S is of the form $e^{\alpha x} \sin \beta x, e^{\alpha x} \cos \beta x$ and $e^{\alpha x} x^n$	2
4.4	Tutorial	2
4.5	Differential equations with variable coefficients: Cauchy's form of linear equations	1
4.6	Differential equations with variable coefficients: Legendre's form of linear equations	2
4.7	Method of variation of parameters	1
4.8	Tutorial	2
5	**Integration**	
5.1	Definite and Indefinite integrals	1
5.2	Substitution rule	1
5.3	Techniques of Integration: Integration by parts	1
5.4	Integration of rational functions by partial fraction	1
5.5	Tutorial	2
5.6	Integration of irrational functions	1
5.7	Improper integrals	1
5.8	Hydrostatic force.	1
5.9	Pressure, moments and centers of mass.	1
5.10	Tutorial	2
	Total	60

Course Designers

1. Dr.C.Chandran - cchandran@ksrct.ac.in
2. Mr. G.Mohan - mohan@ksrct.ac.in

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60 PH 003	PHYSICS FOR ELECTRICAL ENGINEERING (ECE, EE&EEE)

Category	L	T	P	Credit
BS	3	0	0	3

Objective

- To make the students to understand the basics of crystallography, crystal growth and its importance in semiconductor devices
- To enable the students in understanding the importance of quantum physics and its applications.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications
- To understand the dielectric properties of materials including magnetic materials, applications of dielectrics and magnetic materials
- To introduce advanced materials and nano technology for various modern engineering applications

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Recognize the basics of crystallography, different crystal growth techniques and its applications	Understand
CO2	Utilize the fundamentals of quantum mechanics and apply to one dimensional motion of particles	Understand
CO3	Acquire knowledge on basics of semiconductor physics and its applications in various devices	Apply
CO4	Impart the knowledge on magnetic and dielectric properties of materials and their applications	Apply & Analyse
CO5	Interpret the properties of new engineering materials and nano materials for potential applications	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	2	3	2	2	3	-	2	-
CO2	3	3	3	2	2	2	2	-	1	2	2	1	-	2	-
CO3	3	2	3	3	3	3	3	2	2	2	-	2	-	2	-
CO4	3	3	3	3	2	2	2	1	2	1	2	3	-	2	-
CO5	3	3	2	2	3	3	2	2	2	1	2	3	-	2	-
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	30
Understand	20	20	30
Apply	30	30	30
Analyse	0	0	10
Evaluate	0	0	0

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Create	0	0	0

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 PH 003- Physics for Electrical Engineering								
Common to EEE, EE, ECE								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	40	60	100

CRYSTAL STRUCTURE OF SOLIDS* Lattice - Unit cell – crystal systems and Bravais lattice - Miller indices - d spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for HCP structure – Production of single crystal silicon by melt growth techniques (Bridgman and Czochralski) - Basic Properties of Silicon Wafers - wafer orientation – wafer cleaning – pattern alignment - imperfections in crystals.	[9]
QUANTUM MECHANICS* Black body radiation – Dual nature of light - de-Broglie hypothesis – Properties of matter waves - Time-dependent and time independent Schrodinger equation for wave function - Applications: Particle in a box (one dimensional and three dimensional) – Physical significance of wave function-Uncertainty principle – Applications - Electron microscope - Scanning electron microscope.	[9]
SEMICONDUCTING MATERIALS Properties-Elemental and Compound Semiconductors - Carrier Concentration in intrinsic and Extrinsic semiconductors- Experimental determinations of resistivity of semiconductor by four probe method - Hall Coefficient-Experimental Determination of Hall Coefficient- Semiconductor devices – P-N Junction diode, **Solar Cell, LED****.	[9]
MAGNETIC AND DIELECTRIC MATERIALS* Magnetic Materials: Origin of magnetic moment - Bohr magnetron - Classification of magnetic materials -Domain theory - Hysteresis - soft and hard magnetic materials - Applications - Giant Magneto Resistance (GMR). Dielectric Materials: Polarization - Electronic, ionic, orientational and space charge - Frequency and Temperature dependence of polarization- Breakdown mechanisms - Applications of dielectrics in Capacitor and Transformer.	[9]
ADVANCED MATERIALS AND NANOTECHNOLOGY* Advanced Materials: Metallic glasses – preparation, properties and applications - Shape memory alloys (SMA) - characteristics, properties of NiTi alloy applications. Nano Technology: Properties- Top-down process: Ball Milling method – Bottom-up process: Vapour Phase Deposition - Carbon Nano Tube (CNT): Properties, preparation by electric arc method- Application -Single electron phenomena and Single electron transistor (SET)	[9]
Total hours	**45**

Text book(s):	
1.	M. N. Avadhanulu, P. G. Kshirsagar, TVS Arun Murthy “A Text Book of Engineering Physics”, S Chand Publications, New Delhi, 2022.
2.	H. K. Malik, A. K. Singh “Engineering Physics” ,McGraw Hill Education Private Limited, New Delhi. 2021.
3.	D. R. Joshi, “Engineering Physics” ,McGraw Hill Education Private Limited, New Delhi. 2010.
Reference(s):	
1.	S.O. Pillai, “A Textbook Of Engineering Physics” ,New Age International (P) Limited, New Delhi, 2014.
2.	B. B. Laud,“ Lasers and Non-Linear Optics”, New Age International Publications, New Delhi, 2015.
3.	Palanisamy, P.K., “Physics of Materials”, Scitech Publications, Chennai. 2012.

*** SDG:4- Quality Education**

**** SDG:7 - Sustainable and modern energy for all**

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Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	**CRYSTAL STRUCTURE OF SOLIDS**	
1.1	Lattice - Unit cell – crystal systems and Bravais lattice	1
1.2	Miller indices - d spacing in cubic lattice	1
1.3	Calculation of number of atoms per unit cell	1
1.4	Atomic radius - Coordination number - Packing factor for HCP structure	1
1.5	Production of single crystal silicon by melt growth techniques	1
1.6	(Bridgman and Czochralski)	1
1.7	Basic Properties of Silicon Wafers	1
1.8	Wafer orientation – wafer cleaning	
1.9	Pattern alignment - imperfections in crystals	
2.0	**QUANTUM MECHANICS**	
2.1	Black body radiation	1
2.2	Dual nature of light - de-Broglie hypothesis	1
2.3	Properties of matter waves	1
2.4	Time-dependent and time independent Schrodinger equation for wave function	1
2.5	Applications: Particle in a box (one dimensional and three dimensional)	1
2.6	Physical significance of wave function-Uncertainty principle	1
2.7	Applications of Schrodinger equation	1
2.8	Electron microscope	1
2.9	Scanning electron microscope	1
3.0	**SEMICONDUCTING MATERIALS**	
3.1	Properties of semiconductor	1
3.2	Elemental and Compound Semiconductors	1
3.3	Carrier Concentration in intrinsic and Extrinsic semiconductors	1
3.4	Experimental determinations of resistivity of semiconductor	1
3.5	Four probe method	1
3.6	Hall Coefficient	1
3.7	Experimental Determination of Hall Coefficient	1
3.8	Semiconductor devices – P-N Junction diode	1
3.9	Solar Cell, LED	1
4.0	**MAGNETIC AND DIELECTRIC MATERIALS**	
4.1	Origin of magnetic moment - Bohr magnetron	1
4.2	Classification of magnetic materials	1
4.3	Domain theory - Hysteresis - soft and hard magnetic materials	1
4.4	Applications - Giant Magneto Resistance (*GMR*)	1
4.5	Electronic Polarization, Ionic Polarization	1
4.6	Orientational and space charge polarization	1
4.7	Frequency and Temperature dependence ofpolarization	1

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Approved in Academic Council Meeting held on 23/12/2023

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

4.8	Breakdown mechanisms	1
4.9	Applications of dielectrics in Capacitor and Transformer	1
5.0	**ADVANCED MATERIALS AND NANOTECHNOLOGY**	
5.1	Metallic glasses – preparation, properties and applications	1
5.2	Shape memory alloys (SMA)	1
5.3	Characteristics, properties of NiTi alloy applications	1
5.4	Properties- Top-down process: Ball Milling method	1
5.5	Bottom-up process: Vapour Phase Deposition	1
5.6	Carbon Nano Tube (CNT): Properties	1
5.7	Preparation by electric arc method	1
5.8	CNT-Application	1
5.9	Single electron phenomena and Single electron transistor (SET)	1

Course Designers

1. Dr. V. Vasudevan
2. Mr.S. Vanchinathan
3. Dr. M. Malarvizhi

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60 ME 002	ENGINEERING GRAPHICS

Category	L	T	P	Credit
ES	2	0	4	4

Objective

- To acquire various concepts of dimensioning, conventions and standards.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views.
- To learn the concept in projection of solids, section of solids and development of different types of surfaces.
- To learn the concept of isometric projection.
- To learn the geometry and topology of engineered components

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Demonstrate the Impact of computer technologies on graphical communication	Remember/ Understand/ Apply
CO2	Convert the pictorial views in to orthographic views using drafting software	Remember/ Understand/ Apply
CO3	Draw the projection of simple solids, true shape of sections and development of surfaces	Remember/ Understand/ Apply
CO4	Construct the isometric projections of objects using drafting software.	Remember/ Understand/ Apply
CO5	Interpret a design project illustrating engineering graphical skills.	Remember/ Understand/ Apply

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3											3	3
CO2	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
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30

Passed in BoS Meeting held on 18/11/2023
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Department of ECE
K.S.Rangasamy College of Technology
Tiruchengode - 637 215.

Apply	30	30	50
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022

60 ME 002- Engineering Graphics

Common to All 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

Introduction to Computer Aided Drafting (CAD) software* **[6+12]** Theory of CAD software – Menu System, Tool bars (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 – Select and erase objects.	[18]
Orthographic Projection* **[6+12]** Theory of projection – Terminology and Methods of projection – first angle and third angle projection – Conversion of pictorial views into orthographic views	[18]
Projection of Solids and Sections of Solids* **[6+12]** 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 **Development of Surfaces*** Principle of development-Methods of development: Parallel line development-Cube, Prism and Cylinder. Radial line development – Pyramid and cone	[18]
Isometric Projection* **[6+12]** 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	[18]
Application of Engineering Graphics* **[6+12]** Geometry and topology of engineered components: Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – 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).	[18]
Total hours	**90**

Text book(s):

1. Bhatt N.D., 'Engineering Drawing', Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2019
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.

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Tiruchengode - 637 215.

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.

***SDG 9 – Industry Innovation and Infrastructure**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Introduction to Computer Aided Drafting (CAD) software**	
1.1	Theory of CAD software	1
1.2	Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension)	2
1.3	Drawing Area (Background, Crosshairs, Coordinate System)	3
1.4	Dialog boxes and windows – Shortcut menus	3
1.5	The Command Line and Status Bar	1
1.6	Different methods of zoom – Select and erase objects.	2
2	**Orthographic Projection**	
2.1	Introduction to orthographic projections	2
2.2	Planes of projection,	2
2.3	Projection of points	1
2.4	Projection of lines inclined to both planes.	2
2.5	Projection of planes	2
2.6	Projection of planes Inclined to both planes	1
2.7	Conversions of pictorial views to orthographic views.	3
2.8	Practice class for pictorial views to orthographic views.	2
2.9	Practice class for pictorial views to orthographic views.	1
3	**Projection of Solids**	
3.1	Projections of simple solids: prism	2
3.2	Projections of simple solids: cylinder	3
3.3	Projections of simple solids: pyramid	2
3.4	Projections of simple solids: Cone	2
3.5	Practice class for Projection of Solids	2
3.6	Axis of solid inclined to both HP and VP	5
3,7	Section of solids for Prism,	2
3,8	Section of solids for Cylinder,	2
3,9	Section of solids for Pyramid,	2
3,10	Section of solids for Cone	2
3,11	Auxiliary Views - Draw the sectional orthographic views of geometrical solids.	3
3.12	Draw the sectional orthographic views of objects from industry.	3
3,13	Development of surfaces of Right solids Prism,	2
3.14	Development of surfaces of Right solids Pyramid	2
3.15	Development of surfaces of Right solids Cylinder and Cone	2

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4	**Isometric Projection and Introduction to AutoCAD**	
4.1	Principles of isometric projection	1
4.2	Isometric scale	2
4.3	Isometric projections of simple solids: Prism,	2
4.4	Isometric projections of simple solids: Pyramid,	2
4.5	Isometric projections of simple solids: Cylinder	1
4.6	Isometric projections of simple solids: Cone	2
4.7	Isometric projections of frustum	2
4.8	Isometric projections of truncated solids	2
4.9	Combination of two solid objects in simple vertical positions.	3
5	**Application of Engineering Graphics**	
5.1	Geometry and topology of engineered components:	2
5.2	Creation of engineering models and their presentation in standard 2D blueprint form,	3
5.3	3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models	3
5.4	Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc.	3
5.5	Applying colour coding according to building drawing practice	2
5.6	Drawing sectional elevation showing foundation to ceiling	2
5.7	Introduction to Building Information Modelling (BIM).	2

Course Designers

1. Dr.K.Mohan-mohank@ksrct.ac.in

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Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 CS 001	C PROGRAMMING

Category	L	T	P	Credit
ES	3	0	0	3

Objective

- To learn most fundamental element of the C language and to examine the execution of branching, looping statements,
- To examine the concepts of arrays, its characteristics and types 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

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Construct the fundamental building blocks of structured Programming in C	Apply
CO2	Implement the different operations on arrays and strings	Apply
CO3	Develop simple real world applications utilizing functions, recursion and pointers.	Apply
CO4	Demonstrate the concepts of structures ,unions ,user defined data types and preprocessor	Apply
CO5	Interpret the file concepts using proper standard library functions for a given application	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3				2	2		2	3	3
CO2	3	3	3		3				2	2		2	3	3
CO3	3	3	3		3				2	2		2	3	3
CO4	3	3	3		3				2	2		2	3	3
CO5	3	3	3		3				2	2		2	3	3
1- low, 2- medium, 3- high														

Assessment Pattern

Cognitive Levels	Continuous Assessment Tests		End Semester Examination (Marks)
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	40	40	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

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Approved in Academic Council Meeting held on 23/12/2023

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

K.S.Rangasamy College of Technology–Autonomous R2022								
60 CS 001 – C Programming								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Basics of C, I/O, Branching and Loops* Structure of a C Program – Data types – Keywords - Variables – Type Qualifiers - Constants – Operators– expressions and precedence- Console I/O– Unformatted and Formatted Console I/O - Conditional Branching and Loops-Writing and evaluation of conditionals and consequent branching	[9]
Arrays and Strings* Arrays: One Dimensional Arrays - Two Dimensional Arrays – Matrix Manipulation - Character arrays – Strings: String Manipulation with and without String Handling Functions.	[7]
Functions and Pointers* Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes – Call by value and Call by reference – Function Categorization- Arguments to main function—Recursion and application - 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– Function and pointers - Dynamic memory allocation.	[11]
Structures, Unions, Enumerations, Typedef and Preprocessors* Structures - Introduction to Structures and Initialization - Arrays of Structures- Arrays and Structures, Nested Structures - Passing Structures to Functions - Structure Pointers - Unions – Bit Fields - Enumerations - typedef –The preprocessor and commands.	[9]
File Handling* File: Streams –Reading and Writing Characters - Reading and Writing Strings - File System functions – File Manipulation-Sequential access - Random Access Files – Command Line arguments.	[9]
Total Hours	**45**

Text Book(s):

1.	Herbert Schildt, “The Complete Reference C”, Fourth Edition, Tata McGraw Hill Edition, 2010.
2.	Byron Gottfried, “Programming with C”, Third Edition, McGraw Hill Education, 2014.

Reference(s):

1.	E.Balagurusamy, “Programming in ANSI C”, Seventh Edition, Tata McGraw Hill Edition, New Delhi, 2016.
2.	Brian W. Kernighan and Dennis M. Ritchie, “C Programming Language”, Prentice-Hall.
3.	ReemaThareja, “Computer Fundamentals and Programming in C”, Second Edition, Oxford Higher Education, 2016.
4.	K N King, “C Programming: A Modern Approach”, Second Edition, W.W.Norton, New York, 2008.

***SDG:4- Quality Education**

Course Contents and Lecture Schedule

Module No.	Topic	No.of Hours
1	**Basics of C, I/O, Branching and Loops**	

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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K.S.Rangasamy College of Technology
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1.1	Structure of a C Program, Keywords	1
1.2	Data types, Type Qualifiers	1
1.3	Variables and Constants	1
1.4	Operators–expressions and precedence	1
1.5	Console I/O– Unformatted and Formatted Console I/O	1
1.6	Conditional Branching	1
1.7	Iteration and loops	2
1.8	Writing and evaluation of conditionals and consequent branching	1
2	**Arrays and Strings**	
2.1	One Dimensional Array	1
2.2	Two-Dimensional Array and Matrix Manipulation	1
2.3	Character arrays and Strings Basics	1
2.4	String Manipulation without String Handling Functions	2
2.5	String Manipulation with String Handling Functions	2
3	**Functions and Pointers**	
3.1	Scope of a Function – Library Functions, User defined functions and Function Prototypes	1
3.2	Function Call by value and Function Call by reference, Function Categorization	2
3.3	Arguments to main function	1
3.4	Recursion and application	1
3.5	Passing Arrays to Functions	1
3.6	Storage class Specifiers	1
3.7	Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions	1
3.8	Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers	1
3.9	Function and pointers	1
3.10	Dynamic memory allocation	1
4	**Structures, Unions, Enumerations, Typedef and Preprocessors**	
4.1	Introduction to Structures and Initialization	1
4.2	Arrays and Structures, Arrays of Structures	1
4.3	Structures within Structures, Passing Structures to Functions	2
4.4	Structure Pointers	1
4.5	Unions and Bit Fields.	1
4.6	Enumerations - typedef	1
4.7	Preprocessor commands	2
5	**File Handling**	
5.1	File Streams –Reading and Writing Characters - Reading and Writing Strings	2
5.2	File System functions and File Manipulation	2
5.3	Sequential access	2
5.4	Random Access Files	2
5.5	Command Line arguments and files	1
	Total Hours	**45**

CourseDesigners

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60 MY 001	ENVIRONMENTAL STUDIES AND CLIMATE CHANGE (Common to all)

Category	L	T	P	Credit
MC	2	0	0	0

Objective

- To understand the importance of ecosystem and biodiversity.
- To analyze the impacts of pollution, control and legislation.
- To enlighten awareness and recognize the social responsibility in environmental issues.
- To enlighten the waste management

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the impacts of pollution on climate change	Understand
CO2	Enhance the awareness the methods of waste management.	Apply
CO3	Examine the value of sustainable future	Evaluate
CO4	Evaluate the clean and green development for environmental problem	Evaluate
CO5	Analyze the role of Geo-science in environmental management	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	3	1	3	2	3	2		
CO2	3	3	3	3	2	3	3	3	3	2	2	3	2	3	
CO3	3	3	3	3	3	3	3	3	2	2	2	3	2	3	
CO4	2	2	3	3	-	1	3	3	2	2	1	2			
CO5	3	3	3	3	3	3	3	3	3	2	2	3	2	3	
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	30	30	30
Analyze	30	30	30
Evaluate	-	-	-
Create	-	-	-

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 MY 001 - Environmental Studies and Climate Change								
Common to all branches								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	2	0	0	20	0	100	-	100

Pollution and its impact on climate change* Pollution: Sources and impacts of air pollution – green house effect- global warming- climate change - ozone layer depletion - acid rain. Carbon Footprint - Climate change on various sectors – Agriculture, forestry and ecosystem – climate change mitigation and adaptation. Action plan on climate change. IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes. *Activity*: Study of carbon emission nearby place or industry.	[4]
Integrated Waste Management** Waste - Types and classification. Principles of waste management (5R approach) - Swachh Bharat Abhiyan – Commercial waste, plastic waste, domestic waste, e-waste and biomedical waste - risk management: Collection, segregation, treatment and disposal methods. Waste water treatment- ASP *Activity*: Analysis and design of waste management systems, prepare a model / project -wealth from waste	[4]
Sustainable development practices[$] Sustainable development goals (SDGs) **–** Green computing- Carbon trading - Green building – Eco- friendly plastic – Alternate energy: Hydrogen – Bio-fuels – Solar energy – Wind – Hydroelectric power. Water scarcity- Watershed management, ground water recharge and rainwater harvesting. *Activity*: Select a topic and analyze the value of sustainable development.	[4]
Environment and Agriculture[$$] Organic farming – bio-pesticides- composting, bio composting, vermi-composting, roof gardening and irrigation. Waste land reclamation. Climate resilient agriculture. Green auditing *Activity*: Prepare a green auditing report on energy, water etc.	[4]
Geo-science in natural resource management Data base software in environment information, Digital image processing applications in forecasting. GPS, Remote Sensing and Geographical Information System (GIS), World wide web (www), Environmental information system (ENVIS). *Activity*: Prepare the report using IT tool.	[4]
Total hours	**20**

Text book(s):	
1.	AnubhaKaushik , C P Kaushik. Perspectives In Environmental Studies, New Age International publishers; Sixth edition (1 January 2018)
Reference(s):	
1.	G.Tyler Miller Environmental Science 14th Edition Cengage Publications, Delhi, 2013
2.	Gilbert M.Masters and Wendell P. Ela,"Environmental Engineering And Science", Phi Learning Private Limited, 3rd Edition,2015
3.	ErachBharucha. Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 2000

§§ SDG: 3 – Good Health and Well-being
****SDG: 4 – Clean Water and Sanitation**
§SDG: 6 - Affordable and Clean Energy
***SDG: 13 – Climate Action**

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

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Pollution and its impact on climate change**	
1.1	Pollution: Sources and impacts of air pollution – green house effect- Global warming- climate change - ozone layer depletion - acid rain	2
1.2	Climate change on various sectors: Agriculture, forestry and ecosystem. – climate change mitigation and adaptation	1
1.3	Action plan on climate change - IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes	1
2	**Integrated Waste Management**	
2.1	Waste - Types and classification. Principles of waste management (5R approach) - Swachh Bharat Abhiyan	1
2.2	Commercial waste, plastic waste, domestic waste, e-waste and biomedical waste	1
2.3	Risk management: Collection, segregation, treatment and disposal methods.	1
2.4	Waste water treatment- ASP	1
3	**Sustainable development practices**	
3.1	Sustainable development goals (SDGs) **–** Green computing- Carbon trading - Green building – Eco- friendly plastic	1
3.2	Alternate energy: Hydrogen – Bio-fuels – Solar energy – Wind – Hydroelectric power	2
3.3	Water scarcity- Watershed management, ground water recharge and rainwater harvesting	1
4	**Environment and Agriculture**	
4.1	Organic farming – bio-pesticides	1
4.2	Composting, bio composting, vermi-composting	1
4.3	Roof gardening and irrigation	1
4.4	Waste land reclamation. Climate resilient agriculture, Green auditing	1
5	**Geo-science in natural resource management**	
5.1	Data base software in environment information, Digital image processing applications in forecasting	2
5.2	GPS, Remote Sensing and Geographical Information System (GIS)	1
5.3	World wide web (www), Environmental information system (ENVIS)	1
	Total	20

Course Designers

1. Dr.T.A.SUKANTHA
2. Dr.S.MEENACHI
3. Mr.K.TAMILARASU

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Tiruchengode - 637 215.

60 CS 0P1	C PROGRAMMING LABORATORY

Category	L	T	P	Credit
ES	0	0	4	2

Objective

- 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

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Read, display basic information and use selection and iterative statements.	Apply
CO2	Demonstrate C program to manage collection of related data.	Apply
CO3	Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts.	Apply
CO4	Develop a C program to manage collection of different data using structures, Union, user-defined data types and preprocessor directives.	Apply
CO5	Demonstrate C program to store and retrieve data using file concepts.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		3				2	2		2	3	3	
CO2	3	3	3		3				2	2		2	3	3	
CO3	3	3	3		3				2	2		2	3	3	
CO4	3	3	3		3				2	2		2	3	3	
CO5	3	3	3		3				2	2		2	3	3	
1- low, 2- medium, 3- high															

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 1DArray manipulation*.
5. Implementation of 2D Array manipulation*.
6. Implementation of String operations*.
7. ImplementationofSimplefunctionsanddifferentwaysofpassingargumentstofunctionsand 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*.

*** SDG:4- Quality Education**

Course Designers

1. Dr.P.Kaladevi - kaladevi@ksrct.ac.in

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Department of ECE
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60 ME 0P1	FABRICATION AND REVERSE ENGINEERING LABORTORY (Common to All branches)

Category	L	T	P	Credit
ES	0	0	4	2

Objective

- To acquire skills in operating hand tools and instruments.
- To provide hands-on training on Carpentry, Sheet metal, Fitting and Welding.
- To provide hands-on training on household wiring and electronic circuits.
- To offer real time activity on plumbing connections in domestic applications.
- To provide hands-on activities on dismantling, and assembling the Home Appliance, Center lathe operations, computer's internal components and peripherals.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Perform power tools operations.	Apply
CO2	Make a wooden model using carpentry Process	Apply
CO3	Make a model using sheet metal, filing and joining a MS Plate	Apply
CO4	Repair and Maintenances of water lines for home applications	Apply
CO5	Trouble shoots the electrical and electronic circuits, Electrical Machines and realizes the reputation of house wiring, home Appliance, computer internal components and peripherals.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		3		3	2	3		2	3	3	3	
CO2	3	3	3		3	2		2	3	3		3	3	3	
CO3	3	3	3		3	2	2	2	3	3	2	3	2	2	
CO4	3	3	3	2	3	3	2	3	3			3	2	2	
CO5	3	3	3	3	3	2	2	2	3	2	2	3	3	3	
3- Strong; 2-Medium; 1-Low															

Syllabus

Performs of Power Tools
Drilling in different Walls and Materials Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with clamps.

Carpentry Process
Design and Development of Wooden Model using the Carpentry Process T / Cross Joint / different joints

Sheet Metal and Filling Process

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Approved in Academic Council Meeting held on 23/12/2023

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

Design and Development of Metal Model - Make a Tray Components using Sheet Metal Process and Mating of Square joint in MS Plate using the Filling Process

Welding Process
Fabrication of Models with MS Plate using Arc Welding- Lap Joint, Butt Joint, T Joint

Plumbing Process
Repair and Maintenances of Pipe Fitting for Home Applications Study of plumbing tools, assembly of G.I. pipes/ PVC and pipe fittings, cutting of threads in G.I. Pipes by thread cutting dies.

Residential house wiring
Design and Excusion of Residential house wiring With and Without UPS- 1 BHK - 2 BHK. Design and fabrication of domestic LED lamps - Circuit designing (calculation of components)

Electronic Circuit wiring
PCB fabrication – Soldering - Assembling of Audio Amplifiers- Connecting USB/Bluetooth MP3 player board - Connecting Volume controllers - Connecting bass & treble filter boards - Connecting Surround and sub-woofer filter board

Assembling and dismantling of Electronics Machines
Iron box, Induction stove, Water heater, Mixer, Table fan, Ceiling fan

Study Exercises
Demonstration of Centre Lathe operations Facing, Turning, and drilling and its components.
Assemble and dismantle of Vacuum Cleaner / Refrigerator and its components

Computer Hardware Study Exercises
Identify internal components of computer - Assemble and dismantle desktop computer systems

***SDG 9 – Industry Innovation and Infrastructure**

List of Experiments

1. **Fitting of Wall mounting Parts using Power Tools**
    a) Drilling in different Walls and Materials
    b) Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with Clamps.
2. **Making of Wooden model using the Carpentry Process**
    a) T / Cross Joint
    b) Mortise and Tenon Joint / different joints
3. **Making of Metal Model**
    a) Making of Components using Sheet Metal Process
    b) Mating of Components using the Filling Process
4. **Fabrication of Welded model**
5. **Repair and Maintenance of Pipe Fitting for Home Applications**
    a) Assembly of GI pipes/PVC and Pipe Fitting
    b) Cutting of Threads in GI pipes by thread Cutting Dies
6. **Assembling and dismantling of**
    a) Iron box
    b) Induction stove
    c) Water heater

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Approved in Academic Council Meeting held on 23/12/2023

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

d) Mixer

e) Table fan

f) Ceiling fan

7. Design and Execution of Residential house wiring

a) 1 BHK

b) 2 BHK

8. Design and Execution of Residential house wiring with UPS.

a) 1 BHK

b) 2 BHK

9. Design and fabrication of domestic LED lamps

a) Circuit designing (calculation of components)

b) PCB fabrication

c) Soldering

10. Assembling of Audio Amplifiers

a) Connecting USB/Bluetooth MP3 player board

b) Connecting Volume controllers

c) Connecting bass & treble filter boards

d) Connecting Surround and sub-woofer filter board

Study Exercises

1. Demonstration of Centre Lathe and its operations like Facing, Turning, and drilling.
2. Dismantle and Assemble of Vacuum Cleaner / Refrigerator.
3. Study of components of computer. Dismantle and assemble of desktop computer systems

Course Designers

1. Mr.S Sakthivel - sakthivel_s@ksrct.ac.in
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60 EN 002	PROFESSIONAL ENGLISH II

Category	L	T	P	Credit
HS	1	0	2	2

Objective

- 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

Prerequisite

Basic knowledge of reading and writing in English and should have completed Professional English I.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								2	3	3	2	3	2	2	3
CO2								2	3	3	2	3	2	2	3
CO3								2	3	3	2	3	2	2	3
CO4								2	3	3	2	3	3	3	3
CO5								2	3	3	2	3	3	3	3
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	10
Apply (Ap)	20	20	40
Analyse (An)	30	30	50
Create (Cr)	0	0	0

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EN 002 –PROFESSIONAL ENGLISH II								
Common to All Branches								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	1	0	2	30	2	40	60	100

Making Comparisons* **Listening:** Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) **Speaking:** Marketing a product, persuasive speech techniques. **Reading:**Reading advertisements, user manuals and brochures. **Writing:**Professional emails, Email etiquette - compare and contrast essay. **Language Focus:**mixed tenses, prepositional phrases, same words used in different contexts and discourse markers	**[6]**
Expressing Causal Relations in Speaking and Writing* **Listening:** Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects. **Speaking:** Describing and discussing the reasons of accidents or disasters based on news reports. **Reading:**longer technical texts– cause and effect essays, and letters / emails of complaint, **Writing:**Writing responses to complaints **Language Focus:** Active Passive Voice transformations, Infinitive and Gerunds – Word Formation (Noun-Verb-Adj-Adv), Adverbs.	[6]
Problem Solving* **Listening:**Listening to / watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. **Speaking:**Group Discussion (based on case studies), - techniques and Strategies. **Reading:**Case Studies, excerpts from literary texts, news reports etc. **Writing:**Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay **Language Focus:** Error correction; If conditional sentences - Compound Words, Sentence Completion.	[6]
Reporting of Events and Research* **Listening:** Listening Comprehension based on new report and documentaries – **Speaking:** Interviewing, presenting oral reports, Mini presentations on select topics. **Reading:** Newspaper articles. **Writing:** Recommendations, Transcoding, Accident Report, Precis writing and Summarising, and Plagiarism **Language Focus:** Reported Speech – Modals - Conjunctions- use of Prepositions	[6]
The Ability to put Ideas or Information Coherently* **Listening:** Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance). **Speaking:** Participating in role plays, virtual interviews, making presentations with visual aids **Reading:** excerpts of interview with professionals **Writing:** Job / Internship application – Cover letter & Résumé **Language Focus:** Numerical Adjectives, question types: Wh/ Yes or No/ and Tags; Relative Clauses - Idioms.	[6]
Total hours	**30**

Text book(s):

3.	*'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020
4.	Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020

Reference(s):

5.	Raman. Meenakshi, Sharma. Sangeeta,*'Professional English'*. Oxford university press.New Delhi. 2019
6.	Arthur Brookes and Peter Grundy,' *Beginning to Write: Writing Activities for Elementary and Intermediate Learners',* Cambridge University Press, New York, 2003
7.	Prof. R.C. Sharma & Krishna Mohan, *'Business Correspondence and Report Writing'*, TataMcGraw Hill & Co. Ltd., New Delhi, 2001
8.	V.N. Arora and Laxmi Chandra, *'Improve Your Writing'*, Oxford University Press, New Delhi, 2001

***SDG- 04- Quality Education**

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Course Contents and Lecture Schedule

S.No	Topic	No.of Hours	Mode of content Delivery
1	**Making Comparisons**		
1.1	Evaluative Listening	1	Activity Based
1.2	Product Descriptions and filling a graphic organiser	1	Activity Based
1.3	Marketing a product by using persuasive techniques	2	Activity Based
1.4	Reading advertisements, user manuals and brochures	1	Activity Based
1.5	Writing professional emails	1	Lecture
1.6	Compare and contrast essay	1	Lecture
1.7	mixed tenses and prepositional phrases	1	Lecture
1.8	Same words used in different contexts	1	Lecture
2	**Expressing Causal Relations in Speaking and Writing**		
2.1	Listening to longer technical talks	1	
2.2	Listening to process/event descriptions	1	Activity Based
2.3	Describing and discussing the reasons of accidents or disasters	1	Activity Based
2.4	Reading longer technical texts– cause and effect essays	1	Activity Based
2.5	Writing responses to complaints	1	Lecture
2.6	Active Passive Voice transformations	2	Lecture
2.7	Infinitive and Gerunds	1	Lecture
2.8	Word Formation (Noun-Verb-Adj-Adv), Adverbs.	1	Lecture
3	**Problem Solving**		
3.1	Listening to documentaries and suggesting solutions	1	Activity Based
3.2	Group Discussion (based on case studies)	2	Activity Based
3.3	Reading Case Studies, excerpts from literary texts and news reports	1	Activity Based
3.4	Letter to the Editor	1	Lecture
3.5	Checklists	1	Lecture
3.6	Problem solution and argumentative essays	1	Lecture
3.7	Error correction and Sentence Completion	1	Lecture
3.8	If conditional sentences	1	Lecture
4	**Reporting of Events and Research**		
4.1	Listening Comprehension	1	Activity Based
4.2	Interviewing and presenting oral reports	1	Activity Based
4.3	Mini presentations on select topics	1	Activity Based

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4.4	Reading newspaper articles	1	Activity Based
4.5	Recommendations	1	Lecture
4.6	Transcoding	1	Lecture
4.7	Precis writing, Summarising and Plagiarism	1	Lecture
4.8	Reported Speech, Modals	1	Lecture
4.9	Conjunctions	1	Lecture
5	**The Ability to put Ideas or Information Coherently**		
5.1	Listening to Formal job interviews	1	Activity Based
5.2	Role plays	2	Activity Based
5.3	Virtual interviews	1	Activity Based
5.4	Reading Company profiles	1	Lecture
5.5	Writing Statement of Purpose (SoPs)	1	Lecture
5.6	Writing Résumé	1	Lecture
5.7	Numerical Adjectives and Relative Clauses - Idioms	1	Lecture
5.8	question types: Wh/ Yes or No/ and Tags	1	Lecture
	Total	**45**	

Course Designers

1. Dr.A.Palaniappan -palaniappan@ksrct.ac.in

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60 MA 003	INTEGRALS, PARTIAL DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORM

Category	L	T	P	Credit
BS	3	1	0	4

Objective

- To provide exposure in handling situations involving multiple integrals.
- To familiarize the basic concepts in Vector calculus.
- To get exposed to the fundamentals in analytic functions.
- To develop the mathematical skills in solving partial differential equations.
- To facilitate the concepts in Laplace transform techniques.

Prerequisite

NIL.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Evaluate double and triple integrals.	Remember, Apply, Evaluate
CO2	Analyze the basic concepts of vector calculus.	Remember, Analyze, Evaluate
CO3	Construct the Analytic functions and evaluate the complex integrals.	Remember, Understand, Apply
CO4	Compute the solutions of partial differential equations using different methods.	Remember, Apply
CO5	Apply Laplace transform techniques for solving differential equations.	Remember, Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3							2	3	2	
CO2	3	3	2	2	3							2	3	2	
CO3	3	3	3	2	2							2	3	2	
CO4	3	3	3	3	2							2	3	2	
CO5	3	3	2	3	3							2	3	2	
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	0	10	10	10
Apply (Ap)	20	40	40	40
Analyze (An)	10	0	20	20
Evaluate (Ev)	20	0	20	20
Create (Cr)	0	0	0	0
Total	60	60	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 MA 003– INTEGRALS, PARTIAL DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORM								
Common to Mech,ECE, EE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	1	0	60	4	40	60	100

MULTIPLE INTEGRALS Double integration – Cartesian and polar co-ordinates – Change of order of integration – Area as double integral – Triple integration in Cartesian co-ordinates – Change of variables - Cartesian to polar co-ordinates and Cartesian to Cylindrical co-ordinates.	[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 – Application: Green's theorem in the plane – Gauss divergence theorem -Stokes' theorem (statement only) .	[9]
ANALYTIC FUNCTIONS AND INTEGRALS Analytic function – Necessary and Sufficient conditions (statement only)-Properties – Harmonic function – Construction of an analytic function – Cauchy's Integral theorem (statement only) – Cauchy's integral formula – Classification of singularities – Application: Cauchy's residue theorem.	[9]
PARTIAL DIFFERENTIAL EQUATIONS* Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Non- Linear partial differential equations of first order – Lagrange's linear equations – Application: Homogeneous Linear partial differential equations with constant coefficients.	[9]
LAPLACE TRANSFORM Conditions for existence – Transforms of elementary functions – Basic properties - Derivatives and integrals of transforms - Initial and final value theorem – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Application: Solution of second order ordinary differential equations with constant co-efficients.	[9]
Hands on: 1. Evaluating double and triple integrals. 2. Area as double integral. 3. Volume as triple integral. 4. Plotting and visualizing single variable functions. 5. Plotting and visualizing functions of two and three variables. 6. Evaluating Gradient, divergence and curl. 7. Evaluating Laplace & Inverse Laplace transforms. 8. Applying Laplace transform techniques to solve differential equations	
Total hours:45+15(Tutorial)	**60**

Text book(s):

1. Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2. Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.

Reference(s):

1. Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.
2. Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand&Company Ltd, New Delhi, 2017.
3. Bali N P and Manish Goyal," A text book of Engineering Mathematics",10th Edition, Laxmi Publications(P) Ltd, 2016.
4. Dr.P.Agrawal, Dr.D.N.Pandey, "Integral Equations, Calculus of Variations and its Applications", NPTEL online video courses.

***SDG:4 Quality Education**

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Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**MULTIPLE INTEGRALS**	
1.1	Double integration	1
1.2	Cartesian and polar coordinates	1
1.3	Change of order of integration	1
1.4	Area as double integral	1
1.5	Tutorial	2
1.6	Triple integration in Cartesian coordinates	1
1.7	Change of variables	1
1.8	Cartesian to polar coordinates	1
1.9	Cartesian to Cylindrical coordinates	1
1.10	Tutorial	2
2	**VECTOR CALCULUS**	
2.1	Introduction : Gradient of a scalar point function	1
2.2	Directional derivative	1
2.3	Angle of intersection of two surfaces	1
2.4	Divergence and curl (excluding vector identities)	1
2.5	Tutorial	2
2.6	Solenoidal and irrotational vectors	1
2.7	Application : Green's theorem in the plane	1
2.8	Gauss divergence theorem	1
2.9	Stokes' theorem (statement only)	1
2.10	Tutorial	2
3	**ANALYTIC FUNCTIONS AND INTEGRALS**	
3.1	Analytic function	1
3.2	Necessary and Sufficient conditions (statement only)	1
3.3	Properties	1
3.4	Harmonic function	1
3.5	Tutorial	2
3.6	Construction of an analytic function	1
3.7	Cauchy's Integral theorem (statement only), Cauchy's integral formula	1
3.8	Classification of singularities	1
3.9	Applications: Cauchy's residue theorem.	1
3.10	Tutorial	2
4	**PARTIAL DIFFERENTIAL EQUATIONS**	
4.1	Formation of partial differential equations by eliminating arbitrary constants	1
4.2	Formation of partial differential equations by eliminating arbitrary functions	2
4.3	Tutorial	2
4.4	Non- linear partial differential equations of first order	2

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4.5	Lagrange's linear equations	1
4.6	Application:Homogeneous Linear partial differential equations with constant coefficients.	2
4.7	Tutorial	2
5	**LAPLACE TRANSFORM**	
5.1	Conditions for existence	1
5.2	Transforms of elementary functions	1
5.3	Basic properties	1
5.5	Derivatives and integrals of transforms, Initial and final value theorem	1
5.6	Tutorial	1
5.7	Transform of periodic functions	2
5.8	Inverse Laplace transform	1
5.9	Convolution theorem (excluding proof)	1
5.10	Application:Solution of second order ordinary differential equation with constant co-efficient.	1
5.11	Tutorial	2
	Total	60

Course Designers

1. Dr. C. Chandran – cchandran@ksrct.ac.in
2. Dr. K. Prabakaran – prabakaran@ksrct.ac.in

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60 CH 003	CHEMISTRY FOR ELECTRONIC ENGINEERING (Common to EEE & ECE)

Category	L	T	P	Credit
BS	3	0	0	3

Objective

- To help the learners to analyze the hardness of water and its removal
- To analyze the concepts and functions of electrochemistry
- To endow an overview of energy storage devices
- To understand the basics and application of chemical sensors
- To rationalize the types of electronic materials

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Identify the different types of water softening methods	Apply
CO2	Analyse the significance of electro chemistry in engineering	Analyse
CO3	Recognize the types of energy storage devices and its principle	Understand
CO4	Interpret the principles of sensors for various applications.	Understand, Analyse, Apply
CO5	Understand the advantages of advanced electronic materials	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	3	2	3	2	3	3	3		
CO2	3	3	3	3	3	3	3	2	3	3	3	3	3		
CO3	3	3	3	3	3	3	3	3	3	3	3	3	2		
CO4	3	3	3	3	3	3	2	2	3	2	3	3	3		
CO5	3	3	3	3	2	3	3	2	3	3	3	3	3		
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	20
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 CH 003 – Chemistry For Electronic Engineering								
Common to EEE & ECE								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

WATER TECHNOLOGY* Introduction – Commercial and industrial uses of water - hardness - types – estimation of hardness by EDTA method- Internal conditioning (colloidal, phosphate, calgon and carbonate conditioning methods) – external conditioning (Zeolite process, demineralization process) - Desalination methods (Reverse Osmosis and Electro dialysis). Flash evaporation	[7]
ELECTROCHEMISTRY* Electrode potential - Nernst Equation - derivation and problems - reversible and irreversible cells - Types of Electrodes and its applications – reference electrodes - pH, conductometric and Potentiometric titrations - Principles of electro plating and electro less plating- fabrication process of Printed Circuit Board.	[9]
ENERGY STORAGE DEVICES ** Batteries - Types of Batteries. Fabrication and Working of Alkaline Battery - Lead-Acid Battery-Ni-Cd-Lithium Ion Batteries – Fuel Cells: Hydrogen-Oxygen fuel cell - microbial fuel cell (MFC). Organic Solar Cells-working principle and applications organic transistors- construction-working principle and applications in electronic Industries.	[9]
CHEMICAL SENSORS*** Sensors – Chemical Sensors – Characteristics – Elements and Characterization - Potentiometric Sensors - Amperometric Sensors – Sensors Based on Electrochemical Methods – Electrochemical Biosensors – Optical Biosensors : Enzyme Sensors – Bio affinity Sensors - DNA Sensors. Chemical Sensors as Detectors and Indicators: Indicators for Titration Processes – Separation Methods. Nano technology in chemical sensors.	[10]
ELECTRONIC MATERIALS Liquid crystal polymers - Organic Light Emitting Diode (OLED) - [polythiopene] - working and applications – Conductive polymers and Semi conducting polymers: principle and applications- organic: Organic dielectric material [Polystyrene, PMMA]. Smart screen materials: Inorganic Rare earth metals [yttrium, lanthanum, cerium] - Conductive components: Indium tin oxide [properties and applications] - touch screen [resistive and capacitive] - magnetic storage [Iron oxide, cobalt alloy] – optical storage [photo chromic materials] - solid storage.	[10]
Total hours	**45**

Text book(s):

1. O.G. Palanna “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2017.
2. Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 14th edition, 2015.

Reference(s):

1. Pletcher D and Walsh F C, “Industrial Electrochemistry”, Chapman and Hall, 2nd Edition, New York, 1990
2. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.
3. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2nd Edition, 2019.
4. Hagen Klauk, “Organic Electronics: Materials, Manufacturing and Applications”, Wiley-VCH, 2006.

***SDG: 6 – Clean Water and Sanitation**
****SDG: 7 - Affordable and Clean Energy**
*****SDG: 15 – Life on land**

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Course Contents and Lecture Schedule

S.No.	Topic	No.of hours
1.0	**WATER TECHNOLOGY**	
1.1	Introduction – Commercial and Industrial uses of water	**1**
1.2	Hardness - types	**1**
1.3	Estimation of Hardness of ater by EDTA method	**1**
1.4	Internal conditioning (Colloidal, Phosphate, Calgon and Carbonate)	**1**
1.5	External conditioning (Zoelite process & Demineralization process)	**1**
1.6	Desalination methods (Reverse Osmosis and Electrodialysis)	**1**
1.7	Flash Evaporation	**1**
2.0	**ELECTROCHEMISTRY**	
2.1	Electrode potential - Nernst Equation - derivation and problems	**2**
2.2	Reversible and irreversible cells	**1**
2.3	Types of Electrodes and its applications	**1**
2.4	Reference electrodes - pH	**1**
2.5	Conductometric and Potentiometric titrations	**1**
2.6	Principles of electro plating and electro less plating-	**2**
2.7	Fabrication process of Printed Circuit Board.	**1**
3.0	**ENERGY STORAGE DEVICES**	
3.1	Batteries - Types of Batteries.	**2**
3.2	Fabrication and Working of Alkaline Battery	**1**
3.3	Lead-Acid Battery	**1**
3.4	Ni-Cd-Lithium Ion Batteries	**1**
3.5	Fuel Cells: Hydrogen-Oxygen fuel cell	**1**
3.6	Microbial fuel cell (MFC).	**1**
3.7	Organic Solar Cells-working principle and applications organic transistors	**1**
3.8	Construction-working principle and applications in electronic Industries.	**1**
4.0	**CHEMICAL SENSORS**	
4.1	Sensors – Chemical Sensors - Characteristics	**1**
4.2	Elements and Characterization	**1**
4.3	Potentiometric Sensors, Amperometric Sensors	**1**
4.4	Sensors Based on Electrochemical Methods	**1**
4.5	Electrochemical Biosensors	**1**
4.6	Optical Biosensors: Enzyme Sensors – Bio affinity Sensors	**1**
4.7	DNA Sensors. Chemical Sensors as Detectors and Indicators	**1**
4.8	Indicators for Titration Processes	**1**
4.9	Separation Methods. Nano technology in chemical sensors.	**2**

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Approved in Academic Council Meeting held on 23/12/2023

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

5.0	**ELECTRONIC MATERIALS**	
5.1	Liquid crystal polymers - Organic Light Emitting Diode (OLED) - [polythiopene] - working and applications	**2**
5.2	Conductive polymers and Semi conducting polymers: principle and applications	**2**
5.3	organic: Organic dielectric material [Polystyrene, PMMA].	**1**
5.4	Smart screen materials: Inorganic Rare earth metals [yttrium, lanthanum, cerium]	**2**
5.5	Conductive components: Indium tin oxide [properties and applications] - touch screen [resistive and capacitive]	**1**
5.6	magnetic storage [Iron oxide, cobalt alloy]	**1**
5.7	optical storage [photo chromic materials] - solid storage.	**1**

Course Designers

1. Dr.T.A.SUKANTHA
2. Dr.B.SRIVIDHYA
3. Dr.K.PRABHA
4. Dr.S.MEENACHI
5. Mr.K.TAMILARASU
6. Ms.D.KIRTHIGA

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Tiruchengode - 637 215.

60 ME 005	FOUNDATION OF MECHANICAL ENGINEERING

Category	L	T	P	Credit
ES	3	0	0	3

Objective

- To learn a process for analysis of static objects, concepts of force and motion of particles.
- To acquire knowledge on thermodynamics process, laws and entropy.
- To impart the concept of heat transfer mechanism through simple and composite geometries
- To learn the concept of refrigeration & Air-conditioning with its application.
- To identify the different sources of energy and to know the working principle of power plants.

Prerequisite

NIL.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply basic knowledge on statics and dynamics of particles.	Understand, Apply & Analyse
CO2	State the laws of thermodynamics and applied to thermodynamic system.	Understand, Apply & Analyse
CO3	Apply the principles of heat transfer modes in solving heat transfer problems	Understand, Apply & Analyse
CO4	Demonstrate the principle of operation of refrigeration and air-conditioning systems.	Understand & Apply
CO5	Discuss on renewable sources of energy and method of power generation.	Understand & Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2		2				3	3	3	
CO2	3	3	3	3	3	2	2	2				3	3	3	
CO3	3	3	3	3	3	2	2	2				3	3	3	
CO4	3	3	3	3	3	2	2	2				3	3	3	
CO5	3	3	3	3	3	2	2	2				3	3	3	
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember	10	10	30
Understand	20	20	30
Apply	30	30	30
Analyse	0	0	10
Evaluate	0	0	0
Create	0	0	0

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME 005 – FOUNDATION OF MECHANICAL ENGINEERING								
B.E. Electronics and Communications Engineering								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Basics of Statics and Dynamics of Particles Introduction -Units and Dimensions-Laws of Mechanics–Principle of transmissibility-Lame's theorem, Parallelogram and triangular Law of forces. Displacement, Velocity, acceleration and their relationship– Relative motion.	[9]
Thermodynamics – Laws and Entropy Basic concepts – Thermodynamic systems – Laws of Thermodynamics: Zeroth law of Thermodynamics, First law of thermodynamics - Second law of Thermodynamics – cyclic heat engine, heat pump, Carnot cycle. Entropy.	[9]
Heat Transfer Introduction – Modes of Heat Transfer: Conduction, Convection and Radiation – Laws of Conduction - Types of Convection– Laws of Radiation – Radiation Shields - Fourier law of heat conduction in simple and composite wall geometrics, types of boundary and initial conditions – Fins: types – fin efficiency.	[9]
Refrigeration and Air-Conditioning** Introduction – Terminology of Refrigeration and Air conditioning systems – working principle of vapour compression and absorption system – Layout of typical domestic refrigerator. Window, Split and Central air conditioners.	[9]
Sources of Energy* and Power Plants*** Introduction – Energy- Classification of Energy Sources - Conventional Energy Sources: Working principle of Thermal, Gas, Diesel, Hydro-electric and Nuclear power plants. Non - Conventional Energy Sources: working principle of Solar, Wind, Tidal and Geothermal power plants.	[9]
Total hours	**45**

Text book(s):

1.	Pravin Kumar, 'Basic Mechanical Engineering', Pearson India Education Services Pvt. Ltd, 2nd Edition, Chennai, 2018.
2.	Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2017.

Reference(s):

1.	YunusA.Cengel, 'Heat Transfer: A Practical Approach', Mcgraw-Hill, 2nd edition, 2002.
2.	Arora.C.P., 'Refrigeration and Airconditioning', Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi, 2008.
3.	Arora, S. C., Domkundwar.S., 'A Course in Power Plant Engineering', Dhanpatrai& Co., New Delhi, 2014.
4.	Jayakumar, V. and Kumar, M, 'Engineering Mechanics', PHI Learning Private Ltd, New Delhi, 2012.

*** SDG 7 – Affordable and Clean Energy**

****SDG 9 – Industry Innovation and Infrastructure**

*****SDG 12 – Responsible Consumption and Production**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1.0	**BASICS OF STATICS AND DYNAMICS OF PARTICLES**	

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

1.1	Introduction -Units and Dimensions	1
1.2	Laws of Mechanics–Principle of transmissibility	1
1.3	Lame's theorem	1
1.4	Parallelogram Law of forces	1
1.5	Triangular Law of forces	1
1.6	Displacement, Velocity, acceleration and their relationship	2
1.7	Relative motion	2
2.0	**THERMODYNAMICS – LAWS AND ENTROPY**	
2.1	Basic concepts – Thermodynamic systems	2
2.2	Laws of Thermodynamics: Zeroth law of Thermodynamics, First law of thermodynamics	2
2.3	Laws of Thermodynamics: Second law of Thermodynamics	1
2.4	Cyclic heat engine and Heat pump	2
2.5	Carnot cycle and Entropy	2
3.0	**HEAT TRANSFER**	
3.1	Introduction to heat transfer	1
3.2	Modes of Heat Transfer: Conduction, Convection and Radiation	1
3.3	Laws of Conduction - Types of Convection– Laws of Radiation	1
3.4	Radiation Shields	1
3.5	Fourier law of heat conduction in simple wall	1
3.6	Fourier law of heat conduction in composite wall	1
3.7	Types of boundary and initial conditions	1
3.8	Fins: types and efficiency	2
4.0	**REFRIGERATION AND AIR-CONDITIONING**	
4.1	Introduction to Refrigeration and Air-Conditioning and its Terminology	2
4.2	Working principle of vapour compression	1
4.3	Working principle of absorption system	1
4.4	Layout of typical domestic refrigerator	2
4.5	Window and Split air conditioners.	2
4.6	Central air conditioners	1
5.0	**SOURCES OF ENERGY AND POWER PLANTS**	
5.1	Introduction to energy resources and Classification	1
5.2	Working principle of Thermal and Gas power plants	2
5.3	Working principle of Diesel and Hydro-electric power plants	2
5.4	Nuclear power plants	1
5.5	Working principle of Solar and Wind power plants	2
5.6	Tidal and Geothermal power plants.	1
	Total	45

Course Designers

1. Dr.A.Murugesan – murugesana@ksrct.ac.in
2. Mr.M.Gnanaseakran – gnanasekaran@ksrct.ac.in
3. Mr.M.Moorthi – moorthi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 EC 201	ELECTRONIC DEVICES Common to ECE and EV

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- To understand the physics of junction diodes and to learn to implement them in various applications
- To learn different configurations of BJT and FET and applications of MOSFET
- To identify the use of various transducers and sensors.
- To study the construction and operation of various opto devices
- To familiarize the operation of power devices and convertors

Prerequisite

NIL.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Learn the operation and characteristics of diodes	Remember, Understand, Apply
CO2	Discuss the operation of different configurations of transistors	Remember, Understand, Apply
CO3	Identify the type of transducers and sensors used for various application	Remember, Understand
CO4	Explain the operation of various opto devices	Remember, Understand
CO5	Learn the role of power electronics devices and convertors in real life applications	Remember, Understand

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			3	3			3	3	3	
CO2	3	3	3	2	3								3	3	
CO3	3	2	3	2									3	3	
CO4	3	2	2	2									3	3	
CO5	3	3	3	2	2			3	3			3	3	3	
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	50
Understand	40	50	40
Apply	10	0	10
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC 201– ELECTRONIC DEVICES Common to EC and EV								
B.E.Electronics and Communications Engineering								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	40	60	100

DIODES* PN junction diode- Current Voltage Characteristics and Analysis, Diode Logic Gates, Modelling the Diode Forward Characteristics- Graphical analysis, Small signal model, Zener diode, Varactor diode and Diode applications.	[9]
TRANSISTORS* Construction and Operation of a Transistor, Input and Output Characteristics of a Transistor in CE configuration, operation of CB and CC configurations, Construction and Characteristics of n channel JFET, Basic MOSFET operation, Characteristics of depletion type MOSFET and enhancement type MOSFET and **MOSFET applications****.	[9]
TRANSDUCERS AND SENSORS* Classification of Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Noise introduced by transducers and their reduction. smart sensors, fiber optic sensors, MEMS, Ultrasonic Sensors and their typical applications	[9]
OPTO DEVICES* Introduction, Photo emitters, **LASER, LED, Photoconductive Cell, Opto coupler, Solid state relays (light operated relay) and optical fibre***.**	[9]
POWER DEVICES AND CONVERTORS* Construction and operation of switching devices - **SCR, MOSFET and IGBT**** – Static characteristics of SCR - Switching mode regulators: **Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper*****	[9]
Hands on: 1. Simulation of VI characteristics of PN junction diode 2. Simulation of input- output characteristics of BJT 3. Simulation of I-V characteristics of MOSFET	
Total hours	**45**

Text book(s):	
1.	Anil K. Maini, Varsha Agrawal, 'Electronics Devices and Circuits', Wiley India Pvt.Ltd, 2nd edition, 2019.
2.	Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 1999
3.	Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5
Reference(s):	
1.	Robert L. Boylestad, Louis Nashelsky, 'Electronic Devices and circuit theory', Pearson Education, 11th Edition, 2017
2.	M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009
3.	L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009
4.	Dr. P. S. Bimbhra, —Power Electronicsll, Khanna Publishers, Delhi, 2012

***SDG:4- Quality Education**

****SDG:8- Desent work and economic growth**

*****SDG:9 –Industry innovation and Infrastructure**

Assignment activity:

Assignment 1 Covers Module 1 & 2:

- Problems on PN junction diode, Relation between α &β of the BJT, parameters of JFET.
- Simulation on diode logic gates and diode applications like two way clipper, voltage tripler, Zener diode as voltage regulator using Multisim.

Assignment 2 Covers Module 3,4 & 5:

- Problems on Resistive, Capacitive, Inductive and Hall Effect transducers, LED and optical fibre.

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

- Simulate MOSFET model and describe the switching application of MOSFET with its IV characteristics using Simulink.

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Diodes**	
1.1	PN junction diode	1
1.2	Current Voltage Characteristics and Analysis	1
1.3	Diode Logic Gates	1
1.4	Modelling the Diode Forward Characteristics	1
1.5	Graphical analysis, Small signal model	1
1.6	Zener diode	1
1.7	Varactor diode	1
1.8	Diode applications	2
2	**Transistors**	
2.1	Construction and Operation of a Transistor	1
2.2	Input and Output Characteristics of a Transistor in CE configuration	1
2.3	Operation of CB and CC configurations	1
2.4	Construction and Characteristics of n channel JFET	1
2.5	Basic MOSFET operation	1
2.6	Characteristics of depletion type MOSFET	1
2.7	Characteristics of enhancement type MOSFET	1
2.8	MOSFET applications	2
3	**Transducers and Sensors**	
3.1	Classification of Transducers	1
3.2	Transducers Actuating Mechanisms	1
3.3	Resistance Transducers, Variable Inductance Transducers	1
3.4	Capacitive Transducers, Piezoelectric Transducers	1
3.5	Hall Effect Transducers	1
3.6	Noise introduced by transducers and their reduction	1
3.7	Smart sensors, fiber optic sensors, MEMS	1
3.8	Ultrasonic Sensors	1
3.9	Applications	
4	**Optodevices**	
4.1	Introduction	1
4.2	Photo emitters	1
4.3	LASER.	1
4.4	LED	1
4.5	Photoconductive Cell	1
4.6	Opto coupler	1
4.7	Solid state relays (light operated relay)	1
4.8	Optical fibre	2

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

5	**Power devices and convertors**	
5.1	Construction and operation of switching devices - SCR	2
5.2	MOSFET.	1
5.3	IGBT	1
5.4	Static characteristics of SCR	1
5.5	Switching mode regulators: Buck regulator	1
5.6	Boost regulator	1
5.7	Buck-Boost Regulators	1
5.8	Chopper	1

Course Designers

1. Mrs.S.S.Thamilselvi - sstamilselvi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 GE 001	**Heritage of Tamils** (Common to all Branches)

Category	L	T	P	Credit
GE	1	0	0	1

Objectives:

- To learn the extensive literature of classical Tamil.
- To review the fine arts heritage of Tamil culture.
- To realize the contribution of Tamils in Indian freedom struggle.

Prerequisite:

Nil

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Recognize the extensive literature of Tamil and its classical nature.	Understand
CO2	Apprehend the heritage of sculpture, painting and musical instruments of ancient people.	Understand
CO3	Review on folk and martial arts of Tamil people.	Understand
CO4	Insight thinai concepts, trade and victory of Chozha dynasty.	Understand
CO5	Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							3	3		2		3			3
CO2							3	3		2		3			3
CO3							3	3		2		3			3
CO4							3	3		2		3			3
CO5							3	3		2		3			3

3- Strong; 2-Medium; 1-Low

Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 GE 001 – Heritage of Tamils								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	100	-	100
Language and Literature* Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.								3

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Heritage - Rock Art Paintings to Modern Art – Sculpture* Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	3
Folk and Martial Arts* Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	3
Thinai Concept of Tamils* Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	3
Contribution of Tamils to Indian National Movement and Indian Culture* Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

***SDG:4- Quality Education**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 GE 001	தமிழர் மரபு (அனைத்து துறைகளுக்கும் பொதுவானது)

Category	L	T	P	Credit
GE	1	0	0	1

பாடத்தின் நோக்கங்கள்:

- தமிழ் மொழியின் இலக்கணச் செறிவைக் கற்றுணர்தல்.
- தமிழர் பண்பாட்டின் நுண்கலைகள் பற்றிய ஒரு மீள்பார்வை.
- இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பை உணருதல்.

முன்கூட்டிய துறைசார் அறிவு:

தேவை இல்லை

பாடம் கற்றதின் விளைவுகள்:

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	தமிழ் மொழியின் செந்தண்மை மற்றும் இலக்கியம் குறித்த தெரிதல்.	புரிதல்
CO2	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்த தெளிவு.	புரிதல்
CO3	தமிழர்களின் நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு.	புரிதல்
CO4	தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.	புரிதல்
CO5	இந்திய தேசிய இயக்கம், சுயமரியாதையை இயக்கம் மற்றும் சித்த மருத்துவம் பற்றிய புரிதல்.	புரிதல்

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							3	3		2		3			3
CO2							3	3		2		3			3
CO3							3	3		2		3			3
CO4							3	3		2		3			3
CO5							3	3		2		3			3

3- Strong; 2-Medium; 1-Low

Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 GE 001 – தமிழர் மரபு								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	100	-	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

மொழி மற்றும் இலக்கியம்: இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள் - தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	3
மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை–சிற்பக் கலை: நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	3
நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	3
தமிழர்களின் திணைக் கோட்பாடுகள்: தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.	3
இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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CHAIRMAN BOARD OF STUDIES
Department of ECE
K.S.Rangasamy College of Technology
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60 AB 001	NCC STUDIES (AIR WING) – I	Category	L	T	P	Credit
		HS	2	0	2	3

Objective

- To designed especially for NCC Cadets to educate basic military knowledge
- To develop character, camaraderie,discipline, secular outlook
- To inculcate spirit of adventure, sportsman spirit
- To teach selfless service amongst cadets by working inteams
- To learning military subjects including we apontraining and motivate them to join in tri-services

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion	Remember
CO2	Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling	Remember
CO3	Illustrate various forces and moments acting on aircraft	Understand
CO4	Outline the concepts of aircraft engine and rocket propulsion	Understand
CO5	Design, build and fly chuck gliders/model airplanes and display static models	Create

Mapping with Programme Outcomes

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	3	3	3	3					3
CO2					3										3
CO3	3	2	1	1											3
CO4	3	2	1	1											3
CO5	3	2	1	1											3
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom'sCategory	Continuous Assessment (Marks)			End Sem Examination (Marks)
	DST(20)	AM(20)	SBM(10)	
Remember	10	00	00	40
Understand	10	00	10	60
Apply	00	00	00	00
Analyse	00	00	00	00
Evaluate	00	00	00	00
Create	00	20	00	00

DST - Drill SquareTest AM - Aero Modeling SBM - Swachh Bharat Mission

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Approved in Academic Council Meeting held on 23/12/2023

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 AB 001 - NCC STUDIES (AIR WING) – I								
Common to ALL Branches								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	2	0	2	60	3	50	50	100

Note: The hours given against each topic are of indicative. The faculty has 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.

NCC Organisation and National Integration* NCC Organization — History of NCC- NCC Organization- NCC Training- NCC Uniform — Promotion of NCC cadets — Aim and advantages of NCC Training- NCC badges of Rank- Honors‟ and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF- Indo-PakWar-1971-Operation Safed Sagar .National Integration-Unity in diversity- Contribution of youth in nation building-National integration council – Images and Slogans on National Integration.	[12]
Drill and Weapon Training* Basic physical Training- Various exercises for fitness(with Demonstration)- Food- Hygiene and Cleanliness.Drill-Words of commands- Position and commands- Sizing and forming- Saluting-Marching- Turning on the march and wheeling- Saluting on the march-Sidepace, Pace forward and to the rear-Marking time-Drill with arms-Ceremonial drill-Guard mounting.(WITH DEMONSTRATION)	[12]
Principles of Flight* Laws of motion-Forces acting on aircraft- Bernoulli‟s theorem-Staling-Primary control surfaces-Secondary control surfaces-Aircraft recognition.	[12]
Aero Engines* Introduction of Aero engine-Types of engine- Piston engine- Jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.	[12]
Aero Modeling* History of Aero modeling-Materials used in Aeromodeling-Types of Aeromodels – Static Models-Gliders-Control line models-Radio Control Models-Building and Flying of Aeromodels.	[12]
Total Hours	60

Text Books:	
1.	“National Cadet Corps- A Concise hand book of NCC Cadets”, Ramesh Publishing House, NewDelhi,2014.
Reference(s):	
1.	“Cadets Handbook–Common Subjects SD/SW”,published by DGNCC,New Delhi.
2.	“Cadets Handbook-Specialized Subjects SD/SW”,published by DGNCC,NewDelhi.
3.	“NCCOTA Precise”, published by DGNCC, NewDelhi.

***SDG4-Quality Education**

ASSESSMENT PATTERN -THEORY					
Test / Bloom’s Category*	**Knowledge (K1)%**	**Apply (K2)%**	**Analyzing(K3) %**	**Creating(K4)%**	**Total %**
CAT1	-	-	-	-	-
CAT2	-	-	-	-	-
CAT3	-	-	-	-	-
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K4 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to100 marks.				

Course Designers

1. Flt Lt V.R.SADASIVAM- sadasivam@ksrct.ac.in

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60 AB 002	National Cadet Corps- ARMY WING	Category	L	T	P	Credit
		HS	2	0	2	3

Objective

- Develop character, camaraderie
- Inculcate discipline, secular outlook
- Enrich the spirit of adventure, sportsman spirit
- Ideals of selfless service amongst cadets by working in teams
- Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.	Understand
CO2	Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders.	Apply
CO3	Basic knowledge of weapons and their use and handling.	Understand
CO4	Aware about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	Analyse
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1		3							3
CO2								2							3
CO3						1		3							3
CO4								2							3
CO5								3							3
1- low, 2- medium, 3- high															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	10	20
Apply	20	20	20
Analyse	10	10	20
Evaluate		10	20
Create			

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 AB 002 – National Cadet Corps (Army Wing)								
Common to all Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	2	0	2	60	3	50	50	100

NCC Organization & National Integration* NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt. National Integration - Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration	[12]
Basic Physical Training & Drill* Basic physical Training – various exercises for fitness(with Demonstration)-Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION).	[16]
Weapon Training* Main Parts of a Rifle- Characteristics of .303 rifle- Characteristics of .22 rifle- loading and unloading – position and holding safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 5.56mm rifle- Characteristics of 7.62mm SLR- LMG- carbine machine gun – pistol.	[12]
Social Awareness and Community Development* Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSYJGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry – child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility	[12]
Specialized Subject (ARMY)* Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- ParamVir Chakra- Career in the Defence forces- Service tests and interviews.	[08]
Total Hours	**60**

TextBook(s):	
1.	National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014
2.	Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi ,2014
Reference(s):	
1.	"Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi,2019
2.	"Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi,2017

***Quality Education**

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**NCC Organization & National Integration**	
1.1	NCC Organization	1
1.2	History of NCC and NCC Organization	1
1.3	NCC Training and NCC Uniform	1

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Approved in Academic Council Meeting held on 23/12/2023

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

1.4	Promotion of NCC cadet, Aim and advantages of NCC Training	1
1.5	NCC badges of Rank, Honors' and Awards, Incentives for NCC cadets by central and state govt	2
1.6	National Integration, Unity in diversity	1
1.7	Contribution of youth in nation building	2
1.8	National integration council	1
1.9	Images and Slogans on National Integration	2
2	**Basic Physical Training & Drill**	
2.1	Basic physical Training – various exercises for fitness (with Demonstration)-	3
2.2	Food – Hygiene and Cleanliness .	1
2.3	Drill- Words of commands- position and commands- sizing and forming-	3
2.4	saluting- marching- turning on the march and wheeling-	3
2.5	saluting on the march- side pace, pace forward and to the rear- marking time-	3
2.6	Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION)	3
3	**Weapon Training Main Parts of a Rifle**	
3.1	Characteristics of .303 rifle	1
3.2	Characteristics of .22 rifle	2
3.3	Loading and unloading, position and holding safety precautions	2
3.4	Range procedure, MPI and Elevation-	2
3.5	Group and Snap shooting Long/Short range firing (WITH PRACTICE SESSION)	3
3.6	Characteristics of 5.56mm rifle	1
3.7	Characteristics of 7.62mm	1
4	**Social Awareness and Community Development**	
4.1	Aims of Social service, Various Means and ways of social services	1
4.2	Family planning , HIV and AIDS	1
4.3	Cancer its causes and preventive measures	1
4.4	NGO and their activities, Drug trafficking	1
4.5	Rural development programmes	1
4.6	MGNREGA, SGSY, JGSY, NSAP, PMGSY	2
4.7	Terrorism and counter terrorism, Corruption	1
4.8	female foeticide, dowry, child abuse	1
4.9	RTI Act, RTE Act	1
4.10	Protection of children from sexual offences act	1
4.11	Civic sense and responsibility	1
5	**Specialized Subject (ARMY)**	
5.1	Basic structure of Armed Forces	1
5.2	Military History, War heroes	1
5.3	battles of Indo - Pak war	1
5.4	Param Vir Chakra,	1
5.5	Career in the Defence forces	2
5.6	Service tests and interviews.	2
	Total	60

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Course Designer

1. Mr.E.Chandra Kumar -chandrakumar@ksrct.ac.in

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60 CP 0P2	ENGINEERING PHYSICS AND CHEMISTRY LABORATORY (CSE, IT, EEE, ECE,EE)

Category	L	T	P	Credit
BS	0	0	4	2

Objectives

- 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 analyze the behavior and characteristics of various materials for its optimum utilization
- Test the knowledge of theoretical concepts and develop the experimental skills of the learners
- To facilitate data interpretation and expose the learners to various industrial and environmental applications

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Analyze the properties of semiconducting materials for its potential applications	Analyze
CO2	Realize the interference and diffraction phenomena by Air wedge and laser experiments	Apply
CO3	Recognize the magnetic properties by experimental verification	Apply
CO4	Apply different techniques of qualitative and quantitative chemical analysis to generate experimental skills and apply these skills to various analyses	Apply
CO5	Explain and analyze instrumental techniques for chemical analysis	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	2	3	2	2	3		2	2
CO2	3	3	3	2	2	2	2	2	1	3	2	1		2	2
CO3	3	2	3	3	3	2	3	2	2	2	1	2		2	2
CO4	3	3	3	3	2	3	3	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	3	3	3	2	2	3	3		2	2
1- low, 2- medium, 3- high															

PHYSICS LABORATORY (CSE, IT, EEE, ECE)

List of Experiments

1. Determination of Hall coefficient of a given semiconductor and its charge carrier density
2. V-I Characteristics of Zener diode and Solar cell
3. Air wedge - Determination of thickness of a thin sheet/wire
4. a) Laser- Determination of the wave length of the laser using grating
   b) Optical fibre -Determination of numerical aperture and acceptance angle
5. Magnetic field along the axis of current carrying coil – Stewart and Gee.

*** SDG: 4- Quality Education**

Course Designers

Dr. V. Vasudevan

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Mr.S. Vanchinathan
Dr. M. Malarvizhi

CHEMISTRY LABORATORY (CSE, IT, EEE, ECE,EE)

List of Experiments

1. Estimation of HCl by pH meter.
2. Estimation of mixture of acids by conductivity meter
3. Determination of ferrous ion by Potentiometric titration.
4. Determination of corrosion by weight loss method.
5. Estimation of ferrous ion by spectrophotometer.

Case studies/Activity report

1. Activity using chemdraw software.
2. Activity report on cheminformatic structure.
3. Case study on ion selective electrodes.
4. Assembling of cell or battery.

*** SDG 6: Improve Clean Water and Sanitation**
*** SDG 9: Industry, Innovation, and Infrastructure**
*** SDG 8: Decent Work and Economic Growth**

Course Designers

Dr.T.A.Sukantha
Dr.B.Srividhya
Dr.K.Prabha
Dr.S.Meenachi

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

60 EC 2P1	ELECTRONIC DEVICES LABORATORY Common to ECE and EE

Category	L	T	P	Credit
PC	0	0	4	2

Course Objectives

- To analyse the operation of the circuits with diodes in series and parallel combinations
- To design and implement various circuits using diodes
- To design and implement various circuits using BJT& FET
- To analyse the characteristics of various Optical devices
- To implement the application circuits using Power devices

Prerequisite

Nil

CourseOutcomes

On the successful completion of the course, students will be able to

CO1	Analyse the circuits with diodes in series and parallel	Analyse
CO2	Implement the application circuits using diodes	Apply
CO3	Implement the application circuits using BJT& FET	Apply
CO4	Analyse the characteristics of optical devices	Apply & Analyse
CO5	Implement the application circuits using power devices	Apply

Mapping wih Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	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	2	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	2	3	3		3	3		3	3	3	3
1- low, 2- medium, 3- high															

.

LIST OF EXPERIMENTS

Students have to design application circuits using analog electronic components/MOKU GO Kit/ multisim software

1. *Diode circuit analysis
2. *Application circuits using Diodes***
3. *Application circuits using BJT & FET
4. *Analyse the characteristics of Optical devices
5. *Application circuits using Power devices**

***SDG:4- Quality Education**

**** SDG:8- Desent work and economic growth**

*****SDG:9 –Industry innovation and infrastucture**

Course Designer

Mrs.S.S.Thamilselvi - sstamilselvi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN BOARD OF STUDIES
Department of ECE
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60 CG 0P1	Career Skill Development – I

Category	L	T	P	Credit
CG	0	0	2	1

Objective

- 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

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Listen and comprehend complex academic texts	Understand
CO2	Read and infer the denotative and connotative meanings of technical texts	Analyze
CO3	Write definitions, descriptions, narrations, and essays on various topics	Apply
CO4	Speak fluently and accurately in formal and informal communicative contexts	Apply
CO5	Appraise the verbal ability skills in the career development and professional contexts	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								2	3	3	2	3			
CO2								2	3	3	2	3		2	
CO3								2	3	3	2	3		2	
CO4								2	3	3	2	3	2		
CO5								2	3	3	2	3	2	2	3

1- low, 2- medium, 3- high

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 CG 0P1 - Career Skill Development - I								
Common to All Branches								
Semester	**Hours/Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	0	0	2	25	1	100	00	100

Listening* Listening for general information-specific details - audio / video (formal & informal) - Listen to podcasts/ TED talks/ anecdotes / stories / event narration / documentaries and interviews with celebrities - Listen to a product and process descriptions, advertisements about products or services.	[5]
Speaking* Self Introduction; Introducing a friend; conversation - politeness strategies - Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews - Picture description; giving instruction to use the product; presenting a product - Small Talk; Mini presentations - Group discussions, debates & role plays.	[5]
Reading* Loud reading vs Silent reading, Skimming & Scanning of passages, reading brochures (technical context), social media messages relevant to technical contexts and emails - Biographies, travelogues, newspaper reports and travel & technical blogs - Advertisements, gadget reviews and user manuals - Newspaper articles and Journal reports - Editorials; and opinion blogs	[5]
Writing* Writing letters – informal and formal – basics and format orientation - paragraph texting, short report on an event (field trip etc.) - Definitions; instructions; and product /process description - Note-making / Note-taking; recommendations; transferring information from non-verbal (charts, graphs to verbal mode) - Essay texting	[5]
Verbal Ability I* Reading Comprehension (MCQs) – Cloze Test - Sequencing of sentences – Summarizing and paraphrase – Error Detection – Spelling Test – Sentence Improvement - Preposition	[5]
Total Hours	**25**

Reference(s):

1.	'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020
3.	Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, 'A Course Book on Technical English'Scitech Publications (India) Pvt. Ltd. 2020

*** SDG- 04- Quality Education**

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Listening**	
1.1	Listening for general information and Specific details	1
1.2	Listening to podcasts, documentaries and interviews with celebrities	1
1.3	Narrating personal experiences	1
1.4	Reading relevant to technical contexts and emails	1
1.5	Listen to a product and process descriptions	1
2	**Speaking**	
2.1	Self-introduction	1

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2.2	Summarizing of documentaries& Picture Narration	1
2.3	Small Talk; Mini presentations	1
2.4	Group discussions, debates & role plays.	1
2.5	Group discussions	1
3	**Reading**	
3.1	Loud reading vs Silent reading, Skimming & Scanning of passages	1
3.2	Reading social media messages relevant to technical contexts	1
3.3	Reading newspaper reports and travel & technical blogs	1
3.4	Reading advertisements, gadget reviews and user manuals	1
3.5	Reading newspaper articles and journal reports	1
4	**Writing**	
4.1	Writing letters – informal and formal	1
4.2	Paragraph Texting	1
4.3	Definitions and instructions	1
4.4	Note-making / Note-taking	1
4.5	Essay texting	1
5	**Verbal Ability**	
5.1	Reading Comprehension (MCQs) and Cloze Test	1
5.2	Sequencing of sentences	1
5.3	Paraphrasing and Summarizing	1
5.4	Error Detection and Spelling Test	1
5.5	Prepositions	1
	Total	**25**

Course Designers

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

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60 MA 009	LINEAR ALGEBRA AND NUMERICAL METHODS

Category	L	T	P	Credit
BS	3	1	0	4

Objective

- To acquire knowledge about vector spaces.
- To get exposed to the basic concepts of linear transformation.
- To know the concepts of interpolation and numerical integration.
- To learn the basics concepts of initial value problems.
- To acquire knowledge of various methods to solve partial differential equations with boundary conditions

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply the concept of vector spaces.	Remember, Understand, Apply
CO2	Understand the concepts of linear transformation.	Remember, Understand, Apply
CO3	Apply different techniques to find the intermediate values and to evaluate single definite integrals.	Remember, Understand, Apply
CO4	Compute the solution for initial value problems using single and multi-step methods.	Remember, Understand, Apply
CO5	Apply various methods to solve partial differential equations with boundary conditions.	Remember, Understand, Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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							2	3		
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Test (Marks)	End Sem Examination (Marks)
	1	2		
Remember(Re)	06	06	10	08
Understand(Un)	10	08	15	18
Apply(Ap)	44	46	75	74
Analyze(An)	--	--	--	--
Evaluate(Ev)	--	--	--	--
Create(Cr)	--	--	--	--
Total	60	60	100	100

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K.S.Rangasamy College of Technology – Autonomous R 2022

60 MA 009 - Linear Algebra and Numerical Methods

B.E. 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	40	60	100

Vector Space**
Vector space – Subspace – Null space – Row and Column space - Linear combinations – Linear independence and linear dependence – Basis and dimension. [9]

Linear Transformation and Inner Product Spaces*
Linear transformation - Matrix representation of a linear transformation - Inner product - Norm – Gram-Schmidt orthogonalization process. [9]

Interpolation and Numerical Integration**
Lagrange's and Newton's divided difference interpolation (unequal intervals) - Newton's forward and backward interpolation (equal intervals) - Two point and three point Gaussian quadrature – Trapezoidal, Simpson's 1/3 and 3/8 rule (single integral). [9]

Numerical Solution of Ordinary Differential Equations**
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's predictor and corrector method - Adam's predictor and corrector method. [9]

Numerical Solution of Partial Differential Equations***
Classifications of partial differential equations of second order - Finite difference method - Laplace's equations - Liebmann's process - Poisson's equation - Hyperbolic equation. [9]

Hands on:

1. Find a basis and dimension for the vector subspace.
2. Matrix representation of a linear transformation
3. Simpson 1/3 method for definite integral
4. Runge – Kutta method for solving first order equations.
5. Solution of one dimensional wave equation

Total Hours: 45 + 15(Tutorial) 60

Text Book(s):

1. David C. Lay, 'Linear Algebra and its Applications', Pearson Education, 6th Edition, 2022.
2. B.S.Grewal and Grewal J.S., "Numerical Methods in Engineering and Science", 10th Edition, Khanna Publishers, New Delhi, 2015.

Reference(s):

1. Howard Anton and Chris Rorres, 'Elementary Linear Algebra', John Wiley & Sons, 11th Edition, 2014.
2. Gilbert Strang, 'Linear Algebra and Its Applications', Brooks/Cole/Cengage, 4th Edition, 2006.
3. C.F. Gerald and P.O. Wheatley, 'Applied Numerical Analysis', Pearson Education (Asia), 7th Edition, 2007.
4. P Kandasamy, KThilagavathy and K Gunavathi, 'Numerical Methods', S.Chand & Company Ltd, 3rd Edition, 2013

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***SDG:4- Quality Education**
****SDG:9- Industry, Innovation, and Infrastructure**
*****SDG:7- Affordable and Clean Energy**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Vector Spaces**	
1.1	Vector space	2
1.2	Subspace	1
1.3	Null space, Row and Column space	1
1.4	Tutorial	2
1.5	Linear combinations	1
1.6	Linear independence	1
1.7	linear dependence	1
1.8	Basis and dimension.	1
1.9	Tutorial	2
2	**Linear Transformation and Inner Product Spaces**	
2.1	Linear transformation	2
2.2	Matrix representation of a linear transformation	1
2.3	Inner product	1
2.4	Problems	1
2.5	Tutorial	2
2.6	Gram-Schmidt orthogonalization process	2
2.7	Problems	1
2.8	Tutorial	2
3	**Interpolation and Numerical Integration**	
3.1	Lagrange's interpolation	1
3.2	Newton's divided difference Methods	1
3.3	Newton's forward and backward difference Methods.	2
3.4	Two point and three point Gaussian quadratures	2
3.5	Trapezoidal rule	1
3.6	Tutorial	2
3.7	Simpson's1/3 and 3/8 rules	1
3.8	Tutorial	2
4	**Numerical Solution of Ordinary Differential Equations**	
4.1	Taylor series method	1
4.2	Euler and modified Euler methods	1
4.3	Fourth order Runge – Kutta method	2
4.4	Tutorial	2
4.5	Milne's predictor and corrector methods.	1
4.6	Problems	1
4.7	Adam's predictor and corrector methods.	1

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K.S.Rangasamy College of Technology
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4.8	Problems	1
4.9	Tutorial	2
5	**Numerical Solution of Partial Differential Equations**	
5.1	Classifications of partial differential equations of second order	1
5.2	Finite difference method	1
5.3	Laplace's equations	2
5.4	Liebmann's process	1
5.5	Tutorial	2
5.6	Poisson's equation	1
5.7	Hyperbolic equation.	1
5.8	Problems	1
5.9	Tutorial	2
	Total	60

Course Designers

1. Mr. D.Senthil Raja - senthilrajad@ksrct.ac.in
2. Mrs. D.Padmavathi - padmavathi@ksrct.ac.in

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K.S.Rangasamy College of Technology
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60 CS 002	DATA STRUCTURES AND ALGORITHMS

Category	L	T	P	Credit
ES	3	0	0	3

Objective

- To study the asymptotic performance of algorithms and choose the appropriate data structure for a specified application
- To design and implement abstract datatypes such as Linked List, Stack, Queue and Trees
- To Learn and implement the Hashing techniques
- To design a Priority Queue ADT and its applications
- To demonstrate various Sorting, Searching and Graph algorithms

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Analyze the asymptotic performance of algorithms and express the concept of linear data structures, applications and its implementations	Apply
CO2	Appraise the knowledge of Trees with its operations	Apply
CO3	Recognize the concept of Sorting, Searching and its types	Apply, Analyze
CO4	Review various implementations and operations of Priority Queue, and Hashing Techniques	Apply
CO5	Apply Shortest Path and Minimum Spanning Tree algorithms, Biconnectivity and algorithmic design paradigms	Apply, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2			2	2			2	3	3
CO2	3	3	2	3	2			2	3			2	3	3
CO3	3	3	2	2	2	2		2	3	2		2	3	3
CO4	3	3	2	3	2			3	2	2		2	3	3
CO5	3	3	2	3	2	2	2	3	3	2		2	3	3

3- Strong;2-Medium;1-Some

Assessment Pattern

Bloom'sCategory	Continuous Assessment Tests (Marks)		Model Exam (Marks	End Semester Examination (Marks)
	1	2		
Remember (Re)	10	10		20
Understand (Un)	10	10		20
Apply (Ap)	30	30		40
Analyze (An)	10	10		20
Evaluate (Ev)	-	-		-
Create (Cr)	-	-		-
Total	60	60	100	100

Syllabus

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K.S. Rangasamy College of Technology–Autonomous R2022								
60 CS 002 – DATA STRUCTURES AND ALGORITHMS								
B.E.Electronics and Communication Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Lists, Stacks and Queues Abstraction - Abstract data types - Data Representation - Elementary data types - Mathematical preliminaries: big-Oh notation - Efficiency of algorithms - Notion of time and space complexity - performance measures for data structures - **The List ADT – The Stack ADT – The Queue ADT***.	[12]
Trees Preliminaries – Binary Trees – The Search Tree ADT – Binary Search Trees – AVL Trees – Tree Traversals – B–Trees – B+ Trees.	[9]
Sorting and Searching Preliminaries – Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – External Sorting – Searching: Sequential Search - Binary Search – Hashed List Searches.	[7]
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]
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. **Algorithm Design Paradigms** - greedy, divide and conquer, dynamic programming, backtracking	[10]
Total Hours	45

Text Book(s):	
1.	M.A.Weiss, "Data Structures and Algorithm Analysis in C", Second 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 and Tamassia, "Data Structures and Algorithms in C++", Second Edition, John Wiley and Sons, 2011
4.	Reema Thareja, "Data Structures using C", Second Edition, Oxford Higher Education, 2014.

***SDG4 - Quality Education**

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1	**Lists, Stacks and Queues**	
1.1	Abstract Data Type (ADT), Mathematical preliminaries: big-Oh notation	1
1.2	Efficiency of algorithms, Notion of time and space complexity - performance measures for data structures	1

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

1.3	List ADT	4
1.4	Stack ADT	3
1.5	Queue ADT	3
2	**Trees**	
2.1	Preliminaries	1
2.2	Binary Trees	1
2.3	The Search Tree ADT	1
2.4	Binary Search Trees	1
2.5	AVL Trees	1
2.6	Tree Traversals	1
2.7	B-Trees	2
2.8	B+ Trees	1
3	**Sorting and Searching**	
3.1	Preliminaries, Insertion Sort	1
3.2	Shell Sort, Heap sort	1
3.3	Merge Sort, Quick sort	1
3.4	External Sorting	1
3.5	Sequential Searching	1
3.6	Binary Searching	1
3.7	Hashed List Searches	1
4	**Hashing and Priority Queues (Heaps)**	
4.1	Hashing, Hash Function	1
4.2	Separate Chaining, Open Addressing	1
4.3	Rehashing, Extendible Hashing	1
4.4	Priority Queues (Heaps)	1
4.5	Simple Implementations, Binary Heap	1
4.6	Applications of Priority Queues	1
4.7	d –Heaps	1
5	**Graphs**	
5.1	Graph Definitions - Topological Sort	1
5.2	Shortest-Path Algorithms - Unweighted Shortest Paths	1
5.3	Dijkstra's Algorithm	1
5.4	Minimum Spanning Tree	1
5.5	Prim's Algorithm	1
5.6	Kruskal's Algorithm	1
5.7	Applications of Depth-First Search	1
5.8	Undirected Graphs	1
5.9	Biconnectivity	1
5.10	Algorithm Design Paradigms	1
	Total Hours	**45**

Course Designers

1. Ms.K.Poongodi - poongodik@ksrct.ac.in

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CHAIRMAN BOARD OF STUDIES
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60 EC 301	ELECTRONIC CIRCUITS (Common to ECE& EE)

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- To understand the operation of different transistor amplifiers
- To design and analyze the feedback amplifiers and oscillators
- To understand the operation of power amplifiers and differential amplifier
- To acquire the basic knowledge of operational amplifier
- To implement application circuits using OP-AMP.

Prerequisite

Electronic Devices

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the operation of different transistor amplifier circuits	Remember, Understand,
CO2	Describe and analyse the characteristics of negative feedback amplifiers and oscillators	Remember, Understand, Apply, Analyse
CO3	Describe the concepts and characteristics of power amplifiers and design differential amplifier	Remember, Understand, Apply
CO4	Understand the basic concepts of op-amp	Remember, Understand
CO5	Design and analyse the various application of op-amp	Remember, Understand, Apply, Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2					3	3		3	3	3	
CO2	3	3	3	2	3				3	3			3	3	
CO3	3	3	2	2									3	3	
CO4	3	2	2	2									3	3	
CO5	3	3	3	3	3			3	3	3		3	3	3	

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10		20
Understand (Un)	35	40		60
Apply (Ap)	10	10		10
Analyze (An)	5	0		10

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Evaluate (Ev)	0	0		0
Create (Cr)	0	0		0
Total	60	60	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC 301 - ELECTRONIC CIRCUITS (Common to ECE & EE)								
B.E. Electronics and Communication Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	40	60	100

TRANSISTOR AMPLIFIERS* Introduction to biasing schemes for BJT and FET- Overview of single stage BJT amplifiers: Common emitter, common base, common collector- Hybrid-pi model -Miller effect - Frequency response of single stage MOSFET amplifier- Cascade and Cascode amplifiers.	[9]
FEEDBACK AMPLIFIERS AND OSCILLATORS * Different topologies: Voltage series, Voltage shunt, Current series and Current shunt, Effect on gain and frequency response, stability considerations and frequency compensation- Basic concept of oscillators, RC and LC sinusoidal oscillators	[9]
POWER AMPLIFIER & DIFFERENTIAL AMPLIFIER* Different modes of operation of amplifiers and their power efficiency: Class A, Class B, Class AB and Class C, **Push-pull amplifiers and applications**.** Differential amplifier: Basic structure and principle of operation - calculation of differential gain, common mode gain, CMRR and ICMR, Design of differential amplifier for a given specification.	[9]
BASICS OF OPERATIONAL AMPLIFIERS* Ideal op-amp characteristics, General operational amplifier stages and internal circuit diagrams of IC 741, DC characteristics, AC characteristics, Frequency response of op-amp, Slew rate.	[9]
APPLICATIONS OF OPERATIONAL AMPLIFIERS* Basic applications of op-amp – Inverting and Non-inverting Amplifiers, Voltage Follower, Scale changer, Summer, Subtractor, Basic comparator, **Precision rectifier, Clipper and clamper, Peak detector, V/I & I/V converters, Switched capacitor circuits**: Basic concept, Practical configurations**, Application in amplifier****.	[9]
Hands on 1. Design and simulation of self- bias circuit of BJT 2. Design and simulation of CS amplifier using FET **3.** Design and simulation of inverting and non- inverting amplifier	
Total Hours	45

Text book (s) :	
1	David A. Bell, 'Electronic Devices and Circuits ',5th Edition, Oxford University press, 2018.
2	Robert L. Boylestad, Louis Nashelsky, 'Electronic Devices and circuit theory', Pearson Education, 11thEdition, 2017.
3.	D.RoyChoudry , Shail Jain , 'Linear integrated Circuits', 5th Edition, New Age International Pvt Ltd, 2018.
Reference(s) :	
1	Anil K. Maini, VarshaAgrawal, 'Electronics Devices and Circuits', Wiley India Pvt.Ltd, 2nd edition, 2019.
2	S.Salivahanan, N.Sureshkumar, 'Electronic Devices and circuits', 4 th Edition, McGraw-Hill, 2017.

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

3	Ramakant A., Gayakwad, 'Op – Amps and Linear Integrated Circuits', 4th Edition, Prentice Hall, 2017

***SDG:4- Quality Education**
****SDG:9 –Industry innovation and infrastructure**

Assignment activity:

Assignment 1 – Covers Module 1 & 2

- Simulation of biasing circuits, common emitter amplifier for the given specifications.
- Simulation of feedback amplifiers with and without feedback and compare the measured gain.
- Problems in RC and LC oscillators.

Assignment 2 – Covers Module 3, 4 & 5

- Problems in differential amplifier.
- Comparison of op-amp 741 with another op-amp to analyze the features.
- Simulation of inverting amplifier, non-inverting amplifier, voltage follower, level shifter and comparator circuit using op-amp.

Course Contents and Lecture Schedule

Module no	topic	No.of Hours
1	**TRANSISTOR BIASING**	
1.1	Introduction to biasing schemes for BJT	1
1.2	FET	1
1.3	Overview of single stage BJT amplifiers	1
1.4	Common emitter amplifier	1
1.5	Common base, common collector	1
1.6	Hybrid-pi model, Miller effect	1
1.7	Frequency response of single stage MOSFET amplifier	1
1.8	Cascade amplifier	1
1.9	Cascode amplifier	1
2	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	
2.1	Different topologies: Voltage series	1
2.2	Voltage shunt	1
2.3	Current series	1
2.4	Current shunt	1
2.5	Effect on gain and frequency response, stability considerations and frequency compensation	1
2.6	Basic concept of oscillators	1
2.7	RC oscillators	1
2.8	LC sinusoidal oscillators	2
3	**POWER AMPLIFIER & DIFFERENTIAL AMPLIFIER**	
3.1	Different modes of operation of amplifiers	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

3.2	Their power efficiency: Class A, Class B,	1
3.3	Class AB and Class C	1
3.4	Push-pull amplifiers and applications	1
3.5	Differential amplifier: Basic structure and principle of operation	1
3.6	Calculation of differential gain, common mode gain, CMRR and ICMR.	1
3.7	Design of differential amplifier for a given specification	1
4	**BASICS OF OPERATIONAL AMPLIFIERS**	
4.1	Ideal op-amp characteristics	2
4.2	General operational amplifier stages	1
4.3	internal circuit diagrams of IC 741	1
4.4	DC characteristics	1
4.5	AC characteristics	2
4.6	Frequency response of op-amp	1
4.7	Slew rate	1
5	**APPLICATIONS OF OPERATIONAL AMPLIFIERS**	
5.1	Basic applications of op-amp – Inverting and Non-inverting Amplifiers	1
5.2	Voltage Follower, Scale changer	1
5.3	Summer, Subtractor	1
5.4	Basic comparator, Precision rectifier	1
5.5	Clipper and clamper	1
5.6	Peak detector	1
5.7	V/I & I/V converters	1
5.8	Switched capacitor circuits: Basic concept, Practical configurations	1
5.9	Application in amplifier	1

Course Designers

1.Mrs.S.S.Thamilselvi - sstamilselvi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 EC 302	CIRCUIT ANALYSIS (Common to ECE& EE)

Category	L	T	P	Credit
PC	2	1	2	4

Objectives

- To learn the basic concepts and behaviour of DC circuits
- To understand the various network theorems and two port network parameters
- To learn the basic concepts and behaviour of AC circuits
- To understand the transient and steady state response of the circuits subjected to DC excitations and AC with sinusoidal excitations.
- To learn the concept of coupling in circuits and the frequency response of resonant circuits

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply the basic laws to analyses the electric circuits using circuit analysis techniques.	Remember, Understand Apply,
CO2	Apply network theorems and Analyze the two port network behavior.	Remember, Apply, Analyze.
CO3	Analyze the steady state response of AC circuits with phasor diagram	Remember, Understand, Apply.
CO4	Apply Laplace Transform for steady state and transient analysis of RC, RL, and RLC networks	Remember, Apply, Analyze.
CO5	Analyses the frequency response of electric circuits under resonance and coupled circuits	Remember, Understand, Apply, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3							2	3	2	
CO2	3	3	3	3	3							2	3	2	
CO3	3	3	3	3	2							2	3	2	
CO4	3	3	3	3	3							2	3	2	
CO5	3	3	3	3	2							2	3	2	

3- Strong;2-Medium;1-Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Understand (Un)	10	10	10	10
Apply (Ap)	30	20	60	60
Analyze (An)	10	20	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous (R 2022)

60 EC 302 - CIRCUIT ANALYSIS

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	2	1	2	75	4	50	50	100

DC CIRCUIT ANALYSIS* Laws: Ohms Law, Kirchhoff's Current Law, Kirchhoff's voltage law, Connections: Sources, Resistors, Inductors and Capacitors in Series and Parallel, star and delta transformations, voltage, current source conversions. voltage and current division rules, Nodal analysis and Mesh analysis in DC Circuits.	[9]
NETWORK THEOREMS AND TWO PORT NETWORK* Theorems- Superposition, Thevenin's, Norton's, and Maximum power Transfer theorems. Network parameters - Impedance, admittance, transmission and Conversion formulae.	[9]
SINUSOIDAL STEADY STATE ANALYSIS* Sinusoidal Steady – State analysis, Characteristics of Sinusoids, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power, star and Delta Connections	[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]
RESONANCE AND COUPLED CIRCUITS* Behavior of series and parallel resonant circuits, frequency response, quality factor and bandwidth. Magnetically Coupled Circuits, mutual Inductance, Coefficient of Coupling, Dot rule- analysis of coupled circuits.	[9]
Hands on: 1. Measurements of current and voltage and power of a specific branch in a circuit 2. Verification of Mesh and Nodal Analysis 3. AC circuit various power calculation 4. Verification of Theorems – Thevenien, Notrons, Superposition theorem 5. Check the transient response of RL, RC and RLC circuits.	
Total Hours: 45 + 30(Practical)	**75**

Text Book(s):

1. Sudhakar A and Shyammohan S, 'Circuits & Network Analysis and Synthesis', 4th Edition, McGraw Hill, 2021
2. Singh R R, 'Network Analysis and Synthesis', 2nd Edition, McGraw Hill Education Pvt Limited, 2021.

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.

Passed in BoS Meeting held on 18/11/2023

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

***SDG 4: Quality Education**

Course Contents and Lecture Schedule

Module no.	Topic	Number of Hours
1	**DC CIRCUIT ANALYSIS**	
1.1	Basic Components of electric Circuits: Charge, current, Voltage and Power	1
1.2	Voltage and Current Sources. Laws: Ohms Law, Kirchhoff's Current Law, Kirchhoff's voltage law,	1
1.3	Voltage and current division rule	1
1.4	Connections: Series and Parallel Connected Sources, Resistors,	1
1.5	Inductor and Capacitor in Series and Parallel connection	1
1.6	Star and Delta transformation,	1
1.7	Voltage, Current sources conversion.	1
1.8	Nodal analysis	1
1.9	Mesh analysis	1
2	**NETWORK THEOREMS AND TWO PORT NETWORK**	
2.1	Superposition Theorem	1
2.2	Thevenin's Theorem	1
2.3	Norton's Theorem	1
2.4	Maximum power Transfer theorems.	1
2.5	Impedance parameter	1
2.6	Admittance parameter	1
2.7	Transmission parameter	1
2.8	hybrid parameter	1
2.9	Conversion formula between two port parameters	1
3	**SINUSOIDAL STEADY STATE ANALYSIS**	
3.1	Sinusoidal Steady – State analysis, Characteristics of Sinusoids	1
3.2	The Phasor relationship for R, L and C	1
3.3	Impedance and Admittance Diagram	1
3.4	Phasor Diagrams	1
3.5	AC Circuit Power Analysis	1
3.6	Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power	1
3.7	Problems on various Power	1
3.8	Why Connection	1
3.9	Delta Connection	1
4	**TRANSIENTS**	
4.1	Transient analysis of RC without initial conditions	1
4.2	Transient analysis of RL without initial conditions	1
4.3	Transient analysis of RLC networks without initial conditions	2
4.4	Transient analysis of RC with initial conditions	1
4.5	Transient analysis of RL with initial conditions	1
4.6	Transient analysis of RLC networks with initial conditions	2

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Approved in Academic Council Meeting held on 23/12/2023

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

4.7	State equations for networks.	1
5	**RESONANCE AND COUPLED CIRCUITS**	
5.1	Behavior of series resonant circuits, frequency response,	1
5.2	Quality factor and bandwidth of series resonance	1
5.3	Behavior of parallel resonant circuits, frequency response	1
5.4	Quality factor and bandwidth of parallel resonance circuit	1
5.5	Magnetically Coupled Circuits, mutual Inductance, Coefficient of Coupling,	1
5.6	Dot rule- analysis of coupled circuits.	1
5.7	Introduction to filters, classification	1
5.8	T' Filter network and its equation	1
5.9	'π' Filter network and its equation	1
	Total (45+15(Tutorial))	60

Course Designers

1. **Mr S.Jayamani**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 EC 303	DIGITAL SYSTEM DESIGN (Common to ECE& EE)

Category	L	T	P	Credit
PC	2	1	0	3

Objective

- 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

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the fundamentals of numbering system and apply Boolean algebra to design digital systems	Remember, Understand Apply, Evaluate
CO2	Design and analyze combinational circuits and semiconductor memories	Remember, Understand, Apply Analyse
CO3	Design and analyze synchronous sequential logic circuits	Remember, Understand ,Analyse
CO4	Analyse the asynchronous sequential circuits.	Understand Analyse, Evaluate
CO5	Design and verify the digital circuits using HDL.	Remember, Apply, Evaluate

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2								2	2	
CO2	3	3	3	2	3			3	3	3			2	3	
CO3	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	
3- Strong;2-Medium;1-Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Modal exam (marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	20	10	30	20
Analyze (An)	10	10	20	30

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Evaluate (Ev)	10	10	20	20
Create (Cr)	0	10	10	10
Total	60	60	100	100

Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 EC 303 - Digital System Design (Common to ECE& EE)								
B.E. Electronics and Communication Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	2	1	0	45	3	40	60	100

Digital Fundamentals* Review of Number Systems- representation-conversions–– 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, subtractors, decoders, encoders, multiplexers, demultiplexers, Code convertor, Realization of Boolean expressions-using multiplexers. Memories –ROM types, RAM types, PLDs	[9]
Sequential Circuits* Flip flops SR, JK, T, D and Master slave – Characteristic table and equation – Flip flop conversion, 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]**
Hands on: 1. Simulation of combinational circuit 2. Simulation of sequential circuit	
Total Hours: 30 + 15 (Tutorial)	**45**

TextBook(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
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.

***SDG:4 -Quality Education**

****SDG:8 -Decent work and economic growth**

*****SDG:9-Industry,innovation and infrastructure**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Digital Fundamentals**	
1.1	Review of Number Systems	1
1.2	conversions	1
1.3	Boolean postulates and laws	1
1.4	De-Morgan's Theorem	1
1.5	Logic Gates	1
1.6	Minimization of Boolean expressions	1
1.7	Sum of Products (SOP) – Product of Sums (POS)	1
1.8	Canonical forms- Karnaugh map Minimization	1
1.9	Implementation of Boolean expressions using universal gates.	1
2	**Combinational Circuits**	
2.1	Combinational logic circuits	
2.2	Adders, subtractors,	1
2.3	Decoders, encoders	1
2.4	Multiplexers, demultiplexers	2
2.5	Code convertor,	2
2.6	Realization of Boolean expressions-using multiplexers	1
2.7	Memories –ROM types ,RAM types, PLDs	2
3	**Sequential Circuits**	
3.1	Flip flops SR, JK, T, D and Master slave	1
3.2	Characteristic table and equation	1
3.3	Flip flop conversion, Application table	1
3.4	Edge triggering – Level Triggering	1
3.5	Ripple counters – Synchronous counters	1
3.6	Modulo – n counter- Design of Synchronous FSM	1
3.7	Analysis of clocked sequential circuits: state equation – State table – State diagram –	1
3.8	State reduction & assignment	1
3.9	Register : shift registers – Universal shift register– Shift counters	1
4	**Asynchronous Sequential Circuits**	
4.1	Analysis procedure	1
4.2	Transition table – Flow table	1
4.3	Race conditions	1
4.4	Design of fundamental mode circuits	1
4.5	Primitive flow table	1
4.6	Reduction of state and flow table	1
4.7	Race free state assignment	1
4.8	Hazards	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

4.9	overview and comparison of logic families	1
5	**Introduction To HDL**	
5.1	Design flow of VLSI,	1
5.2	Different modelling styles in Verilog HDL, s	2
5.3	Structural, Dataflow and behavioural modelling of combinational and sequential logic circuit	6
	Total	45

Course Designers

1. Dr.S.Malarkhodi–malarkhodi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 MY 002	UNIVERSAL HUMAN VALUES

Category	L	T	P	Credit
MC	3	0	0	3

Objective

- To identify the essential complementarily between 'values' and 'skills'
- To ensure core aspirations of all human beings.
- To acquire ethical human conduct, trustful and mutually fulfilling human behaviour
- To enrich interaction with Nature
- To achieve holistic perspective towards life and profession

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the significance of value inputs in formal education and start applying them in their life and profession	Understand
CO2	Evaluate coexistence of the “I” with the body.	Analyze
CO3	Identify and evaluate the role of harmony in family, society and universal order.	Analyze
CO4	Classify and associate the holistic perception of harmony at all levels of existence and Nature	Analyze
CO5	Develop appropriate human conduct and management patterns to create harmony in professional and personal lives.	Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	2		2	3	3	1	1
CO2						3		3	3			3	3	1	1
CO3						3	3	3	3			3	3	1	2
CO4						3	3	3	3			3	3	1	2
CO5						3	3	3	3	3		3	3	1	2
3- Strong;2-Medium;1-Some															

Assessment Pattern

Bloom’s Category	Continuous Assessment Tests (Marks)			End Semester Examination (Marks)
	1	2	Model	
Remember (Re)	10	10	20	No End Semester Examination
Understand (Un)	10	10	20	
Apply (Ap)	20	20	30	
Analyze (An)	20	20	30	
Evaluate (Ev)	0	0	0	
Create (Cr)	0	0	0	

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

K.S.Rangasamy College of Technology–Autonomous R2022								
60 MY 002 - UNIVERSAL HUMAN VALUES								
Common to all Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	100	00	100

Introduction to value Education * Understanding value Education-Self exploration as the process for value education-Continuous Happiness and prosperity-the basic human aspirations-right understanding-relationship and physical facility –happiness and prosperity - current scenario – **method to fulfill the basic human aspirations****	[9]
Harmony in the Human Being* Understanding Human being as the Co-Existence of the self and the Body-Distinguishing between the needs of the self and the body-the body as an instrument of the self-**understanding harmony in the self-harmony of the self with the body**** – programme to ensure self-regulation and health	[9]
Harmony in the Family and Society* Harmony in the Family –the basic unit of human interaction-values in human- to - human relationship –'Trust' the foundation value in relationship –'Respect'- as the right evaluation-understanding harmony in the society –vision for the universal human order.	[9]
Harmony in the Nature/Existence* Understanding harmony in the Nature-Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature – realizing existence as co-existence at all levels –the holistic perception of harmony in existence.	[9]
Implications of the Holistic Understanding* Natural Acceptance of human values- definitiveness of human conduct- a basis for humanistic education, humanistic constitution and universal human order- competence in professional ethics –holistic technologies, production systems and management models-typical case studies – strategies for transition towards value base life and profession	[9]
Total Hours	**45**

Text Book(s):	
1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana,
Reference(s):	
1.	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age International. Publishers, New Delhi, 2004.

*SDG:3 – Good Health and Well-Being

**SDG:5 – Quality Education

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**INTRODUCTION TO VALUE EDUCATION**	
1.1	Discussion on Present Education System and Skill Based Education	1
1.2	Understanding Value Education	1
1.3	Self exploration as the process for value education	1
1.4	Basic Human Aspirations - Continuous Happiness and Prosperity	1
1.5	Basic requirements to fulfill Human Aspirations - Right understanding, Relationship and Physical facility	1
1.6	Transformation from Animal Consciousness to Human Consciousness	1
1.7	Sources of Happiness and Prosperity – Harmony and Disharmony	1

Passed in BoS Meeting held on 18/11/2023

Approved in Academic Council Meeting held on 23/12/2023

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

1.8	Current Scenario and Role of Education	1
1.9	Outcome of Human Education and Method to fulfill the basic human aspirations	1
2	**HARMONY IN THE HUMAN BEING**	
2.1	Understanding Human being - As Co-Existence of the self and the Body - The Needs of the Self and the Body	1
2.2	Understanding Human being - As Co-Existence of the self and the Body - The Activities and Response of the Self and the Body	2
2.3	The body as an instrument of the self	1
2.4	Understanding harmony in the self	1
2.5	Harmony of the self with the body	2
2.6	Programme to ensure self-regulation and health	1
2.7	My Participation (Value) regarding Self and my Body - Correct Appraisal of our Physical needs	1
3	**HARMONY IN THE FAMILY AND SOCIETY**	
3.1	Harmony in the Family - Understanding Values in Human Relationships	1
3.2	Family as the basic Unit of Human Interaction	1
3.3	Values in human Relationships	1
3.4	Trust - the foundation value in relationship	1
3.5	Respect as the right evaluation, the Basis for Respect, Assumed Bases for Respect today	1
3.6	Harmony from Family to World Family: Undivided Society	1
3.7	Extending Relationship from family to society , Identification of the Comprehensive Human Goal	1
3.8	Programs needed to achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour	1
3.9	Harmony from Family Order to World Family Order – Universal Human Order	1
4	**HARMONY IN THE NATURE / EXISTENCE**	
4.1	The Four Orders in Nature	1
4.2	Participation of Human Being in Entire Nature	1
4.3	Natural Characteristics - Tendency of Human Living with Animal Consciousness / The Holistic Perception of Harmony in Existence	1
4.4	Present day Problems	1
4.5	Recyclability and self-regulation in Nature	1
4.6	Relationship of Mutual Fulfillment	1
4.7	An Introduction to space, Co-existence of Units in Space	1
4.8	Harmony in Existence – Understanding Existence as Co- Existence	1
4.9	Natural Characteristic of Human Living with Human Consciousness	1
5	**IMPLICATIONS OF THE HOLISTIC UNDERSTANDING**	
5.1	Natural Acceptance of human values	1
5.2	Definitiveness of Ethical Human Conduct - Development of Human Consciousness	1
5.3	Identification of Comprehensive Human Goal	1
5.4	Basis for Humanistic Education and Humanistic Constitution	1
5.5	Ensuring Competence in professional Ethics	1
5.6	Issues in Professional Ethics-The Current Scenario	1
5.7	Holistic Technologies and Production Systems and management models -Typical Case Studies	2
5.8	Strategies for transition towards value based life and profession	1

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	Total	45

Course Designers

1. Dr.G.Vennila -vennila@ksrct.ac.in
2. Dr.K.Raja - rajak@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
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60 GE 002	Tamils and Technology (Common to all Branches)

Category	L	T	P	Credit
GE	1	0	0	1

Objectives:

- To learn weaving, ceramic and construction technology of Tamils.
- To understand the agriculture, irrigation and manufacturing technology of Tamils.
- To realize the development of scientific Tamil and Tamil computing.

Prerequisite:

Nil

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understand the weaving and ceramic technology of ancient Tamil people nature.	Understand
CO2	Comprehend the construction technology, building materials in sangam period and case studies.	Understand
CO3	Infer the metal process, coin and beads manufacturing with relevant archeological evidence.	Understand
CO4	Realize the agriculture methods, irrigation technology and pearl diving.	Understand
CO5	Apply the knowledge of scientific Tamil and Tamil computing.	Apply

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							3	3		2		3			3
CO2							3	3		2		3			3
CO3							3	3		2		3			3
CO4							3	3		2		3			3
CO5							3	3		2		3			3

3- Strong; 2-Medium; 1-Low

Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 GE 002 – Tamils and Technology (Common to all Branches)								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	1	0	0	15	1	100	-	100
WEAVING AND CERAMIC TECHNOLOGY* Weaving Industry during Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.								3

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Approved in Academic Council Meeting held on 23/12/2023

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

DESIGN AND CONSTRUCTION TECHNOLOGY* Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period - Type Study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal – Chetti Nadu Houses , Indo – Saracenic architecture at Madras during British Period.	3
MANUFACTURING TECHNOLOGY* Art of Ship Building – Metallurgical studies – Iron Industry – Iron smelting ,Steel -Copper and gold coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads – Terracotta beads – Shell beads/bone beats – Archeological evidences -Gem stone types described in Silappathikaram.	3
AGRICULTURE AND IRRIGATION TECHNOLOGY* Dam,Tank,Ponds, Sluice,Significance of Kumizhi Thoompu of Chola Period,Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea- Fisheries – Pearl – Conche diving -Ancient Knowledge of Ocean – Knowledge Specific Society.	3
SCIENTIFIC TAMIL & TAMIL COMPUTING* Development of Scientific Tamil – Tamil Computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy- Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகைநதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல்துறை வெளியீடு).
4.	பொருநை – ஆற்றங்கரை நாகரீகம் (தொல்லியல்துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

*SDG4-Quality Education

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Approved in Academic Council Meeting held on 23/12/2023

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60 GE 002	தமிழரும் தொழில்நுட்பமும் (அனைத்து துறைகளுக்கும் பொதுவானது)

Category	L	T	P	Credit
GE	1	0	0	1

பாடத்தின் நோக்கங்கள்:

- தமிழர்களின் சங்ககால நெசவு, பனை வனைதல் மற்றும் கட்டிட தொழில் நுட்பம் குறித்து அறிதல்.
- தமிழர்களின் சங்ககால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்.
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்.

முன்கூட்டிய துறைசார் அறிவு:

தேவை இல்லை

பாடம் கற்றதின் விளைவுகள்:

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வனைதல் தொழில்நுட்பம் குறித்த கற்றுணர்தல்	புரிதல்
CO2	சங்ககாலத் தமிழர்களின் கட்டிட தொழில்நுட்பம் கட்டுமானப் பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு.	புரிதல்
CO3	சங்ககாலத் தமிழர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு.	புரிதல்
CO4	சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு.	புரிதல்
CO5	நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்துதலும்.	பகுப்பாய்வு

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							3	3		2		3			3
CO2							3	3		2		3			3
CO3							3	3		2		3			3
CO4							3	3		2		3			3
CO5							3	3		2		3			3
3- Strong; 2-Medium; 1-Low															

Syllabus

K. S. Rangasamy College of Technology – Autonomous (R2022)			
60 GE 002 – **தமிழரும் தொழில்நுட்பமும்**			
	Hours/Week	Credit	Maximum Marks

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Semester	L	T	P	Total hrs	C	CA	ES	Total
III	1	0	0	15	1	100	-	100

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.	3
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கல் - நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.	3
உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை – உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள் , கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	3
வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்கான வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.	3
அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 EC 3P1	ANALOG AND DIGITAL ELECTRONICS LABORATORY (Common to ECE& EE)

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To illustrate the working of transistor biasing circuits
- To understand and analyze the operation of single stage and multistage amplifiers
- To understand and analyze the applications of op-amp
- To design and implement combinational and sequential circuits for practical applications
- To simulate combinational and sequential circuits using HDL

Prerequisite

Electronic Devices Laboratory

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Design and construct different biasing circuits for BJT & MOSFET	Apply & Analyse
CO2	Design, implement and obtain the frequency response of single stage CE amplifier and feedback amplifiers.	Apply& Analyse
CO3	Design and implement an application circuit using power amplifier	Apply
CO4	Design and implement application circuit using combinational and sequential logic circuits	Apply & Analyse
CO5	Design and simulate combinational and sequential logic circuits using HDL	Apply & Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3				3	3		3	3	3	3
CO2	3	3	3	3	2	3			3	3		3	3	3	3
CO3	3	3	3	3	2	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	3		3	3	3	3

List of Experiments

Students have to design application circuits using analog electronic components / MOKU GO Kit / multisim software

Analog experiments*

1. Design and simulation of BJT & MOSFET biasing circuits
2. Design and implementation of MOS amplifier circuits**
3. Analysis of frequency response of feedback amplifiers/ multistage amplifier
4. Design and implementation of application circuits using op-amp**

Digital experiments*

5. Design and implementation of combinational circuits using logic gates**
6. Design and implementation of synchronous sequential circuits**
7. Design and implementation of asynchronous sequential circuits**
8. Design and implementation of FSM (Finite State Machine)**
9. Design and simulation of combinational / synchronous & asynchronous sequential circuits using HDL**

***SDG:4- Quality Education**

****SDG:9 –Industry innovation and infrastucture**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

Course Designers

1. Mrs.S.S.Thamilselvi - sstamilselvi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 CS 0P2	DATA STRUCTURES AND ALGORITHMS LABORATORY

Category	L	T	P	Credit
ES	0	0	4	2

Objective

- To design and implement simple linear and nonlinear 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

Prerequisite

Programming knowledge in C language

Course Outcomes

On the successful completion of the course, students will be able to

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2						2			2	3	3
CO2	3	3	2	3					3			2	3	3
CO3	3	3	2	2	2	2			3	2		2	3	3
CO4	3	3	2	3	2			3	2	2		2	3	3
CO5	3	3	2		2	2	2	3	3	2		2	3	3
3- Strong; 2-Medium; 1-Low														

List of Experiments

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. Implementation Search Tree ADT
6. Implementation of Internal Sorting
7. Develop a program for external sorting
8. Develop a program for various Searching Techniques

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9. **Implementation of Shortest Path Algorithm***
10. **Implementation of Minimum Spanning Tree Algorithm***

***SDG:4- Quality Education**

Course Designers

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60 CG 0P2	CAREER SKILL DEVELOPMENT II

Category	L	T	P	Credit
CG	0	0	2	1

Objective

- 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

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								2	3	3	2	3	2		
CO2								2	3	3	2	3	2		
CO3								2	3	3	2	3	2	2	2
CO4								2	3	3	2	3			
CO5								2	3	3	2	3	2	2	2
3- Strong;2-Medium;1-Some															

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Tiruchengode - 637 215.

K.S.Rangasamy College of Technology–Autonomous R2022								
60 CG 0P2 - Career Skill Development II								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	2	30	1	100	00	100

Listening* Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects, documentaries depicting a technical problem and suggesting solutions - Listening to TED Talks	[6]
Speaking* Marketing a product, persuasive speech techniques - Describing and discussing the reasons of accidents or disasters based on news reports, Group Discussion (based on case studies), presenting oral reports, Mini presentations on select topics with visual aids, participating in role plays, virtual interviews	[6]
Reading* Reading advertisements, user manuals and brochures - longer technical texts– cause and effect essays, and letters / emails of complaint - Case Studies, excerpts from literary texts, news reports etc. - Company profiles, Statement of Purpose (SoPs)	[6]
Writing* Professional emails, Email etiquette - compare and contrast essay - Writing responses to complaints Precis writing, Summarizing and Plagiarism- Job / Internship application – Cover letter & Résumé	[6]
Verbal Ability II* Reading Comprehension (Inferential fillups) – Spotting Errors – Verbal Analogies – Theme Detection – Change of Voice – Change of Speech – One word substitution	[6]
Total Hours	**30**

Reference(s):

1.	'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020
3.	Raman. Meenakshi, Sharma. Sangeeta, 'Professional English'. Oxford University Press. New Delhi. 2019
4.	Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003

* SDG- 04- Quality Education

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Listening**	
1.1	Evaluative Listening: Advertisements, Product Descriptions	1
1.2	Listening to longer technical talks and completing– gap filling exercises.	1
1.3	Listening technical information from podcasts	1
1.4	Listening to process/event descriptions to identify cause & effects and documentaries depicting a technical problem and suggesting solutions	1
1.5	Listening to TED Talks	1

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

2	**Speaking**	
2.1	Marketing a product, persuasive speech techniques	1
2.2	Describing and discussing the reasons of accidents or disasters based on news reports,	1
2.3	Group Discussion (based on case studies)	1
2.4	Presenting oral reports, Mini presentations on select topics with visual aids	1
2.5	participating in role plays and virtual interviews	1
3	**Reading**	
3.1	Reading advertisements, user manuals and brochures	1
3.2	Reading - longer technical texts– cause and effect essays, and letters / emails of complaint	1
3.3	Case Studies, excerpts from literary texts, news reports etc.	1
3.4	Company profiles	1
3.5	Statement of Purpose (SoPs)	1
4	**Writing**	
4.1	Professional emails, Email etiquette	1
4.2	Compare and contrast essay	1
4.3	Writing responses to complaints	1
4.4	Precis writing, Summarizing and Plagiarism	1
4.5	Job / Internship application – Cover letter & Résumé	1
5	**Verbal Ability II**	
5.1	Reading Comprehension (Inferential fillups) and Theme Detection	1
5.2	Spotting Errors	1
5.3	Verbal Analogies	1
5.4	Change of Voice and Change of Speech	1
5.5	One word substitution	1
	Total	**25**

Course Designer

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

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60 MA 016	PROBABILITY AND INFERENTIAL STATISTICS

Category	L	T	P	Credit
BS	3	1	0	4

Objective

- To learn the basic concepts of probability.
- To get exposed to some standard distributions.
- To familiarize the concepts of correlation and regression
- To familiarize various methods in hypothesis testing.
- To get exposed to various statistical methods for time series.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the basics of probability.	Remember, Understand, Apply
CO2	Understand the concepts of standard distributions.	Remember, Understand, Apply
CO3	Calculate coefficient of correlation and regression.	Remember, Understand, Apply
CO4	Apply Student's t test, F test and Chi-square test for testing the statistical hypothesis.	Remember, Understand, Apply
CO5	Apply suitable methods for measuring trend values.	Remember, Understand, Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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							2	3		

3- Strong;2-Medium;1-Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Test (Marks)	End Sem Examination (Marks)
	1	2		
Remember(Re)	06	06	10	08
Understand(Un)	10	08	15	18
Apply(Ap)	44	46	75	74
Analyze(An)	0	0	0	0
Evaluate(Ev)	0	0	0	0
Create(Cr)	0	0	0	0
Total	60	60	100	100

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Tiruchengode - 637 215.

K.S.Rangasamy College of Technology–Autonomous R2022								
60 MA 016 - Probability and Inferential Statistics								
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	40	60	100

Probability and Random Variables* Axioms of probability – Conditional probability –Baye's theorem–Random variable – Expectation – Probability mass function – Probability density function – Moment generating function.	**[9]**
Standard Distributions Discrete Distributions: Binomial, Poisson*** and Geometric distributions – Continuous Distributions: Uniform, Exponential and Normal distributions – Properties.	**[9]**
Two Dimensional Random Variables* Joint distributions - Marginal and conditional distributions – Covariance – Correlation and Regression - Rank Correlation.	**[9]**
Testing of Hypothesis** Type I and Type II errors – Test of significance of small samples : Student's 't' test – Single mean – Difference of means – F- test – Chi-square test – Goodness of fit – Independence of attributes.	**[9]**
Time Series* Components of a time series - Method of least square - Parabolic trend - Exponential trend - Method of seasonal variations – Ratio to trend method - Link relative method.	**[9]**
Hands on: 1. Calculate the mean and variance for discrete distributions. 2. Fit the Normal distribution. 3. Calculate the correlation coefficient and lines of regression. 4. Applied Chi-square test to real data set. 5. Fit a curve to the given data using method of least squares.	
TotalHours:45+15(Tutorial)	**60**

Text Book(s):

1.	Richard A Johnson, "Miller & Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education Limited, New Delhi, 2018.
2	P N Arora and S Arora, 'Statistics for Management', 5th Edition, Sultan Chand & Sons, New Delhi, 2015.

Reference(s):

1.	Sheldon Ross, "A first course in Probability", 10th Edition, Pearson Education, New Delhi, 2019.
2.	T.Veerarajan, 'Probability, Statistics and Random process', Tata McGraw-Hill Education, 4th Edition, 2015.
3.	Gupta S.P, "Statistical Methods", 45th Edition, Sultan Chand & sons, New Delhi, 2017.
4.	D C Montgomery, Cheryl L.Jennings and Murat Kulahci "Introduction to Time Series Analysis and Forecasting", 2nd Edition, John Wiley and Sons, 2015.
5.	V.K.Kapoor and S.C.Gupta, "Fundamentals of Mathematical Statistics", Sultan Chand & sons, 12th Edition, New Delhi, 2020.

***SDG:4- Quality Education**
****SDG:9- Industry, Innovation, and Infrastructure**
*****SDG:2- Zero Hunger**

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Tiruchengode - 637 215.

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Probability and Random Variables**	
1.1	Axioms of probability	1
1.2	Conditional probability	1
1.3	Baye's theorem	2
1.4	Tutorial	2
1.5	Random variable ,Expectation	1
1.6	Probability mass function	1
1.7	Probability density function	1
1.8	. Moments generating function .	1
1.9	Tutorial	2
2	**Standard Distributions**	
2.1	Discrete Distributions- Binomial distribution	2
2.2	Poisson distribution	1
2.3	Geometric distribution	1
2.4	Tutorial	2
2.5	Continuous Distributions - Uniform distribution	1
2.6	Exponentialdistribution	1
2.7	Normal distribution	2
2.8	Properties	1
2.9	Tutorial	2
3	**Two Dimensional Random Variables**	
3.1	Joint distributions	1
3.2	Marginal distribution	1
3.3	conditional distribution	1
3.4	Tutorial	2
3.5	Covariance	1
3.6	Correlation	1
3.7	Regression	2
3.8	Rank correlation	1
3.9	Tutorial	2
4	**Testing of Hypothesis**	
4.1	Type I and Type II errors	1
4.2	Test of significance of small samples -Student's 't' test	1
4.3	Single mean	1
4.4	Difference of means.	2
4.5	Tutorial	2
4.6	F- test	1
4.7	Chi-square test – Goodness of fit	1
4.8	Independence of attributes.	1
4.9	Tutorial	2
5	**Time Series**	

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Approved in Academic Council Meeting held on 23/12/2023

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

5.1	Components of a time series	1
5.2	Method of least square	1
5.3	Parabolic trend	2
5.4	Exponential trend	1
5.5	Tutorial	2
5.6	Method of seasonal variations	1
5.7	Ratio to trend method	1
5.8	Link relative method	1
5.9	Tutorial	2
	Total	60

Course Designers

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60 EC 401	SIGNALS AND SYSTEMS (Common to ECE& EE)

Category	L	T	P	Credit
PC	2	1	0	3

Objectives

- To understand the basic properties of signals & systems and analysis of LTI systems
- To understand the sampling and reconstruction of CT signals.
- To analyse continuous time and discrete time signals and systems in the Fourier series and Fourier transform.
- To analyse discrete time signals and systems using z-transform.
- To study about DFT and FFT algorithms

Prerequisite

Integrals, Partial Differential Equations and Laplace transform.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Describe the classification of signals and systems with their properties and analyse LTI systems.	Remember, Understand Apply
CO2	Understand the concepts of sampling and reconstruction of CT signals.	Remember, Understand Apply, Analyze
CO3	Analyse continuous-time and discrete-time signals and systems using Fourier series and Fourier transform	Remember, Understand, Apply.
CO4	Analyse discrete-time signals and systems using z-transform	Remember, Understand, Apply
CO5	Computation of DFT and FFT algorithms	Remember, Understand, Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2							3	3		
CO2	3	3	3	3	2							3	3	3	
CO3	3	3	3	3	2			3	3			3	3	3	
CO4	3	3	3	3	2			3	3			3	3	3	
CO5	3	3	3	3	2			3	3			3	3	3	

3 - Strong;2 - Medium;1 – Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	30	30	70	70
Analyze (An)	10	10	10	10
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0

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Tiruchengode - 637 215.

Total	60	60	100	100

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC 401 - 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	2	1	0	45	3	40	60	100

INTRODUCTION TO SIGNALS AND SYSTEMS* Basic Continuous-time (CT) & Discrete-Time (DT) signals-Classification of CT & DT Signals – Basic CT and DT signals -Signal operations –Classification-Properties of CT & DT systems - Analysis of LTI systems: Convolution Sum-Convolution Integral—Properties. **Handson:** Signal generation &operations and verification of system properties	[9]
SAMPLING* Representation of CT signals by samples—Sampling theorem-Impulse train sampling-Effects of under sampling-Reconstruction of CT signal from samples using interpolation. **Handson:** Sampling and Reconstruction.	[9]
FOURIER ANALYSIS OF CONTINUOUS TIME AND DISCRETE TIME SIGNALS AND SYSTEMS* Representation of periodic signals by Continuous Time Fourier Series (CTFS) and Discrete Time Fourier Series (DTFS) -Representation of CT aperiodic and periodic signals by Continuous Time Fourier Transform-Representation of DT aperiodic and periodic signals by Discrete Time Fourier Transform—Properties- Frequency response of systems characterized by differential equations and difference equations. **Handson:** Analysis and Synthesis of CT and DT signals and systems using Fourier Transform	[9]
ZTRANSFORMANALYSISOFDISCRETETIMESIGNALSANDSYSTEMS* Z transform - two sided and one sided Z transform - Properties of Z transform - Properties of ROC —Inverse Z transform, Analysis of LTI systems using z transform- Stability and causality in z-domain -Solution of difference equations - frequency response and impulse response. **Handson:** Analysis of DT systems using z-transform.	[9]
DFTANDFFTALGORITHMS* 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 **Handson:** Verification of properties of DFT	[9]
Total Hours: 30 + 15(Tutorial)	**45**

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

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Course Contents and Lecture Schedule

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Approved in Academic Council Meeting held on 23/12/2023

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

S.No.	Topic	Number of Hours
	INTRODUCTION TO SIGNALS AND SYSTEMS	
1.1	Basic Continuous-time (CT) & Discrete-Time (DT) signals	1
1.2	Classification of CT Signals	1
1.3	Classification of DT Signals	1
1.4	Basic CT and DT signals -Signal operations, Classification	1
1.5	Properties of CT systems	1
1.6	Properties of DT systems	1
1.7	Analysis of LTI systems: Convolution Sum	1
1.8	Convolution Integral	1
1.9	Properties	1
1.10	Hands on	3
	SAMPLING	
2.1	**R**epresentation of CT signals by samples- Sampling theorem	3
2.2	Impulse train sampling	2
2.3	Effects of under sampling	2
2.4	Reconstruction of CT signal from samples using interpolation	2
2.5	Hands on	3
	FOURIER ANALYSIS OF CONTINUOUS TIME and DISCRETE TIME SIGNALS AND SYSTEMS	
3.1	Representation of periodic signals by Continuous Time Fourier Series (CTFS)	2
3.2	Representation of periodic signals by Discrete Time Fourier Series (DTFS)	1
3.3	Representation of CT aperiodic and periodic signals by Continuous Time Fourier Transform	2
3.4	Representation of DT aperiodic and periodic signals by Discrete Time Fourier Transform	1
3.5	Properties	1
3.6	Frequency response of systems characterized by differential equations.	1
3.7	Frequency response of systems characterized by difference equations	1
3.8	Hands on	3
	Z TRANSFORM ANALYSIS OF DISCRETE TIME SIGNALS AND SYSTEMS	
4.1	Z transform - two sided and one sided Z transform	2
4.2	Properties of Z transform and Properties of ROC	2
4.3	Inverse Z transform	2
4.4	Analysis of LTI systems using z transform	1
4.5	Stability and causality in z-domain	1
4.6	Solution of difference equations-frequency response and impulse response	1
4.7	Hands on	3
	DFT AND FFT ALGORITHMS	
5.1	Frequency Domain Sampling	1
5.2	Discrete Fourier Transform (DFT)	3

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Approved in Academic Council Meeting held on 23/12/2023

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

5.3	Properties of DFT	2
5.4	Efficient computation of the DFT:FFT algorithms	1
5.5	Radix 2 FFT algorithms: Decimation in Time and Decimation in Frequency	2
5.6	Hands on	3
	Total Hours: 30+15(Hands on)	45

Course Designers

1. Dr.P.Babu
2. Ms.C.Saraswathy

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Tiruchengode - 637 215.

60 EC 402	LINEAR INTEGRATED CIRCUITS

Category	L	T	P	Credit
PC	3	0	0	3

Objectives

- To study the circuit configuration of linear integrated circuits.
- To introduce practical applications of linear integrated circuits.
- To introduce the concept of analog multiplier and Phase Locked Loop with applications.
- To study the application of ADC and DAC in real time systems.
- To introduce special function ICs and its construction.

Pre-requisite

Electronic Circuits

Course Outcomes

On the successful completion of the course,students will be able to

CO1	Explain the circuit configuration of linear integrated circuits.	Remember, Understand
CO2	Design linear and non-linear circuits using op-amps	Remember, Understand Apply, Analyze.
CO3	Explain the operation and applications of analog multiplier and PLL	Remember, Understand
CO4	Design ADC and DAC circuits using op – amps	Remember, Understand Apply, Analyze.
CO5	Explain the working principle of special function ICs	Remember, Understand, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO2
CO1	3	3	3	3				3	3	3			3	3	
CO2	2	2	3	3	3							3	3	3	
CO3	2	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 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	20	20	45	45
Apply (Ap)	15	20	25	25
Analyze (An)	15	10	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EC 402 - 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	40	60	100

CIRCUIT CONFIGURATION FOR LINEAR ICS* Current sources, Analysis of difference amplifiers with active loads, supply and temperature independent biasing, Band gap references, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate. interpretation of TL082	[9]
LINEAR AND NON-LINEAR APPLICATIONS OF OPAMP* Linear and Nonlinear Circuits using operational amplifiers and their analysis, Differentiator, Integrator, Instrumentation amplifier, Sine wave Oscillators, Low pass, High pass and band pass filters, Multivibrator and Schmitt trigger, Triangle wave generator, Log and Antilog amplifiers.	[9]
ANALOG MULTIPLIER AND PLL* Analysis of four quadrants and variable Transconductance multipliers, Analog multiplier MPY634 features, Voltage controlled oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators.	[9]
ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS * Sample and Hold circuit -Digital to Analog converters - Binary weighted and R-2R Ladder types - Analog to digital converters – Flash - Counter ramp, successive approximation, single, dual slope - DAC/ADC performance characteristics and comparison.	[9]
SPECIAL FUNCTION ICS **555 Timers, Voltage regulators - linear and switched mode types, switched capacitor filter, SMPS, Frequency to Voltage converters, Power amplifiers and Isolation Amplifiers, sources for noises, Op Amp noise analysis and Low noise OP-Amps**.**	[9]
Hands on: 1. Design and Simulation of Differential amplifier 2. Design and Simulation of Differentiator 3. AD/DA converters	
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", Mc Graw Hill Education, 2014
2.	Sergio Franco., 'Design with Operational Amplifiers and Analog Integrated Circuits', 4th Edition, Tata McGraw-Hill, 2014.
3.	S.Salivahanan& V.S. KanchanaBhaskaran, 'Linear Integrated Circuits', 3rd Edition, TMH, 2018
4.	Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', 5th Edition, Wiley International, 2010

***SDG:4- Quality Education**

****SDG:9 – Industry, Innovation and Infrastructure**

Assignment activity:

Assignment 1- Covers module 1 & 2: Questions Related to Hands-on and Case Study & presentation on different types of op amps

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Approved in Academic Council Meeting held on 23/12/2023

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

- Design RC Phase shift oscillator, Clipper & clamper using Opamp 741.
- Discuss and analyse the following parameters of ALM2403-Q1 IC & Compare with LM741, Features, ii) Applications.

Assignment 2-Covers module 3 &4: Questions related to Hands-on and Case study & presentation on different types of ADC/DAC:

- Design monostable multivibrator using 555 timer and 8-bit SAR Analog to digital converter.
- Discuss and analyse the following parameters of ADC0804 8-Bit Analog to Digital A/D Converter IC DIP-20 Package IC i) Features, ii) Specifications

Course Contents and Lecture Schedule

S.No.	Topic	Number ofHours
	CIRCUIT CONFIGURATION FOR LINEAR ICS:	
1.1	Current sources	2
1.2	Analysis of difference amplifiers with active loads	2
1.3	Supply and temperature independent biasing	1
1.4	Monolithic IC operational amplifiers, specifications	1
1.5	Frequency compensation	1
1.6	Slew rate and methods of improving slew rate.	1
1.7	Interpretation of TL082 datasheet	1
	APPLICATION OF OPERATIONAL AMPLIFIERS	
2.2	Differentiator, Integrator	1
2.3	Instrumentation amplifier	1
2.4	Sine wave Oscillators	2
2.5	Low pass, High pass and band pass filters	1
2.6	Schmitt trigger	1
2.7	Multivibrator, Triangle wave generator	1
2.8	Log and Antilog amplifiers.	1
	ANALOG MULTIPLIER AND PLL	
3.1	Analysis of four quadrants and variable Transconductance multipliers	2
3.2	Analog multiplier MPY634 features	1
3.3	Voltage controlled oscillator	1
3.4	Closed loop analysis of PLL	2
3.5	AM, PM modulators and demodulators	2
3.6	FSK modulators and demodulators	1
	ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS	
4.1	Digital to Analog converters - Binary weighted	1
4.2	Digital to Analog converters - R-2R Ladder types	1
4.3	Sample and Hold circuit	2

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Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

4.4	Continuous - Counter ramp type ADC	1
4.5	successive approximation	1
4.6	single, dual slope	2
4.7	DAC/ADC performance characteristics and comparison.	1
	SPECIAL FUNCTION ICS	
5.1	555 Timers	2
5.2	Voltage regulators - linear and switched mode types	1
5.3	Voltage regulators -switched capacitor filter	1
5.4	SMPS	1
5.5	Frequency to Voltage converters	1
5.6	Power amplifiers and Isolation Amplifiers	1
5.7	Op Amp noise analysis	1
5.8	Low noise OP-Amps	1
	Total	45

Course Designers

1. Mr.D.Poornakumar - poornakumard@ksrct.ac.in

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60 EC 403	ELECTROMAGNETIC WAVES

Category	L	T	P	Credit
PC	3	1	0	4

Objectives

- To introduce the concept of vector analysis
- To develop an understanding of electromagnetic laws and its application in boundaries
- To study maxwell's equation, plane wave propagation in free space
- To introduce the concept of signal propagation through transmission lines and high frequency lines
- To illustrate the propagation of TE, TM and TEM rectangular, circular waveguides and cavity resonators

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Describe the vector quantities and apply vector integration and differentiation in different coordinate systems	Remember, Understand Apply,
CO2	Apply the laws of electromagnetic to evaluate the boundary conditions for electric and magnetic fields and describe the propagation of plane electromagnetic waves	Remember, Apply, Analyze.
CO3	Apply Faraday's law to find the electromotive force and Calculate displacement current using Maxwell's equation for time varying magnetic field	Remember, Understand, Apply.
CO4	Evaluate the characteristics and wave propagation in high frequency transmission lines	Remember, Apply, Analyze.
CO5	Describe rectangular and circular waveguides and understand the propagation of electromagnetic waves	Remember, Understand, Apply, Analyze

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2									3	2	
CO2	3	3	3	3									3	3	
CO3	3	3	3	3									3	3	
CO4	3	3	3	3		3	3						3	3	
CO5	3	3	3	3									3	2	

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

	Continuous		

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Approved in Academic Council Meeting held on 23/12/2023

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

Bloom's Category	Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	30	20	60	60
Analyze (An)	10	20	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC 403 - ELECTROMAGNETIC WAVES

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	40	60	100

VECTOR ANALYSIS * Vectors analysis: Vector algebra, vector calculus - divergence, gradient, curl, Laplacian; Coordinate systems - Cartesian, cylindrical and spherical **Hands on:** 1. Generate Electromagnetic Wave 2. Find the electrostatic potential in an air-filled annular quadrilateral frame	[9]
ELECTROMAGNETICS * Coulomb's law, Gauss's law, electric scalar potential, Laplace and Poisson's equations, conduction and polarization, boundary conditions, Biot-Savart law, Ampere's law **Hands on:** Solve a 2-D magnetostatic model for a ferromagnetic frame with an H-shaped cavity	[9]
ELECTRODYNAMICS* Maxwell's equations, Faraday's induction, displacement current, Plane wave propagation in free space and in materials; Poynting vector, reflection and transmission of plane waves at media boundary	[9]
TRANSMISSION LINES* Transmission-line general solution - loading. Impedance transformation and matching. Smith Chart, Quarter-wave and half-wave transformers. Single stub matching	[9]
WAVEGUIDES* Classification of guided wave solutions-TE, TM and TEM waves. Rectangular and circular waveguides. Excitation of waveguides. Rectangular and circular cavity resonators	[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.

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Tiruchengode - 637 215.

4.	Umesh Sinha, 'Transmission Lines and Networks', Satya Prakashan Publishing Company, New Delhi, 2010.

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Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
	VECTOR ANALYSIS	
1.1	Electromagnetic waves – Introduction	1
1.2	Vectors, Position & distance vector, component of vectors	1
1.3	Cartesian and cylindrical coordinate systems	1
1.4	Spherical coordinates-constant coordinate surface	1
1.5	Vector calculus-differential length, Area, Volume	1
1.6	Line, surface & volume integrals – Del operator	1
1.7	Gradient of scalar-Divergence of a vector	1
1.8	Divergence theorem-curl of a vector	1
1.9	Stokes theorem- Laplacian of scalar and vector field	1
	ELECTROMAGNETICS	
2.1	Coulomb's law	1
2.2	Gauss's law	1
2.3	Electric scalar potential	1
2.4	Laplace and Poisson's equations	1
2.5	Conduction and polarization	2
2.6	Boundary conditions	1
2.7	Biot-Savart law	1
2.8	Ampere's law	1
	ELECTRODYNAMICS	
3.1	Maxwell's equations	2
3.2	Faraday's induction	1
3.3	Displacement current	1
3.4	Plane wave propagation in free space and in materials	2
3.5	Poynting vector	1
3.6	Reflection of plane waves at media boundary	1
3.7	Transmission of plane waves at media boundary	1
	TRANSMISSION LINES	
4.1	Transmission line – V & I equation of transmission line	2
4.2	Propagation constant & characteristic impedance	1
4.3	Reflection coefficient & VSWR	1
4.4	Impedance transformation and matching	1

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Tiruchengode - 637 215.

4.5	Smith Chart	1
4.6	Admittance Smith Chart, Applications of Smith Chart	1
4.7	Quarter-wave and half-wave transformers	1
4.8	Single stub matching	1
WAVEGUIDES		
5.1	Classification of waveguides	1
5.2	TM waves in rectangular waveguides	1
5.3	TE waves in rectangular waveguides	1
5.4	Characteristics of TE, TM waves	1
5.5	Cut-off wavelength, phase velocity and impossibility of TEM waves	1
5.6	TM and TE waves in circular waveguides	1
5.7	Excitation of waveguides	1
5.8	Rectangular cavity resonators	1
5.9	Circular cavity resonators	1
	Total (45+15(Tutorial))	60

Course Designers

1. Mr Saravanan S - saravanan.s@ksrct.ac.in

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60 EC 404	ANALOG COMMUNICATION

Category	L	T	P	Credit
PC	2	0	2	3

Objective

- To understand the mathematical basis of Random Process in communication
- To impart the fundamentals of basic communication system and describe the amplitude modulation techniques
- To introduce the different angle modulation techniques
- To describe different types of noise and predict its effect on analog communication systems.
- To study the function of various radio transmitters and receivers

Prerequisite

Signal and Systems

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the mathematical basis of random process in communication	Remember, Understand, Apply
CO2	Explain the basics of communication and generation of different amplitude modulation waveforms	Remember, Understand, Apply
CO3	Describe the generation of different angle modulation waveforms	Remember, Understand, Apply
CO4	Analyze noise in continuous wave modulation systems	Remember, Understand, Apply
CO5	Describe the function of various radio transmitters and receivers	Remember, Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	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	2	3			3	3		3	3	3	3
CO4	3	3	3	3	3				3	3		3	3		3
CO5	3	3	3	3	3	3			3	3		3	3	3	3

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	20
Understand (Un)	40	40	60
Apply (Ap)	10	10	20
Analyze (An)	0	0	0

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Tiruchengode - 637 215.

Evaluate (Ev)	0	0	0
Create (Cr)	0	0	0

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC 404 - ANALOG COMMUNICATION								
B.E. Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	2	0	2	60	3	50	50	100

RANDOM PROCESS Mathematical Definition of Random Process – Stationary process – Mean, Correlation and Covariance function, Ergodic Process, Transmission of Random processes through a LTI filter, **Power Spectral Density***, Gaussian process. **Practical: Probability Density Function Estimation of a given Data**	[12]
AMPLITUDE MODULATION TECHNIQUES* Introduction to communication system, Elements of a Communication System, Need for modulation- Theory of Amplitude Modulation Techniques, Generation of AM Signal, DSBSC Signal, SSB Signal, VSB Signal **Practical: Simulation of AM &SSB Modulation****	[12]
ANGLE MODULATION TECHNIQUES* Theory of Angle Modulation Techniques- Frequency Modulation, Phase Modulation, Practical Issues in Frequency Modulation, Generation of FM: FM Methods, Direct Methods, Indirect Method. **Practical: Generation and Detection of FM wave****	[12]
NOISE * External Noise, Internal Noise, Noise Calculations, Noise Figure, Noise Temperature, Noisy receiver model, **Noise in AM and FM Receivers*** **Practical: Noise Spectrum Analysis using Simulation Tool****	[12]
RADIO TRANSMITTER AND RECEIVERS* Introduction to radio communication, **Radio Transmitters** - AM Transmitters****, SSB Transmitters, FM Transmitters, Receiver types: TRF Receiver, **Superheterodyne Receiver****, **AM Receivers**, FM Receivers**** **Practical: Simulation of Low Noise Amplifier ****	[12]
Total hours:30 +30(Practical)	**60**

Text book(s):	
1.	Electronic Communication Systems, George Kennedy, Bernard Davis, S R M Prasanna, 5th Edition, McGraw-Hill, 2012.
2.	Communication Systems, Simon Haykin, 5th Edition, John Wiley & sons, 2010.
Reference(s):	
1.	Communication Systems, B.P.Lathi, BS publications, 2013.
2.	Modern Receiver Front- Ends Systems, Circuits, and Integration, Joy Laskar, Babak Matinpour, Sudipto Chakraborty, Wiley- Interscience, 2007
3.	Communication System, Bruce Carlson et al, 5th Edition, McGraw-Hill, 2013.

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Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

***SDG 4: Quality education**
****SDG 9: Industry, Innovation and Infrastructure**

Assignment 1 – Flipped Class activity, Group Problem Solving, Problem Analysis and Report Submission
Assignment 2 - Flipped Class activity, Group Problem Solving, Seminar

Course Contents and Lecture Schedule

S.No	topic	No.of Hours
1	**AMPLITUDE MODULATION**	
1.1	Introduction to communication system, Need for modulation, Amplitude Modulation, Definition	1
1.2	Spectrum of AM wave, Power relations in AM waves	1
1.3	Switching modulator,	1
1.4	Envelope detector, Limitations of amplitude modulation	1
1.5	DSBSC modulation - Ring Modulator	1
1.6	Coherent detection	1
1.7	**Practical: Generation and detection of AM wave**	6
2	**SSB & VSB MODULATION**	
2.1	Single side band modulation- Spectrum of SSB wave	1
2.2	Discrimination method	1
2.3	Demodulation of SSB Waves	1
2.4	Vestigial side band modulation – Filtering method	1
2.5	**C**oherent detector, VSB transmission in TV broadcasting,	1
2.6	Frequency translation, Comparison of AM Techniques	1
2.7	**Practical: Simulation of SSB modulation**	3
3	**ANGLE MODULATION**	
3.1	Basic definitions	1
3.2	Properties of angle modulated wave	1
3.3	Frequency Modulation- Narrow band FM	1
3.4	Wide band FM	1
3.5	Generation of FM signal,	1
3.6	Detection of FM signal, FM stereo multiplexing, Nonlinear effects in FM systems	1
3.7	**Practical: Generation and detection of FM wave**	6
4	**NOISE**	
4.1	Noisy receiver model	1
4.2	Noise in DSB-SC receiver	1
4.3	Noise in AM receivers	1
4.4	Noise in FM receivers	1
4.5	Capture effect and Threshold effect	1
4.6	Pre-emphasis and De-emphasis in FM	1
4.7	**Practical: Noise spectrum analysis using simulation tool****	6
5	**RADIO RECEIVERS**	
5.1	Heterodyne Receivers	1
5.2	Image Reject Receivers	1
5.3	Hartley Architecture	1

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Approved in Academic Council Meeting held on 23/12/2023

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

5.4	Low IF Receivers	1
5.5	Issues in Direct Conversion Receivers – Noise, LO Leakage and Radiation, Phase and Amplitude Imbalance, DC Offset, Intermodulations	2
5.6	**Practical: Simulation of Low Noise Amplifier ****	6

Course Designers

1.Mrs.S.S.Thamilselvi - sstamilselvi@ksrct.ac.in

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Tiruchengode - 637 215.

60 EC 4P1	LINEAR INTEGRATED CIRCUITS AND ELECTROMAGNETICS LABORATORY

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- 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 field configurations in different geometries and waveguides

Prerequisite

Electronic Circuits

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Design and test the various applications of op-amp	Create
CO2	Design and test the various applications of NE555 timer	Create
CO3	Design and test the various applications of PLL	Create
CO4	Design and test the different data convertors	Create
CO5	Simulate the field configurations in different geometries and waveguides	Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	

3 - Strong; 2 - Medium; 1 – Some

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EC 4P1- Linear Integrated Circuits and Electromagnetics 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

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Approved in Academic Council Meeting held on 23/12/2023

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

List of Experiments

1. Application circuits using op-amp*
2. Application circuits using NE555 Timer*
3. Application circuits using PLL*
4. Application circuits using 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*

***SDG:4- Quality Education**

Course Designers

1. Mr D.Poornakumar - poornakumard@ksrct.ac.in
2. Mr.S.Saravanan - saravanan.s@ksrct.ac.in

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Tiruchengode - 637 215.

60 EC 4P2	ELECTRONIC DESIGN PROJECT LABORATORY

Category	L	T	P	Credit
CG	0	0	4	2

Objective

- 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 design various modules needed for a signal transmitter
- To stimulate student interests and help solve circuit problems using basic concepts

Prerequisite

Analog and Digital Electronics Laboratory

Course Outcomes

On the successful completion of the course, 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	Apply & Analyse
CO2	Design and develop digital circuits for the given specifications	Apply& Analyse
CO3	Exhibit creativity in the design of systems, circuits or processes and implement them	Apply& Analyse
CO4	Design unregulated power supplies	Apply & Analyse
CO5	Switch to design mode of thinking for signal transmitter design with increased competence and success in circuit Implementation	Apply &Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	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
CO5	3	3	3	3	3	3		3	3	3	3	3	3	3	3

K.S. Rangasamy College of Technology – Autonomous R 2022							
60 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

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

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 design*
3. Electronic circuit prototyping, circuit debugging, and testing*
4. Design of power supply**
5. Design of Signal transmitter**

***SDG 4 – Quality Education**

****SDG 9 – Industry, innovation and Infrastructure**

Course Designers

1. Dr.C.Rajasekaran - rajasekaran@ksrct.ac.in

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60 CG 0P3	CAREER SKILL DEVELOPMENT - III

Category	L	T	P	Credit
CG	0	0	2	1

Objective

- To help learners improve their logical reasoning skills at different academic and professional contexts.
- To help learners relate basic quantitative problems and solve them.
- To help learners Infer critically the statements with optimal conclusions and assumptions.
- To Solve the quantitative problems pertaining to calculations of averages, ratio and proportions, and profit and loss effectively
- To compute quantitative problems related to time and work, speed and distance, and simple and compound interest

Prerequisite

Basic knowledge of Arithmetic and Logical Reasoning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Deduce the topics in logical reasoning at the preliminary and intermediate level.	Analyze
CO2	Relate basic quantitative problems and solve them effectively at the preliminary level	Apply
CO3	Infer critically the statements with optimal conclusions and assumptions with the data and information given.	Analyze
CO4	Solve the quantitative problems pertaining to calculations of averages, ratio and proportions, and profit and loss effectively at the pre-intermediate level.	Apply
CO5	Compute quantitative problems related to time and work, speed and distance, and simple and compound interest at intermediate level.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3		3				2	3	3	2	3	3
CO2	3	3	3	3		2				2	3	3	2	3	3
CO3	2	2	2	2		3				2	3	3	2	3	3
CO4	3	3	3	3		2				2	3	3	2	3	3
CO5	3	3	3	3		2				2	3	3	2	3	3
3- Strong;2-Medium;1-Some															

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Approved in Academic Council Meeting held on 23/12/2023

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60 CG 0P3 - Career Skill Development III								
Common to All Branches								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	0	0	2	30	1	100	00	100

Logical Reasoning* Analogies - Alpha and numeric series - Number Series - Coding and Decoding - Blood Relations - Coded Relations - Order and Ranking – odd man out - Direction and distance	**[6]**
Quantitative Aptitude – Part 1* Number system - Squares & cubes - Divisibility - Unit digits - Remainder Theorem - HCF & LCM - Geometric and Arithmetic progression - Surds & indices	**[6]**
Critical Reasoning* Syllogism - Statements and Conclusions, Cause and Effect, Statements and Assumptions - identifying Strong Arguments and Weak Arguments – Cause and Action -Data sufficiency	**[6]**
Quantitative Aptitude – Part 2* Average - Ratio and proportion – Ages – Partnership– Percentage - Profit & loss – Discount - Mixture and Allegation	**[6]**
Quantitative Aptitude – Part 3* Time & Work - Pipes and cistern – Time, Speed & distance - Trains - Boats and Streams - Simple interest and Compound interest	**[6]**
Total Hours	**30**

Reference(s):

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'*, McGraw Hill Education, 6th edition, 2016
3.	Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education 2020
4.	Anne Thomson, *'Critical Reasoning: A Practical Introduction'* Lexicon Books, 3rd edition, 2022. Warszaw

***SDG 4 – Quality Education**
***SDG 8 – Decent work and Economic growth**
***SDG 9 – Industry, innovation and Infrastructure**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Logical Reasoning**	
1.1	Analogies - Alpha and numeric series	1
1.2	Number Series - Coding and Decoding	1

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Approved in Academic Council Meeting held on 23/12/2023

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

1.3	Blood Relations - Coded Relations	1
1.4	Order and Ranking – odd man out	1
1.5	Direction and distance	1
2	**Quantitative Aptitude – Part 1**	
2.1	Number system	1
2.2	Squares & cubes - Divisibility	1
2.3	Unit digits - Remainder Theorem	1
2.4	HCF & LCM- Geometric and Arithmetic progression	1
2.5	Surds & indices	1
3	**Critical Reasoning**	
3.1	Syllogism	1
3.2	Statements and Conclusions, Cause and Effect	1
3.3	Statements and Assumptions	1
3.4	identifying Strong Arguments and Weak Arguments	1
3.5	Cause and Action -Data sufficiency	1
4	**Quantitative Aptitude – Part 2**	
4.1	Average - Ratio and proportion	1
4.2	Ages – Partnership	1
4.3	Percentage	1
4.4	Profit & loss	1
4.5	Discount - Mixture and Allegation	1
5	**Quantitative Aptitude – Part 3**	
5.1	Time & Work	1
5.2	Pipes and cistern	1
5.3	Time, Speed & distance - Trains	1
5.4	Boats and Streams	1
5.5	Simple interest and Compound interest	1
	Total	**25**

Course Designer

1. R. Poovarasan - poovarasan@ksrct.ac.in

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Approved in Academic Council Meeting held on 23/12/2023

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

60 EC 501	CONTROL SYSTEMS ENGINEERING

Category	L	T	P	Credit
PC	3	1	0	4

Objective

- To understand the concepts of mathematical models, transfer function, block diagram reduction techniques and signal flow graphs
- To learn methods for improving system time response and frequency response and types of controllers.
- To learn the concepts of stability in time domain and frequency domain.
- To analyse the frequency domain response of the given systems
- To analyse digital control system using the state space technique.

Prerequisite

Integrals, Partial Differential Equations and Laplace Transform and Signals and Systems.

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Derive the mathematical modeling of the physical systems and find out the transfer function using various methods.	Remember, Understand, Apply
CO2	Apply standard test signals to a second order control system to determine their characteristics in time and frequency domain.	Remember, Understand, Apply
CO3	Analyse the control system behavior using stability analysis technique.	Remember, Understand, Apply
CO4	Analyse the open loop control system using frequency response methods and various types of compensator to determine stability margins.	Remember, Understand, Apply
CO5	Analyse the state variable model of a discrete time control systems.	Remember, Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3		3	3			3	3	3	
CO2	3	3	3	3	2	3		3	3			3	3	3	
CO3	3	3	3	3	2	3		3	3			3	3	3	
CO4	3	3	3	3	2	3		3	3			3	3	3	
CO5	3	3	3	3	2	3		3	3			3	3	3	
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	04	06	10	10
Understand (Un)	08	06	10	10
Apply (Ap)	48	48	70	70

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Analyze (An)	0	10	10	10
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022

60 EC 501 – CONTROL SYSTEMS ENGINEERING

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100

Systems modeling* Open loop and Closed loop systems-Modeling of Electrical and Mechanical systems - Translational and Rotational systems – Block diagram reduction –Signal flow graph - Mason's gain formula -**Applications of control systems-Drone control system design**.** **Hands on:** Write a program to find the overall transfer function if the two system are connected to cascade system Parallel system and feedback system.	[9]
Time and Frequency domain analysis* Standard test signals – Time response of second order systems - Performance specifications on system time response - Types of systems - Steady state error -Introduction to PID Controllers –Performance specifications on system Frequency response. **Hands on:** Plot the time response and frequency response of the given system subjected to standard input	[9]
Stability analysis* Concepts of Stability - Routh Stability Criterion -Concepts of Root locus technique-Guidelines for sketching root locus. **Hands on**: Sketch the root locus of the unity feedback systems governed by the open loop transfer function.	[9]
Frequency Response and system analysis* Polar plot - Nyquist stability Criterion - Bode plot -Compensator design using Bode Plot-Cascade lead compensation-Cascade lag compensation. **Hands on:** Write a program to draw the polar plot and Bode plot for various open loop transfer function and calculate gain margin and phase margin.	[9]
State Space Analysis of Digital Control Systems* State space representation of discrete time systems-Solution of discrete time state space equation –State transition matrix-Decomposition techniques- Controllability and Observability, **Hands on:** Write a program to determine the controllability and observability of the system governed by state model.	[9]
Total Hours: 45+15(Tutorial)	60

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', 5h Edition, Pearson Education India,2015
3. K.Ogata, 'Discrete Time Control Systems, 2nd Edition, Pearson Education India,2012
4. Benjamin.C. Kuo, Farid Golnaraghi, 'Automatic Control Systems', 10th Edition, McGraw-Hill Education, 2017.

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

***SDG:4- Quality Education**
****SDG:9 - Industry Innovation and Infrastructure**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Systems modeling**	
1.1	Open loop and Closed loop systems & Modeling of Electrical systems	1
1.2	Modeling of Mechanical systems	1
1.3	Translational and Rotational systems	1
1.4	Block diagram reduction	2
1.5	Signal flow graph & Mason's gain formula	1
1.6	Applications of control systems-Drone control system design	1
	Tutorial	2
2	**Time and Frequency domain analysis**	
2.1	Standard test signals & Time response of second order systems	1
2.2	Performance specifications on system time response	1
2.3	Types of systems & Steady state error	1
2.4	Introduction to PID Controllers	2
2.5	Performance specifications on system Frequency response	2
	Tutorial	2
3	**Stability analysis**	
3.1	Concepts of Stability	1
3.2	Routh Stability Criterion	2
3.3	Concepts of Root locus technique	2
3.4	Guidelines for sketching root locus.	2
	Tutorial	2
4	**Frequency Response and system analysis**	
4.1	Polar plot	1
4.2	Nyquist stability Criterion	1
4.3	Bode plot	2
4.4	Compensator design using Bode Plot-Cascade lead compensation	1
4.5	Cascade lag compensation	2
	Tutorial	2
5	**State Space Analysis of Digital Control Systems**	
5.1	State space representation of discrete time systems	1
5.2	Solution of discrete time state space equation	1
5.3	State transition matrix	2
5.5	Decomposition techniques	2

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

5.6	Controllability and Observability	1
	Tutorial	2
	Total	45

Course Designers

1. **Dr.P.Babu - pbabu@ksrct.ac.in**
2. **Ms.C.Saraswathy - saraswathy@ksrct.ac.in**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 EC 502	VLSI AND CHIP DESIGN

Category	L	T	P	Credit
PC	3	0	0	3

Objectives

- To study the fundamentals of IC technology components and their characteristics.
- To understand the combinational logic circuits and design principles.
- To understand sequential logic circuits and clocking strategies.
- To know the arithmetic building blocks and memory architecture.
- To learn the concept of testability and ASIC Design of VLSI circuits.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Gain the knowledge of MOS technology	Remember, Understand, Apply
CO2	Understand combinational logic circuits and design principles	Remember, Understand, Apply
CO3	Understand sequential logic circuits and clocking strategies	Remember, Understand, Apply
CO4	Understand arithmetic building blocks and memory architecture	Remember, Understand, Apply
CO5	Understand the ASIC design process and testing	Remember, Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	3
CO5	3	3	3	3	3		3	3	3	3		3	3	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	30	30	60	60
Apply (Ap)	20	20	30	30
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022								
60 EC 502 - VLSI AND CHIP 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	40	60	100

MOS TRANSISTOR PRINCIPLES* Long channel I-V characteristics, VTC parameters (DC characteristics), Second order effects, CMOS Logic, CMOS fabrication: n-well processes, Layout design rules**, Technology scaling****, **Advanced** technologies****: Overview of FinFET, GAA and RibbonFET.	[9]
COMBINATIONAL LOGIC CIRCUITS* Propagation delays, Elmore's constant, Power dissipation, Low power design principles, Static CMOS design, Dynamic CMOS design.	[9]
SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES* Static latches and registers, Dynamic latches and registers, Pipelines, Non-bistable sequential circuits, Timing classification of digital systems, Synchronous design, Self-timed circuit design.	[9]
ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURE* Adders, Multipliers, Shift registers. Logic implementation using programmable devices (ROM, PLA, FPGA), Memory architecture and building blocks, **Memory core and memory peripherals circuitry****.	[9]
ASIC DESIGN AND DESIGN FOR TESTABILITY * ASIC Design Flow, ASIC types: Full custom, Semi-custom, FPGA, Issues in design for testability, Fault model types, Automatic test pattern generation, IC packaging technology: **Overview of chiplet/dis-aggregated technologies**.**	[9]
Total Hours	45

Text Book(s):	
1.	Jan M Rabaey, Anantha Chandrakasan, "Digital Integrated Circuits: A Design Perspective", PHI, 2016.
2.	Neil H E Weste, Kamran Eshranghian, "Principles of CMOS VLSI Design: A System Perspective", Addison Wesley, 2017.
Reference(s):	
1.	M.J. Smith, 'Application Specific Integrated Circuits', Addison Wesley, 2002.
2.	Samir Palnitkar, 'Verilog HDL – A Guide to Digital Design and Synthesis', 2nd Edition, Pearson Education, 2011.
3.	Charles H Roth Jr, Lizy Kurian John and Byeong Kil Lee, 'Digital Systems Design using Verilog', 1st Edition, Cengage Learning, 2016.
4.	Parag K.Lala, 'Digital Circuit Testing and Testability', Academic Press, 1997.

***SDG: 4 - Quality Education**
**** SDG: 8 - Sustainable economic growth, full and productive employment**
**** SDG: 9 - Sustainable industrialization and foster innovation**

Assignment Activity

Assignment 1 – Covers Module 1 & 2 Questions related to simulation / Hands on

- Design and verify digital logic circuits of full adder, Multiplexer, D-flip-flop, and Synchronous counter sequence detector with test bench code. Perform Synthesis, P&R, post P&R simulation and Hardware fusing & testing of each of the blocks simulated using FPGA.
- Design static CMOS circuits of NAND ,NOR,D-Latch, and obtain its DC and transient characteristics
- Design layout circuits of NAND, NOR, D-Latch. Analyse the power, area and delay by performing pre layout and post layout simulations.

Assignment 2- Mini Project using FPGA

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
	MOS TRANSISTOR PRINCIPLES	
1.1	Long channel I-V characteristics	1
1.2	VTC parameters (DC characteristics)	1
1.3	Second order effects	1
1.4	CMOS Logic	1
1.5	CMOS fabrication: n-well processes	1
1.6	Layout design rules	1
1.7	Technology scaling	1
1.8	Advanced technologies: Overview of FinFET, GAA	1
1.9	Overview of Ribbon FET	1
	COMBINATIONAL LOGIC CIRCUITS	
2.1	Propagation delays	1
2.2	Elmore's constant	1
2.3	Power dissipation	1
2.4	Low power design principles	1
2.5	Static CMOS design	3
2.6	Dynamic CMOS design	2
	SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES	
3.1	Static latches and registers	1
3.2	Dynamic latches and registers	1
3.3	Pipelines	1
3.4	Non-bistable sequential circuits	2
3.5	Timing classification of digital systems	2
3.6	Synchronous design	1
3.7	Self-timed circuit design	1
	ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURE	
4.1	Adders	1
4.2	Multipliers	1
4.3	Shift registers	1
4.4	Logic implementation using programmable devices (ROM, PLA, FPGA)	2
4.5	Memory architecture	1
4.6	Memory building blocks	1
4.7	Memory core	1
4.8	Memory peripherals circuitry	1
	ASIC DESIGN AND DESIGN FOR TESTABILITY	
5.1	ASIC Design Flow	1
5.2	ASIC types: Full custom, Semi-custom, FPGA	2
5.3	Issues in design for testability	1
5.4	Fault model types	2
5.5	Automatic test pattern generation	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

5.6	IC packaging technology: Overview of chiplet/dis-aggregated technologies.	2
	Total	45

Course Designer(s)

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Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 EC 503	DIGITAL SIGNAL PROCESSING

Category	L	T	P	Credit
PC	3	1	0	4

Objective

- To design and analyze DSP system FIR and IIR filters.
- To study the fundamentals of multi rate filters
- To study the basic of adaptive filters
- To understand finite word length effects
- To study of digital signal processors systems for given specifications and applications

Prerequisite

Signals and Systems

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Design IIR filters using Impulse Invariant and Bilinear Transformation Techniques	Remember, Understand, Apply
CO2	Design linear phase FIR filters using Windowing Techniques and sampling method	Remember, Understand, Apply
CO3	Explain the concept of sampling rate conversation and adaptive filters in DSP applications	Remember, Understand, Apply
CO4	Analyse the effects of Finite word length on digital filters	Remember, Understand, Apply, Analyse
CO5	Understand the architecture of TMS320C6x DSP processor	Remember, Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3							2	3	2	
CO2	3	3	2	2	3							2	3	2	
CO3	3	3	3	2	2							2	3	2	
CO4	3	3	3	3	2							2	3	2	
CO5	3	3	2	3	3							2	3	2	
3 - Strong;2 - Medium;1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	30	60	60
Analyze (An)	0	10	10	10
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 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	3	1	0	60	4	40	60	100

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* 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 – Concepts of adaptive filter – FIR adaptive filters - LMS algorithm	[9]
FINITE WORD LENGTH EFFECTS* Representation of numbers – Fixed point and Floating point representation – Errors resulting from rounding and truncation – Quantization process and error- Analysis of Coefficient Quantization effects - A/D conversion noise analysis - Quantization noise model – Signal to Quantization Noise Ratio – Round off effects in Digital filters – Limit cycle oscillations in Recursive systems – Scaling to prevent overflow.	[9]
DIGITAL SIGNAL PROCESSORS** Introduction to programmable DSPs – TMS320C6X DSPs, 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: 45 + 15(Tutorial)	**60**

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, 2013.
2. Alan V Oppenheim, Ronald W Schafer, John R Back, 'Discrete Time Signal Processing', 3rd Edition, Pearson, 2013.
3. Monson H.Hayes, 'Statistical Digital Signal Processing and Modeling', John Wiley & Sons, 2013.
4. Thad B. Welch, Cameron H.G. Wright, Michael G. Morrow, 'Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs', CRC Press, 2016.

***SDG:4- Quality Education**
****SDG:3 – Good Health and Well Being**

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**DESIGN OF IIR FILTERS**	
1.1	Design of IIR filters from Analog filters	2
1.2	Frequency Transformation	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

1.3	IIR filters (Butterworth): Properties	1
1.4	IIR filter Design	2
1.5	Impulse Invariant Technique	1
1.6	Bilinear Transformation	1
1.7	Realization of IIR filters.	1
1.8	Tutorial	2
2	**DESIGN OF FIR FILTERS**	
2.1	Design of FIR filters	1
2.2	Symmetric FIR filters	1
2.3	Anti symmetric FIR filters	1
2.4	Design of Linear Phase FIR filters: Windowing Techniques-Rectangular	1
2.5	Windowing Techniques- Hamming	1
2.6	Windowing Techniques - Hanning	1
2.7	Frequency Sampling	2
2.8	Realization of FIR filters.	1
2.9	Tutorial	2
3	**MULTIRATE SIGNAL PROCESSING**	
3.1	Multirate Operations	1
3.2	Decimation and Interpolation	1
3.3	Fractional sampling rate alteration	1
3.4	Interconnection of building blocks	1
3.5	The Noble identities	1
3.6	The poly phase representation	1
3.7	Efficient structure of Decimation and Interpolation filters	1
3.8	Concepts of adaptive filter	1
3.9	FIR adaptive filters & LMS algorithm.	2
3.10	Tutorial	2
4	**FINITE WORD LENGTH EFFECTS**	
4.1	Representation of numbers – Fixed point and Floating point representation	1
4.2	Errors resulting from rounding and truncation	1
4.3	Quantization process and error	2
4.4	Analysis of Coefficient Quantization effects	1
4.5	A/D conversion noise analysis	1
4.6	Quantization noise model	1
4.7	Signal to Quantization Noise Ratio & Round off effects in Digital filters	1
4.8	Limit cycle oscillations in Recursive systems & Scaling to prevent overflow	1
4.9	Tutorial	2
5	**DIGITAL SIGNAL PROCESSORS**	
5.1	Introduction to programmable DSPs	1
5.2	TMS320C6X DSPs & Architectures features	1
5.3	DSP building blocks	1
5.4	Memory space organization	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

5.5	External bus interfacing signals	1
5.6	Memory interface	1
5.7	Parallel I/O interface & Programmed I/O	1
5.8	Direct memory access (DMA & Interrupts and I/O	1
5.9	Tutorial	2
	Total	60

CourseDesigners

1. **Dr.P.Babu – babup@ksrct.ac.in**
2. **Mrs.K.Gogila Devi –gogiladevi@ksrct.ac.in**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 EC 504	MICROPROCESSORS AND MICROCONTROLLERS

Category	L	T	P	Credit
PC	3	0	0	3

Objectives

- To introduce the architecture and programming of 8085 microprocessor
- To introduce the architecture, programming and interfacing of 8051 micro controller
- To understand the special function registers of 8051 and to perform an assembly level programming.
- To introduce the AI boards
- To develop microcontroller-based Applications

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs	Remember, Understand, Apply,
CO2	Learn the architecture and features of 8051	Remember, Apply,
CO3	Understand the special function register functionality and develop the simple simulation projects.	Remember, Understand, Apply.
CO4	Understanding of Edge AI development KIT	Remember, Apply,
CO5	Develop microcontroller-based system and interfacing various input and output peripherals.	Remember, Understand, Apply, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3									3	2	
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	3		3	3	3	3
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	30	20	60	60
Analyze (An)	10	20	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022								
60 EC 504 - MICROPORCESSORS AND MICROCONTROLLERS								
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	40	60	100

8085 – 8 BIT MICROPROCESSOR* 8085 Architecture - Instruction set - Addressing modes -–Interrupt structure - Timing diagrams - Memory interfacing – Interfacing I/O devices - Assembly language programming.	[9]
8051 – 8 BIT MICROCONTROLLER* 8051 – Architecture, Clock and RESET circuits, PSW, Stack and Stack Pointer, Program Counter, I/O Pins Ports and Circuits, Instruction set, Addressing modes.	[9]
8051 SPECIAL PURPOSE REGISTERS AND PROGRAMMING* Special Function register- Interfacing of memory devices - Timer programming, Serial data transfer - UART. I/O ports and port expansion, programing on Interrupts. **Assembly language programs, C language programs using SFR**.**	[9]
PERIPHERAL INTERFACING** Standard interfaces - RS232, USB, SPI and I2C, Interfacing of sensors, DAC, ADC, PWM, DC motor, Stepper motor and LCD interfacing.	[9]
AI BASED BOARD* Basic principles of OS – OS Architecture - Overview of an Edge AI Hardware, Basic Setup and OS installation, Python and C Programming, Linux library installation, **Executing AI models in Edge AI Hardware**.	[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 Gillispie Mazidi, 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.	K. J. Ayala, '8051 Microcontroller', Delmar Cengage Learning, 3rd Edition ,2007.
3.	NPTEL video lectures by M. Krishna Kumar, IISc.

***SDG:4 - Quality Education**

****SDG:9 - Industry Innovation and Infrastructure**

Assignment Activity:

Assignment 1 – Covers Module 1 & 2 Questions related to the problems and simulation / Hands on

1. Arithmetic operation for 8085 processor.
2. Embedded C program for configuring the Ports and Peripheral interface with 8051.

Assignment 2 - Mini Project

Contents and Lecture Schedule

S.No.	Topic	Number of Hours
8085 – 8 BIT MICROPROCESSOR		
1.1	8085 Architecture	1
1.2	Instruction set	1
1.3	Addressing modes	1
1.4	Interrupt structure	1

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1.5	Timing diagrams	1
1.6	Memory interfacing	1
1.7	Interfacing I/O devices	1
1.8	Assembly language programming	2
8051 – 8 BIT MICROCONTROLLER		
2.1	8051 – Architecture	2
2.2	Clock and RESET circuits	1
2.3	PSW, Stack and Stack Pointer, Program Counter	1
2.4	I/O Pins Ports and Circuits	1
2.5	Instruction set	2
2.6	Addressing modes	1
8051 SPECIAL PURPOSE REGISTERS AND PROGRAMMING		
3.1	Special Function register	2
3.2	Interfacing of memory devices	1
3.3	Timer programming	2
3.4	Serial data transfer - UART	1
3.5	I/O ports and port expansion	1
3.6	programing on Interrupts	1
3.7	Assembly language programs, C language programs using SFR.	2
PERIPHERAL INTERFACING		
4.1	Standard interfaces - RS232, USB,	1
4.2	I2C	1
4.3	Interfacing of sensors	2
4.4	DAC, ADC	1
4.5	PWM	1
4.6	DC motor, Stepper motor and	2
4.7	LCD interfacing	1
AI BASED BOARD		
5.1	Basic principles of OS – OS Architecture	1
5.2	Edge AI Hardware,	2
5.3	Setup and OS installation	1
5.4	Python and C Programming	2
5.5	Linux library installation	1
5.6	Executing AI models in Edge AI Hardware.	2
	Total	45

Course Designers

1. **Mr S.Jayamani - jayamani@ksrct.ac.in**

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60 MY 003	STARTUPS AND ENTREPRENEURSHIP

Category	L	T	P	Credit
MC	2	0	0	0

Objective

- 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

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Listen and comprehend Meaning and concept of Entrepreneurship	Understand
CO2	Identify the business opportunities and able prepare business plan	Analyze
CO3	Comprehend the process of innovation, incubation, prototyping and marketing	Understand
CO4	Executing a new venture through various financial resources	Apply
CO5	Grasp the managing growth and rewards in new venture	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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		
3- Strong; 2-Medium; 1-Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Case Study Report
	1 (25 Marks)	2 (25 Marks)	
Remember (Re)	10	10	50 Marks
Apply (Ap)	20	20	
Analyse (An)	30	30	
Create (Cr)	0	0	

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K.S. Rangasamy College of Technology – Autonomous R2022								
60 MY 003 – Startups and Entrepreneurship								
Common to all Branches								
Semester	Hours / Week			Total Hrs.	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	0	30	-	100	--	100

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. [06]	[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, Experimentationin 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 idealdebt-equity mix, and financial institutions and banks. Launching the New Venture: Choosing the legal form of new venture, protection of intellectual property, and formationof 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]
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 Mc Grawhill Company, New Delhi, 2013.
2	Charles Bamford and Garry Bruton, “Entrepreneurship: The Art, Science, and Process for Success”, 2nd Edition, Tata Mc Grawhill 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.

***SDG:8 – Decent Work and Economic Growth**
***SDG:12 – Responsible Consumption and Production**
****SDG:9 – Industry, Innovation and Infrastructure**

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Course Contents and Lecture Schedule

S.No	Topic	No. of Periods
1	**Introduction to Entrepreneurship & Entrepreneur**	
1.1	Meaning and concept of Entrepreneurship, the history of Entrepreneurship development,	1
1.2	Myths of Entrepreneurship, role of Entrepreneurship in Economic Development,	1
1.3	Agencies in Entrepreneurship Management and Future of Entrepreneurship.	1
1.4	The Entrepreneur*:* Meaning, the skills required to be an entrepreneur,	1
1.5	The entrepreneurial decision process	1
1.6	Role models	1
1.7	Mentors and Support system.	1
2	**Business Opportunity Identification and Preparing a Business Plan**	
2.1	Business ideas, methods of generating ideas	1
2.2	Opportunity recognition	1
2.3	Idea Generation Process	1
2.4	Feasibility study	1
2.5	Preparing a Business Plan	1
2.6	Meaning and significance of a business plan	1
2.7	Components of a business plan	1
3	**Innovations**	
3.1	Innovation and Creativity - Introduction, Innovation in Current. Environment	1
3.2	Types of Innovation, School of Innovation,Analyzing the Current Business Scenario	1
3.3	Challenges of Innovation, Steps of Innovation Management	1
3.4	Experimentationin Innovation Management, Participation for Innovation,	1
3.5	Co-creation for Innovation, Proto typing to Incubation.	1
3.6	Blue Ocean Strategy-I, Blue Ocean Strategy-II.	1
3.7	Marketing of Innovation, Technology Innovation Process	1
4	**Financing and Launching the New Venture**	
4.1	Importance of new venture financing, types of ownership,	1
4.2	Venture capital, types of debt securities	1
4.3	Determining idealdebt-equity mix, and financial institutions and banks.	1
4.4	Launching the New Venture	1
4.5	Choosing the legal form of new venture,	1
4.6	Protection of intellectual property	1
4.7	Formationof the new venture	1
5	**Managing Growth and Rewards in New Venture**	
5.1	Characteristics of high growth new ventures	1
5.2	Strategies for growth	1
5.3	Building the new ventures	1
5.4	Managing Rewards	1
5.5	Exit strategies for Entrepreneurs,	1
5.6	Mergers and Acquisition, Succession and exit strategy	1
5.7	Managing failures– bankruptcy.	1
	Total Hours	**30**

Course Designers

1. Dr.N.Tiruvenkadam - tiruvenkadam@ksrct.ac.in

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60 EC 5P1	Microcontrollers and VLSI laboratory

Category	L	T	P	Credit
PC	0	0	4	2

Objectives

- To give an exposure of assembly / C language programming and interfacing of display modules
- To understand the techniques to interface sensors and I/O circuits and to implement applications using these processors
- To learn the fundamental principles of digital system design using HDL and verify with FPGA
- To learn the fundamental principles of VLSI circuit and layout design in analog & digital domain

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Write, compile, debug, link and execute the program for the given target board	Remember, Understand, Apply
CO2	Developing code for accessing GPIO for interfacing input and output peripherals.	Remember, Understand, Apply
CO3	Design a system for temperature acquisition system	Remember, Understand, Apply
CO4	Write HDL code for basic as well as advanced digital integrated circuit and import the logic modules into FPGA boards	Remember, Understand, Apply
CO5	Design, simulate and extract the layouts of digital & analog IC blocks using EDA tools	Remember, Understand, Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			3	3	3		3	3	2	
CO2	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
3 - Strong; 2 - Medium; 1 – Some															

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC 5P1 - Microcontrollers and VLSI 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

Microcontrollers*

1. Developing a C / Assembly program for a dancing light LED.
2. Developing a C / Assembly program to display a given message using LCD.
3. Design a system for accessing ADC through GPIO, timer peripherals and interrupts
4. Design a system for stepper motor control application along with sensor.
5. Design a system for a temperature monitoring application

VLSI*

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6.Design and verify basic digital circuits (Full Adder, Multiplexer, Universal Shift Register and Synchronous Counter) with test bench code. Simulate it using EDA tool and implement by FPGA. 7.Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using EDA tool and implement by FPGA. 8.Design Memories using HDL. Simulate it using EDA tool and implement by FPGA. 9.Design Carry Save Adder & Booth Multiplier using arithmetic building blocks using HDL. 10.Design and simulate a CMOS NAND, NOR, D-Flip-Flop and inverting amplifier. Generate Layout.
Total Hours: 60

***SDG:9 - Industry Innovation**

Course Designers

1. **Mr S.Jayamani - jayamani@ksrct.ac.in**
2. Mrs.C.Saranya - saranyac@ksrct.ac.in

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60 EC 5P2	COMMUNICATION AND SIGNAL PROCESSING LABORATORY

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To obtain a better understanding of the operation of modulation schemes
- To understand and analyze spectrum, multiplexing techniques
- To implement FIR and IIR filters in simulation and DSP Processor
- 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

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Demonstrate the analog modulation techniques	Apply
CO2	Analyze the signals using spectrum analyzer	Apply
CO3	Design FM radio receiver	Apply
CO4	Design of IIR, FIR, Application of multirate filters and verify its performance using simulation and Digital Signal Processor	Apply
CO5	Generate standard waveform and compute arithmetic operation using Digital Signal Processor	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	2	3
CO2	3	3	3	3	3								3	2	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3			3	3	3	3	3	3	2	3
CO5	3	3	3	3	3			3	3	3	3	3	3	2	3
3 - Strong; 2 - Medium; 1 – Some															

K. S. Rangasamy College of Technology – Autonomous R 2022							
60 EC 5P2 - COMMUNICATION AND SIGNAL PROCESSING 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

List of Experiments

Communication

1. Generation of AM DSB-SC modulation and demodulation *
2. Study of Multiplexing and De multiplexing Techniques*
3. Construct and test the characteristics of Pre-Emphasis and De-Emphasis*
4. Spectrum Analysis of modulating signals using spectrum analyzer*
5.. Construct FM Radio Receiver*

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Signal Processing

Using Simulation

7. Design of Digital filters*
8. Implementation of Sub band coding*

Using DSP Processor

9. Generation of standard waveforms*
10. Implementation of arithmetic operations*
11. Design and implementation of FIR & IIR filter for real time applications*

***SDG:4- Quality Education**

Course Designers

1. Dr.P.BABU -pbabu@ksrct.ac.in
2. Mr.D.DHANASEKARAN - dhanasekarand@ksrct.ac.in

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60 CG 0P4	CAREER SKILL DEVELOPMENT - IV

Category	L	T	P	Credit
CG	0	0	2	1

Objective

- 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

Prerequisite

Basic knowledge of Arithmetic and Logical Reasoning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3		3				2	3	3	3	2	2
CO2	3	3	3	3		2				2	3	3	3	2	2
CO3	2	2	2	2		3				2	3	3	3	2	2
CO4	3	3	3	3		2				2	3	3	3	2	2
CO5	3	3	3	3		2				2	3	3	3	2	2
3- Strong; 2-Medium; 1-Some															

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 CG 0P4 - Career Skill Development - IV								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	2	30	1	100	00	100

Verbal & Analytical Reasoning* Seating Arrangements – Analytical Reasoning (PUZZELS) – Machin input and output - Coded Inequality – Eligibility Test	**[6]**
Quantitative Aptitude - Part – 4* Permutation and Combination - Probability - Quadratic equation - Geometry – Clock – Calendar – Logarithmic	**[6]**
Non-Verbal Reasoning * Series Completion of Figures – Classification – Courting of figure – Figure matrix – Embedded Figure – Complete Figure – Paper Cutting and Folding – Mirror images and Water Images	**[6]**
Quantitative Aptitude - Part – 5* Mensuration of Area, Volume and Surface area in 2D and 3D Shapes – 2D Shapes – Square, Rectangle, Triangle, Circle, etc. - 3D Shapes – Cube, Cuboid , Sphere , Cone , etc.	**[6]**
Data Interpretation and Analysis* Data interpretation Based on text - Data interpretation Based on Tabulation , Pie chart , Bar graph , And Line graph – Venn Diagram - Data sufficiency	**[6]**
Total Hours	**30**

Reference(s):

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'*, McGraw Hill Education, 6th edition, 2016
3.	Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education (2020)
4.	Anne Thomson, *'Critical Reasoning: A Practical Introduction'* Lexicon Books, 3rd edition, 2022.

***SDG 4 – Quality Education**
***SDG 8 – Decent work and Economic growth**
***SDG 9 – Industry, innovation and Infrastructure**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Verbal & Analytical Reasoning**	
1.1	Seating Arrangements	1
1.2	Analytical Reasoning (PUZZELS)	1
1.3	Machin input and output	1
1.4	Coded Inequality	1
1.5	Eligibility Test	2
2	**Quantitative Aptitude - Part – 4**	

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Approved in Academic Council Meeting held on 23/12/2023

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

2.1	Permutation and Combination	1
2.2	Probability	1
2.3	Quadratic equation - Geometry	1
2.4	Clock – Calendar	1
2.5	Logarithmic	2
3	**Non-Verbal Reasoning**	
3.1	Series Completion of Figures – Classification	1
3.2	Courting of figure – Figure matrix	1
3.3	Embedded Figure – Complete Figure	1
3.4	Paper Cutting and Folding	1
3.5	Mirror images and Water Images	2
4	**Quantitative Aptitude - Part – 5**	
4.1	Mensuration of Area, Volume	1
4.2	Mensuration of Volume	1
4.3	Surface area in 2D and 3D Shapes	1
4.4	2D Shapes – Square, Rectangle, Triangle, Circle, etc.	1
4.5	3D Shapes – Cube, Cuboid , Sphere , Cone , etc.	2
5	**Data Interpretation and Analysis**	
5.1	Data interpretation Based on text	1
5.2	Data interpretation Based on Tabulation, Pie chart	1
5.3	Bar graph , And Line graph	1
5.4	Venn Diagram	1
5.5	Data sufficiency	2
	Total	**30**

Course Designer

1. R. Poovarasan - poovarasan@ksrct.ac.in

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60 EC 601	EMBEDDED SYSTEMS

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- To impart the knowledge of the Embedded design
- To learn the architecture and features of ARM.
- To program the CORTEX M3
- Learn the architecture and design flow of IoT
- Build an IoT based system

Prerequisite

Microprocessors and Microcontrollers, Basics of C Programming

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Interpret the overall landscape and characteristics of embedded systems	Remember Understand
CO2	Describe the architecture and features of ARM CORTEX	Remember Understand
CO3	Describe the architecture of STM CORTEX-M3/M4	Understand Analyze
CO4	Develop program using ARM CORTEX M3/M4	Apply
CO5	Describe the basic architecture of an operating system and its fundamental operations	Understand

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3							2	3	2	
CO2	3	3	2	2	3							2	3	2	
CO3	3	3	3	2	2							2	3	2	
CO4	3	3	3	3	2							2	3	2	
CO5	3	3	2	3	3							2	3	2	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	30	60	60
Analyze (An)	0	10	10	10
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC 601 - 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	40	60	100

STRUCTURE OF EMBEDDED SYSTEMS* Embedded Computing: Characteristics of Embedding Computing Applications, Embedded System Architecture: Instruction Set Architecture, CISC and RISC, Embedded C Data types and variables, Storage classes, Register data assignment, Bitwise operation, GPIO: Overview, Interfacing.	[9]
ARM CORTEX-M3 ARCHITECTURE* ARM Architecture – Versions, CORTEX-M3/M4 Microcontroller: Block diagram, Bus architecture, Reset value of a register, Register bit positions**,** UART: Protocol, Port accessing, Error management.	[9]
PERIPHERALS IN CORTEX M3 Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence, ADC: SAR ADC, HAL_ADC module, Conversion modes, Resolution, DAC: HAL_DAC module, Pin assignments, I2C Interfacing.	[9]
CORTEX M3 PROGRAMMING* Development Flow, Volatile and effect of optimization, Interrupt handling, Timer Interrupt, SysTick Timer, Watchdog Timer, SPI Peripherals and testing, EEPROM Interface.	[9]
REAL TIME OPERATING SYSTEMS** OS: Basic principles, Architecture, System calls, Threads, tasks and process, 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, Interrupt APIs, Task Creation API, Low Power Management with RTOS.	[9]
Total hours	**45**

Text book(s):	
1.	Wayne Wolf, 'Computers as Components - Principles of Embedded Computing System Design', 2nd Edition, Elsevier, 2008.
2.	Joseph Yiu, 'The Definitive Guide to the ARM CORTEX M3/M4', 2nd Edition, Elsevier, 2007.
3.	Carmine Noviello , 'Mastering STM32', 2018.
4.	Shibu K.V.,Tata , 'Introduction to Embedded Systems', McGraw Hill Education (India) Private Limited, 2009.
Reference(s):	
1.	Israel Gbati ,Embedded Systems Bare-Metal Programming Ground Up™ (STM32) , BHM Engineering Academy, Udemy Course
2.	Mastering RTOS: Hands on FreeRTOS and STM32Fx with Debugging by Fast Bit Embedded Brain Academy, Kiran Navak, Udemy Course

* **SDG: 9 – Industry, Innovation and Infrastructure**
**** SDG: 7 - Affordable and Clean energy**

Assignment Activity:
Assignment-1
GPIO Interfacing and UART Communication (25 marks)
Assignment-2
Implementing an Alarm Clock System with RTOS (50 marks)

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Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**STRUCTURE OF EMBEDDED SYSTEMS**	
1.1	Embedded Computing: Characteristics of Embedding Computing Applications	1
1.2	Embedded System Architecture: Instruction Set Architecture, CISC and RISC	1
1.3	Embedded C Data types and variables, Storage classes	2
1.4	Register data assignment	1
1.5	Bitwise operation	2
1.6	GPIO: Overview, Interfacing	2
2	**ARM CORTEX-M3 ARCHITECTURE**	
2.1	ARM Architecture – Versions, CORTEX-M3/M4 Microcontroller: Block diagram	2
2.2	Bus architecture	1
2.3	Reset value of a register, Register bit positions, UART: Protocol,	2
2.4	Port accessing, Error management	3
3	**PERIPHERALS IN CORTEX M3**	
3.1	Operation Mode, Exceptions and Interrupts	1
3.2	Vector Tables, Stack Memory Operations, Reset Sequence	2
3.3	CORTEX M3 Instruction Sets: Assembly Basics	1
3.4	SAR ADC, HAL_ADC module, Conversion modes, Resolution	2
3.5	HAL_DAC module, Pin assignments	1
3.6	I2C, Interfacing	3
4	**CORTEX M3 PROGRAMMING**	
4.1	Development Flow, Volatile and effect of optimization	1
4.2	Interrupt handling, Timer Interrupt, SysTick Timer, Watchdog Timer	1
4.3	SPI Peripherals and testing	1
4.4	EEPROM Interface	2
5	**REAL TIME OPERATING SYSTEMS**	
5.1	OS: Basic principles, Architecture, System calls	1
5.2	Threads, tasks and process, Kernel and its function	2
5.3	Scheduling: static, dynamic, priority, pre-emptive, round robin, Earliest Deadline First, Rate monotony	2
5.4	First-Come First-Served (FCFS), Shortest-Job-Next, Multiple-Level Queues Scheduling	2
5.5	Interrupt APIs, Task Creation API, Low Power Management with RTOS	2
	Total	45

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in
2. Mr.K.Raguvaran – raguvaran@ksrct.ac.in

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60 EC 602	DIGITAL COMMUNICATION

Category	L	T	P	Credit
PC	2	1	2	4

Objective

- 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 charnels
- To understand baseband signal transmission and reception techniques
- To understand passband signal transmission and reception techniques
- To discuss fundament concepts and limits in information theory in the context of digital communication systems

Prerequisite

Analog Communication

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Analyze the sampling process and various waveform coding techniques	Remember Understand Apply
CO2	Describe the different channel coding techniques which are used to provide reliable transmission of digital information over the channel	Remember Understand Apply Analyze create
CO3	Examine the transmission of a signal at high modulation rate through a band-limited channel and discuss the baseband data transmission systems	Remember Understand Apply Analyze
CO4	Design of optimum receivers and explain the transmission of digital data over a band pass channel	Remember Understand Apply Analyze
CO5	Discuss the fundamental concepts and limits information theory in the context of a digital communication system	Remember Understand Apply Analyze

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

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Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	30	20	60	60
Analyze (An)	10	20	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S.Rangasamy college of Technology-Autonomous R 2022

60 EC 602 - Digital Communication

B.E. Electronics and Communication Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	1	2	75	4	50	50	100

Pulse Digital Modulation Techniques* Pulse code Modulation- Sampling, Quantizing, Encoding-Quantization Noise and robust Quantization, Differential pulse code Modulation, Adaptive differential pulse code modulation- Delta modulation- Adaptive	[9]
Error Control Coding* Linear block codes - encoding and decoding Cyclic codes- Encoder and Syndrome calculator – Convolutional Codes-encoding – Viterbi decoding.	[9]
Baseband Pulse Transmission* Line codes- PSD's- ISI – Nyquist criterion for zero ISI- optimum transmit and receive filters-Correlative Coding-M-Array PAM	[9]
Baseband Modulation* Matched filter receiver-BASK, BFSK, BPSK-- Transmitter, Receiver, signal Space Diagram, Error Probabilities. Coherent quadrature modulation schemes: QPSK, MSK – Non coherent binary modulation schemes: BFSK- Comparison of binary and quaternary modulation schemes – M-ary modulation schemes	[9]
Fundamentals of Information theory* Measure of Information - Entropy - Source coding theorem -Discrete memoryless channels – loss less, deterministic, noiseless, BEC, BSC – Mutual information – Channel capacity - Shannon-Hartley Law. Shannon - Fano coding, Huffman Coding, run length coding, LZW algorithm.	[9]
Hands on: 1.Analog to Digital conversion. 2.Convolutional encoding and decoding. 3.Determtnaton of entropy and Mutual Information. 4.Simulating multiple-input multiple-output (MIMO) communication	
Total Hours: 45+30(Tutorial+ Practical)	**75**

Text Books

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

References

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1	Bernaud Sklar &Ray, 'Digital Communications- Fundamentals and Applications', 2nd Edition, Pearson Education, 2012.
2	Taub & Schilling, "Principles of Digital Communication', 4th Edition, Mc-Graw 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 Univer Press, 2018.**

*SDG:4 – Quality Education

Course Contents and Lecture Schedule

Module no	topic	No.of Hours
1	**Pulse Digital Modulation Techniques**	
1.1	Sampling, Quantizing	1
1.2	Encoding	1
1.3	Quantization Noise	1
1.4	robust Quantization	1
1.5	Differential Pulse Code Modulation	1
1.6	Adaptive differential pulse code modulation	1
1.7	Delta modulation	2
1.8	Adaptive delta modulation	1
2	Error Control Coding	
2.1	Linear block codes - encoding	1
2.2	Linear block codes - decoding	1
2.3	Cyclic codes- Encoder	1
2.4	Cyclic Codes- Syndrome calculator	2
2.5	Convolutional Codes-encoding. (different Structures)	2
2.6	Viterbi decoding	2
3	**Baseband Pulse Transmission**	
3.1	Line codes	1
3.2	PSD's- ISI	1
3.3	Nyquist criterion for zero ISI	1
3.4	optimum transmit and receive filters	2
3.5	Correlative Coding- Duo Binary Signalling, Modified Duo Binary	2
3.6	M-Array PAM	2
4	**Baseband Modulation**	
4.1	Matched filter receiver	1
4.2	BASK -- Transmitter, Receiver, signal Space Diagram, Error Probabilities	1
4.3	BFSK - Transmitter, Receiver, signal Space Diagram, Error	1

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4.4	BPSK- Transmitter, Receiver, signal Space Diagram, Error Probabilities	1
4.5	Coherent quadrature modulation schemes: QPSK	1
4.6	Coherent quadrature modulation schemes: MSK	1
4.7	Non coherent binary modulation schemes: BFSK	1
4.8	Comparison of binary and quaternary modulation schemes	1
4.9	M-ary modulation schemes	1
5	**Fundamentals of Information theory**	
5.1	Measure of Information - Entropy	1
5.2	Source coding theorem	1
5.3	Discrete memoryless channels, loss less, deterministic, noiseless,	1
5.4	Mutual information -Channel Capacity	1
5.5	Shannon-Hartley Law	1
5.6	Shannon-Fano Coding	1
5.7	Huffman Coding	1
5.8	run length coding	1
5.9	LZW algorithm	1

Course Designers

1. **Dr P Kumar- pkumar@ksrct.ac.in**
2. **Mr P Balamurugan- pbalamurugan@ksrct.ac.in**

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60 EC 603	MOBILE COMMUNICATION AND NETWORKS

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- 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 design the different wireless standards and networks
- To understand the basics of Next generation wireless networks

Prerequisite

Digital communication

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Discuss the cellular system design and technical challenges	Remember Understand Apply
CO2	Analyze the different radio wave propagation models and fading effects	Remember Understand Apply
CO3	Compare the performance of modulation and diversity techniques	Remember Understand Apply
CO4	Summarize the principles and applications of wireless systems and standards	Remember Understand Apply
CO5	Investigate the next generation wireless networks	Remember Understand Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	
CO5	3	3	3	3									3	3	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		

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Remember (Re)	12	12	20	20
Understand (Un)	38	38	60	60
Apply (Ap)	10	10	20	20
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022

60 EC 603- 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
VI	3	0	0	45	3	40	60	100

INTRODUCTION Wireless communication systems - 2G/3G/4G cellular networks - Cellular concept: Frequency reuse - channel assignment strategies - hand off - interference & system capacity - Coverage and capacity improvement.	[9]
MOBILE RADIO PROPAGATION Free space propagation model - 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.	[9]
MODULATION TECHNIQUES AND SIGNAL PROCESSING Principles of Offset-QPSK - π/4-DQPSK - GMSK - Error performance in fading channels - Spread Spectrum Modulation – Multi carrier system-OFDM - Diversity reception techniques - MIMO systems – spatial multiplexing - System model.	[9]
WIRELESS STANDARDS AND NETWORKS GSM system overview - GSM network and system architecture, GSM channel concepts, CDMA architecture –power control, system capacity, 60-GHz Millimeter wave radios - Millimeter wave characteristics - Channel performance at 60 GHz, Gigabit wireless communication, Standards - Wi-Gig, IEEE 802.11ad, IEEE 802.15.3c - Millimeter wave applications.	[9]
5G AND BEYOND NETWORKS** Network architecture of 5G-and-beyond systems - Spectrum management and sharing - small cell networks - Heterogeneous Networks - Network densification - Cloud Radio Access Network (C-RAN) - Software Defined Network (SDN) - Network Function Virtualization (NFV) - Unmanned Aerial Vehicles (UAVs) - Unmanned Aerial Base Stations (UABSs) - Emerging services and applications.	[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):

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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.
5.	Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", CRC Press, 1st Edition, 2019, https://www.sciencedirect.com/science/article/pii/B9780128205815000122

****SDG:9 - Build resilient infrastructure and foster innovation**

Assignment Activity:

Assignment 1

Implementation of Two-ray ground-reflection model using MATLAB.

Chart preparation of types of Fading.

Assignment 2

Implementation of MIMO/OFDM system using MATLAB.

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**INTRODUCTION**	
1.1	Wireless communication systems - 2G/3G/4G	2
1.2	cellular networks	1
1.3	Cellular concept: Frequency reuse	1
1.4	channel assignment	1
1.5	hand off	1
1.6	interference	1
1.7	system capacity	1
1.8	Coverage and capacity improvement	1
2	**MOBILE RADIO PROPAGATION**	
2.1	Introduction	1
2.2	Free space propagation model - Reflection	1
2.3	Two-Ray model, Diffraction, Knife-edge diffraction model	1
2.4	Scattering - Log-normal shadowing	1
2.5	Okumara model - Hata model	1
2.6	Log-distance path loss model	1
2.7	Small-scale multipath propagation	1
2.8	Parameters of mobile multipath channels	1
2.9	Types of small-scale fading	1
3	**MODULATION TECHNIQUES AND SIGNAL PROCESSING**	

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3.1	Introduction	1
3.2	Principles of Offset-QPSK	1
3.3	π/4-DQPSK	1
3.4	GMSK - Error performance in fading channels	1
3.5	Spread Spectrum Modulation	1
3.6	Multi carrier system-OFDM	1
3.7	Diversity reception techniques	1
3.8	MIMO systems	1
3.9	spatial multiplexing - System model.	1
4	**WIRELESS STANDARDS AND NETWORKS**	
4.1	Introduction	1
4.2	GSM system overview - GSM network	1
4.3	GSM system architecture & channel concepts	1
4.4	CDMA architecture –power control, system capacity	1
4.5	60-GHz Millimeter wave radios	1
4.6	Millimeter wave characteristics - Channel performance at 60 GHz	1
4.7	Gigabit wireless communication	1
4.8	Standards - Wi-Gig, IEEE 802.11ad	1
4.9	IEEE 802.15.3c - Millimeter wave applications	1
5	**5G AND BEYOND NETWORKS**	
5.1	Network architecture of 5G-and-beyond. systems	1
5.2	Spectrum management and sharing	1
5.3	Small cell networks - Heterogeneous Networks - Network densification	1
5.5	Cloud Radio Access Network (C-RAN) - Software Defined Network (SDN)	1
5.6	Network Function Virtualization (NFV)	1
5.7	Unmanned Aerial Vehicles (UAVs)	1
5.8	Unmanned Aerial Base Stations (UABSs)	1
5.9	Emerging services and applications	1
	Total	45

Course Designers

1. Dr.P.Kumar - kumar@ksrct.ac.in
2. Mr.R.Satheeshkumar - satheeshkumar@ksrct.ac.in

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60 EC 604	MACHINE LEARNING TECHNIQUES

Category	L	T	P	Credit
PC	3	0	2	4

Objectives

- 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.

Prerequisite

Neural Networks, Programming Language -Python, MATLAB.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the basic concepts of machine learning.	Remember, Understand, Apply
CO2	Identify and apply the appropriate machine learning technique for classification, regression and decision making.	Remember, Understand, Apply
CO3	Design and implement solution for clustering and dimensionality problems.	Remember, Understand, Apply
CO4	Describe the inference and learning algorithms for the graphical model.	Remember, Understand, Apply
CO5	Apply reinforcement learning techniques for real life problems.	Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	
3 - Strong; 2 - Medium; 1 - Some															

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Tiruchengode - 637 215.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Marks (100)	End Sem Examination (Marks)
	1	2		
Remember (Re)	12	10	20	20
Understand (Un)	38	30	40	50
Apply (Ap)	10	20	40	30
Analyse (An)	-	-	-	-
Evalute (Ev)	-	-	-	-
Create (Cr)	-	-	-	-
Total	60	60	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022

60 EC 604 – Machine Learning Techniques

B.E.Electronics and Communication Engineering

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	2	75	4	50	50	100

NEURAL NETWORKS* Neural Networks - Training a Perceptron - Learning Boolean Functions, activation - ReLU, hyper parameter tuning, batch normalization, regularization, Multilayer Perceptrons - Back propagation Algorithm -Training Procedures - Types of Machine Learning - generalization tradeoff – bias and variance – Machine Learning Model Deployment techniques. **Hands on:** Backpropagation, multi-layer perceptron Neural Networks, Extract the data from database	[9]
LINEAR MODELS Linear regression- Ridge regression- Lasso, Bayesian regression- Regression with Basis functions- Logistic regression- Large margin classification- Kernel methods- Support Vector Machines, Decision Tree. **Hands on:** Linear, Logistic regression and SVM classification method.	[9]
UNSUPERVISED LEARNING AND DIMENSIONALITY REDUCTION Nearest neighbour models - K means - clustering around medoids - silhouettes - hierarchical clustering - Dimensionality reduction - principle component analysis - factor Analysis – Independent Component Analysis. **Hands on**: Clustering, PCA and ICA method on a given dataset	[9]
GRAPHICAL MODEL AND ENSEMBLE METHODS Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution-Bayesian Belief Networks-Markov Random Fields- Hidden Markov Models -Boosting - Bagging - Simple methods -Stacking technique. **Hands on**: Boosting, ensemble method on a given dataset.	[9]
REINFORCEMENT LEARNING** Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – Generalization in reinforcement learning – policy search – Inverse and Transfer Learning reinforcement. Applications in Health care and robot control.	[9]
Total Hours : 45+30(Practical)	**75**

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.

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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.

* **SDG:3 – Good Health and Well Being**
****SDG:9 - Sustainable industrialization and foster innovation**
Assignment Activity:
Covers Module 1 &2 Questions related to the problems and simulation / Hands on
Assignment 1- Case study, Simulation, Mini Project
Assignment 2- Mini Project and Problem solving

Course Contents and Lecture Schedule

S.No.	Topic	No. of Hours
1	**INTRODUCTION**	
1.1	Neural Networks - Training a Perceptron	1
1.2	Learning Boolean Functions -– ReLU, hyper parameter tuning	1
1.3	Batch normalization, regularization, dropout	1
1.4	Multilayer Perceptron's , Back propagation Algorithm -Training Procedures	2
1.5	Types of Machine Learning -Supervised and unsupervised Learning	1
1.6	Theory of generalization , generalization bound – approximation	1
1.7	Generalization tradeoff – bias and variance	1
1.8	Machine Learning Model Deployment techniques	1
2	**LINEAR MODELS**	
2.1	Linear regression- Ridge regression	1
2.2	Lasso, Bayesian regression	2
2.3	Regression with Basis functions- Logistic regression	2
2.4	Large margin classification- Kernel methods	1
2.5	Support Vector Machines-hard SVM, soft SVM	2
2.6	Decision Tree	1
3	**UNSUPERVISED LEARNING AND DIMENSIONALITY REDUCTION**	
3.1	Nearest neighbour models - K means	2
3.2	Clustering around medoids – silhouettes	1
3.3	Hierarchical clustering	1
3.4	Dimensionality reduction - principle component analysis	1
3.5	Factor Analysis	1
3.6	Independent Component Analysis	1
3.7	Simulation: Clustering, PCA and ICA method on a given dataset	2
4	**GRAPHICAL MODEL AND ENSEMBLE METHODS**	

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Approved in Academic Council Meeting held on 23/12/2023

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4.1	Markov Chain Monte Carlo Methods	1
4.2	Sampling – Proposal Distribution	1
4.3	Bayesian Belief Networks-Markov Random Fields	2
4.4	Hidden Markov Models	1
4.5	Boosting - Adaboost, Gradient Boosting	2
4.6	Bagging - Simple methods -Stacking technique	2
5	**REINFORCEMENT LEARNING**	
5.1	Passive reinforcement learning – direct utility estimation	1
5.2	Adaptive dynamic programming – temporal difference learning	2
5.3	Active reinforcement learning – exploration	2
5.4	Learning an action-utility function – Generalization in reinforcement learning	1
5.5	Policy search –Inverse and Transfer Learning reinforcement	1
5.6	Applications in Health care – applications in robot control	2
	Total	45

Course Designers

Ms.R.Ramya – rramya@ksrct.ac.in

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60 EC 6P1	INNOVATIVE ENGINEERING LABORATORY

Category	L	T	P	Credit
CG	0	0	4	2

Objective

- To disassemble and reassemble circuits
- To diagnose faults in a circuit
- To deconstruct a product and extract design information
- To learn connections and power requirements

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Find the design information of a product	Apply
CO2	Learn efficient assembly and disassembly design in an electronic product	Apply
CO3	Test and troubleshoot an electronic circuit product	Apply
CO4	To efficiently design an electronic product	Apply
CO5	Develop prototype for a product already available in the market with enhanced features	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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
3 - Strong; 2 - Medium; 1 - Some															

K. S. Rangasamy College of Technology – Autonomous R 2022							
60 EC 6P1 - INNOVATIVE ENGINEERING 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

List of Experiments

1. Diagnose and troubleshoot the given PCB
2. Extract the circuit drawing from the given PCB
3. Tear down a product
   i. Find the design information

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ii. Draw the circuit
iii. Find the connections and power requirements
iv. Report on feature enhancement of the product in terms of design, power requirement, packaging or any other feature of interest

The product for experiment 3 can be chosen from the below list or the student can bring his own electronic product

- Pulse oximeter*
- Stabiliser**
- Audio amplifier**
- UPS board**

***SDG 3: GOOD HEALTH AND WELL-BEING**
****SDG 4: Quality Education**

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in

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60 EC 6P2	EMBEDDED SYSTEMS LABORATORY

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To familiarize the operators and registers in Embedded C
- To learn about ADC and DAC
- To interface peripherals and processors associated with embedded systems
- To understand the concept of UART communication
- To familiarize with RTOS in Embedded computing

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the principles of bitwise operators	Apply
CO2	Design a driver for serial communication	Apply
CO3	Develop a driver for acquiring analog signals	Apply
CO4	Develop a program to access synchronized serial communication	Apply
CO5	Design a multitasking system for an application	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3										
CO2	3	3	3	3	3										
CO3	3	3	3	3	3										
CO4	3	3	3	3	3			3	3	3	3	3			
CO5	3	3	3	3	3			3	3	3	3	3			
3 - Strong; 2 - Medium; 1 - Some															

K. S. Rangasamy College of Technology – Autonomous R 2022							
60 EC 6P2 - EMBEDDED SYSTEMS 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

List of Experiments

1. Develop a bare metal Embedded C program to access GPIO ports *****
2. Develop a bare metal Embedded C program to perform UART transmission and reception
3. Develop the bare metal Embedded C program for ADC and print the value in UART ******

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

4. Develop the bare metal Embedded C program for ADXL345 Accelerometer using the I2C **
5. Develop the multitasking bare metal Embedded C program using free RTOS for following task *
   - Task-1: Blink LED for 1 second (using Vtask timer)
   - Task-2: Read ADXL345 print in UART
   - Task-3: Read ADC and trigger an LED once threshold meets and print the value in UART
6. Develop the bare metal Embedded C program for DC motor interface *

Open ended experiments

1. Develop an application using timer or external interrupts and PWM **
2. Develop an application using SPI interface

*** SDG 9 - Industry, Innovation, and Infrastructure**
**** SDG 11 - Sustainable Cities and Communities**

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in
2. Mr.K.Raguvaran – raguvaran@ksrct.ac.in

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60 EC 6P3	MINI PROJECT

Category	L	T	P	Credit
CG	0	0	2	1

Objective

- 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

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Develop empathy based, human centred creative ideas to solve problems in the society	Apply
CO2	Progress in career with increased knowledge retention and confidence	Apply
CO3	Combine knowledge and skills from multiple subject areas and transfer the knowledge to develop new solutions	Apply
CO4	Have environmental awareness and independent decision making capabilities	Apply
CO5	Tackle challenges in creation, development and deployment of technology based solutions	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 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
3 - Strong; 2 - Medium; 1 - Some															

K. S. Rangasamy College of Technology – Autonomous R 2022							
60 EC 6P3 – MINI PROJECT							
B.E. Electronics and Communication Engineering							
Semester	Hours / Week			Total hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VI	0	0	2	30	1	100	00	100

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List of Experiments

- Students are expected to design circuits/systems by applying current technologies to the concepts learnt
- Solution should be in the form of fabrication/coding/modelling/product design/process design with relevant scientific methodology

Students may choose the application from the list given below or build their own

1. Develop proof of concept - Identify a social problem near to your village and develop a real time solution *
2. Design and develop solutions for problems in healthcare**
3. Design and develop modern solutions for agricultural problems***
4. Build a Mini UPS System***
5. Build mobile based Home Appliances control***
6. Build a robotics application***

Continuous Assessment:

- Three reviews with the weightage of 20:30:50
- Assessment will be based on
  - Technology used
  - Target group benefitted
  - Progress/Results
  - Presentation
  - Report
  - Individual contribution
  - Team work
  - Discussion during the contact hours
  - Confidence and commitment exhibited
  - Proposal for product/prototype submitted

*SDG 2 – Zero Hunger
**SDG 3 – Good Health and Well Being
*** SDG 4 – Quality Education

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in

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60 CG 0P5	Comprehension Test*	Category	L	T	P	C	CA	ES	Total
Semester VI		CG	0	0	2	1*	100	-	100

Objectives

- To evaluate the knowledge gained in core courses relevant to the programme of study.
- To assess the technical skill in solving complex engineering problems.

Prerequisite

Fundamental knowledge in all core subjects.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Infer knowledge in their respective programme domain.	Apply
CO2	Attend interviews for career progression	Apply
CO3	Exhibit professional standards to solve engineering problems	Apply
CO3	Promote holistic approach to problem solving	Apply
CO5	Examine the competency of graduates in specific programme domain	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2					1	2	2	3
CO2	3	3	2	2					1	2	2	3
CO3	3	3	2	2					1	2	2	3
CO4	3	3	2	2					1	2	2	3
CO5	3	3	2	2					1	2	2	3
3- Strong;2-Medium;1-Some												

Assessment Pattern

The overall knowledge of the candidate in various courses he/she studied shall be evaluated with multiple choice questions.

***SDG:4- Quality Education**

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60 EC E11	WEARABLE DEVICES

Category	L	T	P	Credit
PE	2	0	2	3

Objective

- To learn the field of wearable devices and applications
- To study the scope of wearable devices and the future roadmap
- To learn the sensors for wearable devices
- To discuss the wearable cameras and microphones for navigation
- To explore the security issues, psychological effects and health issues related to wearable devices

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Discuss the wearable devices and their applications	Remember, Understand, Apply
CO2	Describe the scope and future roadmap of wearable devices	Remember, Understand, Apply
CO3	Analyze the different sensors used in wearable devices	Remember, Understand, Apply
CO4	Explore the wearable cameras and microphones for navigation in wearable devices	Remember, Understand, Apply
CO5	Review the security issues, psychological effects and health concerns related to wearable devices	Remember, Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
3 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 EC E11 – WEARABLE DEVICES								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100

WEARABLE DEVICES Motivation for development of Wearable Devices, The emergence of wearable computing and wearable electronics, Intelligent clothing, sports, healthcare, Fashion and entertainment, military, environment monitoring, mining industry, public sector and safety.	[6]
SCOPE OF WEARABLE DEVICES Role of Wearables, Attributes of Wearables, The Meta Wearables – Textiles and clothing, Social Aspects: Interpretation of Aesthetics, Adoption of Innovation, On-Body Interaction.	[6]
SENSORS FOR WEARABLE DEVICES **Wearable Inertial Sensors*** - Accelerometers, Gyroscopic sensors; Force and Pressure Measurement; Flexible Sensors: Flex sensor, pulse oximeter; Inertial sensor, dehydration sensor; Nano Sensors- CNT based sensors	[6]
WEARABLE CAMERAS AND MICROPHONES FOR NAVIGATION Cameras in wearable devices, navigation, Cameras in smart-watches, Microphones and AI for respiratory diagnostics and clinical trials. Wearable Assistive Devices for the Blind - Hearing and Touch sensation, Wearable devices with Global Positioning System (GPS) integration for tracking and navigation.	[6]
SECURITY ISSUES AND PSYCHOLOGICAL EFFECTS OF WEARABLES Security and privacy issues in wearable technology, Psychological effects of wearables, Social implications, **Technology acceptance factors****, Electromagnetic intolerance and other risks.	[6]
MINI PROJECT Design and assemble a wearable circuit incorporating sensors and necessary hardware components, along with functions of the finalized project.	[30]
Total Hours: 30 + 30 (Project)	60

Text Book(s):	
1.	Toshiyo Tamura and Wenxi Chen, “Seamless Healthcare Monitoring”, Springer, 2018.
2.	Edward Sazonov and Michael R. Neuman, “Wearable Sensors -Fundamentals, Implementation and Applications”, Elsevier Inc., 2014.
Reference(s):	
1.	Aime Lay-Ekuakille and Subhas Chandra Mukhopadhyay, “Wearable and Autonomous Biomedical Devices and Systems for Smart Environment”, Springer, 2010.
2.	Subhas C. Mukhopadhyay, “Wearable Electronics Sensors-For Safe and Healthy Living”, Springer International Publishing, 2015.
3.	HaiderRaad, ‘The Wearable Technology Handbook’, United Scholars Publication, 2017.

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Tiruchengode - 637 215.

***SDG:15- Life on Land**

****SDG:3 – Good Health and Well Being**

Assignment Activity:

Assignment 1: Mini project

Assignment 2: Mini project

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**WEARABLE DEVICES**	
1.1	Motivation for development of Wearable Devices,	1
1.2	The emergence of wearable computing and wearable electronics	1
1.3	Applications in Intelligent clothing, sports	1
1.4	Applications in Healthcare	1
1.5	Applications in Fashion and entertainment, military	1
1.6	Applications in Environment monitoring, mining industry, public sector and safety.	1
2	**SCOPE OF WEARABLE DEVICES**	
2.1	Role of Wearables	1
2.2	Attributes of Wearables	1
2.3	The Meta Wearables – Textiles and clothing	1
2.4	Social Aspects: Interpretation of Aesthetics	1
2.5	Adoption of Innovation	1
2.6	On-Body Interaction	1
3	**SENSORS FOR WEARABLE DEVICES**	
3.1	Wearable Inertial Sensors - Accelerometers, Gyroscopic sensors	1
3.2	Force and Pressure Measurement	1
3.3	Flexible Sensors: Flex sensor	1
3.4	Pulse oximeter	1
3.5	Inertial sensor, dehydration sensor	1
3.6	Nano Sensors- CNT based sensors	1
4	**WEARABLE CAMERAS AND MICROPHONES FOR NAVIGATION**	
4.1	Cameras in wearable devices,	1
4.2	Navigation and Cameras in smart-watches	1
4.3	Microphones and AI for respiratory diagnostics and clinical trials	1
4.4	Wearable Assistive Devices for the Blind	1
4.5	Hearing and Touch sensation	1
4.6	Wearable devices with Global Positioning System (GPS) integration for tracking and navigation.	1
5	**SECURITY ISSUES AND PSYCHOLOGICAL EFFECTS OF WEARABLES**	

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Approved in Academic Council Meeting held on 23/12/2023

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

5.1	Security and privacy issues in wearable technology	1
5.2	Psychological effects of wearables	1
5.3	Social implications	1
5.5	Technology acceptance factors	1
5.6	Electromagnetic intolerance and other risks	1
6	**Mini Project** Design and assemble a wearable circuit incorporating sensors and necessary hardware components, along with functions of the finalized project.	15
	Total	45

Course Designers

1. **Mr.D.Mugilan - mugilan@ksrct.ac.in**

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60 EC E12	IoT HARDWARE

Category	L	T	P	Credit
PE	2	0	2	3

Objective

- To evaluate the unique requirements and challenges associated with deploying IoT
- To develop practical skills in building functional IoT devices using open-source hardware
- To develop skills in combining different sensor types
- To analyze the advantages and challenges of utilizing cloud resources for IoT applications
- To design and implement IoT applications to enhance urban services and sustainability

Prerequisite

Electronic devices and circuits, Basics of C Programming

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Examine the fundamental concepts of the Internet of Things	Understand Analyze
CO2	Demonstrate proficiency in utilizing open-source hardware	Analyze Apply
CO3	Configure and optimize a variety of sensors	Apply Evaluate
CO4	Deploy IoT physical servers and cloud infrastructure	Apply Evaluate
CO5	Develop comprehensive and tailored IoT applications in diverse domains	Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3				3	3	3	2	3	2
CO2	3	3	2	2	3				3	3	3	2	3	2
CO3	3	3	3	2	2				3	3	3	2	3	2
CO4	3	3	3	3	2				3	3	3	2	3	2
CO5	3	3	2	3	3				3	3	3	2	3	2
3 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Bloom'sCategory	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	-	-	-
Understand (Un)	10	-	-	10
Apply (Ap)	40	10	10	20
Analyze (An)	0	10	20	10
Evaluate (Ev)	0	20	20	10
Create (Cr)	0	20	50	50
Total	60	60	100	100

Passed in BoS Meeting held on 18/11/2023
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC E12 - IoT Hardware								
B.E.Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
V	2	0	2	60	3	50	50	100

Internet of Things * Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.	[6]
IoT Physical Devices and Endpoints ** Opensource Hardware, Controlling Hardware- LED, Buzzer, Switching High Power devices with transistors, AC Power devices with Relays, Servo motor, Speed control of DC Motor, Interfaces (Serial, SPI, I2C)	[6]
Sensor Interfaces * Sensors- Light sensor, Temperature sensor with thermistor, Voltage sensor, Temperature and Humidity sensor DHT11, Motion Detection sensors, RFID, Level sensors, Distance Measurement with ultrasound sensor, ADC and DAC	[6]
IoT Cloud * IoT Physical Servers and Cloud – Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT	[6]
Application development ** Biomedical, Agriculture, Smart city, Wearables smart grid, Smart retail, smart manufacturing, Transportation, Fleet management, Predictive maintenance	[6]
Total Hours = 30+30(practical)	**60**

Text book(s):	
1.	Arshdeep Bahga and Vijay Madisetti, 'Internet of Things: A Hands-On Approach', 1st Edition, VPT, 2014.
2.	Scott Klein and Matthijs Hoekstra, 'IoT Solutions in Microsoft's Azure IoT Suite: Data Acquisition and Analysis in the Real World', 1st Edition, Wiley, 2016.
3.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, 'IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things', 1st Edition, Cisco Press, 2017.
Reference(s):	
1.	Zach Shelby and Dominique Guinard, 'IoT Architecture: A Guide to Realizing Value in the Digital Enterprise', 1st Edition, O'Reilly Media, 2016.
2.	Maciej Kranz, 'Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry', 1st Edition, Wiley, 2016
3.	Vincent M. G. Gabaglio and Marco Mancuso, 'IoT Applications for Electronics', 1st Edition, McGraw-Hill Education, 2017.

*** SDG 9: Industry, Innovation, and Infrastructure**
**** SDG 11: Sustainable Cities and Communities - IoT**

Assignment Activity:
Assignment-1
Reverse Engineering and Analysis of an Electronic Product (50 marks)
Assignment-2

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Approved in Academic Council Meeting held on 23/12/2023

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

Smart Environmental Monitoring System (50 marks)

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Internet of Things**	
1.1	Definition and Characteristics of IoT	1
1.2	Sensors, Actuators	1
1.3	Physical Design of IoT – IoT Protocols	1
1.4	Domain Specific IoTs – Home, City, Environment.	1
1.5	Energy, Agriculture and Industry	2
2	**IoT Physical Devices and Endpoints**	
2.1	Opensource Hardware	1
2.2	Controlling Hardware- LED, Buzzer	1
2.3	High Power devices with transistors and AC Power devices with Relays	1
2.4	Servo motor	1
2.5	Speed control of DC Motor	1
2.6	Interfaces (Serial, SPI, I2C)	2
3	**Sensor Interfaces**	
3.1	Light sensor ,Temperature sensor with thermistor	1
3.2	Voltage sensor, ADC and DAC	1
3.3	Temperature and Humidity Sensor DHT11, Motion Detection Sensors	1
3.4	RFID	2
3.5	Level Sensors, Distance Measurement with ultrasound sensor	1
4	**IoT Cloud**	
4.1	IoT Physical Servers and Cloud	2
4.2	Cloud Storage models and communication APIs Web Server	1
4.3	Web server for IoT	1
4.4	Cloud for IoT	2
5	**REAL TIME OPERATING SYSTEMS**	
5.1	Biomedical, Agriculture, Smart city, Wearables smart grid, Smart retail, smart manufacturing, Transportation, Fleet management, Predictive maintenance	6
	Total	30+ Hands on

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in
2. Mr.K.Raguvaran – raguvaran@ksrct.ac.in

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60 EC E13	RADAR TECHNOLOGIES

Category	L	T	P	Credit
PE	2	0	2	3

Objective

- To understand the basic concepts of radar system
- To understand the principles of signal detection in Noise and Radar waveforms
- To understand principles of Radar Transmitter and Receiver
- To understand the principles of radar antennas
- To learn the concepts of MTI and pulse Doppler Radar

Prerequisite

Electromagnetic Fields

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Explain the Basics of radar technologies	Remember, Understand, Apply
CO2	Analyze the detection of signals in noise and radar waveforms	Remember, Understand, Apply
CO3	Describe the concepts of radar transmitter and receiver	Remember, Understand, Apply
CO4	Explain the concepts of radar antenna	Remember, Understand, Apply
CO5	Describe the concept of MTI and doppler radar	Remember, Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	12	12	20	20
Understand (Un)	38	38	70	70
Apply (Ap)	10	10	10	10
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0

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Approved in Academic Council Meeting held on 23/12/2023

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

Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 EC E13 - RADAR TECHNOLOGIES								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100

INTRODUCTION TO RADAR **Basics of radar***- applications of radar, radar frequencies- radar block diagram, Radar Coordinates, Radar equation for hard targets and the SNR-radar cross section of targets, Radar Resolution Elements, Pulse, CW and FMCW Radars–configurations, transmitter power- pulse repetition frequency, Duty Ratio, Pulse Compression. **Hands on:** Design of radar system using MATLAB and Simulink	[6]
DETECTION OF SIGNALS IN NOISE AND RADAR WAVEFORMS Probabilities of detection and false alarm-**matched filter receiver***-detection criteria – integration of radar pulses - constant-false alarm rate receivers - Radar Waveforms, Ambiguity Diagram. **Hands on:** Implementation of Matched filter for signal detector using MATLAB	[6]
RADAR TRANSMITTER AND RECEIVER Introduction- **Types of Transmitters*** - linear-beam power tubes- solid-state RF power sources- magnetron-Klystron, crossed-filed amplifier- radar receiver- receiver noise figure- Digital Receivers, duplexers and receiver protectors- radar displays-**Human Machine Interface (HMI)**.** **Hands on:** Study the characteristics of microwave sources	[6]
RADAR ANTENNA **Functions of radar antenna***- antenna parameters- antenna radiation pattern and aperture illumination - reflector antennas- electronically steered phased array antennas- phase shifters – frequency - scan arrays—architectures for phased arrays, radiators for phased arrays- mechanically steered planar array antennas. **Hands on:** Design of phased array antennas using Ansys HFSS	[6]
MTI AND PULSE DOPPLER RADAR Introduction to Doppler and MTI radar- delay –line cancellers- staggered pulse repetition frequencies- doppler filter banks- digital MTI processing - Moving target detector- limitations to MTI performance pulse Doppler radar-MTD**, tracking radar****- monopulse tracking- conical scan and sequential lobing- comparison of trackers. tracking accuracy- low-angle tracking- Atmospheric & Weather Radars. **Hands on:** Design and Implementation of Pulse-Doppler radar system using MATLAB	[6]
Total Hours:30+ 30(Practical)	60

Text Book(s):	
1.	M.I.Skolnik, 'Introduction to Radar Systems', Tata McGraw Hill, 2nd Edition, 2017.
2.	Peebles P Z , "Radar Principles", Wiley, 2016.
Reference(s):	
1.	Richard J Doviak , Dusan S Zrnic , "Doppler Radar and Weather Observations", Academic Press, 2014
2.	Bringi V N, Chandrasekar V , "Polarimetric Doppler Weather Radar", Cambridge University Press, 2012.
3.	Richards M A, Scheer J A and Holm W A , "Principles of Modern Radar", Scitech Publishing, 2014.
4.	Levanon N , "Radar Signals", Wiley-IEEE Press, 2012.

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***SDG:4- Quality Education**
****SDG:9 – Build resilient infrastructure and foster innovation**
Assignment activity:
Assignment 1
Chart work and presentation on types of Radar.
Assignment 2
Implementation of simple antenna using Ansys HFSS
Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**INTRODUCTION TO RADAR**	
1.1	Basics of radar- applications of radar,	1
1.2	radar frequencies- radar block diagram, Radar Coordinates,	1
1.3	Radar equation for hard targets and the SNR-radar cross section of targets,	1
1.4	Radar Resolution Elements, Pulse CW	1
1.5	FMCW Radars–configurations	1
1.6	transmitter power- pulse repetition frequency, Duty Ratio, Pulse Compression	1
1.7	Design of radar system using MATLAB and Simulink	3
2	**DETECTION OF SIGNALS IN NOISE AND RADAR WAVEFORMS**	
2.1	Probabilities of detection and false alarm	1
2.2	matched filter receiver-detection criteria	1
2.3	integration of radar pulses	1
2.4	constant-false alarm rate receivers	1
2.5	Radar Waveforms,	1
2.6	Ambiguity Diagram.	1
2.7	Implementation of Matched filter for signal detector using MATLAB	3
3	**RADAR TRANSMITTER AND RECEIVER**	
3.1	Introduction- Types of Transmitters	1
3.2	linear-beam power tubes	1
3.3	solid-state RF power sources	1
3.4	magnetron- Klystron, crossed-filed amplifier	1
3.5	radar receiver- receiver noise figure- Digital Receivers,	1

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Tiruchengode - 637 215.

3.6	duplexers and receiver protectors- radar displays-Human Machine Interface (HMI).	1
3.7	Study the characteristics of microwave sources	3
4	**RADAR ANTENNA**	
4.1	Functions of radar antenna	1
4.2	antenna parameters- antenna radiation pattern and aperture illumination	1
4.3	reflector antennas- electronically steered phased array antennas- phase shifters	1
4.4	frequency - scan arrays	1
4.5	architectures for phased arrays	1
4.6	radiators for phased arrays- mechanically steered planar array antennas.	1
4.7	Design of phased array antennas using Ansys HFSS	3
5	**MTI AND PULSE DOPPLER RADAR**	
5.1	Introduction- delay –line cancellers staggered pulse repetition frequencies- doppler filter banks	2
5.2	digital MTI processing - Moving target detector	1
5.3	limitations to MTI performance pulse Doppler radar-MTD, tracking radar	1
5.4	monopulse tracking- conical scan and sequential lobing- comparison of trackers.	1
5.5	tracking accuracy-low-angle tracking- Atmospheric & Weather Radars.	1
5.6	Design and Implementation of Pulse-Doppler radar system using MATLAB	3
	Total	45

Course Designers

1. **Dr.P.Babu- pbabu@ksrct.ac.in**
2. **Mr.R.Satheeshkumar - satheeshkumar@ksrct.ac.in**

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60 EC E14	OPTICAL COMMUNICATION AND NETWORKS

Category	L	T	P	Credit
PE	2	0	2	3

Objective

- 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
- To enrich the idea of optical fiber networks such as SONET/SDH and optical components

Prerequisite

Electromagnetic fields

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Explain the basic concepts of optical communication	Remember, Understand, Apply
CO2	Analyze the different kind of losses& signal degradation in optical waveguides	Remember, Understand, Apply
CO3	Explain about the optical sources and coupling techniques	Remember, Understand, Apply
CO4	Explain the fiber optic receiver operation and parametric measurement techniques	Remember, Understand, Apply
CO5	Describe the basic concepts of different optical components and optical networks.	Remember, Understand, Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

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Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	30	30
Understand (Un)	30	30	50	50
Apply (Ap)	10	10	20	20
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 EC E 14 – OPTICAL COMMUNICATION AND NETWORKS								
B.E. Electronics and Communication Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100

INTRODUCTION TO OPTICAL FIBERS **Element of an Optical Fiber Transmission link*, Ray Optics*,** Optical Fiber Modes and Configurations– Single Mode Fibers – Graded Index fiber structure, Fiber fabrication techniques. **Hands on:** Analog transmission characteristics of fiber optic link	[6]
SIGNAL DEGRADATION IN OPTICAL FIBERS **Attenuation*** – Absorption losses, scattering losses, Bending Losses, Core and Cladding losses, Material Dispersion, Wave guide Dispersion, Intermodal dispersion– Pulse Broadening in GI fibers **Hands on:** Attenuation and numerical aperture measurement in optical fibers	[6]
FIBER OPTICAL SOURCES AND COUPLING **Optical sources***- LEDs and LASER diodes: structures, characteristics and quantum efficiency, Power launching and coupling, Fiber Alignment, Fiber Splicing. **Hands on:** PI characteristics of LED and LASER diodes	[6]
FIBER OPTICAL RECEIVERS AND MEASUREMENTS **PIN and APD*** - structure and working principles, noise in detectors, Optical receiver operation. Fiber optic measurements –attenuation, dispersion, refractive index profile and cut- off wave length **Hands on:** Gain characteristics of APD and photodiode	[6]
OPTICAL NETWORKS AND COMPONENTS **SONET and WDM optical networks****, optical couplers, filters, isolators, switches and amplifiers **Hands on:** Study of WDM using simulator	[6]
Total Hours:30+ 30(Practical)	60

Text Book(s):	
1.	Gerd Kaiser, 'Optical Fiber Communications', 5th Edition, Tata McGraw Hill Publishers, 2013.
2.	John M. Senior, 'Optical Fiber Communication', 3rd Edition, Pearson Education, 2009.
Reference(s):	
1.	Govind P. Agarval, 'Fiber-Optic Communication Systems', 4th Edition, John Wiley & Sons, 2010.

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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

***SDG:4- Quality Education**
****SDG:9 – Build resilient infrastructure and foster innovation**

Assignment Activity

Assignment 1

Chartwork and presentation on electromagnetic spectrum
Flipped class on comparison of single mode, multi-mode and graded index fiber**.**

Assignment 2

Case study on optical fiber attenuation loss
Flipped class on types of Dispersion

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**INTRODUCTION TO OPTICAL FIBERS**	
1.1	Element of an Optical Fiber Transmission link,	1
1.2	Ray Optics	1
1.3	Optical Fiber Modes and Configurations	1
1.4	Single Mode Fibers	1
1.5	Graded Index fiber structure	1
1.6	Fiber fabrication techniques.	1
1.7	**Hands on:** Analog transmission characteristics of fiber optic link	3
2	**SIGNAL DEGRADATION IN OPTICAL FIBERS**	
2.1	Attenuation – Absorption losses, scattering losses	1
2.2	Bending Losses, Core and Cladding losses	1
2.3	Material Dispersion	1
2.4	Wave guide Dispersion	1
2.5	Intermodal dispersion	1
2.6	Pulse Broadening in GI fibers	1
2.7	**Hands on:** Attenuation and numerical aperture measurement in optical fibers	3
3	**FIBER OPTICAL SOURCES AND COUPLING**	
3.1	Optical sources- LEDs structures, characteristics	1
3.2	LED quantum efficiency	1
3.3	LASER diodes: structures	1
3.4	characteristics and quantum efficiency	1

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3.5	Power launching and coupling	1
3.6	Fiber Alignment & Fiber Splicing	1
3.7	**Hands on:** PI characteristics of LED and LASER diodes	3
4	**FIBER OPTICAL RECEIVERS AND MEASUREMENTS**	
4.1	PIN - structure and working principles	1
4.2	APD - structure and working principles	1
4.3	Noise in detectors	1
4.4	Optical receiver operation	1
4.5	Fiber optic measurements –attenuation, dispersion	1
4.6	refractive index profile and cut- off wave length	1
4.7	**Hands on:** Gain characteristics of APD and photodiode	3
5	**OPTICAL NETWORKS AND COMPONENTS**	
5.1	SONET	2
5.2	WDM optical networks,	1
5.3	optical couplers	1
5.5	filters, isolators,	1
5.6	switches and amplifiers	1
5.7	**Hands on:** Study of WDM using simulator	3
	Total	60

Course Designers

1. **Mrs.S S Thamilselvi - sstamilselvi@ksrct.ac.in**
2. **Mr.R.Satheeshkumar - satheeshkumar@ksrct.ac.in**

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60 EC E15	CONSUMER ELECTRONICS

Category	L	T	P	Credit
PE	2	0	2	3

Objectives

- To learn the working principles of audio television systems.
- To study the principle of pervasive devices.
- To study the working principle of home and office system
- To become familiar with power supply and wireless device
- To become familiar with product safety and liability issues

Prerequisite

Basic knowledge of Electrical and Electronics Engineering

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Describe the working principles of basic audio and television system	Understand
CO2	Explain the functions of mobile phone	Apply
CO3	Explain the operating principles of home Appliances	Analyze
CO4	Describe the working principles of wireless devices	Understand
CO5	Discuss the safety issues and safety standards of electronic systems	Analyze

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model exam marks	End Sem Examination (Marks)
	1	2		
Remember (Re)	-	-	10	10
Understand (Un)	10	20	30	30
Apply (Ap)	20	10	20	20
Analyse (An)	20	20	20	20
Evaluate (Ev)	-	-	-	-
Create (Cr)	10	10	20	20
Total	60	60	100	100

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Department of ECE
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Tiruchengode - 637 215.

60 EC E15 – CONSUMER ELECTRONICS								
B.E.Electronics and Communication Engineering								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100

AUDIO AND TELEVISION SYSTEM* Microphones, Loud Speaker, - Digital sound recording on disc-Dolby systems, stereo amplifiers Principles of Television, Types of TV Camera and Picture tube, **Principle and working of HD TV, LCD TV, LED TV, cable TV, DTH and Set top box*** ** **Hands-on:** Exploring the Frequency Response of Microphones in Different Environments	[6]
PERVASIVE DEVICES* Mobile Phone: Elements, design – Mobile Information Architecture -– Types of mobile operating system- Android Overview– Preferences, the File System, the Options Menu and Intents. **Hands-on:** Identifying and replacing Speakers, Microphone and Vibration motor in mobile phones	[6]
HOME AND OFFICE SYSTEMS* Alexa Device, Digital camera system, Microwave oven, washing machine, Air Conditioners, Refrigerators, Construction and working principles of Inkjet Printer, Laser Printer. **Hands-on:** Test the working function of the printer	[6]
POWER SUPPLY AND WIRELESS DEVICES* Power Supplies SMPS/UPS – RFID, Ultrasonic remote transmitter, IR remote-control transmitter. Consumer IoT Devices-smart watches, smart glasses, and smart home technologies like text-controlled home appliances. **Hands-on:** Investigating the Range and Signal Strength of an IR Remote Transmitter.	[6]
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. **Hands-on:** EMI Debugging using Oscilloscopes for consumer electronics	[6]
Total hours: 30+30 (Practical)	**60**

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.

***SDG: 4- Quality Education**
****SDG: 11-Sustainable cities and communities**
*****SDG: 15- Life on Land**

Assignment Activity:

Assignment 1 - Covers Module 1 & 2 Questions related to the problems and simulation / Hands on

1. Frequency Response of Microphones
2. Seminar

Assignment 2 - Group discussion, case study, Mini Project

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

Course Contents and Lecture Schedule

S.No.	Topic	No. of Hours
1	**AUDIO AND TELEVISION SYSTEM**	
1.1	Microphones, Loud Speaker, - Digital sound recording on disc	1
1.2	Dolby systems, stereo amplifiers Principles of Television	1
1.3	Types of TV Camera and Picture tube	1
1.4	Principle and working of HD TV, LCD TV, LED TV	1
1.5	Cable TV DTH and Set top box	2
1.6	Exploring the Frequency Response of Microphones in Different Environments	3
2	**PERVASIVE DEVICES**	
2.1	Mobile Phone: Elements, design	1
2.2	Mobile Information Architecture	1
2.3	Types of mobile operating system	1
2.4	Android Overview	1
2.5	Preferences, the File System	1
2.6	Options Menu and Intents	1
2.7	Identifying and replacing Speakers, Microphone and Vibration motor in mobile phones	3
3	**HOME AND OFFICE SYSTEMS**	
3.1	Alexa	1
3.2	Digital camera system	1
3.3	Microwave oven	1
3.4	Washing machine	1
3.5	Air Conditioners, Refrigerators	1
3.6	Construction and working principles of Inkjet Printer, Laser Printer	1
3.7	Test the working function of the printer	3
4	**POWER SUPPLY AND WIRELESS DEVICES**	
4.1	Power Supplies SMPS/UPS	1
4.2	RFID, Ultrasonic remote transmitter	1
4.3	IR remote-control transmitter	1
4.4	Consumer IoT Devices-smart watches, smart glasses	1
4.5	Smart home technologies like text-controlled home appliances	2
4.6	Investigating the Range and Signal Strength of an IR Remote Transmitter	3
5	**COMPLIANCE**	
5.1	Product safety and liability issues	1
5.2	Standards related to electrical safety and standards related to fire hazards e.g.,UL and VDE	2
5.3	EMI/EMC requirements and design techniques for compliance	1
5.4	ESD, RF interference and immunity.	2
5.5	EMI Debugging using Oscilloscopes for consumer electronics	3
	Total	**45**

Course Designers

1. Dr.S.Malarkhodi - Dr.S.Malarkhodi@ksrct.ac.in

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60 EC E16	FOUNDATIONS OF DATA SCIENCE

Category	L	T	P	Credit
PE	2	0	2	3

Objective

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Define the data science process	Remember Understand
CO2	Understand different types of data description for data science process	Remember Understand Apply
CO3	Gain knowledge on relationships between data	Remember Understand Apply
CO4	Use the Python Libraries for Data Wrangling	Remember Understand Apply
CO5	Apply visualization Libraries in Python to interpret and explore data	Remember Understand Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3									3	3	
CO2	3	3	3	2	3				3	3	3	3	3	3	3
CO3	3	3	2	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 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

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Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	20	20
Understand (Un)	20	20	20	30
Apply (Ap)	20	20	60	50
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

K.S.Rangasamy College of Technology – Autonomous R 2022

60 EC E16 - FOUNDATIONS OF DATA SCIENCE

B.E.Electronics and Communication Engineering

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100

INTRODUCTION* Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.	[6]
DESCRIBING DATA* Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores. **Hands-on:** Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI	[6]
DESCRIBING RELATIONSHIPS* Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.	[6]
PYTHON LIBRARIES FOR DATA WRANGLING ** Basics of NumPy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables. **Hands-on:** • Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.	[6]
DATA VISUALIZATION** Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn. **Hands-on:** • Working with NumPy arrays, Pandas data frames, Basic plots using Matplotlib. Perform EDA on Wine Quality Data Set • Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report. • Perform Time Series Analysis and apply the various visualization techniques.	[6]
Total Hours: 30+30(Practical)	**60**

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Text book(s):	
1.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2.	Robert S. Witte and John S. Witte, “Statistics”, 11th Edition, Wiley Publications, 2017. (Units II and III)
Reference(s):	
1.	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V)
2.	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014
3.	Eric Pimpler, Data Visualization and Exploration with R, Geospatial Training service, 2017.
4.	Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020.

***SDG:4 - Quality Education**
****SDG:9 - Industry Innovation and Infrastructure**
Assignment Activity:
Assignment 1: simulation and report submission
Assignment 2: Miniproject and case study

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**INTRODUCTION**	
1.1	Data Science: Benefits and uses, facets of data	1
1.2	Data Science Process: Overview	1
1.3	Defining research goals, Retrieving data, Data preparation	1
1.4	Exploratory Data analysis, build the model, presenting findings and building applications	1
1.5	Data Mining, Data Warehousing	1
1.6	Basic Statistical descriptions of Data	1
2	**DESCRIBING DATA**	
2.1	Types of Data, Types of Variables	1
2.2	Describing Data with Tables and Graphs	1
2.3	Describing Data with Averages	1
2.4	Describing Variability	1
2.5	Normal Distributions and Standard (z) Scores	2
2.6	Hands on	2
3	**DESCRIBING RELATIONSHIPS**	
3.1	Correlation, Scatter plots	1
3.2	Correlation coefficient for quantitative data	1
3.3	Computational formula for correlation coefficient	1
3.4	Regression, regression line, least squares regression line	1
3.5	Standard error of estimate, interpretation of r2	1
3.6	Multiple regression equations, regression towards the mean	1

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4	**PYTHON LIBRARIES FOR DATA WRANGLING**	
4.1	Basics of Numpy arrays, aggregations	1
4.2	Computations on arrays, comparisons	1
4.3	Masks, boolean logic, fancy indexing	1
4.4	Structured arrays, Data manipulation with Pandas	1
4.5	Data indexing and selection, operating on data, missing data	1
4.6	Hierarchical indexing, combining datasets, aggregation and grouping, pivot tables	1
4.7	Hands on	4
5	**DATA VISUALIZATION**	
5.1	Importing Matplotlib, Line plots, Scatter plots	1
5.2	Visualizing errors, density and contour plots	1
5.3	Histograms, legends, colors	1
5.4	Subplots, text and annotation	1
5.5	Customization, three-dimensional plotting	1
5.6	Geographic Data with Basemap, Visualization with Seaborn	1
5.7	Hands on	9
	Total	45

Course Designers

1. **Mrs.K.Vanitha – vanitha@ksrct.ac.in**

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60 EC E21	HUMAN ASSIST DEVICES

Category	L	T	P	Credit
PE	3	0	0	3

Objective

- To understand the basic principles of assistive technology
- To learn technology and sensory Impairments.
- To explore assist devices for vital organs and advancements in technology
- To identify medical assist devices for disabled persons
- To study about recent techniques used in clinical applications

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Comprehend the assistive technology (AT) used for mobility	Remember Understand
CO2	Summarize the AT for sensory impairment of vision and hearing	Remember Understand
CO3	Uncover the assist devices for vital organs and advancements in AT	Remember Understand Apply
CO4	Describe the principles of medical assist devices	Remember Understand Apply
CO5	Discuss recent techniques used in clinical applications	Remember Understand Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3							2	3	3
CO2	3	3	2	3	3							2	3	3
CO3	3	3	3	3	2							2	3	3
CO4	3	3	3	3	2							2	3	2
CO5	3	3	2	3	3							2	3	2
3 - Strong;2 - Medium;1 - Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	30	10	10	10
Understand (Un)	30	10	20	20
Apply (Ap)	0	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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Syllabus

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60 EC E21 – HUMAN ASSIST DEVICES								
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	40	60	100

ASSISTIVE TECHNOLOGY FOR MOBILITY* Basic assessment and evaluation for mobility- Control systems, navigation in virtual space by wheelchairs- Wheel chair seating and pressure ulcers-Fuzzy logic expert system for automatic tuning of myoelectric prostheses - Intelligent prosthesis	[9]
ASSISTIVE TECHNOLOGY AND SENSORY IMPAIRMENTS * Visual and auditory impairment, assessment methods- Libraille, GRAB, mathematical Braille - Augmentative and alternative methods for hearing impairment- Use of multimedia technology to help hard of hearing children-Haptic as a substitute for vision	[9]
ASSIST DEVICES FOR VITAL ORGANS AND ADVANCEMENTS IN TECHNOLOGY * Cardiac assist devices, Intra-Aortic Balloon Pump (IABP),auxiliary ventricles - Dialysis for kidneys, Intermittent positive pressure breathing (IPPB) type assistance for lungs-Latest use of assistive technology for chronic heart diseases and healthcare- Information technology, telecommunications, new media in assisting healthcare- Future trends in assistive technology, virtual reality based training system for disabled children	[9]
MEDICAL ASSIST DEVICES* Functioning and different types of artificial heart-types of hemodialysis- wearable artificial kidney and its implantation-operating principle of ventilator-types of deafness and its hearing aids.	[9]
RECENT TRENDS* Transcutaneous electric nerve simulator, bio-feedback, Diagnostic and point-of –care devices	
Total Hours:	**45**

TextBook(s):

1	Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, “Clinical Engineering”, CRC Press, 1st Edition,2010.
2	Kenneth J. Turner, “Advances in Home Care Technologies: Results of the match Project”, Springer, 1st Edition, 2011.

Reference(s):

1	Gerr . M. Craddock “Assistive Technology-Shaping the future”, IOS Press, 1st Edition, 2003.
2	Marion. A. Hersh, Michael A. Johnson, “Assistive Technology for visually impaired and blind”, Springer Science & Business Media, 1st Edition, 2010.
3	Donald R. Peterson, Joseph D. Bronzino,” Medical Devices and Human Engineering” ,3rd Edition Three volume set, CRC press 2014.
4	Kenneth J. Turner, “Advances in Home Care Technologies: Results of the match Project”, Springer, 1st Edition, 2011.

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***SDG:3- Good Health and Well Being**

Assignment Activity:

Assignment 1

Module 1 & 2:

- Questions on mobility assistive devices, fuzzy logic systems.
- Poster presentation on sensory impairments

Assignment 2

Module 3,4 & 5:

- Explanatory questions on assistive devices and technologies in replace of vital organs
- Case studies on recent trends in point of care devices

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**ASSISTIVE TECHNOLOGY FOR MOBILITY**	
1.1	Basic assessment and evaluation modality	2
1.2	Control systems	1
1.3	navigation in virtual space by wheelchairs modality	1
1.4	Wheel chair seating and pressure ulcers	2
1.5	Fuzzy logic expert system for automatic tuning of myoelectric prostheses	2
1.6	Intelligent prosthesis	1
2	**ASSISTIVE TECHNOLOGY AND SENSORY IMPAIRMENTS**	
2.1	Visual and auditory impairment	1
2.2	assessment methods	1
2.3	Libraille	1
2.4	GRAB	1
2.5	mathematical Braille	1
2.6	Augmentative and alternative methods for hearing impairment	2
2.7	Use of multimedia technology to help hard of hearing children	1
2.8	Haptic as a substitute for vision	1
3	**ASSIST DEVICES FOR VITAL ORGANS AND ADVANCEMENTS IN TECHNOLOGY**	
3.1	Cardiac assist devices	1
3.2	Intra-Aortic Balloon Pump (IABP)	1
3.3	auxiliary ventricles	1
3.4	Dialysis for kidneys	1
3.5	Intermittent positive pressure breathing (IPPB) type assistance for lungs	1
3.6	Latest use of assistive technology for chronic heart diseases and healthcare	1
3.7	Information technology, telecommunications, new media in assisting	1

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	healthcare	
3.8	Future trends in assistive technology	1
3.9	virtual reality based training system for disabled children	1
4	**MEDICAL ASSIST DEVICES**	
4.1	Functioning and different types of artificial heart	2
4.2	types of hemodialysis	2
4.3	wearable artificial kidney and its implantation	2
4.4	operating principle of ventilator	2
4.5	types of deafness and its hearing aids	1
5	**RECENT TRENDS**	
5.1	Transcutaneous electric nerve simulator,	2
5.2	bio-feedback	2
5.3	Diagnostic and point-of –care devices	5
	Total	45

Course Designers

1. **Mrs.K.Gogila Devi –gogiladevi@ksrct.ac.in**

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60 EC E22	IOT PRODUCT DEVELOPMENT

Category	L	T	P	Credit
PE	2	0	2	3

Objective

- To Identifying and Gathering comprehensive requirements for IoT products
- To Acquire skills in Schematic Block Designing
- To gain proficiency in designing PCB layouts
- To develop proficiency in "3D Modelling" and "Designing" of enclosures
- To develop skills in debugging and functional verification of IoT products

Prerequisite

Electronic devices and circuits, Basics of C Programming, IoT Hardware

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Demonstrate comprehensive understanding of the IoT product development process	Understand Analyze
CO2	Proficiently execute the entire schematic design process	Analyze Apply
CO3	Demonstrate proficiency in PCB Designing and prototyping	Analyze Apply, Create
CO4	Demonstrate proficiency in 3D modeling and 3D printing	Analyze Apply, Create
CO5	Demonstrate competence in IoT hardware Programming	Create Evaluate

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3							2	3	3
CO2	3	3	2	3	3							2	3	3
CO3	3	3	3	3	2							2	3	3
CO4	3	3	3	3	2							2	3	2
CO5	3	3	2	3	3							2	3	2
3 - Strong;2 - Medium;1 - Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	-	-	-
Understand (Un)	10	-	-	10
Apply (Ap)	40	10	10	20
Analyze (An)	0	10	20	10
Evaluate (Ev)	0	20	20	10
Create (Cr)	0	20	50	50
Total	60	60	100	100

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Syllabus

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60 EC E22- IoT Product Development								
B.E.Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	2	0	2	60	3	50	50	100

IOT PRODUCT REQUIREMENT ANALYSIS * Identifying and Gathering Requirements, Requirements Specification and documentation, Validation and verification of requirements, Managing Requirement Changes, Requirements for IoT Security and	[6]
SCHEMATIC DESIGN FOR IOT PRODUCT * Schematic block designing, Components selection, Datasheet analysis, Schematic designing, Simulation and verification, Schematic validation	[6]
PCB DESIGN FOR IOT PRODUCT * PCB design requirements, PCB grade and fabrication capability settings, IPC Standards, PCB designing, EMI and EMC Compliance, PCB prototyping, assembling of components, Testing of prototype PCB	[6]
ENCLOSER DESIGNING * Encloser design requirements, 3D modelling and designing, encloser design validation, 3D printing. Assembling of prototype with encloser	[6]
PROGRAMMING AND TESTING ** Choosing of compiler, Programming standards, Functional Embedded C programming and debugging, Functional verification	[6]
Total hours= 30+30(practical)	**60**

Text book(s):	
1.	Dave Shackleford, "IoT Security: A Guide for IT and Security Professionals", 1st Edition, O'Reilly Media, 2015.
2.	Simon Monk, Paul Scherz, 'Practical Electronics for Inventors", 4th Edition McGraw-Hill Education, , 2016.
3.	C. P. Wong, "Printed Circuit Board Basics for Non-Engineers", 3rd Edition, Wiley-IEEE Press, 2018.
Reference(s):	
1.	Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufmann, "Internet of Things: Principles and Paradigms", 1st Edition.2016.
2.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Cisco Press, 2017.

*** SDG 9 - Industry, Innovation, and Infrastructure**
**** SDG 4 - Quality Education**

Assignment Activity:

Assignment-1
Designing a Secure IoT Device (50 marks)
Assignment-2
Designing and Prototyping an Embedded System (50 marks)

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**IoT product requirement analysis**	
1.1	Identifying and Gathering Requirements	1
1.2	Requirements Specification and documentation	1
1.3	Validation and verification of requirements	1
1.4	Managing Requirement Changes	1
1.5	Requirements for IoT Security and Privacy	2

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2	**Schematic design for IoT product**	
2.1	Schematic block designing	1
2.2	Components selection	1
2.3	Datasheet analysis	1
2.4	Schematic designing	1
2.5	Simulation and verification	1
2.6	Schematic validation	1
3	**PCB design for IoT Product**	
3.1	PCB design requirements,	1
3.2	PCB grade and fabrication capability settings	1
3.3	EMI and EMC Compliance, IPC Standards	1
3.4	PCB designing	1
3.5	PCB prototyping, assembling of components	1
3.6	Testing of prototype PCB	1
4	**Encloser designing**	
4.1	Encloser design requirements	1
4.2	3D modelling and designing	2
4.3	Encloser design validation	1
4.4	3D printing	1
4.5	Assembling of prototype with encloser	1
5	**REAL TIME OPERATING SYSTEMS**	
5.1	Choosing of compiler, Programming standards	1
5.2	Functional Embedded C programming and debugging	4
5.3	Functional verification	1
	Total	30+ Hands on

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in
2. Mr.K.Raguvaran – raguvaran@ksrct.ac.in

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60 EC E23	AVIONICS SYSTEMS

Category	L	T	P	Credit
PE	3	0	0	3

Objectives

- To impart knowledge on fundamentals of avionics and power systems.
- To impart knowledge on radio navigation systems.
- To impart knowledge, understand the flight instruments.
- To impart knowledge on the concepts of power plant systems, recorders.
- To impart knowledge on different advanced radar systems.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the power supply systems, sources, generation, distribution systems and navigation systems.	Remember, Understand
CO2	Articulate the position, speed, direction of the object, warning and collision avoidance systems.	Remember, Understand
CO3	State the various flight instruments and its working.	Remember, Understand
CO4	Describe the different communication systems, control systems, recorders.	Remember, Understand
CO5	Explain the advanced radar systems used in avionics.	Remember, Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2						3	3	3	
CO2	3	3	3	2	2	2						3	3	2	
CO3	3	3	3	3	1	2						3	2	3	
CO4	2	3	3	2	2	1						2	2	1	
CO5	3	3	2	2	2	1						2	2	2	

3 - Strong;2 - Medium;1 – Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	12	12	20	20
Understand (Un)	48	48	80	80
Apply (Ap)	0	0	0	0
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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Syllabus

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60 EC E23 - AVIONICS 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	40	60	100

INTRODUCTION TO FLIGHT-THEORY OF FLIGHT AND CONTROL SURFACES Brief about Avionics - Evolution of Avionics - Brief about various Avionic systems on board an aircraft - Power supply systems-Electrical Power Sources-Power generation and distribution systems - Navigation Systems-Electrical Navigation Systems- Compasses, Inertial Navigation Systems (INS)	[9]
RADIO NAVIGATION SYSTEMS Automatic Direction Finder (ADF) -Global Positioning System (GPS) -Very High Frequency Omni-Range (VOR)-Instrument Landing System (ILS) -Air Traffic Control System (ATC) -Distance Measuring Equipment (DME) -Ground Proximity Warning System (GPWS)-Traffic Collision Avoidance System (TCAS)- Weather Radar **Hands on: Simulation of GPS receiver model**	[9]
FLIGHT INSTRUMENTS * Air Data Systems/ Computers (ADS/ADC), Pitot Static Systems-Air Speed Indicator (ASI)- Vertical Speed Indicator (VSI)-Barometric Altimeters-Radio Altimeters-Artificial Horizon or Attitude Indicator-Flight Directors (FD)	[9]
POWER PLANT SYSTEMS* Communication systems-VHF, HF, Data-link, Voice scramblers - Automatic Flight Control Systems (AFCS)-Automatic Flight Guidance Systems (AFGS)-Autopilot - Miscellaneous Systems-Collision Avoidance Systems (CAS), Flight Data Recorders (FDR), Cockpit Voice Recorders (CVR) - Space avionics-Challenges in design Model-Based Design of Safety-Critical Avionics Systems	[9]
ADVANCED RADAR SYSTEMS* Helmet Mounted Target Designation System (HMTDS)-Full Authority Digital Engine (or electronics) Control (FADEC)-Avionics of Unmanned Aerial Vehicles (UAV) - All Electric Aircraft-Design of In-flight Entertainment Systems **Hands on: Verification of Avionics Systems Using Simulink Test and Simulink Real-Time**	[9]
Total Hours:	**45**

Text Book(s):	
1.	Dr Albert Helfrick, "Principles of Avionics", 8th Edition, Avionics Communications, 2015.
Reference(s):	
1.	Ian Moir and Allan Seabridge, "Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration", 3rd Edition, Wiley, 2011.
2.	RPG Collinson, "Introduction to Avionics Systems", 3rd Edition, Springer, Jun 2011
3.	E H J Pallett, "Aircraft Instruments and Integrated Systems", 1st Edition, Avionics Communications, 1992.

***SDG:4- Quality Education**

Assignment activity:

Assignment 1 – Covers Module 1 & 2

- Power generation and distribution systems, Navigation Systems, Electrical Navigation Systems.
- Instrument Landing System (ILS), Air Traffic Control System (ATC).

Assignment 2 – Covers Module 3, 4 & 5

- Barometric Altimeters, Radio Altimeters.
- Flight Data Recorders (FDR), Cockpit Voice Recorders (CVR).

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- Full Authority Digital Engine (or electronics) Control (FADEC), Avionics of Unmanned Aerial Vehicles (UAV)

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
INTRODUCTION TO FLIGHT-THEORY OF FLIGHT AND CONTROL SURFACES		
1.1	Brief about Avionics - Evolution of Avionics	1
1.2	Brief about various Avionic systems on board an aircraft	1
1.3	Power supply systems	1
1.4	Electrical Power Sources	1
1.5	Power generation and distribution systems	1
1.6	Navigation Systems	1
1.7	Electrical Navigation Systems	1
1.8	Inertial Navigation Systems	2
RADIO NAVIGATION SYSTEMS		
2.1	Automatic Direction Finder (ADF)	1
2.2	Global Positioning System (GPS)	1
2.3	Very High Frequency Omni-Range (VOR)	1
2.4	Instrument Landing System (ILS)	1
2.5	Air Traffic Control System (ATC)	1
2.6	Distance Measuring Equipment (DME)	1
2.7	Ground Proximity Warning System (GPWS)	1
2.8	Traffic Collision Avoidance System (TCAS)	1
2.9	Weather Radar	1
FLIGHT INSTRUMENTS		
3.1	Air Data Systems/ Computers (ADS/ADC)	2
3.2	Pitot Static Systems	1
3.3	Air Speed Indicator (ASI)	1
3.4	Vertical Speed Indicator (VSI)	1
3.5	Barometric Altimeters-Radio	1
3.6	Altimeters	1
3.7	Artificial Horizon or Attitude Indicator	1
3.8	Flight Directors (FD)	1
POWER PLANT SYSTEMS		
4.1	Communication systems-VHF, HF, Data-link, Voice scramblers	1
4.2	Automatic Flight Control Systems (AFCS)	1
4.3	Automatic Flight Guidance Systems (AFGS)	1
4.4	Autopilot	1
4.5	Miscellaneous Systems-Collision Avoidance Systems (CAS)	1
4.6	Flight Data Recorders (FDR)	1
4.7	Cockpit Voice Recorders (CVR)	1

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4.8	Space avionics	1
4.9	Challenges in design	1
ADVANCED RADAR SYSTEMS		
5.1	Helmet Mounted Target Designation System (HMTDS)	2
5.2	Full Authority Digital Engine (or electronics) Control (FADEC)	2
5.3	Avionics of Unmanned Aerial Vehicles (UAV)	2
5.4	All Electric Aircraft	1
5.5	Design of In-flight Entertainment Systems	2
	Total	45

Course Designers

1. **Mr S.Pradeep**

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60 EC E24	OPTOELECTRONIC DEVICES

Category	L	T	P	Credit
PE	3	0	0	3

Objective

- 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

Prerequisite

Electronic Devices

Course Outcomes

On the successful completion of the course, Students will be able to

CO1	Illustrate the concept of light wave theory and solid state physics	Remember Understand Apply
CO2	Describe the operation of various display devices	Remember Understand Apply Analyze
CO3	Describe the working principle of optical detection devices	Remember Understand Apply
CO4	Outline The construction and properties of optical modulator and Optoelectronic Devices, And Identify their applications	Remember Understand Apply Analyze
CO5	Acquire the knowledge of optoelectronic integrated circuits and guided wave devices	Remember Understand Apply Analyze

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2									3	3	
CO2	3	3	3	2									3	3	
CO3	3	3	2	2				3	3	3		3	3	3	3
CO4	3	2	2	2									3	3	
CO5	3	3	3	3									3	3	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	20	20
Understand (Un)	35	40	60	60
Apply (Ap)	10	10	10	10
Analyze (An)	5	0	10	10
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0

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Tiruchengode - 637 215.

Total	60	60	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 EC E24 – OPTOELECTRONIC DEVICES								
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	40	60	100

ELEMENTS OF LIGHT AND SOLID STATE PHYSICS Wave nature of light, Polarization, Interference, Diffraction, Quantum mechanical concept, Band structure and carrier effective masses, Scattering and carrier motilities, 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, Detector performance	[9]
OPTOELECTRONIC MODULATORS AND SWITCHES** Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto optic devices, Acoustic 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', 2nd Edition, Prentice Hall of India Pvt., Ltd., New Delhi, 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', Prentice Hall of India, 2014.**

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***SDG: 7- Affordable and clean energy**
****SDG: 9 - Sustainable industrialization and foster innovation**
Assignment activity:

Assignment 1 – Covers Module 1 & 2 Questions related

1. To make a video by all students related to Optoelectronics real time application and upload in you tube link.
2. Flipped class activity for both modules.

Assignment 2- Covers Module 3 and 4 Questions related to simulation / Hands on

1. Photo detector, Thermal detector, Photo Devices, Photo Conductors, Switching and Logic Devices

Assignment 2

1. Industrial visit related to Optoelectronics Devices Company**.**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**ELEMENTS OF LIGHT AND SOLID STATE PHYSICS**	
1.1	Wave nature of light	1
1.2	Polarization	1
1.3	Interference	1
1.4	Diffraction	1
1.5	Quantum mechanical concept	1
1.6	Band structure and carrier effective masses	1
1.7	Scattering and carrier motilities	1
1.8	Semiconductors statistics	1
1.9	Carrier recombination	1
2	**DISPLAY DEVICES AND LASERS**	
2.1	Introduction, Photo Luminescence	1
2.2	Cathode Luminescence	1
2.3	Electro Luminescence, Injection Luminescence	1
2.4	LED, Plasma Display	1
2.5	Liquid Crystal Displays, Numeric Displays	1
2.6	Laser Emission, Absorption, Radiation, Population Inversion	1
2.7	Optical Feedback, Threshold condition	1
2.8	Laser Modes, Classes of lasers	1
2.9	laser applications	1
3	**OPTICAL DETECTION DEVICES**	
3.1	Photo detector	2
3.2	Thermal detector	2
3.3	Photo Devices	2
3.4	Photo Conductors	2
3.5	Detector performance	1
4	**OPTOELECTRONIC MODULATORS AND SWITCHES**	

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4.1	Introduction, Analog and Digital Modulation	2
4.2	Electro-optic modulators	2
4.3	Magneto optic devices	2
4.4	Acoustic devices	2
4.5	Optical, Switching and Logic Devices	1
5	**OPTOELECTRONIC INTEGRATED CIRCUITS**	
5.1	Introduction, hybrid and Monolithic Integration	2
5.2	Application of Opto Electronic Integrated Circuits	2
5.3	Integrated transmitters	2
5.4	Integrated Receivers	2
5.5	Guided wave devices	1
	Total	45

Course Designers

1.Mrs.M.Devaki devaki@ksrct.ac.in

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60 EC E25	WIRELESS BROAD BAND NETWORKS

Category	L	T	P	Credit
PE	3	0	0	3

Objectives

- To familiarize High Speed Networks
- To learn different wireless LAN network technologies and its application
- To know the various protocols in broadband networks
- To learn the basics of 5G and Beyond Wireless communication
- To learn about the layer level functionalities in interconnecting networks

Prerequisite

- Computer Networks, Wireless Communication

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Discuss the concept of ISDN and frame relay in high speed networks	Remember, Understand
CO2	Describe the architecture of high-speed WLAN technologies	Remember, Understand, Apply
CO3	Illustrate the concepts of various protocols in wireless networks	Remember, Understand, Apply
CO4	Explore the current generation (5G and beyond) network architecture	Remember, Understand, Analyze
CO5	Explain the interconnecting network functionalities by layer level functions	Remember, Understand

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										3	3	
CO2	3	3	3										3	3	
CO3	3	3	3										3	3	
CO4	3	3	3					3	3	3			3	3	3
CO5	3	3	3										3	3	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Marks (100)	End Sem Examination (Marks)
	1	2		
Remember (Re)	12	10	20	20
Understand (Un)	38	40	60	60
Apply (Ap)	10	05	15	20
Analyse (An)	-	05	05	-
Evalute (Ev)	-	-	-	-
Create (Cr)	-	-	-	-
Total	60	60	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EC E25– WIRELESS BROAD BAND NETWORKS								
B.E.Electronics and Communication Engineering								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

HIGH SPEED NETWORKS ISDN: Conceptual view – Standards – Transmission structure – B-ISDN standards and services, protocol architecture-Frame Relay Networks, Call control – LAPF – Frame Relay Congestion Control – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL	[9]
WIRELESS BROADBAND* Local broad band and Ad hoc networks, Introduction –Different versions of IEEE 802.11 standard, Protocol Architecture of WLAN, WLAN technologies: applications, requirements– Hiper LAN: WATM, BRAN, HiperLAN2 – WiMAX Technology protocol and application of Technology, 6LoWPAN, Wireless HART.	[9]
WIRELESS PROTOCOLS Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IP mobility management, – Mobile transport layer-TCP congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements-Indirect TCP, snooping TCP, Mobile TCP. Congestion control in ATM, mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP	[9]
5G AND BEYOND** 5G Roadmap – 5G Architecture – IoT and context awareness - Networking reconfiguration and virtualization support – Mobility QoS control – emerging approach for resource over provisioning, small cells for 5G mobile networks- capacity limits and achievable gains with densification – Mobile data demand, Demand Vs Capacity, and 5G future directions with AI-6G Key Enablers.	[9]
LAYER-LEVEL FUNCTION AND QOS Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme - frame structure, resource structure, mapping, synchronization, reference signals and channel estimation, interference cancellation – CoMP, Carrier aggregation, Services - multimedia broadcast/multicast, location-based services. QoS issues in broadband communication, A case study of broadband service regulations for maintaining QoS by telecom regulatory bodies such as TRAI.	[9]
Total hours	**45**

Text book(s):	
1.	R. Vannithamby and S. Talwar, 'Towards 5G: Applications, Requirements and Candidate Technologies', John Willey & Sons, West Sussex, 2017.
2.	Clint Smith,P.E, Dannel Collins, '3G Wireless Networks', 2nd Edition, Tata McGraw Hill, , 2011.
3.	Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", John Wiley, 2015.
Reference(s):	
1.	Sassan Ahmadi, 'LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies', Elsevier, 2014.
2.	William Stallings, 'ISDN and Broadband ISDN with Frame Relay and ATM', 4th Edition, PHI, 2004.
3.	M. Vaezi, Z. Ding, and H. V. Poor, 'Multiple Access techniques for 5G Wireless Networks and Beyond', Springer Nature, Switzerland, 2019.
4.	Erik Dahlman, Stefan Parkvall, Johan Sko¨ld, '5G NR: The Next Generation Wireless Access Technology', 1st Edition, Elsevier, 2016.

*** SDG:9 - Sustainable industrialization and foster innovation**
****SDG:10 - Reduce inequality within and among countries**

Assignment Activity:
Covers Module 1 &2 Questions related to the problems and simulation / Hands on

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Assignment 1 - Case study, Poster Presentation
Assignment 2 - Group discussion and simulation

Course Contents and Lecture Schedule

S.No.	Topic	No. of Hours
1	**HIGH SPEED NETWORKS**	
1.1	ISDN: Conceptual view – Standards – Transmission structure	2
1.2	B-ISDN standards and services, protocol architecture	1
1.3	Frame Relay Networks, Call control – LAPF	2
1.4	Frame Relay Congestion Control	1
1.5	Asynchronous transfer mode – ATM Protocol Architecture	1
1.6	ATM logical Connection, ATM Cell	1
1.7	ATM Service Categories – AAL	1
2	**WIRELESS BROADBAND**	
2.1	Local broad band and Ad hoc networks, Introduction	1
2.2	Different versions of IEEE 802.11 standard, Protocol Architecture of WLAN	2
2.3	WLAN technologies: applications, requirements	1
2.4	Hiper LAN: WATM, BRAN	2
2.5	WiMAX Technology protocol and application of Technology	1
2.6	6LoWPAN, Wireless HART	1
3	**WIRELESS PROTOCOLS**	
3.1	Mobile network layer- Fundamentals of Mobile IP	1
3.2	Data forwarding procedures in mobile IP	1
3.3	IPv6	1
3.4	IP mobility management, IP addressing	1
3.5	DHCP, Mobile transport layer	1
3.6	TCP congestion control, slow start, fast recovery/fast retransmission	1
3.7	Classical TCP improvements-Indirect TCP, snooping TCP	1
3.8	Mobile TCP. mobile ad-hoc network	1
3.9	Routing: Destination Sequence distance vector, IoT: CoAP	1
4	**5G AND BEYOND**	
4.1	5G Roadmap – 5G Architecture	1
4.2	IoT and context awareness -Networking reconfiguration and virtualization support	2
4.3	Mobility QoS control – emerging approach for resource over provisioning	2
4.4	Small cells for 5G mobile networks	1
4.5	Capacity limits and achievable gains with densification	1
4.6	Mobile data demand, Demand Vs Capacity	1
4.7	Small cell challenges, and 5G future directions with AI	1
5	**LAYER-LEVEL FUNCTION AND QOS**	
5.1	Characteristics of wireless channels - downlink physical layer	1

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5.2	Uplink physical layer, MAC scheme - frame structure	2
5.3	Resource structure, mapping, synchronization	2
5.4	Reference signals and channel estimation	1
5.5	CoMP, Carrier aggregation	1
5.6	Services - multimedia broadcast/multicast	1
5.7	Location-based services	1
5.8	QoS	1
	Total	45

Course Designers

1. Ms.R.Ramya – rramya@ksrct.ac.in

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60 EC E26	DIGITAL IMAGE PROCESSING

Category	L	T	P	Credit
PE	3	0	0	3

Objectives

- 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

Pre requisite

Basic knowledge of Electrical and Electronics Engineering

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Describe the fundamentals of Digital image	Understand
CO2	Discuss image enhancement techniques in spatial domain	Apply
CO3	Analyse image restoration through various filters	Analyze
CO4	Explain the concepts of segmentation	Understand
CO5	Discuss the algorithms for lossy and lossless compression	Analyze

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	-	-	10	10
Understand (Un)	10	20	30	30
Apply (Ap)	20	10	20	20
Analyse (An)	20	20	20	20
Evaluate (Ev)	-	-	-	-
Create (Cr)	10	10	20	20

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 EC E26 – 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	40	60	100

DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS* Steps in Digital Image Processing – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT. **Hands on:** Image fundamentals.	[9]
IMAGE ENHANCEMENT** Basic gray level transformations – Histogram processing – Histogram matching –spatial filtering – smoothing spatial filters – sharpening spatial filters- Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement. **Hands on:** 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. **Hands on:** Statistics Filters	[9]
IMAGE SEGMENTATION* Edge detection – Thresholding – Region Based segmentation Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, **Segmentation by morphological watersheds.***** **Hands on:** Image Segmentation	[9]
IMAGE COMPRESSION AND RECOGNITION* Need for data compression, Huffman, Run Length Encoding codes, Arithmetic coding, JPEG standard, Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes** - Recognition based on matching. **Hands on:** Image Compression.	[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.

***SDG: 4- Quality Education**
****SDG: 8-Decent work and economic growth**
*****SDG: 11- Sustainable cities and communities**

Assignment activity:

Assignment 1 - Covers Module 1 & 2 Questions related to the problems and simulation / Hands on

1. Image enhancement using spatial filtering
2. Histogram equalization of Images

Assignment 2 - Group discussion, case study, seminar

Course Contents and Lecture Schedule

S.No.	Topic	No. of Hours

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1.0	**DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS**	
1.1	Steps in Digital Image Processing	1
1.2	Elements of Visual Perception	1
1.3	Image Sensing and Acquisition	1
1.4	Image Sampling and Quantization	1
1.5	Relationships between pixels	1
1.6	Color image fundamentals	1
1.7	RGB, HSI models,	1
1.8	Two-dimensional mathematical preliminaries	1
1.9	2D transforms - DFT, DCT	1
2.0	**IMAGE ENHANCEMENT**	
2.1	Basic gray level transformations	2
2.2	Histogram processing	1
2.3	Histogram matching	1
2.4	spatial filtering	1
2.5	smoothing spatial filters	1
2.6	sharpening spatial filters	1
2.7	Homomorphic filtering	1
2.8	Color image enhancement	1
3.0	**RESTORATION**	
3.1	Model of the image degradation / Restoration process	1
3.2	Mean filters	1
3.3	Order statistics filters	2
3.4	Adaptive filters	1
3.5	Inverse filtering	1
3.6	minimum mean square error filtering	1
3.7	constrained least squares filtering	1
3.8	Geometric mean filter	1
4.0	**IMAGE SEGMENTATION**	
4.1	Edge detection	1
4.2	Thresholding	1
4.3	Region Based segmentation Region based segmentation	1
4.4	Region growing	1
4.5	Region splitting and merging	1
4.6	Morphological processing	1
4.7	erosion and dilation	1
4.8	Segmentation by morphological watersheds	2
5.0	**IMAGE COMPRESSION AND RECOGNITION**	
5.1	Need for data compression,	1
5.2	Huffman, Run Length Encoding codes	1
5.3	Arithmetic coding	1
5.4	JPEG standard, Boundary representation	1
5.5	Boundary description,	1
5.6	Fourier Descriptor, Regional Descriptors	1
5.7	Topological feature, Texture	1
5.8	Patterns and Pattern classes	1
5.9	Recognition based on matching	1
	Total	**45**

Course Designers

1. Dr.S.Malarkhodi - Dr.S.Malarkhodi@ksrct.ac.in

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60 EC L01	INTERNET OF THINGS

Category	L	T	P	Credit
OE	2	0	2	3

Objective

- To understand basics of an IOT System
- To understand and Evaluate sensors available for IoT applications
- To analysis best IoT hardware and communication protocols for specified applications
- To understand and realize data storage, data analysis for IoT applications
- To design and develop real time IoT enabled applications

Prerequisite

Microprocessors and Microcontrollers, Basics of C Programming

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand basic premise of an IOT System	Understand
CO2	Describe the functionality of sensors and apply the concept learned	Understand, Apply
CO3	Apply the front-end hardware platforms and communication protocols for IoT	Understand, Apply
CO4	Understand cloud storage, data analysis and management	Understand, Apply
CO5	Evaluate the real time IoT enabled applications	Understand, Apply, Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	2	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3- Strong;2-Medium;1-Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Understand (Un)	35	20	55
Apply (Ap)	25	20	45
Analyse (An)	0	10	10
Create (Cr)	0	10	10

Syllabus

Passed in BoS Meeting held on 18/11/2023
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K.S.Rangasamy College of Technology – Autonomous R2022								
60 EC L01 - INTERNET OF THINGS								
OPEN ELECTIVE								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
	2	0	2	60	3	50	50	100

Introduction to IoT * Functional blocks of an IoT system (Sensors, Data Aggregation, Communication, Analysis, Decision making, Actuation) Basic of Physical and logical design of IoT, IoT enabled domains, M2M, Difference between IoT, Embedded Systems and M2M, Industry 4.0 concepts	[6]
IoT sensors and hardware * Passive and active sensors, Different kinds of sensors (Temperature, humidity, pressure, obstacle, water flow, accelerometer, colour, gyro, load cell, finger print, motion, ultrasonic distance, magnetic vibration, eye blink, hear beat, PPG, glucose, body position, blood pressure), IoT front end hardware, Programming ESP32, Interfacing of sensors	[6]
Introduction to IoT protocols* Infrastructure (6LowPAN, IPv4/IPv6, RPL), Identification (EPC, uCode, IPv6, URIs), Communication/ Transport (Wi-Fi, Bluetooth, ZigBee, LPWAN), Data Protocols (MQTT, CoAP, AMQP, WebSocket, Node), Programming MQTT	[6]
IoT Cloud and data analytics * Collecting data from sensors, Data Ingress, Cloud storage, IoT cloud platforms (Amazon AWS, Microsoft Azure, Google APIs), Data analytics for IoT, Software and management tool for IoT, Dashboard design	[6]
IoT and Entrepreneurship* Business models for IoT product, Lean canvas, Market analysis, Startup policy and fundings, **Idea pitching****, Entity formation, Legal and IPR	[6]
Total Hours=30+30(Practical)	**60**

Text book(s):	
1.	Arshdeep Bahga, Vijay Madisetti, Internet – of- Things – A Hands on Approach, Universities Press, 2015
2.	Raj kamal, Internet of Things, Architecture and Design Principles, McGraw-Hill, 2017
Reference(s):	
1.	Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014
2.	Adrian McEwen & Hakim Cassimally, “Designing the Internet of Things”, Wiley,Nov 2013

***SDG 9 – Industry, Innovation and Infrastructure**

****SDG 8 – Decent work and economic growth**

Assignment Activity:

Assignment 1 – Mini project, report submission and presentation

Assignment 2 – Mini project, report submission and presentation

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Introduction to IoT**	
1.1	Functional blocks of an IoT system (Sensors, Data Aggregation)	1
1.2	Communication, Analysis, Decision making, Actuation	2
1.3	Basic of Physical and logical design of IoT	2
1.4	IoT enabled domains	1

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Approved in Academic Council Meeting held on 23/12/2023

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

1.5	M2M, Difference between IoT, Embedded Systems and M2M	2
1.6	Industry 4.0 concepts.	1
2	**IoT sensors and hardware**	
2.1	Passive and active sensors, Different kinds of sensors	1
2.2	Temperature, humidity, pressure, obstacle, water flow,	1
2.3	accelerometer, colour, gyro, load cell, finger print, motion, ultrasonic distance, magnetic vibration,	1
2.4	eye blink, hear beat, PPG, glucose, body position, blood pressure	1
2.5	IoT front end hardware	1
	Programming ESP32, Interfacing of sensors	4
3	**Introduction to IoT protocols**	
3.1	Infrastructure (6LowPAN, IPv4/IPv6, RPL), Identification (EPC, uCode, IPv6, URIs),	2
3.2	Communication/ Transport (Wi-Fi, Bluetooth, ZigBee, LPWAN),	1
3.3	Data Protocols (MQTT, CoAP, AMQP, Websocket, Node),	2
3.4	Programming MQTT	4
4	**IoT Cloud and data analytics**	
4.1	Collecting data from sensors, Data Ingress,	2
4.2	Cloud storage, IoT cloud platforms (Amazon AWS, Microsoft Azure, Google APIs)	2
4.3	Data analytics for IoT	1
4.4	Software and management tool for IoT	1
4.5	Dashboard design	3
5	**IoT and Entrepreneurship**	
5.1	Business models for IoT product	1
5.2	Lean canvas	1
5.3	Market analysis, Startup policy and fundings	1
5.4	Idea pitching	3
5.5	Entity formation	1
5.6	Legal and IPR	2
	Total	75

Course Designers

1. Dr.C.Rajasekaran – rajasekaran@ksrct.ac.in
2. Mr.K.Raguvaran – raguvaran@ksrct.ac.in

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Approved in Academic Council Meeting held on 23/12/2023

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

60 EC L02	WEARABLE DEVICES

Category	L	T	P	Credit
OE	3	0	0	3

Objectives

- 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

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Discuss the history, current devices used as wearables and their applications	Remember, Understand
CO2	Describe the key functions and basic principles of various components and technologies used in wearable devices	Remember, Apply, Analyze.
CO3	Analyze the development process and design considerations in wearable products	Remember, Understand, Apply.
CO4	Review security and privacy issues in wearable technology	Remember, Understand, Apply
CO5	Explore the psychological and social impact, health concerns related to wearable devices	Remember, Understand, Apply, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	15	10	20	20
Understand (Un)	30	35	10	10
Apply (Ap)	15	15	60	60
Analyze (An)	0	0	10	10

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC L02 –Wearable Devices

OPEN ELECTIVE

	Hours / Week			Total hrs	credit	Maximum Marks		
	L	T	P		3	CA	ES	Total
	3	0	0	45		40	60	100

Introduction Evolution of wearable technology Role of Wearables, Applications of wearable Technology in industry sectors' overview, Wearables: challenges and opportunities, future and research, Wearable Biomedical Devices and Its Applications Case Study: Google glass, Health monitoring.	[9]
Components and Technologies Introduction, Components and Technologies: Microcontrollers and microprocessors, Operating systems, Sensors, Wireless connectivity unit, Battery technology, user interface elements, Artificial intelligence, Machine learning, IoT, 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.	Sandeep K.S. Gupta,Tridib Mukherjee, Krishna Kumar Venkatasubramanian, 'Body Area Networks Safety, Security, and Sustainability,' Cambridge University Press, 2013.
4.	Edward Sazonov, Michael R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications" Elsevier, 2014.

***SDG:3 – Good Health and Well Being**

Assignment activity:

Assignment 1- Case study, Poster Presentation

Assignment 2- Group discussion and Mini project, Case study

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

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
	Introduction	
1.1	Evolution of wearable technology Role of Wearables	1
1.2	Applications of wearable Technology in industry sectors' overview	1
1.3	Wearables: challenges and opportunities	1
1.4	Future and research	1
1.5	Wearable Biomedical Devices and Its Applications	1
1.6	Case Study: Google glass	2
1.7	Case Study: Health monitoring	2
	Components and Technologies	
2.1	Introduction, Components and Technologies	1
2.2	Microcontrollers and microprocessors	1
2.3	Operating systems, Sensors	1
2.4	Wireless connectivity unit, Battery technology	1
2.5	User interface elements	1
2.6	Artificial intelligence, Machine learning	2
2.7	IoT, Data mining	1
2.8	Virtual and augmented reality	1
2.9	Voice recognition	1
	Product Development and Design Considerations	
3.1	Introduction, Product development process	1
3.2	Engineering analysis	2
3.3	Prototyping	1
3.4	Testing and validation, Production	1
3.5	Design considerations- Various factors and requirements	2
3.6	Operational, Power packaging and material	2
3.7	Maintenance	1
	Security Issues and Privacy Concerns	
4.1	Introduction	1
4.2	Security and privacy issues in wearable technology	2
4.3	Potential solutions	3
4.4	Product case examples	1
	Psychological and Social Impact, Health Concern	
5.1	Psychological effects of wearables	1
5.2	Social implications	1
5.3	Technology acceptance factors	1
5.4	Electromagnetic radiation, Specific absorption rate,	2
5.5	Thermal effects, Cancer	1
5.6	Fertility, Vision and sleep disorder	2

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

5.7	Pain and discomfort, Electromagnetic intolerance and other risks.	1
	Total	45

Course Designers

1. **Ms.R.Ramya**

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

60 EC L03	PATTERN RECOGNITION AND MACHINE LEARNING

Category	L	T	P	Credit
OE	3	0	0	3

Objective

- To introduce the pattern recognition and machine learning concepts,
- To learn about linear discriminant functions and tree classifiers,
- To study about parametric and non- parametric techniques based on Bayesian decision theory,
- To study about unsupervised learning methods,
- To study classifier ensembles and graphical models

Prerequisite

Probability and Random processes

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Learn the basics of pattern recognition and machine learning	Remember, Understand
CO2	Explore discriminative classifiers and tree classifiers	Apply
CO3	Study the parametric and non- parametric techniques based on Bayesian decision theory,	Apply, Analyse
CO4	Learn about unsupervised methods	Understand, Apply
CO5	Study about classifier ensembles and graphical models	Understand, Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2									3		
CO2	3	3	3	3	3				3	3	3		3	3	3
CO3	3	3	3	3	3								3		
CO4	3	3	3	3					3	3	3		3	3	3
CO5	3	3	3	3					3	3	3		3	3	3

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	35
Apply	30	25	35
Analyse	0	5	10
Evaluate	0	0	0

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Create	0	0	0

Syllabus

.K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC L03 - PATTERN RECOGNITION AND MACHINE LEARNING

OPEN ELECTIVE

	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	40	60	100

Introduction to Pattern Recognition* Design cycle, Learning and Adaptation, Examples, Probability Distributions, Parametric Learning - Maximum Likelihood and Bayesian Decision Theory –BAYES rule, Discriminant Functions, Loss Functions, Bayesian Error Analysis, Problems and Applications.	[9]
Linear discriminant and tree classifiers* Tree classifiers: Decision Trees: CART, C4.5, ID3, Random Forests, Bayesian Decision Theory, Linear Discriminants Discriminative Classifiers: The Decision Boundary, Separability, Perceptrons and **Support Vector Machines**.**	[9]
Parametric Techniques & Non-Parametric Techniques* Parametric Techniques: Maximum Likelihood Estimation, Bayesian Parameter Estimation, Non-Parametric Techniques: Kernel Density Estimators, Parzen Window and Nearest Neighbor Method.	[9]
Unsupervised Methods* Component Analysis and Dimension Reduction: The Curse of Dimensionality, Principal Component Analysis, Fisher Linear Discriminant**, Clustering: K-Means****, Expectation Maximization, fuzzy k-means and hierarchical clustering.	[9]
Ensembling & Graphical Models* Ensembles: Bagging, Boosting – AdaBoost, Graphical Models: Bayesian Networks, Sequential Models, State-Space Models, **Hidden Markov Models**** and Dynamic Bayesian Networks.	[9]
Hands on: 1. Image classification using SVM classifier 2. Object detection by clustering 3. Hidden Markov model simulation	
Total Hours:	**45**

Text Book(s):

1.	Richard O.Duda Peter E.Hart, David G.Stork, " Pattern Classification", 2nd Edition John Wiley & amp; Sons,
2	Bishop, C. M. Pattern Recognition and Machine Learning. Springer. 2006

Reference(s):

1.	Trevor Hastie, Robert Tibshirani, Jerome H.Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2017
2.	Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2009
3.	Marsland, S. Machine Learning: An Algorithmic Perspective. CRC Press. 2015

***SDG 4: Quality education**

****SDG 9: Industry, Innovation and Infrastructure**

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

Assignment activity:

Assignment 1- case study, Problem solving, Mini Project

Assignment 2- Mini Project and Problem solving

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Introduction to Pattern Recognition:**	
1.1	Design cycle	1
1.2	Learning and Adaptation, Examples.	1
1.3	Probability Distributions	1
1.4	Parametric Learning - Maximum Likelihood and Bayesian Decision Theory	1
1.5	BAYES rule	2
1.6	Discriminant Functions, Loss Functions	2
1.7	Bayesian Error Analysis, Problems and Applications	1
2	**Linear discriminant and tree classifiers**	
2.1	Tree classifiers: Decision Trees:	1
2.2	CART,	1
2.3	C4.5, ID3	1
2.4	Random Forests	1
2.5	Bayesian Decision Theory	1
2.6	Linear Discriminants Discriminative Classifiers: the Decision Boundary , Separability	2
2.7	Perceptrons	1
2.8	Support Vector Machines	1
3	**Parametric Techniques & Non-Parametric Techniques**	
3.1	Parametric Techniques: Maximum Likelihood Estimation	2
3.2	Bayesian Parameter Estimation	1
3.3	Non-Parametric Techniques	1
3.4	Kernel Density Estimators	2
3.5	Parzen Window	1
3.6	Nearest Neighbor Method	2
4	**Unsupervised Methods**	
4.1	Component Analysis and Dimension Reduction	1
4.2	The Curse of Dimensionality	1
4.3	Principal Component Analysis	2
4.4	Fisher Linear Discriminant	1
4.5	Clustering: K-Means	1
4.6	Expectation Maximization	1
4.7	fuzzy k-means	1
4.8	hierarchical clustering	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

5	**Ensembling & Graphical Models**	
5.1	Ensembles: Bagging, Boosting –	2
5.2	AdaBoost,	1
5.3	Graphical Models	1
5.4	Bayesian Networks	1
5.5	Sequential Models	1
5.6	State-Space Models	1
5.7	Hidden Markov Models	1
5.8	Dynamic Bayesian Networks	1

Course Designers

1. Mrs.S.S.Thamilselvi - sstamilselvi@ksrct.ac.in

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Tiruchengode - 637 215.

60 EC L04	NEXT GENERATION WIRELESS NETWORKS

Category	L	T	P	Credit
OE	3	0	0	3

Objectives

- To study about advanced wireless networks, 4G/5G
- To study about SDN basics and architecture
- To study about NFV basics and architecture
- To study about Network Slicing & Radio access network
- To understand the recent trends and various applications in Next generation wireless networks

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Illustrate the principles of latest 4G/5G networks	Remember, Understand
CO2	Explain the SDN basics and architecture	Remember, Understand
CO3	Describe the NFV basics and architecture	Remember, Understand
CO4	Discuss about the concepts of Network Slicing & Radio access network	Remember, Understand
CO5	Illustrate the recent trends and various applications in Next generation wireless networks	Remember, Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 - Strong; 2 - Medium; 1 – Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	20	20
Understand (Un)	40	40	40	80

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Apply (Ap)	0	0	0	0
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC L04 – NEXT GENERATION WIRELESS NETWORKS

OPEN ELECTIVE

	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	40	60	100

Introduction 3G and 4G(LTE) overview- Introduction to 5G - Evolving LTE to 5G Capability- 5G NR and 5G core network (5GCN) - 5G Standardization – 5G architecture - Spectrum for 5G – 5G deployment - Options, Challenges and Applications.	[9]
Software-defined networking* Introduction-SDN Origins and Evolution, -Background on Implantation of SDN for 5G-Hybrid architecture of SDN and SDR-SDN based network configuration to deliver content intelligently over LTE.	[9]
Network functions virtualization* Network functions virtualization basics- features of NFV-NFV and SDN Relationship-NFV Architecture, Evolution & background -NFV layers and architecture	[9]
Network Slicing & Radio access network* Introduction to Network slicing-key concepts- Architecture overview- Benefits of 5G infrastructure in Network slicing, architecture, advantages, and challenges of the Cloud (or Centralized) RAN (C-RAN) and the Virtualized RAN (V-RAN).	[9]
Recent Trends and applications* Massive IoT and ultra-low-latency applications, Narrow-Band IoT (NB-IoT) and machine to machine (M2M) communications, 6G applications - unmanned aerial vehicles (UAV), optical wireless communication (OWC).	[9]
Hands on: 1. Implementation of Time division multiplexing. 2. Implementation of CDMA. 3. Modeling a 4G LTE system.	
Total Hours:	**45**

Text Book(s):	
1.	Saad Z. Asif, “5G Mobile Communications Concepts and Technologies”, CRC Press, 1st Edition, 2019.
2	Ulrich Trick, “An Introduction to the 5th Generation Mobile Networks”, Walter de Gruyter ,2021
Reference(s):	
1.	Afif osseiran, Jose .F. Monserrat , Patrick marsch “5G Mobile and wireless communications technology “Cambridge university, 2016
2.	Ying Zhang “Network Function Virtualization: Concepts and Applicability in 5G Networks” , John Wiley & Sons, 2018

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Approved in Academic Council Meeting held on 23/12/2023

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

3.	Guy Pujolle ”Software Networks: Virtualization, SDN, 5G and Security” , John Wiley & Sons, 2015

***SDG:9 - Build resilient infrastructure and foster innovation**

Assignment activity:

Assignment 1

- Chart work and presentation on Electromagnetic spectrum.
- Implementation of SDN using Matlab & Simulink.

Assignment 2

Mini project on M2M communication.

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
	Introduction	
1.1	3G and 4G(LTE) overview	1
1.2	Introduction to 5G	1
1.3	Evolving LTE to 5G Capability	1
1.4	5G NR and 5G core network (5GCN)	1
1.5	5G Standardization	1
1.6	5G architecture	1
1.7	Spectrum for 5G	1
1.8	5G deployment	1
1.9	Options, Challenges and Applications.	1
	Software-defined networking	
2.1	Introduction	1
2.2	SDN Origins	1
2.3	SDN Evolution	1
2.4	Background on Implantation of SDN for 5G	1
2.5	Hybrid architecture of SDN and SDR	1
2.6	Hybrid architecture of SDN and SDR	1
2.7	SDN based network configuration to deliver content intelligently over LTE.	1
2.8	SDN based network configuration to deliver content intelligently over LTE.	1
2.9	Applications	1
	Network functions virtualization	
3.1	Network functions virtualization basics	1
3.2	features of NFV	1
3.3	NFV and SDN Relationship	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

3.4	NFV Architecture	1
3.5	NFV-MANO	1
3.6	Evolution & background	1
3.7	NFV layers	1
3.8	NFV Infrastructure	1
3.9	Applications	1
	Network Slicing & Radio access network	
4.1	Introduction to Network slicing	1
4.2	key concepts	1
4.3	Architecture overview	1
4.4	Benefits of 5G infrastructure in Network slicing,	1
4.5	architecture	1
4.6	Radio access network	1
4.7	advantages, and challenges of the Cloud (or Centralized) RAN	1
4.8	Architecture CRAN	1
4.9	Virtualized RAN (V-RAN).	1
	Recent Trends and applications	
5.1	Massive IoT	1
5.2	ultra-low-latency applications	1
5.3	Narrow-Band IoT (NB-IoT)	1
5.4	machine to machine (M2M) communications	1
5.5	Architecture	1
5.6	6G applications	1
5.7	unmanned aerial vehicles (UAV),	1
5.8	Optical wireless communication (OWC).	1
5.9	Use cases	1
	Total (45)	45

Course Designer

1. **Mr R.Satheesh kumar**

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Approved in Academic Council Meeting held on 23/12/2023

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

60 EC L05	MICROPROCESSORS AND MICROCONTROLLERS

Category	L	T	P	Credit
OE	3	0	0	3

Objectives

- 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

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply the concept of 8 bit microprocessor and develop the assembly language program using 8085 microprocessor	Remember, Understand, Apply
CO2	Learn about Interface and configure the peripheral IC's with 8085 microprocessor.	Remember, Understand, Apply
CO3	Describe the operation of 8051 microcontroller and develop the assembly Language program using 8051 microcontroller.	Remember, Apply, Analyze.
CO4	Apply the interfacing design of peripherals like I/O, A/D, D/A, timer etc.	Remember, Understand, Apply
CO5	Develop the 8051 microcontroller based system for various applications.	Remember, Understand, Apply, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3							2	3	3	
CO2	3	3	3	3	3							2	3	3	
CO3	3	3	3	3	3							2	3	3	
CO4	3	3	3	3	3							2	3	3	
CO5	3	3	3	3	3			3	3	3		2	3	3	3

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

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Approved in Academic Council Meeting held on 23/12/2023

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

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	10	10
Apply (Ap)	30	20	60	60
Analyze (An)	10	20	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC L05- MICROPROCESSORS AND MICROCONTROLLERS

OPEN ELECTIVE

	Hours / Week				Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	40	60	100

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]

Hands on:

1. Simulation of 16 bit addition using 8085 microprocessor
2. Simulation of multiplication and division of 8051 microcontroller
3. Simulation of motor interfacing with microprocessor and microcontroller.

Total Hours 45

Text Book(s):

1. Ramesh S Gaonkar, 'Microprocessor Architecture, Programming and application with 8085', 6thEdition, 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

Passed in BoS Meeting held on 18/11/2023

Approved in Academic Council Meeting held on 23/12/2023

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

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
3.	A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 12th Reprint, 2009.

***SDG 4: Quality education**

****SDG 9: Industry, Innovation and Infrastructure**

Assignment activity:

Assignment 1:

1. Simulation of arithmetic and logical program for 8085.
2. Seminar /poster presentation

Assignment 2:

Mini project

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
8085 Microprocessor		
1.1	8085 Introduction	1
1.2	8085 Internal Architecture	1
1.3	Addressing modes	1
1.4	Instruction set	1
1.5	Assembly language Programming	1
1.6	Machine cycles with states	1
1.7	Machine cycles with timing diagram Interrupts	1
1.8	Interfacing memory	1
1.9	I/O devices	1
Peripherals Interfacing		
2.1	Programmable Peripheral Interface (PPI 8255)	1
2.2	Programmable Interval Timer (PIT 8253)	1
2.3	8259 Programmable Interrupt Controller	1
2.4	Keyboard controller (8279)	1
2.5	Display controller (8279)	1
2.6	Interfacing serial I /O (8251)	2
2.7	ADC interfacing	1
2.8	DAC interfacing	1

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Approved in Academic Council Meeting held on 23/12/2023

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

8051 Microcontroller		
3.1	8051 Architecture	1
3.2	Memory organization	1
3.3	Addressing modes	1
3.4	Instruction set	1
3.5	Microcontroller hardware	1
3.6	I/O pins and ports	1
3.7	Assembly language programming	2
3.8	I/O port programming	1
8051 Peripheral and its Programming		
4.1	Interrupts	1
4.2	Counters	1
4.3	Timers	2
4.4	Timer and counter programming	1
4.5	Serial Communication	1
4.6	Interrupt programming	2
4.7	ADC, DAC and sensor interfacing	1
UNIT V 8051 Applications		
5.1	LCD and Keyboard Interfacing	1
5.2	RTC Interfacing and programming	1
5.3	Stepper motor and DC motor interfacing	1
5.4	Case study: Temperature monitoring system	1
5.5	Turbine monitoring system	1
5.6	traffic light control	1
5.7	washing machine control	1
5.8	Automotive applications	1
5.9	Closed loop process control	1
	Total	45

Course Designers

1. **Dr T.Baranidharan**

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Approved in Academic Council Meeting held on 23/12/2023

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60 EC L06	5G TECHNOLOGY AND MIMO

Category	L	T	P	Credit
OE	3	0	0	3

Objectives

- 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 Massive MIMO for 5G.
- Learn the different 5G applications and its security.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Recall the basic concepts of Wireless communication.	Remember, Understand
CO2	Illustrate the cellular concepts of 5G mobile Communication.	Remember, Understand.
CO3	Contrast the concepts of different multiple access techniques and MIMO techniques.	Remember, Understand
CO4	Illustrate the Massive MIMO of 5G technology.	Remember, Understand
CO5	Outline the concepts of 5G Application and Security.	Remember, Understand, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

3 - Strong; 2 - Medium; 1 – Some

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Tiruchengode - 637 215.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	15	15	25	25
Understand (Un)	35	35	65	65
Apply (Ap)	0	0	0	0
Analyze (An)	10	10	10	10
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC L06 - 5G TECHNOLOGY AND MIMO

OPEN ELECTIVE

	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	40	60	100

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, OFDM, filter banks, GFDM, OTFS, packet radio, non-orthogonal multiple accesses (NOMA).	[9]
MIMO* Point-to-point MIMO, Virtual MIMO (relaying), multiuse MIMO, Massive MIMO, propagation channel model, channel estimation, uplink and downlink data transmission capacity bounds, achievable rate, energy and spectral efficiency trade-off.	[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, Indoor and Outdoor positioning accuracy technologies, enhanced Mobile Broadband (eMBB)	[9]

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

Hands on: 1. Simulation of Time Division Multiple Access 2. Simulation of Space Division Multiple Access 3. MIMO Wireless System Design for 5G using MATLAB **4.** 5G Waveforms generation using MATLAB	
Total Hours	**45**

Text Book(s):	
1.	Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock, 'Millimeter Wave Wireless
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.	Martin Sauter, 'From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband', Wiley-Blackwell, 2016.

***SDG 4: Quality education**

****SDG 9: Industry, Innovation and Infrastructure**

Assignment activity:

Questions related to the simulation / Hands on/chart preparation

Assignment 1 – Covers Module 1 &2;

1. Electromagnetic spectrum- chart preparation
2. Multiplexing- simulation

Assignment 2 - Covers Module 3 &4;

1. FDMA, TDMA, CDMA, SDMA, OFDM- simulation
2. Case study-5G Apllications

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
	Introduction	
1.1	General communication systems	1
1.2	Main classification of signals	1
1.3	Frequency and wavelength	1
1.4	Bandwidth	1
1.5	Half duplex and full duplex	1
1.6	Transmission lines	1
1.7	MODEM, Multiplexing	1
1.8	Electromagnetic spectrum	1
1.9	Evaluation of mobile technologies 1G to 4G	1

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Approved in Academic Council Meeting held on 23/12/2023

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

Cellular concepts		
2.1	Introduction, Frequency reuse-system architecture	1
2.2	Hand off -interference & system capacity	1
2.3	Reflection-diffraction	1
2.4	Scattering-fading	1
2.5	Coverage and capacity improvement	2
2.6	Cell splitting-sectoring	1
2.7	Repeaters	1
2.8	Microcell zone concepts	1
Multiple Access Techniques		
3.1	Introduction to multiple access	1
3.2	FDMA, TDMA	1
3.3	CDMA	1
3.4	SDMA	1
3.5	Filter banks	1
3.6	GFDM	1
3.7	OTFS	1
3.8	Packet radio	1
3.9	Non-orthogonal multiple accesses (NOMA).	1
MIMO		
4.1	Point-to-point MIMO	1
4.2	Virtual MIMO (relaying)	1
4.3	Multiuse MIMO	1
4.4	Massive MIMO	1
4.5	Propagation channel model	1
4.6	Channel estimation	1
4.7	Uplink and downlink data transmission capacity bounds	1
4.8	Achievable rate	1
4.9	Energy and spectral efficiency trade-off	1
5G Applications		
5.1	High speed mobile network	1
5.2	Device-to-device (D2D)	1
5.3	Vehicle to vehicle communication (V2V)	1
5.4	Vehicle to infrastructure communication (V2I)	1
5.5	Smart home, Smart cities	1
5.6	Industrial IOT	1
5.7	Security and surveillance	1
5.8	Indoor and Outdoor positioning accuracy technologies	1
5.9	enhanced Mobile Broadband (eMBB)	1
	Total	45

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Approved in Academic Council Meeting held on 23/12/2023

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Course Designers

1. **Mr K.Rajasekar**

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Tiruchengode - 637 215.

60 EC L07	MOBILE ROBOTICS

Category	L	T	P	Credit
OE	3	0	0	3

Objectives

- 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

Prerequisite

Robotics

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Know about the Robot Locomotion	Remember, Understand Apply,
CO2	Gain knowledge about Kinematics and Dynamics of Mobile Robots	Remember, Apply, Analyze.
CO3	Learn about the Sensors and GPS	Remember, Understand, Apply.
CO4	Describe about the Localization and Planning of Robots	Remember, Apply, Analyze.
CO5	Acquire good knowledge on Navigation	Remember, Understand, Apply, Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3							2	3	2	
CO2	3	3	3	3	3							2	3	2	
CO3	3	3	3	3	2							2	3	2	
CO4	3	3	3	3	3							2	3	2	
CO5	3	3	3	3	2							2	3	2	

3 - Strong; 2 - Medium; 1 – Some

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Tiruchengode - 637 215.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	30	30
Understand (Un)	20	20	30	30
Apply (Ap)	10	10	20	20
Analyze (An)	10	10	20	20
Evaluate (Ev)	-	-	-	-
Create (Cr)	-	-	-	-
Total	60	60	100	100

Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022

60 EC L07- MOBILE ROBOTICS

OPEN ELECTIVE

	Hours / Week				Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	40	60	100

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,	[9]
Localization* Odometric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon systems	[9]
Introduction to Planning and Navigation* 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]
Hands on: 1. Motion Planning in Mobile Robots 2. Sensor Simulation of a robot 3. simultaneous localization and mapping (SLAM) 4. Fault Detection and Recovery 5. Check the transient response of RL, RC and RLC circuits. 6. Reinforcement Learning: Using simulation environments to train and evaluate	
Total Hours	**45**
Text Book(s):	

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

1.	R. Siegwart, I. R. Nourbakhsh, “Introduction to Autonomous Mobile Robots”, The MIT Press, 2017.
2	Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tracts in 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., and Fox, D., Probabilistic Robotics. MIT Press, Cambridge, MA, 2017.
3.	Melgar, E. R., Diez, C. C., Arduino and Kinect Projects: Design, Build, Blow Their Minds, 2016.

***SDG 9: Industry, Innovation and Infrastructure**

Assignment activity:

Assignment 1

Create the actual framework of your mobile robot with open-source CAD software, which includes components like as wheels, motors, sensors, and any other required pieces.

Assignment 2

Provide a simulation of a real-world application in which GPS and navigation are crucial to improving the autonomy and performance of mobile robotics. Examine the limits and potential future improvements in GPS-based navigation for mobile robotics.

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
	ROBOT LOCOMOTION	
1.1	Introduction to Robot locomotion	1
1.2	Hopping robots	2
1.3	Legged robots	2
1.4	Wheeled robots	2
1.5	Stability, maneuverability, controllability	2
	MOBILE ROBOT KINEMATICS AND DYNAMICS	
2.1	Introduction Mobile robot kinematics and dynamics	1
2.2	Forward and inverse kinematics,	2
2.3	Holonomic and nonholonomic constraints,	2
2.4	Kinematic models of simple car and legged robots,	2
2.5	Dynamics simulation of mobile robots;	1
	PERCEPTION	
3.1	Perception	1
3.2	Proprioceptive/Exteroceptive and passive/active sensors	1
3.3	Performance measures of sensors	1
3.4	Sensors for mobile robots	1
3.5	Global positioning system (GPS)	1

Passed in BoS Meeting held on 18/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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

3.6	Doppler effect-based sensors	1
3.7	Vision-based sensors	1
3.8	Uncertainty in sensing	1
3.9	Filtering	1
LOCALIZATION		
4.1	Localization	1
4.2	Odometric position estimation	1
4.3	Belief representation	1
4.4	Probabilistic mapping	1
4.5	Markov localization	1
4.6	Bayesian localization	2
4.7	Kalman localization	1
4.8	Positioning beacon systems	1
INTRODUCTION TO PLANNING AND NAVIGATION		
5.1	Introduction to planning and navigation	1
5.2	Path planning algorithms based on A-star	1
5.3	Dijkstra	1
5.4	Voronoi diagrams	1
5.5	Probabilistic roadmaps (PRM)	2
5.6	Rapidly exploring random trees (RRT)	1
5.7	Markov Decision Processes (MDP)	1
5.8	Stochastic dynamic programming (SDP)	1
	Total	45

Course Designers

1. Mr D.Mugilan

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Approved in Academic Council Meeting held on 23/12/2023

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