K.S. Rangasamy College of Technology

(Autonomous)

CURRICULUM & SYLLABI

of

B.E. Mechanical Engineering

(For the batch admitted in 2025 – 2026)

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 MECHANICAL ENGINEEIRNG

VISION OF THE DEPARTMENT

- To be a leader in providing skill sets for globally competent Engineers, Researchers, Entrepreneurs and Managers in Mechanical Engineering domain.

MISSION OF THE DEPARTMENT

- To offer quality education through experiential learning using ICT tools and socially –relevant projects.
- To engage Faculty and Students in fundamental, heavy engineering and applied research related to energy, environment and safety concerns.
- To groom students to venture into successful entrepreneurs and managers

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: **Professional Competency**: Graduates of the programme will adapt to emerging technological challenges with core competence in mechanical engineering domain.

PEO2: **Employability and Entrepreneurship**: Graduate of the programme will exhibit their technical knowledge and skills to secure suitable positions in technological organizations and to become entrepreneurs

PEO3: **Higher Education and Research**: Graduates of the programme will pursue advanced studies in thrust areas of mechanical engineering to carryout scientific and industrial research to meet/satisfy current requirements in respective sectors ethically

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 modeling to complex engineering activities with an understanding of the limitations

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

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO1: Use modern tools in the design, analysis and manufacturing of mechanical components and systems.
PSO2: Solve multidisciplinary problems in manufacturing and allied industries.
PSO3: Adopt creative and innovative approaches to address real- time industrial challenges.

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

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

Programme Educational Objectives (PEO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PEO 1	3	1	3	2	2	1	1	1	2	2	3	1	3	3	3
PEO 2	3	3	3	2	2	1	1	1	2	2	3	1	3	3	2
PEO 3	3	2	3	2	2	1	1	1	3	2	3	1	3	2	3

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

Year	Sem.	Course Name	POs												PSOs		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	Professional English - I								2	3	3	2	3	2	2	3
		Matrices and Calculus	3	2			2									3	
		Engineering Physics	3							2		2					
		Chemistry for Mechanical Sciences	3	2.2											2.3	2.3	2
		Basic Electrical and Electronics Engineering	2.6	2.8	1.7	1.7	2	2	2.3	1.5	2	2	2	2.3	2		3
		Heritage of Tamils (தமிழர் மரபு)							3	3		2		3			
		Physics and Chemistry Laboratory	3							2	2						
		Basic Electrical and Electronics Engineering Laboratory	3	3	3	3	2	2	2	2.5	2	2	3	3	3	2	
	II	Professional English - II								2	3	3	2	3	2.4	2	3
		Integrals, Partial Differential Equations and Laplace Transform	3	2			2									3	
		C Programming	3	3	3		3				2	2		2	3	3	
		Engineering Drawing	3	2.8	3										2.8	2.8	
		Engineering Mechanics	3	3	2.8		3			3					3	2.8	
		Environmental Studies and Climate Change	2.8	2	2	2	2.3	2.5	2.6	2				2	2	3	
		Tamils and Technology							3	3		2		3			

		(தமிழரும் தொழில்நுட்பமும்)															
		Fabrication and Reverse Engineering Laboratory	3	2	3			2	2		3			3		3	3
		Computer Aided Drafting	3	3	3		3			3					3	3	
		C Programming Laboratory	3	3	3		3				2	2		2	3	3	
		Career Skill Development - I								2	3	3	2	3		2	2
II	III	Statistics and Numerical Methods	3	2			2									3	
		Electrical Drives and Control	3	3	2	2	3	2		2	2	2	2	2	2.4	2	2
		Engineering Materials and Metallurgy	3	2.6	2.5	2.5										2.7	2.5
		Strength of Materials	3	2.8	2.6		3			3					3	3	
		Thermodynamics	3	2.8	2.6		2.5							2.5	2.5	3	2.5
		Manufacturing Techniques	3	2.4	2.6			3	3					2.6	3	2.6	
		Universal Human Values*						3	3	3	2.8	3	2	3			
		Electrical Drives and Control Laboratory	3	3	2.6	3	2.4	2	2	2	2	2	2	2.4	2.4	2	2
		Computer Aided Machine Drawing Laboratory	3	3			2.6	2.5		2.7	2.5	2.7	2.5	2.5	2.4	2.4	3
		Career Skill Development - II								2	3	3	2	3	2	2	2
		Internship#															
	IV	Fluid Mechanics and Fluid Machines	3	3	3		3			3					2.5		
		Machining Processes	3	2.8	2.8		3	3	3			3		3	3	3	
		Kinematics of Machines	3	3	3	3	3								3		
		Thermal Engineering	3	3	3	3	3	3				3		3	3		3
		Engineering Metrology	3	2.8		3	3	3	3			3		3	3		
		Applied Hydraulics and Pneumatics	3	3	3		3			3	3				3	3	3
		Open Elective – I															
		Strength of Materials and Fluid Machinery Laboratory	3	3	3		3				3	3	3		2.5		
		Manufacturing and Machining Processes Laboratory	3		2.8	3	3	3		3	3			2.8		3	
		Career Skill Development - III	2.6	2.6	2.6	2.8		2.4				2	3	3	2.4	2	
		Internship#															
III	V	Automobile Engineering	3								2	2		2			2
		Dynamics of Machines	3	3	3		3								3	3	3
		Design of Machine Elements	3	3	3	3	2.7			2.7				3	3	3	3

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		Professional Elective -I															
		Open Elective - II															
		Startups and Entrepreneurship	2.8	2.6	3	2.4	2.2	2.5	1.66	1.75	1.33	2	2.2	2.4	2.8	2.6	-
		Thermal Engineering Laboratory	3	2	2.6			3	3	3	3	3		2	2	3	
		Metrology and Dynamics Laboratory	3		3	3				3	3	3			3	3	3
		Design Thinking and Innovation Laboratory	3	3	3	3				3	3	3		3	2.4	2.3	3
		Career Skill Development - IV								2	3	3	2	3		2	2.8
		Internship#															
	VI	Heat and Mass Transfer	3	3	2	2	1							2	3	2.6	
		Finite Element Analysis	3	3	3	3	3			3	3	3			3	3	3
		Design of Mechanical Transmission Systems	3	3	3	3	1			1				1	2.4	1.8	1
		Professional Elective – II															
		Professional Elective – III															
		Open Elective - III															
		Heat Transfer Laboratory	3	2	2.6			3	3	3	3	3		2	2	3	
		Analysis and Simulation Laboratory	3	3	3	3	3			3	3	3			3	3	3
		Design Thinking and Product Development laboratory															
		Comprehension Test	3	3	2	2					1	2	2	3		3	2.6
		Internship#															
IV	VII	Machine Learning	2.8	2.6	2.8	2.8	2.8						2.6	2.2	2.4	1.4	2
		Mechatronics and Robotics	2.8	2.6	2.4	2.4						2.2		2.8		2.6	2.8
		Operations Research	2.8	2.6	2.8	2.6							2.6	2.6		2.5	2.6
		Total Quality Management	3	2.5			2.5	2.6	2.5	3	2.5	2.7		3	2.6	2.5	
		Professional Elective – IV															
		Research Skill Development	2	2	2	2	3	2	2	3	3	3		3	2.8		3
		NCC/NSS/NSO/YRC /RRC/Fine Arts%															
		Mechatronics Laboratory	2.4	2.6			3				2				2.4	2.6	3

		Project Work - Phase I	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Internship#															
	VIII	Professional Elective – V															
		Project Work – Phase II	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Internship#															

K.S. RANGASAMY COLLEGE OF TECHNOLOGY

Credit Distribution for B.E (MECH) Programme – 2024 –2025 Batch

S. No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1	HS	2	2	-	-	-	-	3	-	**7**	**04.26**
2	BS	12	4	4	-	-	-	-	-	**20**	**12.19**
3	ES	5	15	5	-	-	-	-	-	**25**	**15.24**
4	PC	-	-	14	23	15	15	11	-	**78**	**47.56**
5	PE	-	-	-	-	3	6	3	3	**15**	**09.15**
6	OE	-	-	-	3	3	3	-	-	**9**	**05.49**
7	GE	-	-	-	-	-	-	-	-	**3***	**-**
8	CG	-	CSD I	CSD II	CSD III	CSD IV	CT	2	8	**10+3***	**06.09**
9	MC		MC I	MC II	-	MC III		-	-	**-**	**-**
10	AC	-	-	-	-	-	-	AC	-	**-**	**-**
Total		**19**	**21**	**23**	**26**	**21**	**24**	**19**	**11**	**164**	**100**

HS – HUMANITIES AND SOCIAL SCIENCES
BS – BASIC SCIENCE
ES – ENGINEERING SCIENCES
PC – PROFESSIONAL CORE
PE – PROFESSIONAL ELECTIVES
OE – OPEN ELECTIVES
CG - CAREER GUIDANCE COURSES
CT – COMREHENSION TEST
MC – MANDATORY COURSES
AC- AUDIT 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.

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HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 EN 001	Professional English - I	HS	3	1	0	2	2	-NIL-
2.	60 EN 002	Professional English - II	HS	3	1	0	2	2	-NIL-
3.	60 AB 001	National Cadet Corps (Air Wing)	HS	4	2	0	2	3	-NIL-
4.	60 AB 002	National Cadet Corps (Army Wing)	HS	4	2	0	2	3	-NIL-
5.	60 HS 003	Total Quality Management	HS	3	3	0	0	3	-NIL-

BASIC SCIENCES (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 MA 001	Matrices and Calculus	BS	5	3	1	0	4	-NIL-
2.	60 PH 001	Engineering Physics	BS	3	3	0	0	3	-NIL-
3.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	5	3	1	0	4	-NIL-
4.	60 CH 001	Chemistry for Mechanical Sciences	BS	3	3	0	0	3	-NIL-
5.	60 CP 0P1	Physics and Chemistry Laboratory	BS	4	0	0	4	2	-NIL-
6.	60MA 007	Statistics and Numerical Methods	BS	5	3	1	0	4	-NIL-

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 CS 001	C Programming	ES	3	3	0	0	3	-NIL-
2.	61 ME 001	Engineering Drawing	ES	5	1	2	0	3	-NIL-
3.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2	-NIL-
4.	61 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2	-NIL-
5.	61 ME 0P2	Computer Aided Drafting	ES	2	0	0	2	1	-NIL-
6.	60 ME 004	Engineering Mechanics	ES	5	3	1	0	4	-NIL-
7.	60 EE 001	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3	-NIL-
8.	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2	-NIL-
9.	60 EE 004	Electrical Drives and Control	ES	3	3	0	0	3	Basic Electrical and Electronics Engineering
10.	60 EE 0P4	Electrical Drives and Control Laboratory	ES	4	0	0	4	2	Basic Electrical and Electronics Engineering Laboratory

PROFESSIONAL CORE COURSES (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME 301	Engineering Materials and Metallurgy	PC	3	3	0	0	3	Engineering Physics
2.	60 ME 302	Strength of Materials	PC	3	3	0	0	3	Engineering Mechanics
3.	60 ME 303	Thermodynamics	PC	3	3	0	0	3	Engineering Physics
4.	60 ME 304	Manufacturing Techniques	PC	3	3	0	0	3	Engineering Physics
5.	60 ME 3P1	Computer Aided Machine Drawing Laboratory	PC	4	0	0	4	2	Engineering Drawing
6.	60 ME 401	Fluid Mechanics and Fluid Machines	PC	5	3	1	0	4	Engineering Chemistry
7.	60 ME 402	Machining Processes	PC	3	3	0	0	3	Conventional and Smart Manufacturing
8.	60 ME 403	Kinematics of Machines	PC	3	3	0	0	3	Strength of Materials
9.	60 ME 404	Thermal Engineering	PC	3	3	0	0	3	Thermodynamics
10.	60 ME 405	Engineering Metrology	PC	3	3	0	0	3	Engineering Physics
11.	61 ME 406	Applied Hydraulics and Pneumatics	PC	4	2	0	2	3	Fluid Mechanics
12.	60ME4P1	Strength of Materials and Fluid Machinery Laboratory	PC	4	0	0	4	2	Strength of Materials, Fluid Mechanics
13.	60 ME4P2	Manufacturing and Machining Processes Laboratory	PC	4	0	0	4	2	Computer Integrated Machining Processes
14.	60 ME 501	Automobile Engineering	PC	3	3	0	0	3	Thermal Engineering
15.	60 ME 502	Dynamics of Machines	PC	5	3	1	0	4	Kinematics of Machines
16.	60 ME 503	Design of Machine Elements	PC	5	3	1	0	4	Strength of Materials
17.	60 ME 5P1	Thermal Engineering Laboratory	PC	4	0	0	4	2	Thermal Engineering
18.	60 ME 5P2	Metrology and Dynamics Laboratory	PC	4	0	0	4	2	Kinematics of Machines
19.	60 ME 5P3	Design Thinking and Innovation Laboratory	PC	2	0	0	2	1	-Nil-
20.	60 ME 601	Heat and Mass Transfer	PC	3	3	0	0	3	Thermodynamics, Thermal Engineering
21.	60 ME 602	Finite Element Analysis	PC	3	3	0	0	3	Kinematics of Machines, Dynamics of Machines

22.	60 ME 603	Design of Mechanical Transmission Systems	PC	5	3	1	0	4	Design of Machine Elements
23.	60 ME 6P1	Heat Transfer Laboratory	PC	4	0	0	4	2	Thermal Engineering Laboratory
24.	60 ME 6P2	Analysis and Simulation Laboratory	PC	4	0	0	4	2	Applied Hydraulics and Pneumatics
25.	60 ME 6P3	Design Thinking and Product Development Laboratory	PC	2	0	0	2	1	-Nil-
26.	60 ME 701	Machine Learning	PC	3	3	0	0	3	Mathematics
27.	60 ME 702	Mechatronics and Robotics	PC	5	3	1	0	4	Mathematics
28.	60 ME 703	Operations Research	PC	3	3	0	0	3	Mathematics
29.	60 ME 7P1	Mechatronics Laboratory	PC	4	0	0	4	2	Mathematics

PROFESSIONAL ELECTIVES (PE) / HONOURS

SEMESTER V, PROFESSIONAL ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME E11	Design for Manufacture and Assembly	PE	3	3	0	0	3	-Nil-
2.	60 ME E12	Product Design for Manufacturing	PE	3	3	0	0	3	-Nil-
3.	60 ME E13	Composite Materials and Mechanics	PE	3	3	0	0	3	Strength of Materials
4.	60 ME E14	Manufacturing Information System	PE	3	3	0	0	3	Nil
5.	60 ME E15	Power Plant Engineering	PE	3	3	0	0	3	Thermal Engineering
6.	60 ME E16	Reverse Engineering	PE	3	3	0	0	3	-NIL-
7.	60 HS 002	Engineering Economics and Financial Accounting	PE	3	3	0	0	3	-NIL-

SEMESTER VI, PROFESSIONAL ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME E21	Piping Design	PE	4	2	0	2	3	Fluid Mechanics
2.	60 ME E22	Design of Jigs, Fixtures and Press Tools	PE	4	2	0	2	3	Engineering Drawing
3.	60 ME E23	Additive manufacturing	PE	4	2	0	2	3	Manufacturing Techniques,
4.	60 ME E24	Flexible Manufacturing System	PE	4	2	0	2	3	Fluid Mechanics and Fluid Machines
5.	60 ME E25	Internal Combustion Engines	PE	4	2	0	2	3	Thermal Engineering
6.	60 ME E26	Process Planning and Cost Estimation	PE	4	2	0	2	3	Statistics
7.	60 ME E27	Optimization Techniques in Design	PE	3	3	0	0	3	Operations Research

SEMESTER VI, PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME E31	Advanced Mechanics of Materials	PE	3	3	0	0	3	Strength of Materials
2.	60 ME E32	Bio-Mechanics	PE	3	3	0	0	3	Kinematics of Mechanics
3.	60 ME E33	Welding Technology	PE	3	3	0	0	3	Manufacturing Technology
4.	60 ME E34	Renewable Sources of Energy	PE	3	3	0	0	3	Fluid Mechanics and Machines
5.	60 ME E35	Logistics and Supply Chain Management	PE	3	3	0	0	3	Operations research
6.	60 ME E36	Plastic Manufacturing Processes	PE	3	3	0	0	3	Engineering Drawing
7.	60 ME E37	Integrated Product Development	PE	3	3	0	0	3	-Nil-

SEMESTER VII, PROFESSIONAL ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME E41	Industrial Tribology	PE	3	3	0	0	3	Engineering Mechanics
2.	60 ME E42	Non-Destructive Evaluation of Materials	PE	3	3	0	0	3	Engineering materials and metallurgy
3.	60 ME E43	Production Planning and Control	PE	3	3	0	0	3	Machining Process
4.	60 ME E44	Computational Fluid Dynamics	PE	3	3	0	0	3	Fluid Mechanics
5.	60 ME E45	Thermal Turbomachines	PE	3	3	0	0	3	Thermal Engineering
6.	60 ME E46	Quality Control and Reliability Engineering	PE	3	3	0	0	3	Statistics
7.	60 ME E47	Micro and Precision Engineering	PE	3	3	0	0	3	-Nil-

SEMESTER VIII, PROFESSIONAL ELECTIVE V

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME E51	Lean Manufacturing	PE	3	3	0	0	3	Manufacturing Process
2.	60 ME E52	Precision Engineering	PE	3	3	0	0	3	Dimensional Metrology
3.	60 ME E53	Energy Conservation in HVAC System	PE	3	3	0	0	3	Thermal Engineering
4.	60 ME E54	Cryogenic Engineering	PE	3	3	0	0	3	Thermal Engineering
5.	60 ME E55	Maintenance Engineering	PE	3	3	0	0	3	-NIL-
6.	60 ME E56	Industrial Safety Engineering	PE	3	3	0	0	3	-NIL-
7.	60 ME E57	Quality Engineering	PE	3	3	0	0	3	-Nil-
8.	60 ME E58	Surface Engineering	PE	3	3	0	0	3	-Nil-

Note: Any of the above elective courses shall be opted for honours degree.

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

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MANDATORY COURSES (MC)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 MY 001	Environmental Science 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	Startups and Entrepreneurship	MC	2	2	0	0	2*	-NIL-

AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 AC 001	Research Skill Development	AC	1	1	0	0	0	-NIL-

OPEN ELECTIVE COURSES (OE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME L01	Direct Digital Manufacturing	OE	3	3	0	0	3	-NIL-
2.	60 ME L02	Product Design and Development	OE	3	3	0	0	3	-NIL-
3.	60 ME L03	Composite Materials and Processing	OE	3	3	0	0	3	-NIL-
4.	60 ME L04	Reliability Engineering	OE	3	3	0	0	3	-NIL-
5.	60 ME L05	Logistics Management	OE	3	3	0	0	3	-NIL-
6.	60 ME L06	Power Generation Engineering	OE	3	3	0	0	3	-NIL-
7.	60 ME L07	Green Energy Sources	OE	3	3	0	0	3	-NIL-

INTEGRATED COURSE (IC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	61 ME 406	Applied Hydraulics and Pneumatics	PC	4	2	0	2	3	Fluid Mechanics

CAREER GUIDANCECOURSES (CG)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 CG0P1	Career Skill Development - I	CG	2	0	0	2	1*	-NIL-
2.	60 CG 0P2	Career Skill Development - II	CG	2	0	0	2	1*	-NIL-
3.	60 CG 0P3	Career Skill Development - III	CG	2	0	0	2	1*	-NIL-
4.	60 CG 0P4	Career Skill Development - IV	CG	2	0	0	2	1*	-NIL-
5.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*	-NIL-
6.	60 CG 0P6	Internship	CG	-	-	-	-	3*	-NIL-
7.	60 ME 7P3	Project Work - Phase I	CG	4	0	0	4	2	-NIL-
8.	60 ME 8P1	Project Work - Phase II	CG	16	0	0	16	8	-NIL-

Internship* additional credits is offered based on the duration

GENERAL ELECTIVE (GE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
2.	60 AB 001	National Cadet Corps (Air Wing)	HS	4	2	0	2	3	-NIL-
3.	60 AB 002	National Cadet Corps (Army Wing)	HS	4	2	0	2	3	-NIL-

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COURSES OF STUDY

(For the candidates admitted in 2024-2025)

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	5	3	1	0	4
3.	60 PH 001	Engineering Physics	BS	3	3	0	0	3
4.	60 CH 001	Chemistry for Mechanical Sciences	BS	3	3	0	0	3
5.	60 EE 001	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
6.	61 GE 001	Heritage of Tamils (தமிழர் மரபு) [&]	GE	1	1	0	0	1[&]
		PRACTICALS						
7.	60 CP 0P1	Physics and Chemistry Laboratory	BS	4	0	0	4	2
8.	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2
			Total	**26**	**14**	**1**	**10**	**19**

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.

Heritage of Tamils[&] additional 1 credit is offered and 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	5	3	1	0	4
3.	60 CS 001	C Programming	ES	3	3	0	0	3
4.	61 ME 001	Engineering Drawing	ES	5	1	2	0	3
5.	60 ME 004	Engineering Mechanics	ES	5	3	1	0	4
6.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0
7.	60 GE 002	Tamils and Technology(தமிழரும் தொழில்நுட்பமும்) [$]	GE	1	1	0	0	1[$]
		PRACTICALS						
8.	61 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2
9.	61 ME 0P2	Computer Aided Drafting	ES	2	0	0	2	1
10.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2
11.	60 CG 0P1	Career Skill Development – I	CG	2	0	0	2	1*
			Total	**35**	**13**	**4**	**14**	**21**

Tamils and Technology[$] additional1 credit is offered and not accounted for CGPA.

Rev. No.1/w.e.f. 20.07.2025
Passed in BoS Meeting held on 13.06.2025
Approved in Academic Council Meeting held on 19.07.2025

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SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	60 MA 007	Statistics and Numerical Methods	BS	5	3	1	0	4
2.	60 EE 004	Electrical Drives and Control	ES	3	3	0	0	3
3.	60 ME 301	Engineering Materials and Metallurgy	PC	3	3	0	0	3
4.	60 ME 302	Strength of Materials	PC	3	3	0	0	3
5.	60 ME 303	Thermodynamics	PC	3	3	0	0	3
6.	60 ME 304	Manufacturing Techniques	PC	3	3	0	0	3
7.	60 MY 002	Universal Human Values[&]	MC	3	3	0	0	3[&]
		PRACTICALS						
8.	60 EE 0P4	Electrical Drives and Control Laboratory	ES	4	0	0	4	2
9.	60ME 3P1	Computer Aided Machine Drawing Laboratory	PC	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	-	-	-	-	1/2/3[#]
			Total	**33**	**21**	**1**	**10**	**23**

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 ME 401	Fluid Mechanics and Fluid Machines	PC	5	3	1	0	4
2.	60 ME 402	Machining Processes	PC	3	3	0	0	3
3.	60 ME 403	Kinematics of Machines	PC	3	3	0	0	3
4.	60 ME 404	Thermal Engineering	PC	3	3	0	0	3
5.	60 ME 405	Engineering Metrology	PC	3	3	0	0	3
6.	61 ME 406	Applied Hydraulics and Pneumatics	PC	4	2	0	2	3
7.	60 OE L0*	Open Elective - I	OE	3	3	0	0	3
		PRACTICALS						
8.	60 ME 4P1	Strength of Materials and Fluid Machinery Laboratory	PC	4	0	0	4	2
9.	60 ME4P2	Manufacturing and Machining Processes Laboratory	PC	4	0	0	4	2
10.	60 CG 0P3	Career Skill Development III	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship[#]	CG	-	-	-	-	1/2/3[#]
			Total	**34**	**20**	**1**	**12**	**26**

SEMESTER V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 ME 501	Automobile Engineering	PC	3	3	0	0	3
2.	60 ME 502	Dynamics of Machines	PC	5	3	1	0	4
3.	60 ME 503	Design of Machine Elements	PC	5	3	1	0	4
4.	60 ME E1*	Professional Elective -I	PE	3	3	0	0	3
5.	60 OE L0*	Open Elective – II	OE	3	3	0	0	3
6.	60 MY 003	Startups and Entrepreneurship	MC	2	2	0	0	2*
PRACTICALS								
7.	60 ME 5P1	Thermal Engineering Laboratory	PC	3	0	0	3	1.5
8.	60 ME 5P2	Metrology and Dynamics Laboratory	PC	3	0	0	3	1.5
9.	60 ME 5P3	Design Thinking and Innovation Laboratory	PC	2	0	0	2	1
10.	60 CG 0P4	Career Skill Development IV	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship#	CG	-	-	-	-	1/2/3#
			Total	**31**	**17**	**2**	**10**	**21**

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 ME 601	Heat and Mass Transfer	PC	3	3	0	0	3
2.	60 ME 602	Finite Element Analysis	PC	5	3	1	0	4
3.	60 ME 603	Design of Mechanical Transmission Systems	PC	5	3	1	0	4
4.	60 ME E2*	Professional Elective – II	PE	4	2	0	2	3
5.	60 ME E3*	Professional Elective – III	PE	3	3	0	0	3
6.	60 OE L0*	Open Elective - III	OE	3	3	0	0	3
PRACTICALS								
7.	60 ME 6P1	Heat Transfer Laboratory	PC	3	0	0	3	1.5
8.	60 ME 6P2	Analysis and Simulation Laboratory	PC	3	0	0	3	1.5
9.	60 ME 6P3	Design Thinking and Product Development Laboratory	PC	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#
			Total	**33**	**17**	**2**	**12**	**24**

Comprehension Test* - one 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 ME 701	Machine Learning	PC	3	3	0	0	3
2.	60 ME 702	Mechatronics and Robotics	PC	3	3	0	0	3
3.	60 ME 703	Operations Research	PC	3	3	0	0	3
4.	60 HS 003	Total Quality Management	HS	3	3	0	0	3
5.	60 ME E4*	Professional Elective – IV	PE	3	3	0	0	3
6.	60 AC 001	Research Skill Development	AC	1	1	0	0	0
7.	60 AB 00[#]	NCC/NSS/NSO/YRC/RRC/Fine Arts[#]	HS	4[#]	2[#]	0	2[#]	3[#]
PRACTICALS								
8.	60 ME7P1	Mechatronics Laboratory	PC	4	0	0	4	2
9.	60 ME7P2	Project Work - Phase I	CG	4	0	0	4	2
10.	60 CG 0P6	Internship[#]	CG	-	-	-	-	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 ME E5*	Professional Elective – V	PE	3	3	0	0	3
PRACTICALS								
2.	60 ME 8P1	Project Work – Phase II	CG	16	0	0	16	8
3.	60 CG 0P6	Internship[#]	CG	-	-	-	-	1/2/3[#]
			Total	**19**	**3**	**0**	**16**	**11**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 164

Note:
HS- Humanities and Social Sciences Courses; BS- Basic Science Courses; ES- Engineering Science Courses; PC- Professional Core Courses; PE- Professional Elective Courses; GE- General Elective Courses; OE - Open Elective Courses; CGC-Career Guidance Courses; MC- Mandatory Courses; AC- Audit Courses.
L: Lecture;
T: Tutorial;
P: Practical;
C: Credit
1 Hour Lecture = 1 credit
1 Hour tutorial = 1 credit
2 Hours practical = 1 credit

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B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

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 001	Engineering Physics	2	40	60	100	45	100
4	60 CH 001	Chemistry for Mechanical Sciences	2	40	60	100	45	100
5	60 EE 001	Basic Electrical and Electronics Engineering	2	40	60	100	45	100
6	61 GE 001	Heritage of Tamils (தமிழர் மரபு) &	2	40	60	100	45	100
PRACTICAL								
6	60 CP 0P1	Physics and Chemistry Laboratory	3	60	40	100	45	100
7	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	3	60	40	100	45	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 put a 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 theory End Semester Examination and 40 marks for Practical End Semester Examination.

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60 EN 001	Professional English – I	Category	L	T	P	Credit
		HS	1	0	2	2

Objectives

- 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

Pre-requisites

- 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 interpret complex academic texts	Understand
CO2	Recall the denotative and connotative meanings of technical texts	Remember
CO3	Interpret definitions, descriptions, narrations, and essays on various topics	Understand
CO4	Express fluently and accurately in formal and informal communicative contexts	Understand
CO5	Summarize their opinions effectively in both oral and written medium of communication	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	3	3	2	3	3	2	2
CO2	-	-	-	-	-	-	-	2	3	3	2	3	2	2	2
CO3	-	-	-	-	-	-	-	2	3	3	2	3	3	2	3
CO4	-	-	-	-	-	-	-	2	3	3	2	3	2	3	3
CO5	-	-	-	-	-	-	-	2	3	3	2	3	2	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	20
Understand (Un)	50	50	80
Apply (Ap)	-	-	-
Analyse (An)	-	-	-
Create (Cr)	-	-	-
Total	60	60	100

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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	45	2	40	60	100

Content	Hours
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).	**[9]**
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.	**[9]**
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)	**[9]**
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.	**[9]**
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.	**[9]**
Total Hours:	**45**

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, 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

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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.	Topics	No. of hours
1.0	**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
2.0	**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
3.0	**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
4.0	**Classification and Recommendations**	
4.1	Listening to TED Talks and educational videos	1
4.2	Listening to scientific lectures	1
4.3	Small Talk and mini presentations	1
4.4	Reading newspaper articles and journal reports	1
4.5	Note-making / Note-taking	1
4.6	Recommendations	1
4.7	Transferring information from non-verbal	1
4.8	Articles and Pronouns	1
4.9	Subject-verb agreement and collocations	1
5.0	**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

Course Designer(s)

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

Objectives

- To familiarize the basic concepts in Cayley-Hamilton theorem and orthogonal transformation
- To get exposed to the fundamentals of differentiation
- 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

Pre-requisites

- -NIL-

Course Outcomes

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

CO1	Apply the concepts of Cayley-hamilton theorem and orthogonal transformation to the matrix	Apply
CO2	Apply the concepts of differentiation in solving various Engineering problems	Apply
CO3	Obtain Jacobians and maxima and minima of functions of two variables	Apply
CO4	Employ various methods in solving differential equations	Apply
CO5	Apply different techniques to evaluate definite and indefinite integrals	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	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	10
Understand	10	10	20
Apply	40	40	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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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

Content	Hours
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 **Hands-On:** Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank	[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 Minima of Functions of One Variable*** **Hands-on:** **Determine the Solution of System of Linear Equations**	[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*** **Hands-on: Compute the Eigen Values and Eigen Vectors of a Matrix**	[9]
Differential Equations Linear Differential Equations of Second and Higher order With Constant Coefficients - 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 **Hands-on: Solve the First and Second Order Ordinary Differential Equations**	[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 Centres of Mass **Hands-On: Compute The Maxima and Minima of A Function of one Variable**	[9]
Total Hours: 45 + 5 (Hands-on) + 10 (Tutorial)	**60**

Text Book(s):

1.	Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.

Reference(s):

1.	Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.
3.	Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017.
4.	Bali N P and Manish Goyal," A text book of Engineering Mathematics",10th Edition, Laxmi Publications (P) Ltd, 2016.

* **SDG: 4 – Quality Education**

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Matrices**	
1.1	Characteristic equation	1
1.2	Eigen values and Eigen vectors of a real matrix	1
1.3	Properties of Eigen values and Eigen vectors	1
1.4	Cayley-Hamilton theorem	1
1.5	Orthogonal transformation of a symmetric matrix to diagonal form	1
1.6	Nature of quadratic form	1
1.7	Reduction of quadratic form to canonical form by Orthogonal transformation	2
1.8	Stretching of an elastic membrane	1
1.9	Tutorial	2
1.10	Hands-on	1
2.0	**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)	2
2.4	Successive differentiation	1
2.5	Leibnitz's theorem	2
2.6	Maxima and minima of functions of one variable	2
2.7	Tutorial	2
2.8	Hands-on	1
3.0	**Functions of Several Variables**	
3.1	Partial differentiation	1
3.2	Homogeneous functions and Euler's theorem	1
3.3	Jacobians	2
3.4	Taylor's series for functions of two variables	1
3.5	Maxima and minima of functions of two variables	2
3.6	Lagrange's Method of Undetermined Multipliers	2
3.7	Tutorial	2
3.8	Hands-on	1
4.0	**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 $e^{\alpha x}$, $\sin\alpha x$, $\cos\alpha x$, $x^n, n > 0$	2
4.3	Differential equations with variable coefficients: Cauchy's form of linear equations	2
4.4	Differential equations with variable coefficients: Legendre's form of linear equations	2
4.5	Method of variation of parameters	2
4.6	Tutorial	2
4.7	Hands-on	1
5.0	**Integration**	
5.1	Definite and Indefinite integrals	2
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	Integration of irrational functions	1
5.6	Improper integrals	1
5.7	Hydrostatic force.	1

5.8	Pressure, moments and centres of mass.	1
5.9	Tutorial	2
5.10	Hands-on	1

Course Designer(s)

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

60 PH 001	Engineering Physics	Category	L	T	P	Credit
		BS	3	0	0	3

Objectives

- To make the students to understand the basics of crystallography, crystal growth and its importance in studying materials properties.
- To establish a sound grasp of knowledge on optics, laser and its 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
- To instil the knowledge on next generation energy device and its applications

Pre-requisites

- Nil

Course Outcomes

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

CO1	Realize the basics of crystallography and its importance for varied materials properties	Remember
CO2	Acquire the fundamentals of optics, laser technology and its applications in various fields	Apply
CO3	Appraise the knowledge on magnetic properties of materials and their applications in sensors	Understand
CO4	Infer the properties of advanced materials and nano materials for potential applications	Understand
CO5	Recognize the next generation energy device and its applications in electric vehicles	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	2	-	2	-	-	-	-	-
CO2	3	-	-	-	-	-	-	2	-	2	-	-	-	-	-
CO3	3	-	-	-	-	-	-	2	-	2	-	-	-	-	-
CO4	3	-	-	-	-	-	-	2	-	2	-	-	-	-	-
CO5	3	-	-	-	-	-	-	2	-	2	-	-	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	14	16
Understand	46	46	80
Apply	04	-	04
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 PH 001– Engineering Physics

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 Physics* Lattice - Unit Cell – Crystal Systems and Bravais Lattice - Crystal Planes and Miller Indices - D Spacing In Cubic Lattice -Calculation of Number of Atoms Per Unit Cell - Atomic Radius - Coordination Number - Packing Factor for Hcp Structure-Crystal Growth Techniques– Solution (Slow Solvent Evaporation and Slow Cooling)- Melt (Bridgman and Czochralski)- Imperfections in Crystals.	[9]
Optics And Laser Technology* **Optics:** Reflection, Refraction and Diffraction of Light Waves -Interference - Application of Interference in Thin Films: Newton's Ring and Air Wedge Experiment - Overview of Linear and Nonlinear Optics. **Laser:** Theory of Laser - Characteristics -Einstein'scoefficients-Populationinversion-Nd-Yaglaser,CO_2laser - Applications of Lasers in Industry: Drilling, Welding, Cutting Micro Machining, Measurement of Long Distances and IR Thermography.	[9]
Magnetic Materials and Dielectric Materials* **Magnetic Materials:** Origin of Magnetic Moment-Bohrmagnetron – 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-Break Down 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, Applications of Carbon Nano Tube: Mechanical Reinforcement & Sensors.	[9]
Next Generation Energy Device** Introduction - Capacitor-Battery-Comparison – Super Capacitor (Sc)- Role of Active Materials, Electrodes, Electrolyte and Separator in Sc - Types of Sc – Principle, Construction and Working of Electric Double Layer Capacitor (Edlc), Pseudo Capacitor and Hybrid Capacitor- Advantages and Disadvantages of Sc – Construction, Working, and Performance of Hybrid (Super Capacitor/ Battery) Device and Its Application in Electric Vehicles.	[9]
Total Hours:	**45**

Text Book(s):

1.	Avadhanulu, M N., Kshirsagar P G, Arun Murthy, TVS. "A Text Book of Engineering Physics", S.Chand Publications, NewDelhi, 2022.
2.	Malik H K, Singh, A K. "Engineering Physics "McGraw Hill Education Private Limited, NewDelhi
3.	Joshi D R., " Engineering Physics "McGraw Hill Education Private Limited, New Delhi.2010

Reference(s):

1.	Pillai S O, "A Textbook Of Engineering Physics" New Age International (P) Limited, New Delhi, 2014
2.	Puri, B R., Sharma L R, and Madan S P., "Principles of Physical Chemistry", Vishal Publishing Company. Gumber Market, Old Railway Road, Jalandhar, 2018.
3.	Laud B B, "Lasers and Non-Linear Optics", New Age International Publications, New Delhi,2015
4.	Rajagopal,S, Pulapparambil Vallikkattil R, Mohamed Ibrahim, M, Velev D G, "Electrode Materials for Supercapacitors in Hybrid Electric Vehicles: Challenges and Current Progress", 2022.

* **SDG:4- Quality Education & ** SDG:7 – Affordable and sustainable energy**

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Crystal physics**	
1.1	Introduction to Lattice ,Unit cell	1
1.2	Crystal systems and Bravais lattice	2
1.3	Crystal planes and Miller indices	1
1.4	d spacing in cubic lattice -Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for HCP structure	2
1.5	Crystal growth techniques–solution (Slow solvent evaporation and slow cooling	1
1.6	Melt growth technique(Bridgman and Czochralski)	1
1.7	Imperfections in crystals	1
2.0	**Optics and Laser Technology**	
2.1	**Optics:** Reflection, refraction and diffraction of light waves -	1
2.2	Interference -Application of interference in thin films:	1
2.3	Newton's ring and Air wedge experiment	1
2.4	Overview of linear and nonlinear optics.	1
2.5	**Laser:** Theory of laser - characteristics.	1
2.6	Einstein's coefficients- Population inversion	1
2.7	Nd-YAGlaser,CO_2laser	1
2.8	Applications of lasers in industry: Drilling, welding, cutting micro machining,	1
2.9	Measurement of long distances and IR Thermography.	1
3.0	**Magnetic and Dielectric Materials**	
3.1	**Magnetic Materials:** Origin of magnetic moment-Bohrmagnetron	1
3.2	Classification of magnetic materials	1
3.3	Domain theory-Hysteresis	1
3.4	Soft and hard magnetic materials- Applications	1
3.5	Giant Magneto Resistance(*GMR*)	1
3.6	**Dielectric Materials:**Polarization- Electronic,ionic,orientationalandspacecharge	1
3.7	Frequency and Temperature dependence of polarization	1
3.8	Break down mechanisms	1
3.9	Applications of dielectrics in Capacitor and Transformer.	1
4.0	**Advanced Materials and Nano Technology**.	
4.1	**AdvancedMaterials:**Metallicglasses-preparation,propertiesandapplications	2
4.2	Shape memory alloys(SMA) -characteristics, properties of NiTi alloy applications	2
4.3	**Nano Technology:** Properties -Top-down process: Ball Milling method	2
4.4	Bottom-up process: Vapour Phase Deposition	1
4.5	Carbon Nano Tube (CNT): Properties, preparation by electric arc method, Applications of carbon nano tube .	1
4.6	Mechanical reinforcement &Sensors	1
5.0	**Next Generation Energy Device**	
5.1	Introduction - Capacitor-Battery-Comparison	1
5.2	Super capacitor (SC)	1
5.3	Role of active materials, electrodes, electrolyte and separator in SC	1
5.4	Types of SC – Principle, construction and working of Electric double layer capacitor (EDLC)	1
5.5	Principle, construction and working of Pseudo capacitor	1
5.6	Principle, construction and working of hybrid capacitor	1
5.7	Advantages and disadvantages of SC	1

5.8	Construction, working, and performance of hybrid (super capacitor/battery)device	1
5.9	Its application in electric vehicles	1

Course Designer(s)

1. Dr. V. Vasudevan - vasudevanv@ksrct.ac.in
2. Dr. M. Malarvizhi - malarvizhi@ksrct.ac.in
3. Dr. P. Suthanthira Kumar - suthanthirakumar@ksrct.ac.in

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60 CH 001	Chemistry for Mechanical Sciences	Category	L	T	P	Credit
		BS	3	0	0	3

Objectives

- To help the learners to analyse the hardness of water and its removal
- To study the concepts of electrochemistry and corrosion control.
- To learn about the types of engineering materials.
- To explain the characteristics and application of chemical sensors
- To study the types of batteries and fuel cells.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Identify the types of hardness of water and its removal.	Apply
CO2	Interpret the applications of electrochemistry, corrosion and its control	Apply
CO3	Summarize the application of protective coatings.	Understand
CO4	Categorize the types of sensors for various applications.	Apply
CO5	Illustrate the significance of the types of batteries and fuel cells	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	1	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	30	30	60
Apply	10	10	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

<table>
<tr><td colspan="10">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="10">(Common to Mechanical and Mechatronics)</td></tr>
<tr><td colspan="10">60 CH 001- Chemistry for Mechanical Sciences</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>I</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
</table>

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.	[9]
Electrochemistry and Corrosion*** Electrode Potential - Nernst Equation - Derivation and Problems - Reversible and Irreversible Cells - Types of Electrodes and Its Applications - Reference Electrodes - Ph, Conductometric and Potentiometric Titrations. Electrochemical Corrosion, Corrosion Due to Dissimilar Metal Cells (Galvanic Cells), Corrosion Due to Differential Aeration - Factors Influencing Corrosion - Corrosion Control: Cathodic Protection (Sacrificial Anodic Protection, Impressed Current Cathodic Protection).	[9]
Protective Coatings *** Protective Coatings: Classification - Metallic Coating: Electroplating – Electroless Plating - Diffusion Coating. Paint: Types and Characteristics of Paints - Constituents - Drying Process. Varnishes: Characteristics - Constituents. Enamels and Lacquers (Natural Resins). Electro Polishing of Mild Steel- Electrochemical Machining – Electrophoretic Painting in Automotive Industry, Technology of Electro Priming – Electrochemical Etching for Conductors and Semiconductors – Electroforming – Electro Winning Of Aluminium – Anodizing of Aluminium.	[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.	[9]
Energy Storage Devices ** ,* &** **** Reversible and Irreversible Cells – 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]
Total Hours:	**45**

Text Book(s):

1.	Palanna, O G., “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2017.

Reference(s):

1.	Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 14^{th} Edition, 2015.
2.	Pletcher D and Walsh F C, “Industrial Electrochemistry”, Chapman and Hall, 2nd Edition, New York, 1990.
3.	Roussak, O V. and Gesser, H D. “Applied Chemistry-A Text Book for Engineers and Technologists”, Springer Science Business Media, New York, 2^{nd} Edition, 2013.
4.	Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2^{nd} Edition, 2019.

*SDG 6 Improve Clean Water and Sanitation
**SDG 7 Affordable and clean energy
***SDG 9 Industry, innovation and infrastructure
****SDG 12 Responsible consumption and production

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Course Contents and Lecture Schedule

S. No.	Topics	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 Water by EDTA Method	1
1.4	Internal Conditioning (Colloidal, Phosphate, Calgon And Carbonate)	1
1.5	External Conditioning (Zeolite Process)	1
1.6	Demineralization Process	1
1.7	Desalination Methods (Reverse Osmosis)	1
1.8	Electro Dialysis	1
1.9	Flash Evaporation	1
2.0	**Electrochemistry and Corrosion**	
2.1	Electrode Potential - Nernst Equation - Derivation and Problems	1
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	Electrochemical Corrosion, Corrosion Due to Dissimilar Metal Cells (Galvanic Cells),	1
2.7	Corrosion Due to Differential Aeration - Factors Influencing Corrosion	2
2.8	Corrosion Control: Cathodic Protection (Sacrificial Anodic Protection, Impressed Current Cathodic Protection).	1
3.0	**Protective Coatings**	
3.1	Protective Coatings: Classification	1
3.2	Metallic Coating: Electroplating – Electroless Plating - Diffusion Coating.	1
3.3	Paint: Types and Characteristics of Paints - Constituents - Drying Process.	1
3.4	Varnishes: Characteristics - Constituents. Enamels and Lacquers (Natural Resins).	1
3.5	Electro Polishing of Mild Steel- Electrochemical Machining – Electrophoretic Painting In Automotive Industry,	2
3.6	Technology of Electro Priming – Electrochemical Etching for Conductors and Semiconductors	2
3.7	Electroforming – Electro Winning of Aluminium – Anodizing of Aluminium.	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.	1
5.0	**Energy Storage Devices**	
5.1	Reversible and Irreversible Cells – Batteries - Types of Batteries.	1
5.2	Fabrication and Working of Alkaline Battery	1
5.3	Lead-Acid Battery	1
5.4	Ni-Cd-Lithium Ion Batteries	2
5.5	Fuel Cells: Hydrogen-Oxygen Fuel Cell	1
5.6	Microbial Fuel Cell (MFC).	1
5.7	Organic Solar Cells-Working Principle and Applications Organic Transistors	1
5.8	Construction-Working Principle and Applications in Electronic Industries.	1

Course Designer(s)

1. Dr.T.A.Sukantha - sukantha@ksrct.ac.in
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60 EE 001	Basic Electrical and Electronics Engineering	Category	L	T	P	Credit
		BS	3	0	0	3

Objectives

- To familiarize the basic concept on electrical circuits and its various parameters
- To facilitate the various types of electrical machines and their uses
- To gain knowledge on Electrical safety
- To provide exposure on the functions of various semiconductor devices
- To familiarize the use of various measuring instruments

Pre-requisites

- Nil

Course Outcomes

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

CO1	Apply the basic laws of electric circuits to calculate the unknown quantities.	Apply
CO2	Acquire knowledge on different electrical machines and select suitable machines for industrial applications.	Apply
CO3	Express the significance of various components of low voltage electrical installations and create awareness on electrical safety.	Understand
CO4	Demonstrate the operation and characteristics of various semiconductor devices.	Understand
CO5	Interpret the operating principles of measuring instruments and choose suitable instrument for measuring the parameters.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3											2		3
CO2	3	3					2					2	2		3
CO3	3	3				2						2	2		3
CO4	2	2					2			2		2	2		3
CO5	2	3					3		3	2		2	2		3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	20	40	40
Apply	20	0	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

Common to CSE, IT, AIDS, AIML, MECH, MCT, BT, FT and CIVIL Branches

60 EE 001 - Basic Electrical and Electronics Engineering

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Electrical Circuits DC Circuits: Circuit Components: Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws– Simple problems. Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform real power, reactive power and apparent power, power factor – Steady state analysis of RLC series circuits- Simple problems. Introduction to three phase AC circuits	[9]
Electrical Machines* Construction and Working principle - Separately and Self excited DC Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phases Alternator, Synchronous motor and Three Phase Induction Motor.	[9]
Electrical Installations* Domestic wiring, types of wires and cables, earthing, protective devices- switch fuse unit- Miniature Circuit Breaker-Moulded Case Circuit Breaker- Earth Leakage Circuit Breaker, Batteries and types, UPS, Safety precautions and First Aid.	[9]
Analog Electronics Introduction to Semiconductor Materials– PN Junction Diodes, Zener Diode – Characteristics and Applications – Bipolar Junction Transistor - Biasing and Configuration (NPN) - **Regulated Power Supply Unit, Switched Mode Power Supply***.	[9]
Measurements and Instrumentation Functional Elements of an Instrument, Standards and Calibration, Operating Principle, Types -Moving Coil and Moving Iron meters, Operating Principles and Types of Wattmeter, Energy Meter, Instrument Transformers-**CT and PT, DSO-** Block Diagram**- Data Acquisition*.**	[9]
Total Hours:	**45**

Text Book(s):

1.	Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Reference(s):

1.	Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
3.	Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
4.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Electrical Circuits**	
1.1	Circuit Components: Resistor, Inductor, Capacitor	1
1.2	Ohm’s Law - Kirchhoff’s Laws	1
1.3	Ohm’s Law - Kirchhoff’s Laws - Problems	1
1.4	Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform	2
1.5	Real power, reactive power and apparent power, power factor	1
1.6	Steady state analysis of RLC series circuits	1
1.7	RLC series circuits - Problems	1
1.8	Introduction to three phase system	1
2.0	**Electrical Machines**	
2.1	Construction and Working principle of DC Generator	1
2.2	Types and Applications of Separately and Self excited DC Generators	1
2.3	EMF equation of DC Generator	1
2.4	Working Principle of DC motors	1
2.5	Torque Equation, Types and Applications	1
2.6	Construction, Working principle and Applications of Transformer	1
2.7	Construction, Working principle and Applications of Three phase Alternator	1
2.8	Construction, Working principle and Applications of Synchronous motor	1
2.9	Construction, Working principle and Applications of Three Phase Induction Motor	1
3.0	**Electrical Installations**	
3.1	Domestic wiring, types of wires and cables	1
3.2	Earthing, protective devices	2
3.3	Switch fuse unit- Miniature Circuit Breaker	1
3.4	Molded Case Circuit Breaker- Earth Leakage Circuit Breaker	1
3.5	Batteries and types	2
3.6	UPS	1
3.7	Safety precautions and First Aid	1
4.0	**Analog Electronics**	
4.1	Introduction to Semiconductor Materials	1
4.2	Characteristics and Applications of PN Junction Diodes	2
4.3	Characteristics and Applications of Zener Diode	1
4.4	Bipolar Junction Transistor	1
4.5	Biasing & Configuration (NPN)	2
4.6	Regulated power supply unit	1
4.7	Switched mode power supply	1
5.0	**Measurements and Instrumentation**	
5.1	Functional elements of an instrument	1
5.2	Standards and calibration	1
5.3	Moving Coil meters - Operating Principle, types	1
5.4	Moving Iron meters - Operating Principle, types	1
5.5	Operating principles and Types of Wattmeter	1
5.6	Energy Meter	1
5.7	Instrument Transformers – CT & PT	1
5.8	DSO- Block diagram- Data acquisition	2
5.9	Functional elements of an instrument	1

Course Designer(s)

Mr.S.Srinivasan - srinivasan@ksrct.ac.in
Ms.R.Radhamani - radhamani@ksrct.ac.in
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Mr.T.Prabhu - prabhut@ksrct.ac.in

61 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

Pre-requisites

- 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	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1							3	3		2		3			
CO2							3	3		2		3			
CO3							3	3		2		3			
CO4							3	3		2		3			
CO5							3	3		2		3			
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	**Continuous Assessment (Marks)**	**End Sem Examination (Marks)**
Remember	30	30
Understand	30	70
Apply	-	-
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	60	100

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
61 GE 001- Heritage of Tamils[&]								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1	40	60	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]
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, Leather puppetry, 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.

61 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

Pre-requisites

தேவை இல்லை

பாடம்கற்றதின் விளைவுகள்

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	தமிழ் மொழியின் செந்தண்மை மற்றும் இலக்கியம் குறித்த தெரிதல்.	புரிதல்
CO2	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்ததெளிவு.	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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3	3		2		3			
CO2							3	3		2		3			
CO3							3	3		2		3			
CO4							3	3		2		3			
CO5							3	3		2		3			
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment (Marks)	End Sem Examination (Marks)
Remember	30	30
Understand	30	70
Apply	-	-
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	60	100

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022
B.E - Mechanical Engineering
61 GE 001- தமிழர் மரபு [&]

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1	40	60	100

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 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.

60 CP 0P1	Physics and Chemistry Laboratory (CIVIL, MECH & MCT)	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

Pre-requisites

- Nil

Course Outcomes

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

CO1	Apply the concept of stress, strain and elastic limit for a given sample to find their properties	Apply
CO2	Recognize the concept of quantum Physics & magnetic properties by experimental verification	Apply
CO3	Infer the properties of light and fiber optic cable	Apply
CO4	Apply the concepts of chemistry and develop analytical skills for applications in engineering to determine the rate of corrosion	Apply
CO5	Analyze the pH, electrode potential, conductance sample solutions	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	2	2	-	-	-	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	10	-	10	10
Understand	30	30	30	30
Apply	40	40	40	40
Analyse	20	30	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
Total	100	100	100	100

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Tiruchengode - 637 215.

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 CP 0P1– PHYSICS AND CHEMISTRY LABORATORY (CIVIL, MECH & MCT)								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	0	0	4	60	2	60	40	100

List of Experiments (Physics):

1. Determination of Young's Modulus of a given Material - Uniform Bending
2. Determination of Rigidity Modulus of a Wire - Torsional Pendulum
3. Determination of Planck's Constant
4. Magnetic Field Along the Axis of Current Carrying Coil – Stewart and Gee
5. (a) Laser- Determination of the Wave Length of the Laser Using Grating
   (b) Optical Fibre -Determination of Numerical Aperture and Acceptance Angle

* **SDG: 4- Quality Education**

List of Experiments (Chemistry):

1. Estimation of Hardness of Water Sample by Complexometric Method.
2. Determination of Dissolved Oxygen in Water sample by Winkler's Method
3. Determination of Corrosion by Weight Loss Method
4. Estimation of HCl by pH Meter.
5. Estimation of Mixture of Acids by Conductivity Meter.

Case studies/Activity report

1. Case study on Dissolved Oxygen in Various Water Samples.
2. Activity Report for Determination of HCl Using Conductometric Titration

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

Lab Manual	
1.	"Engineering Physics Lab Manual", Department of Physics, KSRCT.
2.	"Chemistry Lab Manual Volume I & II", Department of Chemistry, KSRCT.

*** SDG: 4- Quality Education**

Course Designer(s) - Physics

1. Dr. V. Vasudevan - vasudevanv@ksrct.ac.in
2. Mr. S. Vanchinathan - vanchinathan@ksrct.ac.in
3. Dr. P. Suthanthira Kumar - suthanthirakumar@ksrct.ac.in

Course Designer(s) - Chemistry

1. Dr.T.A.Sukantha – sukantha@ksrct.ac.in
2. Dr.B.Srividhya - srividyab@ksrct.ac.in
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60 EE 0P1	**Basic Electrical and Electronics Engineering Laboratory** (Common to Civil, Mech, MCT and FT Branches)	**Category**	**L**	**T**	**P**	**Credit**
		BS	**0**	**0**	**4**	**2**

Objectives

- To acquire knowledge in conducting basic electrical laws
- To gain knowledge on three phase power measurement
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To gain practical experience in using measuring devices

Pre-requisites

- Nil

Course Outcomes

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

CO1	Practice experimental methods to verify the Ohm's and Kirchhoff's Laws.	Apply
CO2	Perform the three-phase power measurement.	Apply
CO3	Demonstrate the load characteristics of electrical machines.	Apply
CO4	Describe the characteristics of basic electronic devices.	Understand
CO5	Use the appropriate measuring devices to measure the electrical parameters.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	3	2	-	-	-	3	2	-
CO2	3	2	-	-	-	-	-	3	2	-	2	-	3	2	-
CO3	3	2	-	-	-	-	-	3	2	-	2	-	3	2	-
CO4	3	2	-	-	-	-	-	3	2	2	2	-	3	2	-
CO5	3	1	-	-	-	-	-	3	2	2	2	-	3	2	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	**Lab Experiments Assessment (Marks)**		**Model Examination (Marks)**	**End Sem Examination (Marks)**
	Lab	**Activity**		
Remember	-	-	-	-
Understand	25	12	50	50
Apply	25	13	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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B.E - Mechanical Engineering								
60 EE 0P1 - Basic Electrical and Electronics Engineering Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	0	0	4	60	2	60	40	100

List of Experiments:

1. Verification of Ohm’s and Kirchhoff’s Laws.
2. Measurement of Three Phase Power.
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator.
5. Load test on Single phase Transformer.
6. Load test on Induction Motor.
7. Characteristics of PN and Zener Diodes.
8. Characteristics of BJT (CE).
9. Calibration of Single-Phase Energy Meter*.
10. Mini Project*.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Mr.S.Srinivasan - srinivasan@ksrct.ac.in
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(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

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 CS 001	C Programming	2	40	60	100	45	100
4	61 ME 001	Engineering Drawing	2	40	60	100	45	100
5	60 ME 004	Engineering Mechanics	2	40	60	100	45	100
6	60 MY 001	Environmental Studies and Climate Change	2	100	-	100	-	100
7	60 GE 002	Tamils and Technology (தமிழரும் தொழில்நுட்பமும்) $	2	40	60	100	45	100
PRACTICAL								
8	61 ME 0P1	Fabrication and Reverse Engineering Laboratory	3	60	40	100	45	100
9	61 ME 0P2	Computer Aided Drafting	3	60	40	100	45	100
10	60 CS 0P1	C Programming Laboratory	3	60	40	100	45	100
11	60 CG 0P1	Career Skill Development – I	3	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 put a 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 theory End Semester Examination and 40 marks for Practical End Semester Examination.

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60 EN 002	Professional English II	Category	L	T	P	Credit
		HS	1	0	2	2

Objectives

- 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

Pre-requisites

- 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.	Understand
CO2	Illustrate cause and effects in events, industrial processes through technical texts	Understand
CO3	Infer problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Understand
CO4	Relate events and the processes of technical and industrial nature.	Remember
CO5	Demonstrate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	3	3	2	3	3	2	3
CO2	-	-	-	-	-	-	-	2	3	3	2	3	2	2	3
CO3	-	-	-	-	-	-	-	2	3	3	2	3	3	2	3
CO4	-	-	-	-	-	-	-	2	3	3	2	3	2	2	3
CO5	-	-	-	-	-	-	-	2	3	3	2	3	2	2	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	50	50	80
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

Common to All Branches

60 EN 002 Professional English II

Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	1	0	2	45	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	**[9]**
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.	**[9]**
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.	**[9]**
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	**[9]**
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.	**[9]**
Total Hours:	**45**

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.	Raman. Meenakshi, Sharma. Sangeeta, ‘Professional English’. Oxford university press. New Delhi. 2019
2.	Arthur Brookes and Peter Grundy,’ Beginning to Write: Writing Activities for Elementary and Intermediate Learners’, Cambridge University Press, New York, 2003

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

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3	Prof. R.C. Sharma & Krishna Mohan, 'Business Correspondence and Report Writing', Tata McGraw Hill & Co. Ltd., New Delhi, 2001
4.	Arora, V N, and Laxmi Chandra, 'Improve Your Writing', Oxford University Press, New Delhi, 2001

SDG- 04- Quality Education

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Making Comparisons**	
1.1	Evaluative Listening	1
1.2	Product Descriptions and filling a graphic organiser	1
1.3	Marketing a product by using persuasive techniques	2
1.4	Reading advertisements, user manuals and brochures	1
1.5	Writing professional emails	1
1.6	Compare and contrast essay	1
1.7	mixed tenses and prepositional phrases	1
1.8	Same words used in different contexts	1
2.0	**Expressing Causal Relations in Speaking and Writing**	
2.1	Listening to longer technical talks	1
2.2	Listening to process/event descriptions	1
2.3	Describing and discussing the reasons of accidents or disasters	1
2.4	Reading longer technical texts– cause and effect essays	1
2.5	Writing responses to complaints	1
2.6	Active Passive Voice transformations	2
2.7	Infinitive and Gerunds	1
2.8	Word Formation (Noun-Verb-Adj-Adv), Adverbs.	1
3.0	**Problem Solving**	
3.1	Listening to documentaries and suggesting solutions	1
3.2	Group Discussion (based on case studies)	2
3.3	Reading Case Studies, excerpts from literary texts and news reports	1
3.4	Letter to the Editor	1
3.5	Checklists	1
3.6	Problem solution and argumentative essays	1
3.7	Error correction and Sentence Completion	1
3.8	If conditional sentences	1
4.0	**Reporting of Events and Research**	
4.1	Listening Comprehension	1
4.2	Interviewing and presenting oral reports	1
4.3	Mini presentations on select topics	1
4.4	Reading newspaper articles	1
4.5	Recommendations	1
4.6	Transcoding	1
4.7	Precis writing, Summarising and Plagiarism	1
4.8	Reported Speech, Modals	1
4.9	Conjunctions	1
5.0	**The Ability to put Ideas or Information Coherently**	
5.1	Listening to Formal job interviews	1
5.2	Role plays	2
5.3	Virtual interviews	1

5.4	Reading Company profiles	1
5.5	Writing Statement of Purpose (SoPs)	1
5.6	Writing Résumé	1
5.7	Numerical Adjectives and Relative Clauses - Idioms	1
5.8	Question types: Wh/ Yes or No/ and Tags	1

Course Designer(s)

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60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To acquire the knowledge about multiple integrals.
- To familiarize the basic concepts of vector calculus.
- To get exposed to the fundamentals of analytic functions.
- To solve various types of partial differential equations.
- To familiarize the concepts of Laplace transform

Pre-requisites

- Nil

Course Outcomes

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

CO1	Interpret the basic concepts of double and triple integrals.	Apply
CO2	Interpret the basic concepts of vector calculus.	Apply
CO3	Construct the analytic functions and evaluate complex integrals.	Apply
CO4	Compute the solution of partial differential equations using different methods.	Apply
CO5	Apply Laplace transform techniques for solving differential equations.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	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	10
Understand	10	10	20
Apply	40	40	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT								
60 MA 003 - Integrals, Partial differential Equations and Laplace Transform								
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. **Hands - On:** Evaluating Double Integrals, Triple Integrals, Area as Double Integrals and Volume As Triple Integrals	**[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) . **Hands - On:** Evaluating Gradient, Divergence and Curls.	**[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. **Hands - On:** Plotting and Visualizing Functions of Single Variable, Two and Three Variables.	**[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. **Hands - On:** Calculate Homogeneous Linear Partial Differential Equations.	**[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. **Hands - On:** Evaluating Laplace, Inverse Laplace Transforms and Solve Differential Equations.	**[9]**
Total Hours: 45 + 5(Hands on) + 10(Tutorial)	**60**

Text Book(s):	
1.	Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.
Reference(s):	
1.	Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.
3.	Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017
4.	Bali N P and Manish Goyal, "A text book of Engineering Mathematics",10th Edition, Laxmi Publications (P) Ltd, 2016.

***SDG: 4 – Quality Education**

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**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	Triple integration in Cartesian coordinates	1
1.6	Change of variables	2
1.7	Cartesian to polar coordinates	1
1.8	Cartesian to Cylindrical coordinates	1
1.9	Tutorial	2
1.10	Hands on	1
2.0	**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	Solenoidal and irrotational vectors	1
2.6	Application: Green’s theorem in the plane	1
2.7	Gauss divergence theorem	2
2.8	Stokes’ theorem (statement only)	1
2.9	Tutorial	2
2.10	Hands on	1
3.0	**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	Construction of an analytic function	1
3.6	Cauchy’s Integral theorem (statement only), Cauchy’s integral formula	2
3.7	Classification of singularities	1
3.8	Applications: Cauchy’s residue theorem.	1
3.9	Tutorial	2
3.10	Hands on	1
4.0	**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	Non- linear partial differential equations of first order	3
4.4	Lagrange’s linear equations	1
4.5	Application: Homogeneous Linear partial differential equations with constant coefficients.	2
4.6	Tutorial	2
4.7	Hands on	1
5.0	**Laplace Transform**	
5.1	Conditions for existence	1
5.2	Transforms of elementary functions	1
5.3	Basic properties	1
5.4	Derivatives and integrals of transforms, Initial and final value theorem	1

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5.5	Transform of periodic functions	1
5.6	Inverse Laplace transform	1
5.7	Convolution theorem (excluding proof)	1
5.8	Application: Solution of second order ordinary differential equation with constant co-efficient.	2
5.9	Tutorial	2
5.10	Hands on	1
5.11	Conditions for existence	1

Course Designer(s)

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2. Dr. K. Prabakaran – prabakaran@ksrct.ac.in

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60 CS 001	C Programming	Category	L	T	P	Credit
		ES	3	0	0	3

Objectives

- 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

Pre-requisites

- Logical reasoning

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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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	-
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	10	10	20
Apply	40	40	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 CS 001 – C Programming

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 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.	Balagurusamy, E. “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.	Reema Thareja, “Computer Fundamentals and Programming in C”, Second Edition, Oxford Higher Education, 2016.
4.	King, K N. “C Programming: A Modern Approach”, Second Edition, W.W. Norton, New York, 2008.

*__SDG: 4- Quality Education__

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of C, I/O, Branching and Loops**	
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
2.0	**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
3.0	**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
4.0	**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
5.0	**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

Course Designer(s)

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

61 ME 001	Engineering Drawing	Category	L	T	P	Credit
		ES	1	2	0	3

Objectives

- To convey 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.
- To draws the section of solids and to know development of different types of surfaces.
- To learn the concept in isometric projection.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Use the drafting instruments for construct the conic sections	Apply
CO2	Convert the pictorial views of solids in to orthographic views	Apply
CO3	Draw the projections of regular solids	Apply
CO4	Draw the true shape of sections and develop the lateral surfaces of right solids.	Apply
CO5	Sketch the three-dimensional view of solids for given orthographic views and 2D drawing using drafting software.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3										2	2	
CO2	3	3	3										3	3	
CO3	3	3	3										3	3	
CO4	3	3	3										3	3	
CO5	3	3	3										2	2	
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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to MECH, MCT, CIVIL & TXT Branches								
61 ME 001- Engineering Drawing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	1	2	0	75	3	40	60	100

Content	Hours
Introduction to Engineering Drawing and Plane Curves* Use of drawing instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning – Drawing sheet layouts - Title block – Line types – Scales: plain, diagonal and vernier scales. Construction of ellipse, parabola and hyperbola (Eccentricity method) - Construction of rectangular hyperbola - Construction of cycloids, epicycloids and hypocycloids	[3+12]
Orthographic Projection* Introduction to orthographic projections – Planes of projection – Projection of points and lines inclined to both planes – Projection of planes (Inclined to one plane and parallel to other – Inclined to both planes) - Conversions of pictorial views to orthographic views	[3+12]
Projection of Solids* Projections of simple solids: prism, pyramid, cylinder and cone (Axis of solid inclined to both HP and VP).	[3+12]
Sections of solids and Development of surfaces* Sections of solids :Prism, Cylinder, Pyramid, Cone – Auxiliary Views - Draw the sectional orthographic views of geometrical solids, objects from industry - Development of surfaces of Right solids – Prism, Pyramid, Cylinder and Cone	[3+12]
Isometric Projection and Introduction to AutoCAD* Principles of isometric projection – Isometric scale – Isometric projections of simple solids: Prism, pyramid, cylinder and cone - Isometric projections of frustum and truncated solids - Combination of two solid objects in simple vertical positions. Theory of CAD Software-Menu system-tool bar-drawing area-command lines-2D drafting practice.	[3+12]
Total Hours	**75**

Text Book(s):

1.	Bhatt N.D., —Engineering Drawing‖, Charotar Publishing House Pvt. Ltd., 54th Edition, Gujarat, 2023.
2.	Basant Agarwal and C.M.Agarwal., “Engineering Drawing”, McGraw Hill Education, 2013.

Reference(s):

1.	Shah M.B., Rana B.C., and V.K.Jadon., —Engineering Drawing‖, Pearson Education, 2011.
2.	Natarajan K.V., —A Text Book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2014.
3.	Venugopal K., “Engineering Graphics”, New Age International (P) Limited, 2014.
4.	Dhawan, R.K., “A Text Book of Engineering Drawing” 3 rd Revised Edition, S. Chand Publishing, New Delhi, 2012.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Engineering Drawing and Plane Curves**	
1.1	Use of drawing instruments	2
1.2	BIS conventions and specifications – Size, layout and folding of drawing sheets	2
1.3	Lettering and dimensioning -Drawing sheet layouts - Title block - Line types	2
1.4	Scales: plain, diagonal and vernier scales	1
1.5	Construction of ellipse	1
1.6	Construction of parabola	1
1.7	Construction hyperbola by eccentricity method	1
1.8	Practice class for ellipse, parabola and hyperbola	1
1.9	Construction of rectangular hyperbola	1
1.10	Construction of cycloids	1
1.11	Construction of epicycloids and hypocycloids	1
1.12	Practice class for cycloids and hypocycloids	1
2.0	**Orthographic Projection**	
2.1	Introduction to orthographic projections	2
2.2	Planes of projection	2
2.3	Projection of points	2
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	2
2.7	Conversions of pictorial views to orthographic views	1
2.8	Practice class for pictorial views to orthographic views	1
2.9	Practice class for pictorial views to orthographic views	1
3.0	**Projection of Solids**	
3.1	Projections of simple solids: prism	3
3.2	Projections of simple solids: cylinder	3
3.3	Projections of simple solids: pyramid	3
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	2
4.0	**Sections of solids and Development of surfaces**	
4.1	Section of solids for Prism	2
4.2	Section of solids for Cylinder	2
4.3	Section of solids for Pyramid	2
4.4	Section of solids for Cone	2
4.5	Auxiliary Views - Draw the sectional orthographic views of geometrical solids	2
4.6	Draw the sectional orthographic views of objects from industry	2
4.7	Development of surfaces of Right solids Prism	1
4.8	Development of surfaces of Right solids Pyramid	1
4.9	Development of surfaces of Right solids Cylinder and Cone	1
5.0	**Isometric Projection and Introduction to AutoCAD**	
5.1	Principles of isometric projection	2
5.2	Isometric scale	2
5.3	Isometric projections of simple solids: Prism	2
5.4	Isometric projections of simple solids: Pyramid	2
5.5	Isometric projections of simple solids: Cylinder	2

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5.6	Isometric projections of simple solids: Cone	2
5.7	Isometric projections of frustum	1
5.8	Isometric projections of truncated solids	1
5.9	Combination of two solid objects in simple vertical positions	1

Course Designer(s)

1. Dr.G.Venkatachalam-venkatachalam@ksrct.ac.in

60 ME 004	Engineering Mechanics	Category	L	T	P	Credit
		ES	3	1	0	4

Objectives

- To learn a process for analysis of static objects, concepts of force, moment, and mechanical equilibrium in two and three dimensions.
- To learn the equilibrium of rigid bodies such as frames, trusses, beams.
- To identify the properties of surfaces and solids by using different theorem.
- To learn the principle of frictional forces at the contact surfaces and impart basic concept of dynamics of particles.
- To acquire the concept of elements of rigid body dynamics

Pre-requisites

- Nil

Course Outcomes

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

CO1	Use scalar and vector analytical techniques for analysing forces in statically determinate structures.	Apply
CO2	Apply basic knowledge of scientific concepts to solve real-world problems.	Apply
CO3	Calculate the properties of surfaces and solids using various theorems.	Apply
CO4	Determine the effect of frictional forces and the dynamic forces exerted in the particle.	Apply
CO5	Analyse the rigid body dynamics and calculation of member forces in the rigid body.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	3	-	-	-	-	3	3	-
CO4	3	3	3	-	3	-	-	3	-	-	-	-	3	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	20	20	30
Apply	30	30	40
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E - Mechanical Engineering</td></tr>
<tr><td colspan="9">60 ME 004 - Engineering Mechanics</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>II</td><td>3</td><td>1</td><td>0</td><td>60</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
</table>

Basics and Statics of Particles* Introduction -Units and Dimensions-Laws of Mechanics–Principle of Transmissibility-Lame's Theorem, Parallelogram and Triangular Law of Forces–Vectors–Vectorial Representation of Forces and Moments. **Vector Operations*** Addition, Subtraction, Dot Product, Cross Product-Coplanar Forces–Resolution and Composition of Forces–Equilibrium of a Particle–Forces in Space-Equilibrium of a Particle In Space-Equivalent Systems of Forces-Single Equivalent Force	**[9]**
Equilibrium Of Rigid Bodies* Free Body Diagram–Types of Supports and Their Reactions–Requirements of Stable Equilibrium–Static Determinacy, Moments and Couples–Moment of a Force About a Point and About an Axis–Vectorial Representation of Moments and Couples–Varignon's Theorem-Equilibrium of Rigid Bodies in Two Dimensions.	**[9]**
Properties of Surfaces and Solids* Determination of Areas and Volumes-Centroid, Moment of Inertia of Plane Area (Rectangle, Circle, Triangle Using Integration Method; T Section, I Section, Angle Section, Hollow Section Using Standard Formula) - Parallel Axis Theorem and Perpendicular Axis Theorem- Polar Moment of Inertia -Mass Moment of Inertia of Thin Rectangular Section. **Hands On**: Determination of Centroid for Standard Geometries Determination of Moment of Inertia of the Standard Geometries	**[9]**
Friction* Frictional Force–Laws of Coloumb Friction–Simple Contact Friction–Ladder Friction-Rolling Resistance–Ratio of Tension in Belt. **Hands On**: Measure of Frictional Force in Block, Ladder and Belts **Dynamics of Particles*** Displacement, Velocity, Acceleration and Their Relationship–Relative Motion -Projectile Motion in Horizontal Plane– Newton's Law–Work Energy Equation – Impulse and Momentum. **Hands On**: Estimation of Velocity and Acceleration of Particles/Rigid Body By Newton's Law and Work Energy Equation	**[9]**
Elements of Rigid Body Dynamics* Translation and Rotation of Rigid Bodies: Velocity and Acceleration–General Plane Motion: Crank and Connecting Rod Mechanism.	**[9]**
Total Hours: 45 + 15(Tutorial)	**60**

Text Book(s):

1.	Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2017.
2.	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 11th Edition, 2016.

Reference(s):

1.	Jayakumar, V. and Kumar, M, "Engineering Mechanics", PHI Learning Private Ltd, New Delhi, 2012
2.	Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd.,
3.	Bansal R.K," Engineering Mechanics" Laxmi Publications (P) Ltd, 2011.
4.	Irving H. Shames, Engineering Mechanics: Statics and Dynamics", Pearson Education Asia Pvt. Ltd, 4thEdition, 2003.
5	James M. Gere and Timoshenko, "Mechanics of Materials", CBS Publisher, New Delhi, 6th Edition, 2012

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
1	**Basics and Statics Of Particles**	
1.1	Introduction, Units and Dimensions, Laws of Mechanics	1
1.2	Principle of transmissibility, Lame's theorem,	1
1.3	Parallelogram and triangular Law of forces	1
1.4	Tutorial	2
1.5	Vectors, Vectorial representation of forces and moments	1
1.6	Vector operations, Coplanar Forces–Resolution and Composition of forces	2
1.7	Equilibrium of a particle, Forces in space	1
1.8	Equivalent systems of forces-Single equivalent force.	1
1.9	Tutorial	2
2	**Equilibrium of Rigid Bodies**	
2.1	Free body diagram, Types of supports and their reactions	1
2.2	Requirements of stable equilibrium, Static determinacy	1
2.3	Moments and Couples–Moment of a force about a point and about an axis	2
2.4	Vectorial representation of moments and couples	1
2.5	Tutorial	2
2.6	Varignon's theorem	1
2.7	Equilibrium of Rigid bodies in two dimensions	2
2.8	Tutorial	2
3	**Properties of Surfaces and Solids**	
3.1	Determination of Areas and Volumes-Centroid	1
3.2	Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method)	2
3.3	Tutorial	2
3.4	Moment of Inertia of plane area(T section, I section, Angle section)	1
3.5	Moment of Inertia of plane area(Hollow section)	1
3.6	Parallel axis theorem and perpendicular axis theorem	1
3.7	Polar moment of inertia	1
3.8	Mass moment of inertia of thin rectangular section.	1
3.9	Tutorial	2
4	**Friction &Dynamics of Particles**	
4.1	Frictional force, Laws of Coloumb friction, Simple contact friction	1
4.2	Ladder friction	1
4.3	Rolling resistance–Ratio of tension in belt	1
4.4	Tutorial	2
4.5	Displacement, Velocity, acceleration and their relationship, Relative motion	1
4.6	Projectile motion in horizontal plane	1
4.7	Newton's law	1
4.8	Work Energy Equation	1
4.9	Impulse and Momentum	1
4.10	Tutorial	2
5	**Elements of Rigid Body Dynamics**	
5.1	Translation and Rotation of Rigid Bodies	1
5.2	Translation and Rotation of Rigid Bodies - Velocity	2
5.3	Translation and Rotation of Rigid Bodies - acceleration	2
5.4	Tutorial	2

5.5	General Plane motion	1
5.6	General Plane motion - Crank and Connecting rod mechanism	2
5.7	Tutorial	2

Course Designer(s)

1. Mr.S.KARTHICK -skarthick@ksrct.ac.in

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60 MY 001	Environmental Studies and Climate Change	Category	L	T	P	Credit
		MC	2	0	0	0

Objectives

- To understand the impact climate changes in ecosystem and biodiversity.
- To analyze the impacts of pollution, control and legislation.
- To explain the importance of sustainable development practices.
- To explore the significance of organic farming.
- To identify the Geo-spatial tools for resource management

Pre-requisites

- Nil

Course Outcomes

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

CO1	Interpret the impacts of pollution on climate change	Understand
CO2	Categorize the wastes and its management.	Analyze
CO3	Identify the different types of sustainable practices	Apply
CO4	Classify the organic farming techniques	Apply
CO5	Categorize the Geo-spatial tools for resource management	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	3		-	-	-	2	-	-	-
CO2	3	2	-	-	-	3	3	2	-	-	-	2	-	-	-
CO3	3	2	-	-	-	3	3	2	-	-	-	2	-	-	-
CO4	3	2	-	-	-	2	3	-	-	-	-	2	-	-	-
CO5	3	2	-	-	3	-	2	-	-	-	-	2	-	-	-

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (30 Marks)		Quiz (20 marks)		Seminar presentation (50 marks)
	Case Study	**Activity Report**	**Quiz 1**	**Quiz 2**	
Remember	10	10	5	5	10
Understand	30	20	10	10	15
Apply	-	30	-	5	15
Analyse	20	-	5	-	10
Evaluate	-	-	-	-	-
Create	-	-	-	-	-
Total	**60**	**60**	**20**	**20**	**50**

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 MY 001– Environmental Studies and Climate Change								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	2	0	0	30	0	100	-	100

Pollution and Its Impact on Climate Change* Pollution: Sources and Impacts of Air Pollution – Greenhouse 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.	[6]
Integrated Waste Management** Waste - Types and Classification. Principles of Waste Management (5r Approach) - Swachh Bharat Abhiyan – Commercial Waste, Plastic Waste, Domestic Waste, E-Waste - Biomedical Waste - RiskManagement: Collection, Segregation, Treatment and Disposal Methods. Waste Water Treatment- Activate Sludge Process.	[6]
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.	[6]
Environment and Agriculture**** Organic Farming – Bio-Pesticides- Composting, Bio Composting, Vermi- Composting, Roof Gardening and Irrigation. Waste Land Reclamation. Climate Resilient Agriculture. Green Auditing	[6]
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).	[6]
Total Hours	30

Text Book(s):	
1.	Anubha Kaushik , Kaushik, C. P, “Perspectives In Environmental Studies”, New Age International publishers; Sixth edition (1 January 2018)
Reference(s):	
1.	Tyler Miller, G. “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.	Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 2000

*SDG 13 – Climate Action
**SDG 4 Clean water and Sanitation
***SDG 6 Affordable and Clean Energy
****SDG 3 – Good Health and Well Being

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Pollution and its impact on climate change**	
1.1	Pollution: Sources and impacts of air pollution – greenhouse 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
2.0	**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
3.0	**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
4.0	**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
5.0	**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

Course Designer(s)

1. Dr.T.A.Sukantha - sukantha@ksrct.ac.in
2. Dr.B.Srividhya - srividhya@ksrct.ac.in
3. Dr.S.Meenachi - meenachi@ksrct.ac.in
4. Ms.D.Kirthiga - kiruthiga@ksrct.ac.in

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

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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

Pre-requisites

- 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment (Marks)	End Sem Examination (Marks)
Remember	20	40
Understand	40	40
Apply	-	20
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 GE 002- Tamils and Technology								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	40	60	100

Weaving and Ceramic Technology* Weaving Industry During Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	[3]
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 and 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 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

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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

Course Outcomes

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	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment (Marks)	End Sem Examination (Marks)
Remember	20	40
Understand	40	40
Apply	-	20
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 GE 002 – தமிழரும் தொழில்நுட்பமும்								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	40	60	100

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்ககாலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம்-கருப்பு சிவப்புபாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.	[3]
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில்வீட்டுப் 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]
உற்பத்தித்தொழில்நுட்பம்: கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை -இரும்பை உருக்குதல்,எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல்- மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள் ,கண்ணாடிமணிகள் - 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 பண்டையஅறிவு - அறிவுசார் சமூகம்.	[3]
அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்புசெய்தல் - 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.

*SDG 4 – Quality Education

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61 ME 0P1	Fabrication and Reverse Engineering Laboratory (Common to All branches)	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To provide hands-on training on Carpentry, Sheet metal, Fitting and Welding.
- To offer real time activity on plumbing connections and power tools in domestic applications.
- To provide hands-on training on CNC Wood Router and 3D Printing
- To provide hands-on training on household wiring and dismantling and assembling the home appliances.
- To offer real time activity on embedded programming using Arduino

Pre-requisites

- Nil

Course Outcomes

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

CO1	Make a wooden model using carpentry, Sheet metal Process.	Apply
CO2	Mate a model using filing and joining using MS Plate and repair & maintenances of water lines, power tools for home applications.	Apply
CO3	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends and technological advancement into the design process.	Apply
CO4	Trouble shoot the electrical and electronic circuits, electrical appliances and facilitate the house wiring.	Apply
CO5	Acquire practical knowledge on embedded programming using Arduino.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3			2	2		3			3		3	3
CO2	3	2	3			2	2		3			3		3	3
CO3	3	2	3			2	2		3			3		3	3
CO4	3		3			2	2		3			3		3	3
CO5	3		3			2	2		3			3		3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	25	12	50	50
Apply	25	13	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Rev. No.1/w.e.f. 01.07.2024
Passed in BoS Meeting held on 21.05.2024
Approved in Academic Council Meeting held on 25.05.2024

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
(Common to All branches)								
61 ME 0P1 -Fabrication and Reverse Engineering Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100

List of Experiments:

1. Making of Metal Model and Carpentry Process

a) Making of Tray using Sheet Metal Process

b) Making of T / Cross Joint using Carpentry Process.

2. Mating of Square Joint using the Filling Process

3. Fabrication of Welded model

4. Repair and Maintenance of Pipe Fitting for Home Applications

a) Assembly of GI pipes/PVC, Pipe Fitting and Cutting of Threads in GI pipes.

b) Fitting of Pipe with Clamps using Power Tools

5. Making of Model using CNC Wood Router

a) 2D profile cutting on plywood/MDF (6-12 mm) for press fit design

b) Machining of 3D geometry on soft material such as softwood

6. 3D Printing of scanned geometry using FDM or SLA Printer.

7. Dismantling and Assembling of

a) Iron Box

b) Mixer Grinder

c) Ceiling Fan

d) Table Fan

e) Water Heater

f) Induction Stove

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) Schematic and PCB layout design of the given circuit and fabrication and testing of the same.

b) Soldering

10. Embedded programming using Arduino

Lab Manual

"Fabrication and Reverse Engineering Laboratory Manual", Department of Mechanical Engineering, KSRCT.

Course Designer(s)

1. Mr.S Sakthivel - sakthivel_s@ksrct.ac.in
2. Dr.G.Vijayagowri – vijayagowri@ksrct.ac.in
3. Mr. K.Raguvaran – raguvaran@ksrct.ac.in

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61 ME 0P2	Computer Aided Drafting	Category	L	T	P	Credit
		ES	0	0	2	1

Objectives

- To understand the CAD software interface
- To apply 2D drawing and modification tools
- To draw basic and advanced 2D drawings
- To interpret and convert pictorial views to orthographic projections
- To draw simple 3D models from 2D views

Pre-requisites

- Engineering Drawing

Course Outcomes

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

CO1	Apply basic 2D drawing tools to draw simple geometries with dimensions	Apply
CO2	Utilize advanced CAD commands to draw complex 2D components with dimensions	Apply
CO3	Apply projection techniques to draw orthographic views from simple pictorial objects	Apply
CO4	Interpret complex pictorial views to draw orthographic projections	Apply
CO5	Apply 3D modeling tools to draw simple 3D components from orthographic views	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom'sCategory	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	50	25	100	100
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

Rev. No.1/w.e.f. 20.07.2025
Passed in BoS Meeting held on 13.06.2025
Approved in Academic Council Meeting held on 19.07.2025

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
61 ME 0P2 – Computer Aided Drafting								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	2	30	1	60	40	100

AutoCAD Software:
Introduction to CAD Interface - Menu Bar and Command Line - File Types and Management - Toolbars and Drawing Area – Coordinate Systems: Absolute, Relative, Polar - Drawing, Editing & Modify Commands - Dimensioning Methods and Styles - Text Style, Font, and Annotation - Layer Management and Properties - Printing/Layout Configuration.

List of Exercises:
1.Draw simple 2D drawings with dimensions.*
2.Draw advanced 2D drawings with dimensions.*
3.Draw front, top, and side views of an object from simple pictorial views.*
4.Draw front, top, and side views of an object from complex pictorial views.*
5.Draw a simple 3D model from orthographic views.*

Reference Book(s):

1.	Bhatt N.D., “Engineering Drawing”, Charotar Publishing House Pvt. Ltd., 54th Edition, Anand, Gujarat, 2023.
2.	D.M.Kulkarni,A.P.RAstogi, A.K.Sarkar, ”Engineering Graphics with Auto CAD”, PHI Private Limited, New Delhi, 2009

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Mr.S.Sakthivel – sakthivel_s@ksrct.ac.in
2. Dr.K.Raja – rajak@ksrct.ac.in

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

60 CS 0P1	C Programming Laboratory	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- 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

Pre-requisites

- Nil

Course Outcomes

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

CO1	Implement computational problems using 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	12	-	-
Apply	50	13	100	100
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 CS 0P1– C Programming Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100

List of Experiments:

1. Implementation of Simple Computational Problems using Various Formulas.
2. Implementation of Problems Involving SELECTION Statements.
3. Implementation of Iterative Problems e.g., Sum of Series.
4. Implementation of 1D Array Manipulation.
5. Implementation of 2D Array Manipulation.
6. Implementation of String Operations.
7. Implementation of Simple Functions and Different ways of Passing Arguments to Functions and RECURSIVE Functions.
8. Implementation of Pointers
9. Implementation of structures and Union.
10. Implementation of Bit Fields, Typedef and Enumeration.
11. Implementation of Preprocessor Directives.
12. Implementation of File Operations.

SDG:4- Quality Education

Course Designer(s)

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

BoS - Chairman
Mechanical Engineering (UG & PG)
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Tiruchengode - 637 215.

60 CG 0P1	Career Skill Development - I	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- 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

Pre-requisites

- 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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
3 - Strong; 2 - Medium; 1 - Some															

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

BoS - Chairman
Mechanical Engineering (UG & PG)
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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to All Branches								
Career Skill Development - I								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	0	0	2	30	1*	100	--	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.	[6]
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.	[6]
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	[6]
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	[6]
Verbal Ability I Reading Comprehension (Mcqs) – Cloze Test - Sequencing of Sentences – Summarizing and Paraphrase – Error Detection – Spelling Test – Sentence Improvement - Preposition	[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.	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 4 – Quality Education

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**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
2.0	**Speaking**	
2.1	Self-introduction	1
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
3.0	**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
4.0	**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
5.0	**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

Course Designer(s)

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

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

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 007	Statistics and Numerical Methods	2	40	60	100	45	100
2	60 EE 004	Electrical Drives and Control	2	40	60	100	45	100
3	60 ME 301	Engineering Materials and Metallurgy	2	40	60	100	45	100
4	60 ME 302	Strength of Materials	2	40	60	100	45	100
5	60 ME 303	Thermodynamics	2	40	60	100	45	100
6	60 ME304	Manufacturing Techniques	2	40	60	100	45	100
7	60 MY 002	Universal Human Values*	2	100	-	100	-	100
		PRACTICAL						
8	60 EE 0P4	Electrical Drives and Control Laboratory	3	60	40	100	45	100
9	60 ME 3P1	Computer Aided Machine Drawing Laboratory	3	60	40	100	45	100
10	60 CG 0P2	Career Skill Development - II	3	100	-	100	-	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 put a 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 theory End Semester Examination and 40 marks for Practical End Semester Examination.

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Tiruchengode - 637 215.

60 MA 007	Statistics and Numerical Methods	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To familiarize the basic concepts of probability and random variables.
- To familiarize various distributions and testing of hypothesis.
- To learn basics of descriptive statistics.
- To get exposed to various techniques to solve equations numerically.
- To know the concepts of interpolation and numerical integration

Pre-requisites

- Nil

Course Outcomes

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

CO1	Interpret the basic concepts of probability and random variables.	Apply
CO2	Apply Student's t test, F test and Chi-square test for testing the statistical hypothesis.	Apply
CO3	Compute measures of central tendency, measures of dispersion and correlation coefficient.	Apply
CO4	Employ various iteration techniques for solving algebraic, transcendental and system of linear equations.	Apply
CO5	Apply different techniques to find the intermediate values and to evaluate single definite integrals.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	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	10
Understand	10	10	20
Apply	40	40	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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

Syllabus

K.S.Rangmatricesasamy College of Technology – Autonomous R2022

Common to Mech, MCT and Civil

60 MA 007- Statistics and Numerical Methods

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	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. **Hands - on:** **Calculate** Expectation for Discrete Random Variable.	[9]
Standard Distributions and Testing of Hypothesis* Binomial Distribution - Poisson Distribution – 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. **Hands - on:** Apply Student's T - Test, F- Test and Chi-Square Test To Real Dataset.	[9]
Empirical Statistics Measures of Central Tendency: Mean, Median, Mode - Measures of Dispersion: Range - Quartile Deviation - Standard Deviation - Measures of Skewness: Bowley's Co-Efficient of Skewness - Pearson's Co-Efficient of Skewness - Correlation. **Hands - on:** Calculate Mean, Median, Mode and Range for Discrete Frequency Distribution.	[9]
Solutions of Equations and Eigen Value Problem Algebraic and Transcendental Equations - Newton Raphson Method – Regula Falsi Method -Gauss Elimination Method - Gauss Jordan Method - Iterative Methods: Gauss Jacobi Method - Gauss Seidel Method - Eigen Value of a Matrix by Power Method. **Hands - on:** Visualize The Iterative Methods for Solving Linear System of Equations	[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). **Hands - on:** Numerical Integration by Trapezoidal and Simpson's Rules	[9]
Total Hours: 45 + 5 (Hands-on) + 10 (Tutorial)	**60**

Text Book(s):

1.	Gupta S. P., "Statistical Methods", 46th Revised Edition, Sultan Chand & Son, New Delhi, 2021.
2.	Faires, J. D. and Burden, R., "Numerical Methods", 4th Edition, Brookes / Cole (Thomson Publications), New Delhi, 2011.

Reference(s):

1.	Kapoor V. K., and Gupta S. C., "Fundamentals of Mathematical Statistics'', 12th Edition, Sultan Chand & sons, New Delhi, 2020.
2.	Johnson, R. A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2023.
3.	Grewal, B. S., and Grewal, J. S., "Numerical Methods in Engineering and Science", 10th Edition, Khanna Publishers, New Delhi, 2015.
4.	Kandasamy P., Thilagavathy K. and Gunavathi K., "Numerical Methods", 3rd Edition, S.Chand & Company Ltd, New Delhi, 2003.

***SDG:4 Quality Education,**

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

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Probability and Random Variables**	
1.1	Axioms of probability	1
1.2	Conditional probability	1
1.3	Baye's theorem	1
1.4	Random variable	2
1.5	Expectation	1
1.6	Probability mass function	1
1.7	Probability density function	1
1.8	Moment generating function	1
1.9	Tutorial	2
1.10	Hands on	1
2.0	**Standard Distributions and Testing of Hypothesis**	
2.1	Binomial Distribution	1
2.2	Poisson Distribution	1
2.3	Fit a Binomial and Poisson Distribution	1
2.4	t test	1
2.5	F test	2
2.6	Chi- square test	1
2.7	Test for Independency	1
2.8	Goodness of fit.	1
2.9	Tutorial	2
2.10	Hands on	1
3.0	**Empirical Statistics**	
3.1	Mean, Median and Mode	2
3.2	Range, Quartile deviation	1
3.3	Standard deviation	1
3.4	Pearson's co-efficient ofskewness	1
3.5	Bowley's co-efficient ofskewness	1
3.6	Measures of skewness	1
3.7	correlation	2
3.8	Tutorial	2
3.9	Hands on	1
4.0	**System of Equations and EigenValue Problem**	
4.1	Newton Raphson method	1
4.2	Gauss elimination method	2
4.3	Gauss Jordan method	1
4.4	Gauss Jacobi method	1
4.5	Gauss Seidel method	1
4.6	Matrix inversion by Gauss Jordan method	1
4.7	Eigen values of a matrix by power method	2
4.8	Tutorial	2
4.9	Hands on	1
5.0	**Interpolation and Numerical Integration**	
5.1	Lagrange's interpolations	1
5.2	Newton's divided difference interpolations	2
5.3	Newton's forward and backward difference interpolations	2

5.4	Two and three point Gaussian quadratures	2
5.5	Single integration using Trapezoidal andSimpson's1/3and3/8rules	2
5.6	Tutorial	2
5.7	Hands on	1

Course Designer(s)

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BoS - Chairman
Mechanical Engineering (UG & PG)
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60 EE 004	Electrical Drives and Control	Category	L	T	P	Credit
		ES	3	0	0	3

Objectives

- To select an appropriate electrical drive system based on its loading and thermal factors.
- To discuss the basic concepts of different types of electrical machines and their performance.
- To summarize the conventional and solid-state DC drives with its applications
- To illustrate the conventional and solid-state AC drives with its applications
- To recognize the fundamentals of electric traction.

Pre-requisites

- Basics of Electrical Engineering

Course Outcomes

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

CO1	Employ the fundamental criteria for designing an electrical drive system based on specific application and load conditions.	Apply
CO2	Appraise the various types of DC motors and Induction motors based on its characteristics	Analyze
CO3	Explain the converter and chopper-based speed control of DC drives	Understand
CO4	Illustrate the solid state speed control of AC drives	Understand
CO5	Describe the electric traction and its topologies.	Remembering

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	2	-	-	2	2	
CO2	3	3	2	2	-	-	-	-	-	2	-	-	2		2
CO3	3	3	2	2	3	2	-	2	2	2	2	2	3	2	2
CO4	3	3	2	2	3	2	-	2	2	2	2	2	3	2	2
CO5	3	3	2	2	-	-	-	-	-	2	-	2	2	2	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	20
Understand	20	40	30
Apply	20	-	30
Analyse	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 EE 004– Electrical Drives and Control								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction of Electrical Drives* Basic Elements of Electrical Drive System–Types of Electrical Drives– Factors Influencing The Choice of Electrical Drives–Heating and Cooling Curves–Classes of Motor Duty–Selection of Power Rating for Drive Motors With Regard to Thermal Over Loading and Load Variation Factors.	[9]
Drive Motor Characteristics* Mechanical Characteristics: Speed–Torque Characteristics of Various Types of Load and Drive Motors. Braking of Electrical Motors–Dc Motors: Shunt Series and Compound–Three Phase Induction Motors-Torque and Slip Equations–Torque-Slip Characteristics.	[9]
Solid State Speed Control of DC Drives* Speed Control of DC Series and Shunt Motors: Armature Voltage Control, Field Flux Control and Ward Leonard Control-Single Phase and Three Phase Fully Controlled Rectifiers–Working Principle-Single Phase and Three Phase Fully Controlled Rectifiers Fed DC Motor Speed Control and DC Chopper Fed DC Motor Speed Control–Applications.	[9]
Solid State Speed Control of AC Drives* Conventional Speed Control of Three Phase Induction Motors: Stator Voltage Control, Stator Frequency Control, Rotor Resistance Control-Voltage/Frequency Control of Induction Motor, Voltage Source Inverter and Current Source Inverter–Working Principle-VSI Fed Three Phase Induction Motors–CSI Fed Three Phase Induction Motors-Static Rotor Resistance Control–Static Scherbius and Static Kramer Drives-Applications.	[9]
Introduction to Electric Traction** Electric Drivetrains: Basic Concept of Electric Traction-Introduction to Various Traction System Topologies-Requirements of an Ideal Traction System-Track Electrification Systems-Electric Traction System–Power Supply.-Introduction to Energy Storage Requirements in Electric Vehicles-Battery Based Energy Storage and its Analysis.	[9]
Total Hours	**45**

Text Book(s):

1.	Gopal.K.Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House, 2^{nd}Edition, 2020.
2.	Theraja, B.L and Theraja, A.K.,“A text book of Electrical Technology–Volume II (AC & DC Machines)” S.Chand & Company Ltd.,New Delhi, 2015.

Reference(s):

1.	Vedam Subrahmanyam, “Electric Drives Concepts and Applications” Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2011.
2.	Singh M.D. and Khanchandani, K.B. “Power Electronics”, TataMc GrawHill Publishing Company Ltd.,New Delhi, 2010.
3.	Krishnan R,” Electric Motor Drives: Modeling, Analysis, And Control”, Pearson India, first edition, 2015.
4.	Rajput, R. K. “Utilisation of Electrical Power”, Laxmi Publications (P) Ltd, 2018.

*SDG 7 – Clean and Affordable Energy
**SDG 9 – Industry Innovation and Infrastructure

BoS - Chairman
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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction of Electrical Drives**	
1.1	Basic Elements of an electrical drive system	1
1.2	Types of Electrical Drives – Factors influencing the choice of electrical drives	2
1.3	Heating and cooling curves	2
1.4	Classes of motor duty	2
1.5	Selection of power rating for drive motors with regard to thermal overloading and load variation factors.	2
2.0	**Drive motor characteristics**	
2.1	Mechanical characteristics: Speed –Torque characteristics of various types of load and drive motors	1
2.2	Braking of Electrical motors	1
2.3	DC motors: Shunt series and compound	1
2.4	Three phase induction motors	
2.5	Torque and slip Equations	1
2.6	Torque -slip Characteristics	1
3.0	**Solid State Speed control of DC drives**	
3.1	Speed Control of DC series and shunt motors: Armature Voltage Control, Field Flux Control	1
3.2	Ward Leonard control	1
3.3	Single phase and three phase fully controlled rectifiers–working principle	2
3.4	Single phase and three phase fully controlled rectifiers fed DC motor speed control	2
3.5	DC chopper fed DC motor speed control	2
3.6	Applications	1
4.0	**Solid State Speed Control of AC drives**	
4.1	Conventional Speed Control of three phase Induction Motors: Stator Voltage Control, Stator Frequency Control	1
4.2	Rotor Resistance Control-Voltage/Frequency Control of induction motor	1
4.3	Voltage Source Inverter and Current Source Inverter–working principle	2
4.4	VSI fed Three Phase Induction Motors	1
4.5	CSI Fed Three Phase Induction Motors	1
4.6	Static Rotor resistance Control	1
4.7	Static Scherbius and static Kramer Drives-applications.	2
5.0	**Introduction to Electric Traction**	
5.1	Electric Drivetrains: Basic concept of electrictraction	1
5.2	Introduction to various traction system topologies	2
5.3	Requirements of an ideal traction system	1
5.4	Track electrification systems - electric traction system - power supply	2
5.5	Introduction to Energy Storage Requirements in Electric Vehicles	1
5.6	Battery based energy storage and its analysis.	2

Course Designer(s)

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

60 ME 301	Engineering Materials and Metallurgy	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To provide a detailed interpretation of equilibrium phase diagrams.
- To Predict the Metallurgical properties of Non-ferrous metals, Aluminium alloy and Bearing materials.
- To learn about different phases and heat treatment methods to tailor the properties of Fe-C alloys.
- To learn the physical and Mechanical properties of Ceramic, Composite materials for Engineering fields.
- To learn testing of engineering materials.

Pre-requisites

- Applied Physics, Strength of Materials, Thermodynamics

Course Outcomes

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

CO1	Analyze the Microstructure of materials in phase diagrams.	Analyze
CO2	Choose appropriate metal and incorporate in the alloy to tailor the material properties.	Apply
CO3	Select the suitable heat treatment process to get the required properties of steel.	Apply
CO4	Identify the suitable process for manufacturing of nonmetallic materials and powder.	Apply
CO5	Choose appropriate testing methods to study the Mechanical properties of the materials.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	3	-	-	-	-	-	-	-	-	-	-	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	20	20	40
Apply	10	20	20
Analyse	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

BoS - Chairman
Mechanical Engineering (UG & PG)
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 301- Engineering Materials and Metallurgy								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Constitution of Alloys and Phase Diagrams* Constitution of Alloys – Solid Solutions, Substitutional and Interstitial – Phase Diagrams, Isomorphous, Eutectic, Eutectoid, Peritectic, and Peritectoid Reactions, Iron – Iron Carbide Equilibrium Diagram. Classification of Steel and Cast-Iron Microstructure, Properties and Application.	[9]
Ferrous and Non-Ferrous Metals* Effect of Alloying Additions on Steel (Mn, Si, Cr, Mo, Ni, V,Ti& W) – Stainless and Tool Steels – HSLA - Maraging Steels – Grey, White, Malleable, Spheroidal – Alloy Cast Irons, Copper and its Alloys – Brass, Bronze And Cupronickel – Aluminium and its Alloys.	[9]
Heat Treatment* Full Annealing, Stress Relief, Recrystallisation and Spheroidising –Normalizing, Hardening and Tempering of Steel. Isothermal Transformation Diagrams – Cooling Curves Superimposed on Time Temperature Transformation (Ttt) Diagram– Continuous Cooling Transformation (Cct) Diagram – Austempering, Martempering – Hardenability, Jominy End Quench Test -Case Hardening, Carburizing, Nitriding, Cyaniding, Carbonitriding – Flame and Induction Hardening – Vacuum and Plasma Hardening – Thermo-Mechanical Treatments- Elementary Ideas on Sintering	[9]
Non Metallic Materials and Other Engineering Materials** Polymers – Types of Polymers, Commodity And Engineering Polymers – Properties and Applications of Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), Polyvinyl Chloride (PVC), - Poly Methyl Methaacrylate (PMMA), - Polyethylene Terephthalate (PET), Polycarbonate (PC), Poly Tetra Fluro Ethylene (PTFE), Thermo Set Polymers – Urea and Phenol Formaldehydes –Nylon, Engineering Ceramics – Properties and Applications of Al_2O_3, Sic, Si_3N_4, PSZ And SIALON – Intermetallics- Composites- Matrix and Reinforcement Materials Applications of Composites - Nano Composites, Bio-Degradable Materials.	[9]
Testing of Engineering Materials and Deformation Mechanisms* Mechanisms of Plastic Deformation, Slip and Twinning – Types of Fracture – Fracture Mechanics- Griffith's Theory- Testing of Materials Under Tension, Compression and Shear Loads – Hardness Tests (Brinell, Rockwell and Vickers, Micro and Nano-Hardness Tests, Impact Test Lzod and Charpy, Fatigue and Creep Failure Mechanisms. Metallography - Preparation of Specimen, Metallurgical Microscope and Scanning Electron Microscope.	[9]
Total Hours	**45**

Text Book(s):

1.	Khanna O.P, "A Text Book of Material Science and Metallurgy", Dhanpat Rai Publishers, New Delhi, 2010.
2.	Sidney H. Avner "Introduction to Physical Metallurgy" 2nd Edition, Tata McGraw-Hill Companies Inc., New Delhi, 2013.

Reference(s):

1.	Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", 7thEdition, Prentice Hall of India Private Limited, 2010.
2.	Raghavan.V, "Materials Science and Engineering: A First Course", 6th Edition, Prentice Hall of India Pvt.Ltd., New Delhi, 2019.
3.	William D. Callister, "Material Science and Engineering: An Introduction", 5thEdition Wiley India Pvt Ltd, New Delhi, 2016.
4.	Sina Ebnesajjad. "Handbook of Biopolymers and Biodegradable Plastics: Properties, Processing and Applications", 1 st Edition, Elsevier, Amsterdam, Netherlands, 2012.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Constitution of Alloys and Phase Diagrams**	
1.1	Constitution of alloys – Solid solutions	1
1.2	substitutional and interstitial – phase diagrams	1
1.3	Eutectic, eutectoid, peritectic, and peritectoid reactions	2
1.4	Iron – Iron carbide equilibrium diagram	2
1.5	Classification of steel and cast-Iron - Microstructure	2
1.6	Classification of steel and cast-Iron - Properties and application.	1
2.0	**Ferrous and Non-Ferrous Metals**	
2.1	Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V,Ti& W)	2
2.2	stainless and tool steels	2
2.3	HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons	3
2.4	Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys.	2
3.0	**Heat Treatment**	
3.1	Full annealing, stress relief, recrystallisation and spheroidising	1
3.2	Normalizing, hardening and tempering of steel	1
3.3	Isothermal transformation diagrams – cooling curves superimposed on Time Temperature Transformation (TTT) Diagram	1
3.4	Continuous cooling Transformation (CCT) diagram	1
3.5	Austempering, Martempering – Hardenability, Jominy end quench test	1
3.6	case hardening, carburizing, Nitriding, cyaniding, carbonitriding	1
3.7	Flame and Induction hardening – Vacuum and Plasma hardening	1
3.8	Thermo-mechanical treatments- elementary ideas on sintering	2
4.0	**Non-Metallic Materials and other Engineering Materials**	
4.1	Polymers – types of polymers, commodity and engineering polymers	1
4.2	Properties and applications of Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), Polyvinyl chloride (PVC)	1
4.3	Poly methyl methaacrylate (PMMA), - Polyethylene terephthalate (PET), Polycarbonate (PC), Poly tetra fluro ethylene (PTFE)	1
4.4	Thermo set polymers	1
4.5	Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON	2
4.6	Matrix and reinforcement Materials applications of Composites - Nano composites, Bio-degradable Materials.	2
4.7	Nano composites, Bio-degradable Materials.	1
5.0	**Testing of Engineering Materials and Deformation Mechanisms**	
5.1	Mechanisms of plastic deformation, slip and twinning	1
5.2	Types of fracture – fracture mechanics- Griffith's theory- Testing of materials under tension, compression and shear loads	2
5.3	Hardness tests (Brinell, Rockwell and Vickers , Micro and nano-hardness tests	2
5.4	Impact test Izod and charpy, fatigue and creep failure mechanisms	2
5.5	Metallography - Preparation of specimen, Metallurgical microscope and Scanning Electron Microscope.	2

Course Designer(s)

1. Dr.V.P.Arthanarieswaran – arthanarieswaran@ksrct.ac.in

60 ME 302	Strength of Materials	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To compute slopes and deflections in determinate beams by various methods
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To study the stresses and deformations induced in thin and thick shells.

Pre-requisites

- Engineering Mechanics

Course Outcomes

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

CO1	Interpret the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.	Understand
CO2	Comprehend the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.	Understand
CO3	Calculate slope and deflection in beams using different methods.	Apply
CO4	Apply basic equation of torsion in designing of shafts and helical springs	Apply
CO5	Analyse thin and thick shells for applied pressures	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO5	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	20	20	20
Understand	40	20	30
Apply	-	20	30
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME 302- Strength of Materials

Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Stress, Strain and Deformation of Solids* Rigid Bodies and Deformable Solids – Tension, Compression and Shear Stresses - Deformation of Simple and Compound Bars – Thermal Stresses – Elastic Constants - Volumetric Strains – Stresses on Inclined Planes – Principal Stresses and Principal Planes – Mohr's Circle of Stress.	[9]
Transverse Loading on Beams and Stresses in Beam* Beams – Types - Transverse Loading on Beams – Shear Force and Bending Moment in Beams – Cantilever, Simply Supported and Over Hanging Beams. Theory of Simple Bending – Bending Stress Distribution – Shear Stress Distribution.	[9]
Deflection of Beams* Elastic Curve – Double Integration Method - Area Moment Method- Macaulay's Method - Conjugate Beam Method for Computation of Slope and Deflection of Determinant Beams.	[9]
Torsion* Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined Bending Moment and Torsion of Shafts - Power Transmitted to Shaft – Shaft in Series and Parallel – Closed and Open Coiled Helical Springs – Springs in Series and Parallel.	[9]
Thin Cylinders, Spheres and Thick Cylinders* Stresses in Thin Cylindrical Shell Due to Internal Pressure - Circumferential and Longitudinal Stresses -Deformation in Thin Cylinders – Spherical Shells Subjected to Internal Pressure – Deformation In Spherical Shells – Thick Cylinders - Lame's Theory.	[9]
Total Hours	**45**

Text Book(s):

1.	Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 7th edition, 2018.
2.	Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt.Ltd., New Delhi, 2017.

Reference(s):

1.	Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., NewDelhi, 2015.
2.	Beer. F.P. & Johnston. E.R. "Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi, 2019.
3.	Singh. D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021.
4.	Vazirani. V.N, Ratwani. M.M, Duggal .S.K "Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1", Khanna Publishers, New Delhi 2014.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.1	Rigid bodies and deformable solids	
1.2	Tension, Compression and Shear Stresses	1
1.3	Deformation of simple and compound bars	1
1.4	Thermal stresses	1
1.5	Elastic constants	1
1.6	Volumetric strains	1
1.7	Stresses on inclined planes	1
1.8	Principal stresses and principal planes	1
1.9	Mohr's circle of stress.	1
2.0	**Transverse Loading on Beams and Stresses in Beam**	
2.1	Beams, Types & Transverse loading on beams	1
2.2	Shear force and Bending moment in beams	1
2.3	Shear force and Bending moment in Cantilever beams	1
2.4	Shear force and Bending moment in Simply supported beams	1
2.5	Shear force and Bending moment in over hanging beams	1
2.6	Theory of simple bending	1
2.7	Bending stress distribution	1
2.8	Shear stress distribution	2
3.0	**Deflection of Beams**	
3.1	Elastic curve, Double integration method	2
3.2	Area moment method	2
3.3	Macaulay's method	2
3.4	Conjugate beam method	2
3.5	Computation of slope and deflection of determinant beams	2
4.0	**Torsion**	
4.1	Theory of Torsion	1
4.2	Stresses and Deformations in Solid and Hollow Circular Shafts	1
4.3	Combined bending moment and torsion of shafts	1
4.4	Power transmitted to shaft	1
4.5	Shaft in series and parallel	1
4.6	Closed and Open Coiled helical springs	2
4.7	springs in series and parallel	2
5.0	**Thin Cylinders, Spheres And Thick Cylinders**	
5.1	Stresses in thin cylindrical shell due to internal pressure	1
5.2	Circumferential and longitudinal stresses	1
5.3	Deformation in thin cylinders	1
5.4	Spherical shells subjected to internal pressure	2
5.5	Deformation in spherical shells	1
5.6	Thick cylinders	2
5.7	Lame's theory	1

Course Designer(s)

1. Dr. K. Santhanam -santhanam@ksrct.ac.in

60 ME 303	Thermodynamics	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To evaluate the properties changes in open, closed and isolated systems.
- To apply the concept of thermodynamics laws to various practical applications such as heat engines, heat pump and refrigeration systems.
- To analyze the performance of steam power cycles.
- To derive the mathematical relation for thermodynamic properties.
- To impart the knowledge on the properties and process of psychrometry

Pre-requisites

- Calculus and Differential Equations

Course Outcomes

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

CO1	Recognize the basic concepts of thermodynamic processes and first law of thermodynamics.	Apply
CO2	Solve the problems by applying the second law of thermodynamics	Apply
CO3	Apply the thermodynamic properties of pure substances using steam table	Apply
CO4	Distinguish the behavior of real & ideal gases and derive the thermodynamic relations	Apply
CO5	Apply the psychometric concepts in air conditioning processes	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

BoS - Chairman
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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 303- Thermodynamics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Basics, Zeroth and First Law of Thermodynamics* Basic Concepts - Zeroth Law of Thermodynamics, First Law of Thermodynamics - Application to Closed and Open Systems - Steady Flow Energy Equation (SFEE) With Reference to Thermal Equipments.	[9]
Second Law of Thermodynamics And Entropy* Kelvin - Planck Statement, Clausius Statement - Carnot Cycle - Carnot's Theorem – Application: Heat Engine - COP - Refrigerator - Heat Pump - Availability and Irreversibility for Open and Closed System Processes- Inequality of Clausius, Entropy - Basic Concepts of Exergy.	[9]
Properties of Pure Substances* Properties of Pure Substances - Gibbs Phase Rule - P-V Diagram -P-T Diagram - T-S Diagram - H-S Diagram - Pvt Surfaces. Steam - Formation of Steam - Thermodynamic Properties of Steam - Use of Steam Tables And Mollier Chart - Calculations of Work Done and Heat Transfer in Non-Flow and Flow Processes. Rankine Cycle - Reheat & Regenerative Rankine Cycle.	[9]
Thermodynamic Mathematical Relations* Thermodynamic Relations - Exact Differentials - Tds Equations - Difference and Ratio of Heat Capacities - Maxwell's Equations - Clausius-Clapeyron Equation - Joule-Kelvin Coefficient.	[9]
Psychrometry** Properties of Atmospheric Air - Psychrometric Chart - Psychrometric Processes - Sensible Heating - Sensible Cooling - Cooling and Dehumidification - Heating and Humidification - Adiabatic Mixing - Evaporative Cooling.	[9]
Total Hours	**45**

Text Book(s):

1.	Cengel, Y. A., "Thermodynamics - An Engineering Approach", 9th Edition, Tata McGraw Hill Pub., New Delhi, 2019.
2.	Nag. P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw-Hill Publications, New Delhi, 2017

Reference(s):

1.	Moran, M. J. and Shapiro, H. N., "Fundamentals of Engineering Thermodynamics", 8th Edition, John Wiley and Sons, 2014.
2.	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., "Fundamentals of Thermodynamics", 6th Edition, John Wiley and Sons, 2003.
3.	Holman,J.P., "Thermodynamics", 4th Edition, McGraw-Hill Publications, 1995.
4.	Rajput, R.K., "A Textbook of Engineering Thermodynamics, 4th Edition, Laxmi Publications, 2010.

SDG 4 – Quality Education

**SDG 9 – Industry Innovation and Infrastructure

BoS - Chairman
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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basic Concepts and First Law of Thermodynamics**	
1.1	Basic Concepts - Thermodynamic systems	1
1.2	Property, state, path and process	1
1.3	Zeroth, First law of thermodynamics & Problem	2
1.4	Non Flow Process	1
1.5	Problem Solving on Non flow process	1
1.6	Energy Balance for Steady-Flow Systems	1
1.7	Problem Solving on SFEE	2
2.0	**Second Law of Thermodynamics**	
2.1	Second law of thermodynamics	1
2.2	Carnot cycle & Carnot Theorem	1
2.3	Heat engine & Problem Solving	2
2.4	Refrigerator & Problem Solving	1
2.5	Heat Pump & Problem Solving	1
2.6	Clausius inequality & PMM	1
2.7	Entropy concept & Problem Solving	2
3.0	**Properties of Pure Substances**	
3.1	Basic Concepts - Pure Substances, Steam Properties	1
3.2	Problem Solving on properties of steam	2
3.3	Ideal Rankine cycle & Problem Solving	2
3.4	Ideal Rankine reheat cycle & Problem Solving	2
3.5	Ideal Rankine regenerative cycle & Problem Solving	2
4.0	**Thermodynamic Mathematical Relations**	
4.1	Equation of state, Compressibility factor & Chart	1
4.2	Thermodynamic Relations	1
4.3	Maxwell’s relations	1
4.4	Energy relations	2
4.5	Cp & Cv relations	1
4.6	Clausius Clapeyron equations	2
4.7	Joule – Thomson coefficient	1
5.0	**Psychrometry**	
5.1	Psychrometry Properties	1
5.2	Problem Solving on Psychrometry Properties	2
5.3	Sensible Heating	1
5.4	Sensible Cooling	1
5.5	Cooling and dehumidification	1
5.6	Heating and humidification	1
5.7	Adiabatic mixing	1
5.8	Evaporative Cooling	1

Course Designer(s)

1. Dr.M.Gnanasekaran – gnanasekaran@ksrct.ac.in
2. Mr.R.Prakash - prakashr@ksrct.ac.in

60 ME 304	Manufacturing Techniques	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To acquire theoretical and practical knowledge in material casting processes.
- To expose the students to the principles of the various metal joining methods.
- To study the various metal forming process.
- To interpret the manufacturing sheet metal processes.
- To impart the knowledge on the Smart manufacturing.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Explain different metal casting processes, associated defects, merits and demerits	Apply
CO2	Compare different metal joining processes.	Apply
CO3	Summarize various hot working and cold working methods of metals.	Apply
CO4	Explain various sheet metal making processes.	Apply
CO5	Acquire knowledge on smart manufacturing	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	3	3	-	-	-	-	3	3	3	-
CO2	3	3	2	-	-	3	3	-	-	-	-	2	3	3	-
CO3	3	2	3	-	-	3	3	-	-	-	-	3	3	3	-
CO4	3	2	3	-	-	3	3	-	-	-	-	2	3	2	-
CO5	3	2	2	-	-	3	3	-	-	-	-	3	3	2	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	50
Understand	30	20	30
Apply	10	10	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 304- Manufacturing Techniques								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Metal Casting Processes* Sand Casting : Sand Mould – Type of Patterns - Pattern Materials – Pattern Allowances – Moulding Sand Properties and Testing – Cores –Types and Applications – Moulding Machines– Types and Applications, Melting Furnaces: Blast and Cupola Furnaces; Principle of Special Casting Processes : Shell - Investment – Ceramic Mould – Pressure Die Casting - Centrifugal Casting - Co2process – Stir Casting; Defects in Sand Casting.	[9]
Metal Joining Processes** Operating Principle, Basic Equipment, Merits and Applications of: Fusion Welding Processes: Gas Welding - Types – Flame Characteristics; Manual Metal Arc Welding – Gas Tungsten Arc Welding- Gas Metal Arc Welding – Submerged Arc Welding – Electro Slag Welding; Operating Principle and Applications Of: Resistance Welding - Plasma Arc Welding – Thermit Welding – Electron Beam Welding – Friction Welding and Friction Stir Welding; Brazing and Soldering; Weld Defects: Types, Causes and Cure.	[9]
Metal Forming Processes** Hot Working and Cold Working of Metals – Forging Processes – Open, Impression and Closed Die Forging – Forging Operations. Rolling of Metals– Types of Rolling – Flat Strip Rolling – Shape Rolling Operations – Defects in Rolled Parts. Principle of Rod and Wire Drawing – Tube Drawing – Principles of Extrusion – Types – Hot and Cold Extrusion.	[9]
Sheet Metal Processes** Sheet Metal Characteristics – Shearing, Bending and Drawing Operations – Stretch Forming Operations – Formability of Sheet Metal – Test Methods –Special Forming Processes-Working Principle and Applications – Hydro Forming – Rubber Pad Forming – Metal Spinning– Introduction of Explosive Forming, Magnetic Pulse Forming, Peen Forming, Super Plastic Forming – Micro Forming.	[9]
Introduction to Smart Manufacturing* Smart Manufacturing Differ from Conventional and Legacy Manufacturing - Computer Integrated Manufacturing Systems Structure And Functional Areas Ofcim System, - Computer Aided Design (CAD), Computer Aided Process Planning (CAPP), Computer Aided Manufacturing (CAM), Computer Aided Quality Control (CAQC), Automated Storage And Retrieval System (ASRS).	[9]
Total Hours	**45**

Text Book(s):

1.	Kaushish, J.P., "Manufacturing Processes," PHI Learning Ltd, New Delhi, 2021.
2.	Rajput, R.K., "A Textbook of Manufacturing Technology", Laxmi publications (P) ltd, 2020.

Reference(s):

1.	Jain R.K., Production Technology, Khanna Publishers, 2021
2.	Rao P N, " Manufacturing Technology", Tata McGraw Hill Publishing Co. Ltd., Volume 1, New Delhi, 2021
3.	Serope Kalpakjian and Stephen Schmid, "Manufacturing, Engineering and Technology", SI 6th Edition -Ⅱ, Pearson Education, 2022
4.	Masoud Soroush, McKetta Michael Baldea, Thomas F. Edgar "Smart Manufacturing: Concepts and Methods" Elsevier; 1st edition 2020

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Metal Casting Processes**	
1.1	Sand Casting : Sand Mould – Type of patterns	1
1.2	Pattern Materials – Pattern allowances	1
1.3	Moulding sand Properties and testing	1
1.4	Cores –Types and applications – Moulding machines	1
1.5	Types and applications, Melting furnaces: Blast and Cupola Furnaces	1
1.6	Principle of special casting processes : Shell - investment	1
1.7	Ceramic mould – Pressure die casting	1
1.8	Centrifugal Casting - CO2 process	1
1.9	Stir casting; Defects in Sand casting	1
2.0	**Metal Joining Processes**	
2.1	Operating principle, basic equipment	1
2.2	Merits and applications of: Fusion welding processes	1
2.3	Gas welding - Types – Flame characteristics	1
2.4	Manual metal arc welding – Gas Tungsten arc welding	1
2.5	Gas metal arc welding – Submerged arc welding	1
2.6	Electro slag welding; Operating principle and applications of resistance welding	1
2.7	Plasma arc welding – Thermit welding	1
2.8	Electron beam welding – Friction welding and Friction Stir Welding	1
2.9	Brazing and soldering; Weld defects: types, causes and cure.	1
3.0	**Metal Forming Processes**	
3.1	Hot working and cold working of metals	1
3.2	Forging processes – Open, impression	1
3.3	Closed die forging – forging operations.	1
3.4	Rolling of metals– Types of Rolling	1
3.5	Flat strip rolling – shape rolling operations	1
3.6	Defects in rolled parts	1
3.7	Principle of rod and wire drawing	1
3.8	Tube drawing – Principles of Extrusion	1
3.9	Types – Hot and Cold extrusion	1
4.0	**Sheet Metal Processes**	
4.1	Sheet metal characteristics	1
4.2	Shearing, bending and drawing operations	1
4.3	Stretch forming operations – Formability of sheet metal	1
4.4	Test methods –special forming processes	1
4.5	Working principle and applications – Hydro forming	1
4.6	Rubber pad forming – Metal spinning	1
4.7	Introduction of Explosive forming	1
4.8	Magnetic pulse forming, peen forming	1
4.9	Super plastic forming – Micro forming	1
5.0	**Introduction to Smart Manufacturing**	
5.1	Smart manufacturing differ from conventional and legacy manufacturing	2
5.2	Computer Integrated Manufacturing Systems Structure	1
5.3	Functional areas of CIM system	1
5.4	Computer Aided Design (CAD)	1
5.5	Computer Aided Process Planning (CAPP)	1

5.6	Computer Aided Manufacturing (CAM)	1
5.7	Computer Aided Quality Control (CAQC)	1
5.8	Automated Storage and Retrieval System (ASRS)	1

Course Designer(s)

1. Venkatachalam-venkatachalam@ksrct.ac.in

60 MY 002	Universal Human Values	Category	L	T	P	Credit
		MC	3	0	0	3*

Objectives

- 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

Pre-requisites

- 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	3	2	-	2	3	-	-	-
CO2	-	-	-	-	-	3	-	3	3	-	-	3	-	-	-
CO3	-	-	-	-	-	3	3	3	3	-	-	3	-	-	-
CO4	-	-	-	-	-	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)		End Sem Examination (Marks)
	1	2	
Remember	10	10	No End Semester Examination
Understand	10	10	
Apply	20	20	
Analyse	20	20	
Evaluate	-	-	
Create	-	-	
Total	60	60	

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18.05.2023
Approved in Academic Council Meeting held on 03.06.2023

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 MY 002 - Universal Human Values								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3*	100	--	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.	Gaur, R R, Asthana, R and Bagaria, G P. "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Gaur, R R, Asthana, R and Bagaria, G P. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
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 4 – Quality Education

**SDG 3 – Good Health and Well Being

***SDG 16 – Peace, Justice and Strong Institutions

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**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
1.8	Current Scenario and Role of Education	1
1.9	Outcome of Human Education and Method to fulfill the basic human aspirations	1
2.0	**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
3.0	**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
4.0	**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
5.0	**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

Course Designer(s)

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

60 EE 0P4	Electrical Drives and Control Laboratory	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To determine the performance characteristics of the given DC motor and AC motors
- To control the speed of DC shunt motor by applying different techniques.
- To gain practical experience in controlling the AC motors
- To acquire knowledge in conducting speed control of DC and AC drives using power electronic circuits.
- To design a speed control system for DC and AC motors using MATLAB simulation software.

Course Outcomes

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

CO1	Test and analyze the performance of DC motors under different load conditions.	Apply
CO2	Test and analyze the performance of induction motors under different load conditions.	Apply
CO3	Analyze the performance of conventional speed control systems for motors.	Analyze
CO4	Design the power electronics-based speed control systems for DC drives.	Analyze
CO5	Design the power electronics- based speed control systems for induction motor drives.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	2	2	-	-	-	2	-	2	2	-	-
CO2	3	3	2	3	2	2	-	-	-	2	-	2	2	-	-
CO3	3	3	3	3	2	2	2	2	2	2	2	2	2	-	-
CO4	3	3	3	3	3	2	2	2	2	2	2	3	3	2	2
CO5	3	3	3	3	3	2	2	2	2	2	2	3	3	2	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 EE 0P4– Electrical Drives and Control Laboratory

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

List of Experiments:

1. Load Characteristics of DC Shunt Motor And Compound Motor
2. Load Characteristics of DC Series Motor
3. Load Test on Three-Phase Squirrel Cage Induction Motor
4. Load Test on Three-Phase Slip Ring Induction Motor
5. Load Test on Single Phase Induction Motor
6. Speed Control of DC Shunt Motor*
7. Speed Control of DC Shunt Motor Using Controlled Rectifier*
8. Speed Control of DC Shunt Motor Using Chopper*
9. Speed Control of Three –Phase Induction Motor By V/F Method*
10. Simulation of DC Motor Speed Control Using Phase-Controlled Converters*
11. Simulation of AC Motor Speed Control Using Inverters*.

Note: For Simulation, MATLAB Software Can Be Used*.

SDG 7 – Clean and Affordable Energy

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

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Tiruchengode - 637 215.

60 ME 3P1	Computer Aided Machine Drawing Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To demonstrate how to utilize Indian Standard code of practice, represent the fits, tolerances, allowances and symbols on drawings.
- To provide the students with the opportunity of visualizing and comprehending information presented verbally or graphically.
- To provide basic understanding and drawing practice of various joint, simple mechanical parts Selection of Views, additional views for the following machine elements and parts with every drawing proportions.
- To draw assembly from the individual part drawing. Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.
- To provide information of assembly drawing for manufacturing showing all parts, its dimensions, explanatory notes, relationship of each part and part list manually using computer software.

Course Outcomes

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

CO1	Select conventional representation of threaded parts, springs and gears on drawing using Indian standard code of practice	Understand
CO2	Select fit, allowance, tolerance, and symbols for mechanical components based on requirement.	Understand
CO3	Prepare the assembly drawing to assist the manufacturing from the given joints and couplings part drawing with the application of CAD software.	Apply
CO4	Prepare the assembly drawing to assist the manufacturing from the given bearings and connecting rod part drawing with the application of CAD software.	Analyze
CO5	Prepare the assembly drawing to assist the manufacturing from the given screw jack and machine vice part drawing with the application of CAD software.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	2	3	-	3	2	3	2	3	3	3	3
CO2	-	3	-	-	2	3	-	-	-	-	-	3	2	2	3
CO3	-	-	-	-	3	2	-	3	3	-	-	-	-	3	3
CO4	3	-	-	-	3	-	-	2	3	3	2	2	2	2	3
CO5	3	3	-	-	3	2	-	-	-	2	3	2	2	2	3

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 3P1– Computer Aided Machine Drawing Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	4	60	2	60	40	100

Indian Standard Code of Practice for Engineering Drawing*
General Principles of Presentation-Conventional Representation of Threaded Parts, Springs, Gear and Common Features-Abbreviations and Symbols for Use in Technical Drawings-Conventions for Sectioning and Dimensioning.

Fits and Tolerances*
Types of Fits-Selection of Fits-Allowances-Types of Tolerances-Representation of Tolerances on Drawing-Geometric Tolerances-Form and Positional Tolerances-Datum Features –Maximum Material Principle-Symbols-Methods of Indicating Symbols on Drawing-Surface Finish Symbols-Welding Symbols-Methods of Indicating Welding Symbols on Drawing. Fastening Nuts-Bolts-Screws-Keys and Keyways-Joints.

List of Experiments:
Preparation of Parts Modeling and Assembly Drawing of Machine Components Using CAD Software**

- Cotter Joint
- Knuckle Joint
- Protected Flange Coupling
- Universal Coupling
- Plummer Block
- Bushed Bearing
- Swivel Bearing
- Connecting Rod (I/C Engine)
- Screw Jack (Bottle Type)
- Machine Vice

*SDG 4 – Quality Education
**SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)
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60 CG 0P2	Career Skill Development - II	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- 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

Pre-requisites

- 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	3	3	2	3	-	-	2
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	2
3 - Strong; 2 - Medium; 1 - Some															

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 CG 0P2- Career Skill Development - II								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	2	30	1*	100	--	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 & Résume.	[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**
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
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 4 – Quality Education

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**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
2.0	**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
3.0	**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
4.0	**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
5.0	**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

Course Designer(s)

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

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215

(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

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 ME 401	Fluid Mechanics and Fluid Machines	2	40	60	100	45	100
2	60 ME 402	Machining Processes	2	40	60	100	45	100
3	60 ME 403	Kinematics of Machines	2	40	60	100	45	100
4	60 ME 404	Thermal Engineering	2	40	60	100	45	100
5	60 ME 405	Engineering Metrology	2	40	60	100	45	100
6	61 ME 406	Applied Hydraulics and Pneumatics	2	50	50	100	45	100
7	60 OE L0*	Open Elective - I	2	40	60	100	45	100
PRACTICAL								
8	60 ME 4P1	Strength of Materials and Fluid Machinery Laboratory	3	60	40	100	45	100
9	60 ME4P2	Manufacturing and Machining Processes Laboratory	3	60	40	100	45	100
10	60 CG 0P3	Career Skill Development - III	3	100	-	100	-	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 put a 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 theory End Semester Examination, 50 marks for theory cum practical End Semester Examination and 40 marks for Practical End Semester Examination.

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60 ME 401	Fluid Mechanics and Fluid Machines	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To gain knowledge about the properties of fluids, manometry and buoyancy
- To understand the mass and momentum conservation laws for fluid flows.
- To impart knowledge on pressure and velocity variation in flow of fluids through pipes
- To acquire the importance of hydraulic turbines.
- To analyze the flow in hydraulic pumps.

Pre-requisites

- Calculus and Differential Equations
- Engineering Mechanics

Course Outcomes

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

CO1	Explore the properties and behavior of fluids under static conditions	Apply
CO2	Apply conservation laws to measure flow and estimate losses in pipelines for both laminar and turbulent conditions	Apply
CO3	Formulate the relationship among the variables in a fluid phenomenon	Apply
CO4	Select and estimate the characteristics of hydraulic turbine	Apply
CO5	Evaluate the performance characteristics of different hydraulic pumps	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	3	-	-	3	-	-	-	-	3	-	-
CO2	3	3	3	-	3	-	-	3	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	2	-	-
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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME 401- Fluid Mechanics and Fluid Machines

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

Content	Hours
Fluid Properties and Flow Characteristics Properties Of Fluids – Fluid Statics - Pressure Measurements - Buoyancy and Floatation – Flow Characteristics - Eulerian and Lagrangian Approach - Concept of Control Volume and System - Reynold's Transportation Theorem - Continuity Equation, Energy Equation and Momentum Equation – Applications **Hands on:** Evaluation of the Various Properties of Fluids Estimation of Fluid Flow BY Continuity and Bernoulli's Equation	[9]
Flow Through Pipes and Boundary Layer Reynold's Experiment - Laminar Flow Through Circular Conduits - Darcy Weisbach Equation – Friction Factor - Moody Diagram - Major and Minor Losses - Hydraulic and Energy Gradient Lines - Pipes in Series and Parallel - Boundary Layer Concepts - Types of Boundary Layer Thickness. **Hands On:** Calculation of Velocity and Pressure Variation in Flow Through Pipes	[9]
Dimensional Analysis and Model Studies Fundamental Dimensions - Dimensional Homogeneity - Rayleigh's Method and Buckingham Pi Theorem- Dimensionless Parameters - Similitude and Model Studies - Distorted and Undistorted Models.	[9]
Turbines* Impact of Jets - Velocity Triangles - Theory of Rotodynamic Machines - Classification of Turbines – Working Principles - Pelton Wheel - Francis Turbine - Kaplan Turbine - Work Done - Efficiencies – Draft Tube - Specific Speed - Performance Curves for Turbines - Governing of Turbines. Application of Turbines in Different Hydroelectric Power Plants**. **Hands on:** Performance Assessment of Turbines.	[9]
Pumps* Classification of Pumps - Centrifugal Pumps - Working Principle - Heads and Efficiencies– Velocity Triangles - Work Done by the Impeller - Performance Curves - Reciprocating Pump Working Principle -Indicator Diagram and it's Variations - Work Saved By Fitting Air Vessels - submersible Pumps. Application of Pumps in Different Processing Industries. **Hands on:** Performance assessment of Pumps.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1.	Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 22nd edition, 2022
2.	Jain A. K.,"Fluid Mechanics including Hydraulic Machines", Khanna Publishers, New Delhi, 2020.

Reference(s):

1.	Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2020.
2.	Cengel Yunus A. and Cimbala, John M., "Fluid Mechanics", Tata McGraw – Hill, New Delhi, 3rd Edition, 2021.
3.	Pani B S, "Fluid Mechanics: A Concise Introduction", Prentice Hall of India Private Ltd, 2021.
4.	Som S K. Gautam Biswas and Chakraborty S, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Education Pvt. Ltd., 2022.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Fluid properties and flow characteristics**	
1.1	Properties of fluids	1
1.2	Fluid statics- Pressure Measurements	2
1.3	Buoyancy and floatation	2
1.4	Flow characteristics - Eulerian and Lagrangian approach	1
1.5	Concept of control volume and system - Reynold’s transportation theorem	1
1.6	Continuity equation, energy equation and momentum equation	2
1.7	Applications	1
2.0	**Flow through pipes and boundary layer**	
2.1	Reynold’s Experiment	1
2.2	Laminar flow through circular conduits	1
2.3	Darcy Weisbach equation	1
2.4	Friction factor - Moody diagram	1
2.5	Major and minor losses	1
2.6	Hydraulic and energy gradient lines	1
2.7	Pipes in series and parallel	2
2.8	Boundary layer concepts - Types of boundary layer thickness	1
3.0	**Dimensional analysis and model studies**	
3.1	Fundamental dimensions	1
3.2	Dimensional homogeneity	1
3.3	Rayleigh’s method	1
3.4	Buckingham Pi theorem	2
3.5	Dimensionless parameters	1
3.6	Similitude and model studies	1
3.7	Distorted and undistorted models	2
4.0	**Turbines**	
4.1	Impact of jets	1
4.2	Velocity triangles	1
4.3	Theory of rotodynamic machines - Classification of turbines	1
4.4	Pelton wheel	1
4.5	Modern Francis turbine	2
4.6	Kaplan turbine	2
4.7	Governing of turbines	1
4.8	Application of turbines in different hydroelectric power plants.	1
5.0	**Pumps**	
5.1	Classification of pumps	1
5.2	Centrifugal pumps	1
5.3	Heads and efficiencies	1
5.4	Velocity triangles	1
5.5	Work done by the impeller- Performance curves	1
5.6	Reciprocating pump	2
5.7	Indicator diagram and it’s variations - Air vessels	1
5.8	Submersible pumps	1
5.9	Application of pumps in different processing industries	1

Course Designer(s)

1. Mr.M.Gnanaseakran – gnanasekaran@ksrct.ac.in
2. Dr.M.Kathirselvam – mkathirselvam@ksrct.ac.in

Rev. No.0/w.e.f. 10.06.2023
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Approved in Academic Council Meeting held on 03/06/2023

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60 ME 402	Machining Processes	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To study the concepts and basic mechanics of metal cutting and the factors affecting machinability
- To learn working of basic and advanced turning machines
- To impart knowledge on working of standard machine tools and allied machines
- To study process parameters, grinding and abrasive machining technique
- To study the basic concepts of CNC of machine tools and constructional features of CNC.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Indicate appropriate cutting tools and cutting fluids for machining processes.	Understand
CO2	Perform various machining operations on Reciprocating machine.	Understand
CO3	Compare various machine tools for industrial applications.	Understand
CO4	Apply the appropriate abrasive machining processes for making components.	Understand
CO5	Identify the various basic concepts of Computer Numerical Control machine tools.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	3	-	-	-	3	-	3	3	-	-
CO2	3	3	3	-	-	3	-	-	-	3	-	3	3	-	-
CO3	3	3	3	-	-	3	3	-	-	3	-	3	3	-	-
CO4	3	2	3	-	-	3	-	-	-	3	-	3	3	-	-
CO5	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	20	20	20
Understand	40	40	80
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev. No.0/w.e.f. 10.06.2023
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 402- Machining Processes								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Fundamentals Of Metal Cutting* Mechanism of metal cutting - Types, cutting force- chip formation - Tool geometry - Mechanics of orthogonal and oblique cutting - Merchant’s circle diagram-calculations - Thermal aspects - Machinability-Tool wear - Tool life - Cutting tool materials-Cutting fluids - Types.	[9]
Turning Machines* Centre lathe, constructional features, specification, operations – Taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- Tool layout – Automatic lathes: semi-automatic – Single spindle: Swiss type, automatic screw type – Multi spindle.	[9]
Machine Tools* Shaper - Types - Operations. Hole Making- Drilling, reaming, boring, Tapping. Milling Machine- Operations - types of milling cutter – Planer - Slotter- Types - Operations- Broaching machines: Broach construction – Push, pull, surface and continuous broaching machines. Work holding devices - Concept of Jigs and Fixtures and its applications.	[9]
Abrasive Processes and Gear Cutting* Abrasive processes: Introduction - Grinding wheel: Designations and selection, types of grinding machines cylindrical grinding, surface grinding, centre less grinding – Grinding process parameters - Honing, lapping, super finishing, polishing and buffing - Gear cutting: forming, generation, shaping, and hobbing.	[9]
CNC Machines** Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres,- Coolant systems, Safety features.	[9]
Total Hours:	**45**

Text Book(s):

1.	Kaushish, J.P., “Manufacturing Processes,” PHI Learning Ltd, New Delhi, 4^{th} Edition 2018.
2.	Rajput, R.K., “A Textbook of Manufacturing Technology”, Laxmi publications (P) ltd, 2^{nd}Edition 2015.

Reference(s):

1.	Jain R.K., “‘Production Technology,” Khanna Publishers, 19^{th} Edition 2021
2.	Rao P N, “Manufacturing Technology”, Tata McGraw Hill Publishing Co. Ltd., Volume 1, New Delhi, 4^{th} Edition, 2018
3.	Serope Kalpakjian Steven R. Schmid,” Manufacturing, Engineering and Technology”, SI 6^{th}Edition -Ⅱ, Pearson Education, 2020
4.	Mikell P. Groover, “Principles of Modern Manufacturing”, SI Version 5^{th} Edition, Wiley & sons Pvt. Ltd, 2018.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Fundamentals of Metal Cutting**	
1.1	Mechanism of metal cutting and its types	1
1.2	Cutting force- chip formation	1
1.3	Tool geometry	1
1.4	Mechanics of orthogonal and oblique cutting	1
1.5	Merchant’s circle diagram	1
1.6	Calculations and thermal aspects	1
1.7	Machinability and tool wear	1
1.8	Tool life and Cutting tool materials	1
1.9	Cutting fluids and its types.	1
2.0	**Turning Machines**	
2.1	Centre lathe and constructional features	1
2.2	Specification, operations – taper turning methods	1
2.3	Thread cutting methods	1
2.4	Special attachments	1
2.5	Machining time and power estimation	1
2.6	Capstan and turret lathes- tool layout	1
2.7	Automatic lathes: semi-automatic	1
2.8	Single spindle : Swiss type	1
2.9	Automatic screw type – multi spindle	1
3.0	**Machine Tools**	
3.1	Shaper - Types - Operations	1
3.2	Hole Making - Drilling, reaming, boring, Tapping.	1
3.3	Milling Machine - Operations	1
3.4	types of milling cutter	1
3.5	Planer - Slotter - Types - Operations	1
3.6	Broaching machines: Broach construction – push, pull	1
3.7	Surface and continuous broaching machines	1
3.8	Work holding devices	1
3.9	Concept of Jigs and Fixtures and its applications.	1
4.0	**Abrasive Processes and Gear Cutting**	
4.1	Abrasive processes: Introduction	1
4.2	Grinding wheel: Designations and selection	1
4.3	Types of grinding machines cylindrical grinding	1
4.4	Surface grinding, centre less grinding	1
4.5	Grinding – Grinding Process parameters	1
4.6	Honing, lapping, super finishing	1
4.7	Polishing and buffing	1
4.8	Gear cutting: forming, generation	1
4.9	Gear cutting: shaping, and hobbing	1
5.0	**CNC Machines**	
5.1	Computer Numerical Control (CNC) machine tools	1
5.2	Constructional details and special features	1
5.3	Drives, Recirculating ball screws	1
5.4	Tool changers	1
5.5	CNC Control systems – Open/closed	1

5.6	Point-to-point/continuous	1
5.7	Turning and machining centres	1
5.8	Work holding methods in Turning centres	1
5.9	Coolant systems, Safety features	1

Course Designer(s)

1. Dr.G. Venkatachalam-venkatachalam@ksrct.ac.in
2. Mr.S.Venkatesan-venkatesans@ksrct.ac.in

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60 ME 403	Kinematics of Machines	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To facilitate students to evaluate the velocity and acceleration of mechanisms
- To design the cam mechanism for specific output motion
- To impart basic knowledge of toothed gearing and gear trains
- To get an insight into friction in machine elements

Pre-requisites

- Engineering Mechanics

Course Outcomes

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

CO1	Identify the difference between links, pairs, joints and mechanisms.	Apply
CO2	Compute velocity and acceleration in simple mechanisms.	Apply
CO3	Develop CAM profiles based on follower motion, types and position.	Apply
CO4	Solve problems on gears and gear trains.	Apply
CO5	Evaluate friction in machine elements.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
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)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev. No.0/w.e.f. 10.06.2023
Passed in BoS Meeting held on 18/05/2023
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME 403 & Kinematics of Machines

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Content	Hours
Basics of Mechanisms* Classification of Mechanisms – Basic Kinematic Concepts and Definitions – Degree of Freedom, Mobility – Kutzbach Criterion, Gruebler's Criterion – Grashof's Law – Kinematic Inversions of Four-Bar Chain and Slider Crank Chains – Mechanical Advantage – Transmission Angle – Straight Line Generators, Universal Joint.	[9]
Kinematics of Mechanisms* Displacement, Velocity and Acceleration Analysis of Simple Mechanisms – Graphical Method–Velocity and Acceleration Polygons – Velocity Analysis Using Instantaneous Centres – Coincident Points – Coriolis Component of Acceleration. **Hands on**: MATLAB Programming for Evaluation of Velocity and Acceleration in Simple Mechanisms	[9]
Cam Mechanisms* Classification of Cams and Followers – Terminology and Definitions – Displacement Diagrams –Uniform Velocity, Parabolic, Simple Harmonic and Cycloidal Motions – Derivatives of Follower Motions – Layout of Plate Cam Profiles –Pressure Angle and Undercutting **Hands on**: Matlab Programming for Modeling Contact Forces in a Cam Follower	[9]
Gears And Gear Trains* Law of Toothed Gearing – Involutes and Cycloidal Tooth Profiles –Spur Gear Terminology and Definitions –Gear Tooth Action – Contact Ratio – Interference and Undercutting. Gear Trains – Speed Ratio, Train Value – Parallel Axis Gear Trains – Epicyclic Gear Trains. **Hands On**: MATLAB Programming for Model a Compound Gear Train	[9]
Friction In Machine Elements* Surface Contacts – Sliding and Rolling Friction – Friction Drives – Friction in Screw Threads – Pivot and Collar Friction– Friction Clutches – Single, Multiplate and Cone Clutch – Belt and Rope Drives- Power Calculation. **Hands On**: MATLAB Programming for Fundamental Friction Clutch.	[9]
Total hours:	45

Text Book(s):

1. Bansal R.K and Brar.J S, "A Textbook of Theory of Machines", Laxmi Publication (P) Ltd., New Delhi, 5th Edition, 2023.
2. Uicker JJ, Pennock GR, Shigley JE. "Theory of Machines and Mechanisms", Oxford University Press, New York, 5th Edition, 2017.

Reference(s):

1. Rattan, S.S, "Theory of Machines", Tata McGraw-Hill, 5th Edition, 2019.
2. Rao JS, and Dukkipati. RY., "Mechanism and Machine Theory", Reprint, New Age International, New Delhi, 2nd Edition, 2014.
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 3rd Edition 2006.
4. Khurmi RS, and Gupta JK., "Theory of machines", S.Chand & Company Ltd., New Delhi, 14th Edition, 2014.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of Mechanisms**	
1.1	Classification of mechanisms, Basic kinematic concepts and definitions –	1
1.2	Degree of freedom	1
1.3	Mobility – Kutzbach criterion	1
1.4	Gruebler's criterion, Grashof's Law	1
1.5	Kinematic inversions of four-bar chain and slider crank chains	3
1.6	Mechanical advantage – Transmission Angle	1
1.7	Straight line generators	1
2.0	**Kinematics of Linkage Mechanisms**	
2.1	Displacement, velocity and acceleration analysis of simple mechanisms	2
2.2	Velocity analysis using instantaneous centres	2
2.3	kinematic analysis of simple mechanisms	1
2.4	Coincident points – Coriolis component of Acceleration	2
2.5	Introduction to linkage synthesis problem.	2
3.0	**Kinematics of Cam Mechanisms**	
3.1	Classification of cams and followers – Terminology and definitions – Displacement diagrams	2
3.2	Uniform velocity, parabolic, simple harmonic and cycloidal motions	2
3.3	Derivatives of follower motions	2
3.4	Layout of plate cam profiles	1
3.5	Pressure angle and undercutting	2
4.0	**Gears and Gear Trains**	
4.1	Law of toothed gearing	2
4.2	Involutes and cycloidal tooth profiles	1
4.3	Spur Gear terminology and definitions	1
4.4	Gear tooth action	1
4.5	Helical, Bevel, Worm, Rack and Pinion gears	1
4.6	Gear trains – Speed ratio, train value	1
4.7	Parallel axis gear trains – Epicyclic Gear Trains.	2
5.0	**Friction in Machine Elements**	
5.1	Surface contacts – Sliding and Rolling friction	2
5.2	Friction drives – Friction in screw threads	2
5.3	Bearings and lubrication	2
5.4	Friction clutches – Belt and rope drives-power calculation	3

Course Designer(s)

1. Dr.K.Santhanam – santhanamk@ksrct.ac.in

60 ME 404	Thermal Engineering	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic analysis and applications like IC engines.
- To apply thermodynamic concepts to thermodynamic applications like Boiler, steam.
- To enable the students to the working of steam nozzles and steam turbines.
- To introduce students to the working of compressors.
- To teach students the principles of Refrigeration and Air conditioning systems.

Pre-requisites

- Thermodynamics

Course Outcomes

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

CO1	Apply the concept of air standard efficiency to Otto, diesel, dual and Brayton cycles & its demonstration to internal combustion engines	Apply
CO2	Demonstrate the operation of steam boiler and it components	Apply
CO3	Analyze the shapes and maximum discharge of the steam nozzle and recognize the functions of steam turbines	Analyze
CO4	Identify the various problems in single stage and multistage air compressors	Apply
CO5	To impart the knowledge of refrigeration and air-conditioning and its components	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3	-	-	-	3	-	3	3	-	-
CO2	3	-	3	-	-	3	-	-	-	3	-	3	3	-	3
CO3	3	3	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 - 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	30	20	30
Apply	20	20	30
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 404 - Thermal Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Gas Power Cycles and Internal Combustion Engines* Introduction – Classification of Cycles - Air Standard Efficiency - Otto, Diesel, Dual and Brayton Cycles -I.C Engines - Classification, Components and Functions. P-V Diagram - Valve Timing Diagram, Four -Stroke Engines - Petrol and Diesel Engine – Ignition, Fuel Injection System, Cooling Systems, Performance Calculations. **Hands On:** Calculating Efficiency of Otto Cycle by Matlab Simulink	[9]
Steam Boilers* Classification of Steam Boilers - Fire Tube, Water Tube, Low Pressure and High-Pressure Boiler - Super-Critical Boiler - Boiler Mountings And Accessories.	[9]
Steam Nozzles and Steam Turbines** Nozzles and its Shapes, Friction in a Nozzle, Maximum Discharge Through a Nozzle.Introduction - Classification of Steam Turbines - Compounding- Velocity Diagrams for Turbines	[9]
Air Compressor** Classification of Air Compressor-Working Principle-Effect of Clearance on Volumetric Efficiency, Equations for Work and Shaft Efficiencies. Multi-Stage Compression, Inter-Cooler, Optimum Intermediate Pressure in At Two Stage Compressor, Rotary Positive Displacement Compressor-Types-Roots Blower, Sliding Vane Compressor, Screw Compressor, Performance Calculations.	[9]
Refrigeration and Air Conditioning** Refrigeration Systems - Vapour Compression and Vapour Absorption System- Compare – Properties of Refrigerants. Air-Conditioning: Types - Working Principle of Air-Conditioning Systems - Air Handling Unit (AHU) - Concept of RSHF - GSHF – ESHF. Basic Problems in Summer and Winter Air-Conditioning. **Hands On:** Performance Assessment of Vapour Compression and Vapour Absorption System	[9]
Total Hours	**45**

Text Book(s):	
1.	Rajput, R.K.“Thermal Engineering”, 11th Edition, Laxmi Publications (P) Ltd., New Delhi, 2020.
2.	Yunus A. Cengel, Michael A. Boles, and Mehmet Kanoglu. “Thermodynamics: An Engineering Approach”. 9th Edition, McGraw Hill Education Pvt. Ltd.New Delhi, 2019.
Reference(s):	
1.	Ballaney P.L., “Thermal Engineering”. 25th Edition, Khanna Publisher, New Delhi, 2018.
2.	Kothandaraman C.P., Domkundwar S, Domkundwar. A.V., “A course in thermal Engineering", 5thEdition, Dhanpat Rai & sons, 2016.
3.	Khurmi, R.S and Guptha, J K, “A Textbook of Thermal Engineering”, 15thEdition, S.Chand publisher, 2013.
4.	Moran, M.J and Shapiro, H.N., “Fundamentals of Engineering Thermodynamics” 8th Edition, John Wiley and Sons, 2014.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Gas Power Cycles & Internal Combustion Engines**	
1.1	Introduction – Classification of Cycles	1
1.2	Air standard efficiency, Otto Cycle	1
1.3	Diesel cycle, Dual cycle	1
1.4	Brayton cycle	1
1.5	I.C engines	1
1.6	Classification, components and functions. P-V diagram	1
1.7	Valve timing diagram, Four -stroke engines	1
1.8	Petrol and diesel engine	1
1.9	Ignition, Fuel injection system, Cooling systems – Governing	1
2.0	**Steam Boilers**	
2.1	Classification of steam boilers	2
2.2	Fire tube, water tube boiler.	1
2.3	Low pressure and high-pressure boiler	1
2.4	super-critical boiler	1
2.5	Boiler mountings	2
2.6	Boiler accessories	2
3.0	**Steam Nozzles and Steam turbines**	
3.1	Nozzles and its shapes	2
3.2	Friction in a nozzle	1
3.3	Maximum discharge through a nozzle	2
3.4	Introduction - Classification of steam turbines	2
3.5	Compounding- velocity diagrams for turbines	2
4.0	**Air Compressor**	
4.1	Classification of air compressor	2
4.2	Construction of reciprocating compressor	2
4.3	Intercooler - applications	1
4.4	Applications of Compressor	1
4.5	Rotary positive displacement compressor, types, Roots Blower	1
4.6	Sliding Vane compressor, Screw compressor, Performance calculations	2
5.0	**Refrigeration and Air Conditioning**	
5.1	Refrigeration systems - Vapour compression and vapour absorption system	2
5.2	Compare - Properties and classification of an ideal refrigerant.	2
5.3	Simple air-conditioning cycle	2
5.4	Classification and principle of air conditioning system	1
5.5	Air conditioning system – Simple Problems	1
5.6	MATLAB programming for Vapour compression refrigeration	1

Course Designer(s)

1. Dr.A.Murugesan – hodmech@ksrct.ac.in
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60 ME 405	Engineering Metrology	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To learn basic concepts of the metrology and importance of measurements.
- To teach measurement of linear and angular dimensions assembly and transmission elements
- To be familiarized with the right instrument and method of measurement for surface finish and form measurements.
- To describe the various measurement techniques using laser metrology.
- To provide the knowledge of the advanced measurements for quality control in manufacturing industries.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Describe the concepts of measurements to apply in various metrological instruments	Understand
CO2	Outline the principles of linear and angular measurement tools used for industrial applications	Understand
CO3	Demonstrate the techniques of form measurement used for industrial components.	Understand
CO4	Discuss various measuring techniques of mechanical properties in industrial applications	Understand
CO5	Apply the advances in measurements for quality control in manufacturing Industries	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	3	-	-	3	-	-	3	-	3	3	-	-
CO2	3	3	-	3	-	-	3	-	-	3	-	3	3	-	-
CO3	3	3	-	3	-	-	3	-	-	3	-	3	3	-	-
CO4	3	2	-	3	-	-	3	-	-	3	-	3	3	-	-
CO5	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	20	20	20
Understand	40	40	60
Apply	-	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="9">B.E - Mechanical Engineering</th></tr>
<tr><th colspan="9">60 ME 405 Engineering Metrology</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hours</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>IV</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Basics of Metrology*
Introduction to Metrology –Generalized Measurements Systems-Need –Process, Role in Quality Control- Methods-Elements –Factors Influencing Measurements-Instruments – Precision and Accuracy – Errors – Errors In Measurements-Calibration of Measuring Instruments, ISO Standards.</td><td>[9]</td></tr>
<tr><td colspan="8">Measurement Of Linear and Angular Dimensions*
Linear Measuring Instruments – Vernier Caliper, Micrometer, Vernier Height Gauge, Depth Micrometer, Bore Gauge, Telescoping Gauge; Gauge Blocks – Tolerance - Gauges Types: Slip Gauges - Limit Gauges - Snap Gauges - Plug Gauges - Thread Gauge - Ring Gauge. Terminology – Procedure – Concepts of Interchangeability and Selective Assembly – Angular Measuring Instruments – Types – Bevel Protractor-Optical Protractors - Sine Bar-Clinometers - Angle Gauges – Angle Dekkor – Autocollimator – Alignment Telescope-Applications.</td><td>[9]</td></tr>
<tr><td colspan="8">Form Measurement*
Need of Form Measurements - Measurement of Screw Thread - External Thread Measurement - Measurement Of Minor Diameter - Measurement Of Effective Diameter - Pitch Measurement. Gear Measurement–, Profile Measurement, Tooth Thickness Measurement - Gear Alignment Testing. Radius Measurements– Radius of Circle - Radius of Concave Surface. Surface Finish Measurement, Roundness Measurement– Straightness Measurement – Flatness Measurement.</td><td>[9]</td></tr>
<tr><td colspan="8">Measurement of Power, Flow and Temperature*
Force, Torque, Power - Mechanical, Pneumatic, Hydraulic and Electrical Type. Flow Measurement: Venturimeter, Orifice Meter, Rotameter, Pitot Tube – Temperature: Bimetallic Strip, Pressure Thermometers, Thermocouples, Thermistor and RTD-Pyrometer.</td><td>[9]</td></tr>
<tr><td colspan="8">Advances In Metrology*
Basic Concept of Lasers, Advantages of Lasers – Laser Scan Micrometer – Laser Interferometers– DC and AC Lasers Interferometer – Applications – Straightness – Alignment – Ball Bar Tests. Basic Concept of CMM – Types of CMM – Constructional Features – Probes and Accessories – Software – Applications – Video Measuring Machine. Basic Concepts of Machine Vision System – Element – Applications.</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2018.</td></tr>
<tr><td>2.</td><td colspan="8">Jain R.K. “Engineering Metrology”, Khanna Publishers, 2018.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.</td></tr>
<tr><td>2.</td><td colspan="8">John H. Lienhard V Thomas G. Beckwith, Roy D. Marangoni “Mechanical Measurements”, Pearson Education, 2020</td></tr>
<tr><td>3.</td><td colspan="8">Ammar Grous, J “Applied Metrology for Manufacturing Engineering”, Wiley-ISTE, 2011</td></tr>
<tr><td>4.</td><td colspan="8">Raghavendra N.V. and Krishnamurthy. L., “Engineering Metrology and Measurements,” Oxford University Press, 2013.</td></tr>
</table>

SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of Metrology**	
1.1	Introduction to Metrology	1
1.2	Generalized Measurements Systems-Need –process	1
1.3	Role in quality control	1
1.4	Methods-Elements	1
1.5	Factors influencing measurements-Instruments	1
1.6	Precision and Accuracy	1
1.7	Errors in Measurements	1
1.8	Calibration of measuring instruments	1
1.9	ISO Standards	1
2.0	**Measurement of Linear and Angular Dimensions**	
2.1	Linear Measuring Instruments – Vernier caliper, Micrometer,	1
2.2	Vernier height gauge, Depth Micrometer	1
2.3	Bore gauge, Telescoping gauge	1
2.4	Gauge blocks	1
2.5	Tolerance- Gauges types: Slip Gauges	1
2.6	Limit Gauges - Snap Gauges - Plug Gauges - Thread Gauge - Ring Gauge	1
2.7	Concepts of interchangeability and selective assembly	1
2.8	Angular measuring instruments – Types – Bevel protractor-optical protractors - Sine bar- Clinometers	1
2.9	Angle gauges – Angle Dekkor – Autocollimator	1
2.10	Alignment telescope- Applications.	1
3.0	**Form Measurement**	
3.1	Need of form measurements	1
3.2	Measurement of Screw Thread - External Thread Measurement.	1
3.3	Measurement of Minor Diameter - Measurement of Effective Diameter	1
3.4	Pitch Measurement	1
3.5	Gear measurement–, Profile Measurement	1
3.6	Tooth Thickness Measurement	1
3.7	Gear Alignment Testing. Radius Measurements– Radius of Circle - Radius of Concave Surface	1
3.8	Surface finish measurement, Roundness measurement	1
3.9	Straightness measurement – Flatness measurement	1
4.0	**Measurement of Power, Flow and Temperature**	
4.1	Force, torque, power	1
4.2	Mechanical, Pneumatic, Hydraulic and Electrical type	1
4.3	Flow measurement: Venturi meter,	1
4.4	Orifice meter, rotameter	1
4.5	Pitot tube	1
4.6	Temperature: bimetallic strip	1
4.7	Pressure thermometers,	1
4.8	Thermocouples,	1
4.9	Thermistor and RTD-pyrometer	1
5.0	**Advances in Metrology**	
5.1	Basic concept of lasers, Advantages of lasers	1
5.2	Laser Scan Micrometer	1
5.3	Laser Interferometers	1

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5.4	DC and AC Lasers interferometer – Applications	1
5.5	Straightness – Alignment – Ball bar tests	1
5.6	Basic concept of CMM	1
5.7	Types of CMM – Constructional features-Probes and Accessories – Software – Applications	1
5.8	Video Measuring Machine	1
5.9	Basic concepts of Machine Vision System – Element – Applications	1

Course Designer(s)

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61 ME 406	Applied Hydraulics and Pneumatics	Category	L	T	P	Credit
		PC	2	0	2	3

Objectives

- To familiarize about the basics fundamentals of hydraulic and pneumatic transmission power using pressurized fluids.
- To understand working principles, operation of hydraulic and pneumatic components.
- To expose to various techniques for choosing pumps, valves and pneumatics components for suitable application.
- To have exposure to diagnose/troubleshoot hydraulic, pneumatic, electro pneumatic circuits.
- To design the circuits using pneumatic/hydraulic components for an industrial application

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Explain the fundamental properties of fluids and understand the applications, advantages of fluid power system.	Apply
CO2	Identify the various pumps, valves, actuators and its working principles in hydraulic circuit.	Apply
CO3	Describe and illustrate the construction and working principles of various compressors, pneumatic valves and FRL unit importance in pneumatic circuit.	Apply
CO4	Design and develop the hydraulic and pneumatic circuit for various applications.	Apply
CO5	Know the significance of failures and trouble shooting, fluid power circuit for industry 4.0 and software used in fluid power automation	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	2	-	-	-	-	-	-	-	2	2	-
CO2	3	2	2	-	2	-	-	-	-	-	-	-	2	2	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	2	2	-
CO4	3	2	2	-	3	-	-	-	-	-	-	-	2	2	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	2	2	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	30	50	30	50	50	50	50
Apply	10	50	10	50	50	30	50
Analyse	-	-	-	-	-	-	-
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
61 ME 406- Applied Hydraulics and Pneumatics								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	2	0	2	60	3	50	50	100

Fluid Power Systems and Hydraulic Pumps Introduction to fluid power – advantages and applications of fluid power systems – types of fluid power system –Pascal's law and its applications –fluid power symbols, Hydraulic pumps: Pump Classification, Pump Performance - Problems.	[6]
Hydraulic Actuators and Control Components Hydraulic actuators: Cylinders – types, construction and applications – telescopic cylinders - Hydraulic motors -types and construction, Control components: direction control, flow control and pressure control valves – types, construction and operation – Servo valves – applications.	[6]
Pneumatic and Electro Pneumatic Systems Introduction - Properties of air, Compressors – types - construction details, Filter - Regulator and Lubricator unit, Pneumatic actuators- single cylinder and multi cylinder circuits. Electro Pneumatic System – Elements – Ladder diagram – Introduction to fluidics and pneumatic logic circuits.	[6]
Fluid Power Circuit Design Speed control circuits, Regenerative circuits, Deceleration circuits, Sequencing circuits, Synchronizing circuits, Automatic cylinder reciprocation circuit, Cascade method, Accumulators - types and circuits - Intensifier circuits - Air-over oil.	[6]
Trouble Shooting and Applications Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic system. Design of hydraulic circuits for Drilling, Surface grinding, Low cost Automation.	[6]
Practical: 1. Assembling of Hydraulic Components for Basic Hydraulic Circuit. 2. Assembling of Pneumatic Components for Basic Pneumatic Circuit. 3. Assembling of Pneumatic Components for Meter In &Meter Out Circuit 4. Assembling of Pneumatic Components for Synchronizing Circuit. 5.Execution of Electro Pneumatic Circuit	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Anthony Esposito, "Fluid Power with Applications", Pearson Education New Delhi, 2015.
2.	Srinivasan R,"Hydraulic and Pneumatic Controls", 2nd Edition', Vijay Nicole Imprint (P) Ltd., Chennai, 2016.

Reference(s):

1.	S.R.Majumdar, "Oil Hydraulics",Tata Mc Graw Hill Publishing Company Pvt Ltd. New Delhi,2014.
2.	S.R.Majumdar,"Pneumatic systems- Principles and Maintenance",Tata Mc Graw Hill Publishing Company Pvt Ltd. New Delhi, 2014.
3.	Andrew Parr, Hydraulics and Pneumatics, Jaico Publishing House, 2015.
4.	James L. Johnson, "Introduction to Fluid Power", Delmar Thomson Learning, 2013.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Fluid Power Systems and Hydraulic Pumps**	
1.1	Introduction to fluid power advantages and applications of fluid power systems	2
1.2	Types of fluid power system –Pascal’s law and its applications	2
1.3	Fluid power symbols	1
1.4	Hydraulic pumps: Pump Classification	1
1.5	Pump Performance - Problems	2
2	**Hydraulic Actuators and Control Components**	
2.1	Hydraulic actuators: Cylinders – types, construction and applications	2
2.2	Telescopic cylinders	1
2.3	Hydraulic motors -types and construction	1
2.4	Control components: direction control flow control and pressure control valves	2
2.5	Types, construction and operation – Servo valves – applications.	2
3	**Pneumatic and Electro Pneumatic Systems**	
3.1	Introduction - Properties of air, Compressors	1
3.2	Types - construction details, Filter - Regulator and Lubricator unit	2
3.3	Pneumatic actuators- single cylinder and multi cylinder circuits.	2
3.4	Electro Pneumatic System – Elements – Ladder diagram	2
3.5	Introduction to fluidics and pneumatic logic circuits.	1
4	**Fluid Power Circuit Design**	
4.1	Speed control circuits, Regenerative circuits,	2
4.2	Deceleration circuits, Sequencing circuits,	2
4.3	Synchronizing circuits, Automatic cylinder reciprocation circuit,	2
4.4	Cascade method, Accumulators	1
4.5	Types and circuits - Intensifier circuits - Air-over oil	1
5	**Industrial Automation**	
5.1	Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic system.	3
5.2	Design of hydraulic circuits for Drilling, Surface grinding, Low cost Automation.	5
Practicals		
1.	Assembling of Hydraulic Components for Basic Hydraulic Circuit.	4
2.	.Assembling of Pneumatic Components for Basic Pneumatic Circuit.	4
3.	Assembling of Pneumatic Components for Meter In &Meter Out Circuit	4
4.	Assembling of Pneumatic Components for Synchronizing Circuit.	4
5.	Electro Pneumatic Circuit	4

Course Designer(s)

1. Dr.S.Gopalakrishnan - sgopalakrishnan@ksrct.ac.in
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3. Dr.M.Gnanasekaran- gnanasekaran@ksrct.ac.in

60 ME 4P1	Strength of Materials and Fluid Machinery Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To impart the knowledge of tensile properties, torsion and hardness of metals
- To acquire knowledge of spring by testing
- To verify the principles of venturimeter and friction factor in flow through pipes
- To acquire knowledge on impact of jet by applying momentum principle
- To impart the characteristics of turbine and pumps

Pre-requisites

- Engineering Mechanics
- Strength of materials

Course Outcomes

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

CO1	Determine the tensile, torsion and hardness properties of metals	Apply
CO2	Determine the stiffness properties of helical spring	Apply
CO3	Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe	Analyze
CO4	Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet	Apply
CO5	Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	3	-	-	-	3	3	3	-	3	-	-
CO2	3	3	3	-	3	-	-	-	3	3	3	-	3	-	-
CO3	3	3	3	-	3	-	-	-	3	3	3	-	2	-	-
CO4	3	3	3	-	-	-	-	-	3	3	3	-	-	-	-
CO5	3	3	3	-	3	-	-	-	3	3	3	-	2	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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Approved in Academic Council Meeting held on 03/06/2023

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 4P1– Strength of Materials and Fluid Machinery Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	4	60	2	60	40	100

List of Experiments:

Strength Of Materials Laboratory

1. A) Tension Test on Mild Steel Rod
   B) Double Shear Test on Mild Steel Rod
2. A) Torsion Test on Mild Steel Rod
   B) Deflection Test on Simply Supported Beam
3. Hardness Test on Metal (Rockwell and Brinell Hardness)
4. Tension and Compression Test on Helical Spring
5. Impact Test on Metal (Charpy and Izod Test)

Fluid Machinery Laboratory

1.(A) Determination of Coefficient of Discharge of a Venturimeter
(B) Determination of Friction Factor for Flow Through Pipes
2. (A) Determination of Metacentric Height
(B) Determination of Forces Due to Impact of Jet on a Fixed Plate
3. Characteristics of Centrifugal Pumps
4. Characteristics of Reciprocating Pump
5. Characteristics of Pelton Wheel Turbine

Lab Manual

1.	Strength of Materials and Fluid Machinery Laboratory Manual" by Mechanical Faculty Members

SDG 4 – Quality Education

Course Designer(s)

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60 ME 4P2	Manufacturing and Machining Processes Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To infer practical knowledge in metal casting process.
- To Study and practice the various operations that can be performed in lathe
- To study and practice the various operations that can be performed in shaping, drillingand milling machines.
- To study and practice the various operations that can be performed in gear hobbing and grinding machines.
- To study and practice various operations performed in Computer Numerical Machine

Pre-requisites

- Nil

Course Outcomes

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

CO1	Describing the casting process and determining a parts suitability for this process	Analyze
CO2	Demonstrate the use of operation manuals for the lathes as well as any necessary materials and equipment associated with the lathe.	Analyze
CO3	Machine a dovetail, keyway in shaper machine and horizontal milling machine,	Apply
CO4	Perform grinding operation in cylindrical grinding, surface grinding and Centerless grinding machine	Apply
CO5	Understand CNC machining and uses, and applications of CNC program.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	3	3	-	3	-	-	3	-	-	3	-	3	-
CO2	3	-	3	3	-	3	-	-	3	-	-	2	-	3	-
CO3	3	-	3	3	-	3	-	-	3	-	-	3	-	3	-
CO4	3	-	2	3	-	3	-	-	3	-	-	3	-	3	-
CO5	3	-	3	3	3	3	-	3	3	-	-	3	-	3	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 4P2 - Manufacturing and Machining Processes Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	4	60	2	60	40	100

List of Experiments:

1. Preparing green sand moulds with cast patterns.
2. a) External thread cutting and Grooving circular parts using lathe machine.
   b) Cutting force calculation using dynamometer in lathe machine
3. Knurling and Taper Turning on circular parts using lathe machine.
4. Milling –Hexagonal Heads on circular parts using Milling machine.
5. Cutting spur gear using milling machine.
6. a) Machining of external splines using slotting machine.
   b) Drilling and Tapping using Radial drilling machine.
7. Generating gears using gear hobbing machine.
8. Machining of Square and V-block using Shaping machine.
9. Grinding components using Surface/ Cylindrical /Centerless grinding machine
10. CNC - Stock Removal using CNC Turning machine.
11. CNC - Stock Removal using CNC Milling machine

Lab Manual

1.	Manufacturing Technology I Laboratory Manual" by Mechanical Faculty Members

*SDG 12 Responsible Consumption and Production

Course Designer(s)

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60 CG 0P3	Career Skill Development - III	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- 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

Pre-requisites

- 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	3	-	3	-	-	-	2	3	3	3	2	-
CO2	3	3	3	3	-	2	-	-	-	2	3	3	3	2	-
CO3	2	2	2	2	-	3	-	-	-	2	3	3	2	2	-
CO4	3	3	3	3	-	2	-	-	-	2	3	3	2	2	-
CO5	3	3	3	3	-	2	-	-	-	2	3	3	2	2	-
3 - Strong; 2 - Medium; 1 - Some															

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 CG 0P3 & Career Skill Development - III								
Semester	**Hours/Week**			**Total Hours**	**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

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Logical Reasoning**	
1.1	Analogies - Alpha and numeric series	1
1.2	Number Series - Coding and Decoding	1
1.3	Blood Relations - Coded Relations	1
1.4	Order and Ranking – odd man out	1
1.5	Direction and distance	1
2.0	**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
3.0	**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
4.0	**Quantitative Aptitude – Part 2**	
4.1	Front Axle - Wheel Geometry - Wheel Alignment and Balancing	1
4.2	Steering Geometry - Steering Linkages. Gear Box: Function, Types, Construction and Working Principle	1
4.3	Average - Ratio and proportion	1
4.4	Ages – Partnership	1
4.5	Percentage	1
5.0	**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

Course Designer(s)

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

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215

(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

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 ME 501	Automobile Engineering	2	40	60	100	45	100
2	60 ME 502	Dynamics of Machines	2	40	60	100	45	100
3	60 ME 503	Design of Machine Elements	2	40	60	100	45	100
4	60 ME E1*	Professional Elective -I	2	40	60	100	45	100
5	60 OE L0*	Open Elective – II	2	40	60	100	45	100
6	60 MY 003	Startups and Entrepreneurship	2	100	-	100	-	100
		PRACTICAL						
7	60 ME5P1	Thermal Engineering Laboratory	3	60	40	100	45	100
8	60 ME5P2	Metrology and Dynamics Laboratory	3	60	40	100	45	100
9	60 ME 5P3	Design Thinking and Innovation Laboratory	3	60	40	100	45	100
10	60 CG 0P4	Career Skill Development-IV	3	100	-	100	-	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 put a 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 theory End Semester Examination and 40 marks for Practical End Semester Examination.

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60 ME 501	Automobile Engineering	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To study the vehicle structure and role of electronics in engine management system
- To learn about electrical, emission control system and BS VI norms in automobile
- To study the construction and working principle of transmission systems and types of tyres
- To explain the construction and its working principle of steering, suspension and electronics in systems.
- To study the concepts of electric, hybrid and autonomous vehicle

Pre-requisites

- Thermal Engineering

Course Outcomes

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

CO1	Recognize the parts of the vehicle structure and electronics in engine management system and working of turbocharger.	Understand
CO2	Summarize the battery, ignition, starting and emission control systems and BS VI norms of an automobile	Understand
CO3	Distinguish the working of different types of transmission systems tyres and its inner elements.	Understand
CO4	Illustrate the working of steering, suspension and electronics in braking systems	Understand
CO5	Discuss the benefits and challenges of electric, hybrid and autonomous vehicles.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	-	2	2	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	-	-	-	-	2	2	-	1	-	-	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	34
Understand	40	40	66
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 501 - Automobile Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Vehicle Structure and Electronics in Engine Systems* Automobiles - Types - Chassis - Frame and Body. Vehicle Aerodynamics. Electronically Injection System (Mpfi, GDI & Crdi) - Electronic Ignition System (TCI & CDI)-Variable Valve Timing (VVT) - Turbo Charger.	[10]
Electrical and Emission Control System Battery-Types (Lead Acid and Lithium Ion) and Construction – Starting and Charging System – Lighting System. **Vehicle Pollutants and its Effect - Emission Control System for SI & CI Engine (Catalytic Convertor & Exhaust Gas Recirculation) - Emission Norms in India – Bharat Stage VI*.**	[7]
Transmission Systems* Clutch-Types and Construction, Fluid Flywheel - Torque Converter. Gear Boxes - Manual and Automatic (Mt, Amt, Cvt & At)-Over Drive. Propeller Shaft, Slip Joints, Universal Joints. Differential And Rear Axle Drive. Hotchkiss Drive and Torque Tube Drive Tyre-Types..	[9]
Steering, Suspension and Braking Systems* Front Axle- Wheel Geometry - Wheel Alignment and Balancing - Steering Geometry - Steering Linkages & Gear Box - Power Steering (Electric & Hydraulic). Suspension – Components – Types. Hydraulic And Pneumatic Braking Systems- Disc & Drum Brakes - Antilock Braking System (ABS), Electronic Brake Force Distribution (EBD) And Traction Control (TC).	[10]
Electric and Autonomous Vehicles** Electric Vehicles –Types - Layout & Components– Fuel Cell Vehicle – Hybrid Vehicle - Types - Series & Parallel. Autonomous Vehicles - Levels of Autonomous Vehicles - Advanced Driver-Assistance Systems (ADAS) – Connected Vehicle – Types of Vehicle Connectivity- Iot in Automobile	[9]
Total Hours:	**45**

Text Book(s):

1.	Kirpal Singh, "Automobile Engineering", 14th Edition, Volume I & II, Standard Publishers Distributor, New Delhi, 2021.
2.	Crouse W. H., Anglin D. L., “Automotive Mechanics”, 10th Edition, McGraw Hill Education Private Limited, New Delhi, 2017

Reference(s):

1.	Technical Teacher's Training Bhopal, “Automobile Engineering”, 1st Edition, McGraw Hill Education Private Limited, New Delhi, 2017.
2.	Rajput R.K., "A Text book of Automobile Engineering", 2nd Edition, Laxmi Publication, New Delhi, 2017..
3.	Jain K.K. and Asthana R.B., “Automobile Engineering”, Tata McGraw Hill Publishers, New Delhi, 6th Edition, 2002.
4.	https://archive.nptel.ac.in/courses/107/106/107106088/ Prof. C.S.Shankar Ram, IIT Madras.

*SDG 7 – Affordable and Clean Energy
**SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Vehicle Structure and Electronic Engine Systems**	
1.1	Automobiles and its types	1
1.2	Chassis : function, types and construction	1
1.3	Frame: function, types and construction	1
1.4	Car and heavy vehicle bodies.	1
1.5	Vehicle aerodynamics	1
1.6	Electronically injection system: function, layout and working principle (MPFi,GDI & CRDi)	2
1.7	Electronic ignition system: function, layout and working principle (TCI & CDI)	1
1.8	Variable valve timing (VVT): function, construction and working principle	1
1.9	Turbo charger: function, construction and working principle	1
2.0	**Electrical and Emission control system**	
2.1	Battery: function, types, construction and working principle (lead acid and lithium ion)	2
2.2	Starting and Charging system : function, layout and working principle	1
2.3	Lighting system : function and layout	1
2.4	Vehicle pollutants and its effect	1
2.5	Emission control system: function, construction and working principle (Catalytic Convertor & Exhaust Gas Recirculation)	1
2.6	Emission norms in India – Bharat Stage VI	1
3.0	**Transmission Systems**	
3.1	Clutch: function, types , construction and working Principle (Manual)	1
3.2	Fluid flywheel & torque converter	1
3.3	Manual Gear Box : function, types , construction and working principle	1
3.4	Automatic Gear Box: function, types , construction and working principle (AMT,CVT & AT)	2
3.5	Propeller shaft, slip joints, universal joints : function, construction and working principle	1
3.6	Differential: function, types , construction and working principle	1
3.7	Rear axle drive: function, types, construction and working principle.	1
3.8	Tyre : function, types and construction	1
4.0	**Steering, Brakes and Suspension Systems**	
4.1	Front axle - Wheel geometry - Wheel alignment and balancing	1
4.2	Steering geometry - Steering linkages. Gear box : function, types , construction and working principle	1
4.3	Power steering: function, types, construction and working principle ((Electric & hydraulic).	1
4.4	Suspension: function, types, components and working	1
4.5	Dependent suspension system: components and working	1
4.6	Independent suspension system: types, components and working	1
4.7	Braking systems : disc & drum brakes – function, construction and working principle	1
4.8	Braking systems Hydraulic and pneumatic braking systems - function, construction and working principle.	2
4.9	Antilock Braking System (ABS), Electronic brake force distribution (EBD) and Traction Control (TC).	1
5.0	**Electric and Autonomous Vehicles**	
5.1	Electric Vehicles: function, types, layout, components, working principle and challenges.	1
5.2	Fuel Cell vehicle: function, types, layout, components and working principle	1
5.3	Hybrid Vehicle: function, types, layout, components and working principle	1

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5.4	Autonomous vehicles : levels of autonomous vehicles, layout, components ,working principle and challenges	2
5.5	Advanced driver-assistance systems (ADAS): function, layout, components and working principle	1
5.6	Connected Vehicle: function, types of vehicle connectivity, components ,working principle and challenges	2
5.7	IoT in automobile	1

Course Designer(s)

1. Dr.K. Raja - rajak@ksrct.ac.in

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60 ME 502	Dynamics of Machines	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To apply the force-motion relationship in components to evaluate static and dynamics forces.
- To apply the concepts of static and dynamics balancing to evaluate the unbalancing forces.
- To evaluate the effect of free vibrations.
- To evaluate the effects of forced vibrations.
- To apply the principle of speed and stability control in governors and gyroscopes

Pre-requisites

- Engineering Mechanics
- Kinematics of Machinery

Course Outcomes

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

CO1	Evaluate the problems related to static force analysis and investigate the problems related with turning moment diagrams and flywheel.	Apply
CO2	Evaluate the principle of static and dynamic balancing to solve the problems related to unbalancing of revolving and reciprocating masses.	Apply
CO3	Apply the concepts of free vibrations to evaluate natural frequency of given system.	Apply
CO4	Apply the forced vibrations principles to evaluate the frequency of forced vibrations.	Apply
CO5	Apply the principle of governors and effect of gyroscopic couple for speed control and stability.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	-	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	-	3	-	-	-	-	-	-	-	3	3	3
3 - 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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev. No.0/w.e.f. 30.12.2023
Passed in BoS Meeting held on 24.11.2023
Approved in Academic Council Meeting held on 23.12.2023

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 502- Dynamics of Machines								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100

Force Analysis* Introduction to Static Force and Dynamic Force. D'Alembert's Principle, Dynamic Force Analysis in Reciprocating Engines- Engine Force Analysis–Equivalent Masses–Bearing Loads. Turning Moment Diagrams–Fluctuation of Energy, Flywheels–Dimensions of Flywheel Rims–Punching Press. **Hands on:** Engine Force Analysis	[9]
Balancing* Static and Dynamic Balancing–Balancing of Rotating Masses–Balancing of Reciprocating Masses–Primary and Secondary Unbalanced Forces–Partial Balancing of Locomotives–Balancing of Multi Cylinder Inline Engines, Balancing of Radial Engines, Balancing of V Engines–Balancing Machines. **Hands on:** Balancing of Rotating Masses	[9]
Free Vibrations* Basic Features of Vibratory Systems– Types of Vibrations–Degrees of Freedom–Free Vibrations of Single Degree of Freedom Systems: Longitudinal Vibration with Damping, Transverse Vibration–Critical Speed of Shaft, Torsional Vibrations – Natural Frequency of Two and Three Rotor Systems. **Hands On:** Evaluation of Natural Frequency	[9]
Forced Vibrations* Step–Input Forcing–Harmonic Forcing–Periodic Forcing–Magnification Factor–Vibration Isolation and Transmissibility. **Hands on:** Evaluation of Frequency of Forced Vibrations	[9]
Governors and Gyroscopic Couple** Functions of Governors–Gravity Controlled and Spring-Controlled Governor Characteristics. Stability–Hunting and Isochronism. Gyroscopic Couple–Gyroscopic Effects on Aero Planes, Ships and Automobiles. **Hands on:** Evaluation of Mean Speed of Governors	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1.	Uicker J J, Pennock G R, Shigley J E. "Theory of machines and mechanisms" Oxford University Press, New York, 5th edition, 2017.
2.	Bansal R K, Brar J S. "A textbook of theory of machines (in S.I. units)" Laxmi publications, New Delhi, 6th edition, 2023.

Reference(s):

1.	Rao J S, and Dukkipati. R Y., "Mechanism and Machine Theory", Reprint, New Age International, New Delhi, 2nd Edition, 2014.
2.	Rattan S S., "Theory of Machines", Tata McGraw–Hill Publishing Co. Ltd., New Delhi, 4th Edition, 2014.
3.	Amitabh Ghosh and Malik, A K., "Theory of Mechanisms and Machines", Reprint, Affiliated East West Press Pvt. Ltd., 3rd Edition, 2011.
4.	Thomas Bevan, "The Theory of Machines", Pearson Education Ltd., 3rd Edition, 2010.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 8 – Decent work and Economic Growth

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Force analysis**	
1.1	Introduction to static force and dynamic force, D'Alembert's principle	1
1.2	Dynamic force analysis in reciprocating engines, engine force analysis	2
1.3	Equivalent masses–bearing loads.	2
1.4	Turning moment diagrams–fluctuation of energy	2
1.5	Flywheels, dimensions of flywheel rims, punching press.	2
2.0	**Balancing**	
2.1	Static and dynamic balancing	1
2.2	Balancing of rotating masses, balancing of reciprocating masses	1
2.3	Primary and secondary unbalanced forces	2
2.4	Partial balancing of locomotives, balancing of multi cylinder inline engines	2
2.5	Balancing of radial engines, balancing of V engines	2
2.6	Balancing machines	1
3.0	**Free vibrations**	
3.1	Basic features of vibratory systems, types of vibrations	1
3.2	Degrees of freedom, free vibrations of single degree of freedom systems	2
3.3	Longitudinal vibration with damping	2
3.4	Transverse vibration, critical speed of shaft	2
3.5	Torsional vibrations, natural frequency of two and three rotor systems	2
4.0	**Forced vibrations**	
4.1	Step–input forcing	1
4.2	Harmonic forcing	2
4.3	Periodic forcing	2
4.4	Magnification factor	2
4.5	Vibration isolation and transmissibility	2
5.0	**Governors and Gyroscopic Couple**	
5.1	Functions of Governors	1
5.2	gravity controlled and spring, controlled governor characteristics	2
5.3	Stability, Hunting and Isochronism	2
5.4	Gyroscopic couple	2
5.5	Gyroscopic effects on aero planes, ships and automobiles	2

Course Designer(s)

1. Dr.K.Santhanam – santhanam@ksrct.ac.in

60 ME 503	Design of Machine Elements	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To learn the various steps involved in the design of machine members.
- To familiarize the design of shafts and couplings for various applications.
- To impart knowledge on design of temporary and permanent Joints
- To learn the concept of energy storing elements and engine components for various applications.
- To learn the selection of bearings, seals and gaskets

Pre-requisites

- Engineering mechanics
- Strength of materials

Course Outcomes

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

CO1	Explain the design of machine members subjected to static and variable loads	Apply
CO2	Design of shafts and couplings	Apply
CO3	Apply the concepts of design of temporary and permanent joints.	Apply
CO4	Design of energy storing elements and engine components.	Apply
CO5	Select the bearings, seals and gaskets.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	2	-	-	2	-	-	-	-	3	3	3
CO4	3	3	3	3	3	-	-	3	-	-	-	-	3	3	3
CO5	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	30
Apply	40	40	30
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 503 – Design of Machine Elements								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100

Fundamental Concepts in Design* Introduction to the Design Process – Factors Influencing Machine Design, Selection of Materials Based on Mechanical Properties – Preferred Numbers – Direct, Bending and Torsional Loading – Modes of Failures – Factor of Safety – Combined Loads – Curved Beams – Crane Hook And 'C' Frame- Theories of Failure – Design Based on Strength and Stiffness - Stress Concentration – Fluctuating Stresses – Endurance Limit –Design for Finite and Infinite Life Under Variable Loading – Exposure to Standards	[9]
Design of Shafts and Couplings** Shafts And Axles – Design of Solid and Hollow Shafts Based on Strength, Rigidity And Critical Speed – Keys And Splines – Rigid And Flexible Couplings.	[9]
Design of Temporary and Permanent Joints** Threaded Fasteners: Design of Bolted Joints Including Eccentric Loading. Knuckle Joints, Cotter Joints Welded Joints, Riveted Joints for Structures – Theory of Bonded Joints. **Hands on:** -Determination of Efficiency and Length in Welded Joints and Riveted Joints	[9]
Design of Energy Storing Elements and Engine Components** Types of Springs – Design of Helical and Leaf Springs. Rubber Springs, Theory of Disc and Torsional Springs, Flywheel – Stresses in Rims and Arms – Connecting Rod and Crank Shaft. **Hands on**: -Solving Problems in Helical Spring and Leaf Spring -Determination of Flywheel Considering Stresses	[9]
Design of Bearings** Sliding and Rolling Contact Bearings – Hydrodynamic Journal Bearings, Sommerfeld Number, Raimondi and Boyd Graphs, Selection of Rolling Contact Bearings – Design of Seal and Gaskets – Bearing Lubrication. **Hands on:** -Solving Problems in Journal Bearing and Rolling Contact Bearings ***Note: Use Of Approved Design Data Book Is Permitted for Examination.*** .	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):	
1.	Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill education Pvt. Ltd., 5th Edition, 2020.
2.	Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill , 2015.
Reference(s):	
1.	Khurmi R S., Gupta J K., "A Text book of Machine Design", Eurasia Pub. House Pvt. Ltd., 14th Ed., 2005.
2.	Norton R.L, "Design of Machinery", McGraw-Hill Book co, 3rd Edition, 2004.
3.	Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",6th Edition, Wiley, 2017
4.	Design of Machine Elements | SI Edition | Eighth Edition | By Pearson by M. F. Spotts, Terry E. Shoup, et al. | 25 March 2019.
5.	Juvinall R. C., Marshek K.M., "Fundamentals of Machine Component Design", John Wiley & Sons, 5th Edition, 2011.
6.	NPTEL video IIT Kharagpur:: https://archive.nptel.ac.in/courses/112/105/112105124/
Data Book(s):	
1.	Design Data – Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam– Coimbatore, 2012.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamental Concepts in Design**	
1.1	Introduction to the design process, factors influencing machine design	2
1.2	Selection of materials based on mechanical properties – Preferred numbers	2
1.3	Direct, bending, and torsional loading, Modes of failures	2
1.4	Factor of safety, Combined loads, curved beams – crane hook and ‘C’ frame	2
1.5	theories of failure, Design based on strength and stiffness stress concentration – Fluctuating stresses	2
1.6	Endurance limit, Design for finite and infinite life under variable loading – Exposure to standards	2
2.0	**Design of shafts and Couplings**	
2.1	Shafts and Axles	2
2.2	Design of solid based on strength, rigidity	2
2.3	Design of hollow based on strength, rigidity	2
2.4	critical speed, Keys and Splines	2
2.5	Rigid couplings	2
2.6	flexible couplings	2
3.0	**Design of Temporary and Permanent Joints**	
3.1	Threaded fasteners: Design of bolted joints including eccentric loading	2
3.2	Design of Knuckle joints	2
3.3	Design of Cotter joints	2
3.4	Design of Welded joints	2
3.5	Design of riveted joints for structures	2
3.6	theory of bonded joints	2
4.0	**Design of Energy Storing Elements and Engine components**	
4.1	Types of springs – Design of helical	2
4.2	Design of leaf springs	2
4.3	Design of Rubber springs	2
4.4	Theory of disc torsional springs	2
4.5	Flywheel – stresses in rims and arms	2
4.6	Connecting rod and crank shaft	2
5.0	**Governors and Gyroscopic Couple**	
5.1	Sliding and rolling contact bearings	2
5.2	Hydrodynamic journal bearings, Sommerfeld Number	2
5.3	Raimondi and Boyd graphs	2
5.4	Selection of rolling Contact bearings	2
5.5	Design of seal and gaskets	2
5.6	Bearing lubrication.	2

Course Designer(s)

1. Mr.S.Sakthivel – sakthivel_s@ksrct.ac.in

60 MY 003	Startups and Entrepreneurship	Category	L	T	P	Credit
		MY	2	0	0	2*

Objectives

- To Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
- To provide practical proven tools for transforming an idea into a product or service that creates value for others.
- To Comprehend the process of opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution and prototypes
- To create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
- To Prepare and present an investible pitch deck of their practice venture to attract stakeholders

Pre-requisites

- Basic knowledge of reading and writing in English

Course Outcomes

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

CO1	Develop an entrepreneurial mindset and appreciate the concepts of design thinking, entrepreneurship and innovation	Understand
CO2	Apply process of problem -opportunity identification and validation through human centred approach to design thinking in building solutions	Apply
CO3	Understand market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product	Apply
CO4	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture	Apply
CO5	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders	Create

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	1	3	1	2	1	-	2	2	3	3	-
CO2	2	3	3	2	2	-	2	2	2	-	2	2	2	3	-
CO3	3	2	3	1	2	-	-	-	1	3	1	3	3	2	-
CO4	3	3	3	3	3	2	2	1	-	1	3	3	3	3	-
CO5	3	2	3	3	3	-	-	2	-	-	3	2	3	2	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Pitch Deck final submission & Via voce
	Milestone 1 (25 Marks)	Milestone 2 & 3 (25 Marks)	
Remember	10	-	50
Understand	05	10	
Apply	10	15	
Analyse	-	-	
Evaluate	-	-	
Create	-	-	
Total	25	25	

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

Common to All Branches

60 MY 003 – Startups and Entrepreneurship

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

Introduction to Entrepreneurship and 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.Innovation and Creativity, Types of Innovations, Innovations in Current Scenario.	[6]
Problem-Opportunity Identification, Customers Discovery and Competitive Advantage Understanding the Problem and Opportunity, Define Problem using Design Thinking Principles and Validate Problem. Exploring Market Types and Estimating the Market Size, Knowing Your Customer and Consumer, Customer Segmentation and Creating Customer Personas. Importanceo of Value Proposition, Value Proposition Canvas, Developing Problem-Solution Fit, Competition Analysis, Blue Ocean Strategy, Competitive Positioning and Understanding Unique Selling Points.	[6]
Business Model and Build Your MVP Introduction to Business Model and Types, Lean Approach, 9 Block Lean Canvas Model, Riskiest Assumptions to Business Models. Prototyping, Building a Minimum Viable Product, Hypothesis Testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Learn Approach.	[6]
Business Plan, Financial Feasibility and Managing Growth Business Planning: Components of Business Plan- Sales Plan, People Plan and Financial Plan, Preparing a Business Plan. Financial Planning: Types of Costs, Preparing the Financial Plan using Financial Template, Understanding Basics of Unit Economics and Analyzing Growth and the Financial Performance.	[6]
Go to Market Strategies and Funding Introduction to Go to Market Strategies, Start-Up Branding and its Elements, Selecting the Right Channel, Creating Digital Presence, Building Customer Acquisition Strategy. Choosing a Form of Business Organization Specific to Your Venture, Identifying Sources of Funds: Debt & Equity, Map the Start-Up Lifecycle to Funding Options, Build an Investor Ready Pitch Deck.	[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.	Ignite program, wadhwani platform, Entrepreneurship, NPTEL online course By Prof. C Bhaktavatsala Rao | IIT Madras

*SDG 12 – Responsible Consumption and Production

**SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Entrepreneurship & Entrepreneur**	
1.1	Meaning and concept of Entrepreneurship and the history of Entrepreneurship development	1
1.2	The Entrepreneur: Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process,	1
1.3	Myths of Entrepreneurship, How to Become a Successful Entrepreneur - Dr Romesh Wadhwani (Platform on boarding)	1
1.4	Role models, Mentors and Support system- Masterclass on My Story - Joshua Salins	1
1.5	Role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship	1
1.6	Innovation and Creativity, types of innovations, Innovations in current scenario, Concepts of Entrepreneurial Thinking, General Enterprising tendency test	1
2.0	**Problem-Opportunity Identification, Customers Discovery and competitive advantage**	
2.1	Understanding the Problem and opportunity, define problem using Design thinking principles and validate problem. Case study and Fireside chat – Desi Hangover	1
2.2	Identifying a problem for practice venture and filling Problem statement canvas (Handout week 1 - class activity)	1
2.3	Customer and markets discovery, knowing your customer and consumer, Customer segmentation and Exploring market types and estimating the market size. Case study and Fireside chat – Verloop	1
2.4	Creating customer personas & Market estimation (Handout week 2 - class activity)	1
2.5	Importance of Value Proposition, Introduce Value Proposition Canvas, and Developing Problem-solution fit. Case study and Fireside chat – Honey Twigs	1
2.6	Competition analysis, Blue ocean strategy, Competitive positioning and understanding unique selling points. Case study and Fireside chat on Inzpira Fill Value Proposition Canvas (Handout week 3 - class activity) and Competition analysis framework (Handout week 5 - class activity) **Briefing on Assignment 1 - Milestone 1**	1
3.0	**Business model and Build your MVP**	
3.1	Introduction to Business model and types. Case study and Fireside chat – NUOS	1
3.2	Lean approach, 9 block lean canvas model, riskiest assumptions to Business models	1
3.3	Class Activity- Fill Lean canvas for you idea and understand revenue model (Handout week 6)	1
3.4	Prototyping, Meaning of MLP, Difference between MLP and MVP, How to build an MLP? Different types MLP that you can build. Case study and Fireside chat – KNORISH	1
3.5	Hypothesis testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Learn approach	1
3.6	Class Activity- Fill MVP framework (Handout week 7) and learn validation	1
4.0	**Business Plan, Financial feasibility and Manging growth**	
4.1	Business planning: components of Business plan- Sales plan, People plan and financial plan, Preparing a business plan. Case study and Fireside chat – Bodh Gems	1
4.2	Financial Planning: Types of costs, preparing the financial plan using financial template (Handout week 9)	1
4.3	Class activity - starting up costs, COGS, Sales plan and people plan template.	1
4.4	Class activity - One year P&L projection, Breakeven Analysis, Five year projection	1
4.5	Understanding basics of Unit economics and analyzing Growth and the financial performance	1
4.6	Class activity - Financial template - Unit economics (Handout week 12)	1
5.0	**Go To Market Strategies and Funding**	

5.1	Introduction to Go to market strategies, start-up branding and its elements, Selecting the Right Channel	1
5.2	Creating digital presence, building customer acquisition strategy.	1
5.3	Class activity: Handout week 10 - create your GTM strategy	1
5.4	Choosing a form of business organization specific to your venture	1
5.5	Identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options	1
5.6	Class activity - Visit relevant GOI websites, other sites to help students explore funding opportunities and **briefing on final submission of the pitch deck** Build an Investor ready pitch deck, What Should You Cover in Your Pitch Deck? Art of pitching and storytelling	1

Course Designer(s)

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

60 ME 5P1	Thermal Engineering Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To demonstrate the valve timing diagram and analyze the thermo-physical properties of fuels & lubricants
- To investigate the performance of I.C engines,
- To study the performance of air compressor,
- To investigate the COP of refrigerator and air-conditioner.
- To study the working of steam boilers and steam turbine

Pre-requisites

- Thermal Engineering

Course Outcomes

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

CO1	Measure the fuel and lubricant characteristics	Apply
CO2	Examine the performance and characteristics of IC engines	Apply
CO3	Evaluate the performance and characteristics of air compressor	Apply
CO4	Analyse the COP of refrigeration and air conditioning system	Analyze
CO5	Demonstrate the working principles of steam turbine and steam generator	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	3	3	3	3	3	-	2	2	3	-
CO2	3	2	2	-	-	3	3	3	3	3	-	2	2	3	-
CO3	3	2	3	-	-	-	-	3	3	3	-	2	2	3	-
CO4	3	2	3	-	-	3	3	3	3	3	-	2	2	3	-
CO5	3	2	3	-	-	3	3	3	3	3	-	2	2	3	-

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="9">B.E - Mechanical Engineering</th></tr>
<tr><th colspan="9">60 ME 5P1 – Thermal Engineering Laboratory</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>0</td><td>0</td><td>3</td><td>45</td><td>1.5</td><td>60</td><td>40</td><td>100</td></tr>
</table>

List of Experiments:

1. a) Draw the Valve Timing Diagram of CI Engine

   b) Determination of Flash Point and Fire Point of Fuels.
2. Determination of Viscosity of Lubricating Oil by Redwood Viscometer
3. Performance Test on 4 - Stroke Diesel Engine.
4. Heat Balance Test on 4-Stroke Diesel Engine.
5. Morse Test on Multi-Cylinder Petrol Engine.
6. Determination of Frictional power of a Diesel Engine by Retardation Test.
7. Measurement of Engine Emission and Smoke using Exhaust Gas Analyser and Smoke Meter
8. Performance Test on Two Stage Reciprocating Air-Compressor
9. Performance Test on Air-Conditioning Test Rig
10. Performance Test on Vapour Compression Refrigeration Test Rig
11. Performance and Energy Balance Test on a Steam Generator and Steam Turbine

Lab Manual

1.	"Thermal Engineering Lab Manual", Department of Mechanical Engineering, KSRCT.

SDG 4 – Quality Education
SDG 8 – Decent work and Economic Growth
SDG 12 – Responsible Consumption and Production

Course Designer(s)

1. Dr.D.Vasudevan – dvasudevan@ksrct.ac.in

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60 ME 5P2	Metrology and Dynamics Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To familiarize the basic concepts in various methods of engineering measurement techniques and applications.
- To make students familiar with the fundamental principles of measuring techniques by practicing exercises on various measuring instruments.
- To familiarize the importance of measurement and inspection in manufacturing industries.
- To evaluate the moment of inertia of connecting rod
- To demonstrate the concepts of free and forced vibrations

Pre-requisites

- Engineering Metrology
- Kinematics of Machinery

Course Outcomes

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

CO1	Describe the basic concepts of Metrology and classify different measuring tools related to experiments.	Apply
CO2	Measure the gear tooth dimensions, angle using sine bar.	Apply
CO3	Measure the screw thread parameters, temperature using thermocouple.	Apply
CO4	Calculate the moment of inertia of connecting rod.	Analyze
CO5	Evaluate the natural frequency of free vibrations and estimate the transmissibility ratio using vibrating table	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	3	3	-	-	-	3	3	3	-	-	3	3	3
CO2	3	-	3	3	-	-	-	3	3	3	-	-	3	3	3
CO3	3	-	3	3	-	-	-	3	3	3	-	-	3	3	3
CO4	3	-	3	3	-	-	-	3	3	3	-	-	3	3	3
CO5	3	-	3	3	-	-	-	3	3	3	-	-	3	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 5P2 – Metrology and Dynamics Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Calibration and Use of Measuring Instruments – Vernier Caliper, Micrometer, Dial Gauge and Vernier Height Gauge – Using Gauge Blocks
2. Measurement of Various Dimensions of the Given Component Using Profile Projector
3. Measurement of Angle and Pitch by Using Tool Maker's Microscope
4. Measurement of Taper Angle Using Sine Bar
5. Measurement of Major and Effective Diameter of Screw Thread Using 2 Wire Methods
6. Measurement of Temperature Using Transducers. (Thermo Couple, RTD, Thermistor, Semiconductor).
7. Determination of the Moment of Inertia of Connecting Rod by Oscillation Method
8. Determination of Natural Frequency and Critical Speed of Given Shaft
9. Determination of Natural Frequency of Given Spring Mass System
10. Determination of Natural Frequency and Deflection of Free Beam
11. Determination of Torsional Frequency of A Single Rotor System
12. Determination of Transmissibility Ratio Using Vibrating Table

Lab Manual

1.	Metrology and Dynamics Laboratory Manual" by Mechanical Faculty Members

SDG 8 – Decent work and Economic Growth
SDG 9 – Industry Innovation and Infrastructure
SDG 12 – Responsible Consumption and Production

Course Designer(s)

1. Mr.S.Karthick – skarthick@ksrct.ac.in
2. Mr. P.Tamilarasu – tamilarasup@ksrct.ac.in

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60 ME 5P3	Design Thinking and Innovation Laboratory	Category	L	T	P	Credit
		PC	0	0	2	1

Objectives

- Understand the principles of design thinking and their application in engineering innovation
- Identify real-world engineering problems through brainstorming and mind mapping
- Explore problem space using secondary research methods, including the 5Ws and 1H Matrix, and user participant mapping
- Conduct primary research from multiple perspectives to ensure a user-centered approach
- Define and analyze problem areas to develop clear and well-structured problem statements

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Apply design thinking principles to promote innovation.	Apply
CO2	Identify and articulate real-world engineering problems through brainstorming and mind map techniques.	Apply
CO3	Perform secondary research using tools 5Ws and 1H Matrix and user participant mapping to explore problem spaces.	Apply
CO4	Conduct primary research to gather insights from diverse perspectives, ensuring a user- centered approach in problem-solving.	Apply
CO5	Define and analyze problem areas to create precise and actionable problem statements.	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	3	3	3	-	-	-	-	3
CO2	3	-	-	-	-	3	3	3	3	3	-	-	2	2	3
CO3	3	-	-	-	-	-	-	3	3	3	-	-	2	2	-
CO4	3	-	-	-	-	-	-	3	3	3	-	-	3	3	3
CO5	3	3	-	-	-	-	-	3	3	3	-	-	2	-	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Review I (CO1)			Review II (CO2,CO3,CO4)			Review III (CO5)			Total (R1+R2+R3)	Internal
Identification of Existing Problems and Solutions	Apply design thinking principles	Case study report	Selection of Problem	Secondary and Primary Research on Problem Space	Presentation	Analysis of Problem Space	OIOR	Presentation	Total	
10	10	10	10	30	10	5	10	5	100	60

Report and Presentation (CO1, CO2, CO3, CO4 & CO5)			External
Report	Presentation	Total	
50	50	100	40

Rev. No.0/w.e.f. 30.12.2023
Passed in BoS Meeting held on 24.11.2023
Approved in Academic Council Meeting held on 23.12.2023

BoS - Chairman
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K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 5P3 – Design Thinking and Innovation Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	0	0	2	30	1	60	40	100

Design Thinking and Innovation Process Introduction to Design Thinking and Innovation - Design, Design Thinking, Innovation - Stages of Design Thinking Process – Case Study: Analysis of Existing Problems and Solutions.	[8]
Selection of Problem Identification and Selection of Problem to Solve, Tools - Brain-storming- Sorting & affinity-Links, Mind-mapping- affinity-Links.	[4]
Secondary research on Problem Space Information Gathering: from past and existing - Secondary Research - Ask questions: Why, who, what, where, when, how, etc, 5Ws and 1H Matrix Table - User Participant Mapping.	[6]
Primary research on Problem Space Understanding your Users environment - Primary research - Observation, Conversations, Questionnaires, Documentation - Conducting Contextual Inquiry.	[6]
Analysis of Problem Space Identify, Classify, Compare, Prioritize, Cross-relate information - Personas Observations, Inference, Opportunities, and Recommendations (OIOR) - Redefining the Problem Statement.	[6]
Total Hours:	30

Reference(s):	
1.	NPTEL: Design Thinking and Innovation by Prof. Ravi Poovaiah, IDC School of Design, IIT Bombay. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview, https://dsource.in/dti
2.	NPTEL: Design, Technology and Innovation by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay. https://onlinecourses.nptel.ac.in/noc20_de03/preview
3.	NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview.
4.	www.dsource.in , The Resource for Design by e-Kalpa Design Team, IDC, IIT Bombay,DoD, IIT Guwahati & NID, Bengaluru.

SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.K.Raja – raja@ksrct.ac.in

60 CG 0P4	Career Skill Development IV	Category	L	T	P	Credit
		CG	0	0	2	1*

Objectives

- 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

Pre-requisites

- 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	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	3	-	3	-	-	-	2	3	3	3	2	-
CO2	3	3	3	3	-	2	-	-	-	2	3	3	3	2	-
CO3	2	2	2	2	-	3	-	-	-	2	3	3	2	2	-
CO4	3	3	3	3	-	2	-	-	-	2	3	3	2	2	-
CO5	3	3	3	3	-	2	-	-	-	2	3	3	2	2	-
3 - Strong; 2 - Medium; 1 - Some															

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to All Branches								
Career Skill Development – IV								
Semester	**Hours/Week**			**Total Hours**	**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. Warszaw.

SDG 4 – Quality Education

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**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
2.0	**Quantitative Aptitude – Part – 4**	
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
3.0	**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
4.0	**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
5.0	**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

Course Designer(s)

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

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

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 ME 601	Heat and Mass Transfer	2	40	60	100	45	100
2	60 ME 602	Finite Element Analysis	2	40	60	100	45	100
3	60 ME 603	Design of Mechanical Transmission Systems	2	40	60	100	45	100
4	60 ME E2*	Professional Elective – II	2	50	50	100	45	100
5	60 ME E3*	Professional Elective – III	2	40	60	100	45	100
6	60 OE L0*	Open Elective - III	2	40	60	100	45	100
PRACTICAL								
7	60 ME6P1	Heat Transfer Laboratory	3	60	40	100	45	100
8	60 ME6P2	Analysis and Simulation Laboratory	3	60	40	100	45	100
9	60 ME 6P3	Design Thinking and Product Development Laboratory	3	60	40	100	45	100
10	60 CG 0P5	Comprehension Test*	3	100	-	100	-	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 put a 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 theory End Semester Examination, 50 marks for theory cum practical End Semester Examination and 40 marks for Practical End Semester Examination.

60 ME 601	Heat and Mass Transfer	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To familiarize conduction heat transfer mechanisms.
- To expose the mechanisms of free and forced convection.
- To develop the shape factor and electrical analogy for black and grey body radiation.
- To demonstrate the phase change heat transfer and the performance of heat exchanging devices.
- To infer diffusion and convective mass transfer.

Pre-requisites

- Engineering Thermodynamics,
- Thermal Engineering

Course Outcomes

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

CO1	Recognize the basic concepts and evaluate the rate of conductive heat transfer under steady and transient state.	Apply
CO2	Assess the convection phenomena and determine the heat transfer rate in free and forced convection.	Apply
CO3	Determine the heat transfer rate in radiation using shape factor algebra and electrical analogy.	Apply
CO4	Demonstrate the concept of phase change heat transfer and heat exchangers using LMTD and NTU approach.	Apply
CO5	Develop solutions for combined heat and mass transfer problems.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	1	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	-	2	-
CO4	3	3	2	2	1	-	-	-	-	-	-	2	3	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	2	-	2	-
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	20
Apply	30	30	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 601 – Heat and Mass Transfer								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Conduction Heat Transfer* Fourier'S Law of Conduction – Thermal Conductivity – Three Dimensional Heat Conduction Equation in Cartesian Coordinate System – One Dimensional Steady State Heat Conduction Through Plane and Composite Wall, Cylinder And Sphere – Critical Radius of Insulation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite And Infinite Solids – Use of Heisler'S Charts.	[9]
Convection Heat Transfer* Free and Forced Convection – Newton's Law of Cooling – Boundary Layer Concept – Forced Convection – External – Flow Over Plates And Internal Flows – Cylinders Spheres – Combined Free and Forced Convection.	[9]
Radiation Heat Transfer* Basic Laws of Radiation – Black Body Radiation – Grey Body Radiation – Shape Factor Algebra – Electrical Analogy – Radiation Shields.	[9]
Phase Change Heat Transfer and Heat Exchangers* Nusselt Theory of Condensation – Regimes of Boiling – Pool Boiling And Flow Boiling – Correlations In Boiling And Condensation. Heat Exchangers: Types Of Heat Exchangers – Overall Heat Transfer Coefficient – Fouling Factor – LMTD Method – Effectiveness – NTU Method.	[9]
Mass Transfer* Basic Concepts – Diffusion Mass Transfer – Fick's Law Of Diffusion - Equimolar Counter Diffusion – Convective Mass Transfer – Convective Mass Transfer Correlations (***Use Of Approved Heat And Mass Transfer Data Book Are Permitted***)	[9]
Total Hours	**45**

Text Book(s):	
1.	Sachdeva R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publishers, 5th edition, 2022.
2.	Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", Wiley, Eighth Edition, 2020.
Reference(s):	
1.	Rajput R.K., "Heat and mass Transfer", S.Chand Publishers, 7th edition, 2018.
2.	Holman J.P., "Heat Transfer", Tata McGraw-Hill company, 10th edition, 2017.
3.	Kothandaraman C.P. "Fundamental of Heat and Mass Transfer", New age International Publishers, New Delhi, 4th Edition, 2012.
4.	Nag. P.K, "Heat and Mass Transfer" Tata McGraw-Hill, 3rd Edition, 2015.
5.	Nptel Video: https://youtu.be/YGvD5HPl3uw?si=sBfc8fd8F5Du406H
Data book(s):	
1.	Kothandaraman, C.P., Subramanyam. S., "Heat and Mass Transfer Data Book" New age International Publishers, New Delhi, 9th Edition, 2018.
2.	Khurmi. R.S "Steam Tables" S.Chand Publishers, 2012.

* SDG 12 – Responsible Consumption and Production

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Conduction Heat Transfer**	
1.1	Basic Concepts – Fourier's Law of Conduction	1
1.2	Three Dimensional Heat Conduction Equation in Cartesian Coordinate System	1
1.3	ID Steady State Heat Conduction through Plane Wall	1
1.4	ID Steady State Heat Conduction through Plane Cylinder	1
1.5	ID Steady State Heat Conduction through Plane Sphere	1
1.6	Critical Radius of Insulation & Composite Wall and Cylinder	1
1.7	Extended Surfaces	1
1.8	Unsteady Heat Conduction	2
2.0	Convection Heat Transfer	
2.1	Newton's Law of Cooling – Dimensionless Number	1
2.2	Boundary Layer Concept	1
2.3	Natural Convection	2
2.4	Forced convection – External – Flow over Plates	2
2.5	Forced convection – Internal flows – Cylinders	1
2.6	Forced convection – Internal flows – Spheres	1
2.7	Combined free and forced convection	1
3.0	**Radiation Heat Transfer**	
3.1	Basic laws of radiation	1
3.2	Black body radiation – Grey body radiation	2
3.3	Shape factor algebra	2
3.4	Electrical analogy	2
3.5	Radiation shields	2
4.0	**Phase Change Heat Transfer and Heat Exchangers**	
4.1	Nusselt theory of condensation – Regimes of boiling	1
4.2	Pool boiling and Flow boiling	1
4.3	Film-wise and drop wise condensation	1
4.4	Heat Exchangers, Types of Heat Exchangers	1
4.5	Parallel flow heat exchanger	1
4.6	Counter flow heat exchanger	1
4.7	Overall Heat Transfer Coefficient – Fouling Factor – LMTD Method	1
4.8	Effectiveness – NTU Method	2
5.0	**Electric and Autonomous Vehicles**	
5.1	**Mass Transfer**	**9**
5.2	Basic Concepts	2
5.3	Diffusion Mass Transfer – Fick's Law of Diffusion	2
5.4	Equimolar Counter Diffusion	2
5.5	Convective Mass Transfer	2

Course Designer(s)

1. Mr.R.Prakash – prakashr@ksrct.ac.in

60 ME 602	Finite Element Analysis	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To develop mathematical models for Boundary Value Problems and their numerical solution
- To apply concepts of Finite Element Analysis to solve a one dimensional problem
- To determine field variables for two dimensional scalar variable problems
- To determine field variables for two dimensional vector variable problems
- To apply the need for isoparametric transformation and the use of numerical integration

Pre-requisites

- Strength of Materials

Course Outcomes

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

CO1	Apply the Rayleigh-Ritz, Weighted residual and Gaussian Elimination methods to solve engineering problems.	Apply
CO2	Formulate 1D elements and apply them to solve structural and thermal problems.	Apply
CO3	Implement the formulation techniques to solve 2D structural and thermal problems using triangular elements	Apply
CO4	Develop the stiffness matrices for axisymmetric element and solve structural problems.	Apply
CO5	Formulate the iso-parametric elements to solve complex problem with irregular geometries.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO3	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO4	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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B.E - Mechanical Engineering

60 ME 602 – Finite Element Analysis

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

Introduction Historical Background – Mathematical Modeling of Field Problems in Engineering – Governing Equations – Discrete and Continuous Models – Boundary, Initial and Eigen Value Problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic Concepts of the Finite Element Method.	[9]
One-Dimensional Problems* One Dimensional Second Order Equations – Discretization – Element Types- Linear and Higher Order Elements – Derivation of Shape Functions and Stiffness Matrices and Force Vectors- Assembly of Matrices – Solution of Problems from Application to Bars, Beams and Plane Trusses. One Dimensional Heat Transfer Problems	[9]
Two Dimensional Scalar Variable Problems* Second Order 2d Equations Involving Scalar Variable Functions – Variational Formulation –Finite Element Formulation – Cst and Lst Elements – Shape Functions and Element Matrices and Vectors. Application to Field Problems – Thermal Problems.	[9]
Two Dimensional Vector Variable Problems* Equations of Elasticity – Plane Stress, Plane Strain and Axisymmetric Problems – Body Constitutive Matrices and Strain Displacement Matrices – Stress Calculations – Plate and Shell Elements.	[9]
Isoparametric Formulation* Natural Co-Ordinate Systems – Isoparametric Elements – Shape Functions for Iso Parametric Elements – One and Two Dimensions – Serendipity Elements – Numerical Integration and Application to Plane Stress Problems – Matrix Solution Techniques – Solutions Techniques to Dynamic Problems – Introduction to Analysis Software.	[9]
Total Hours (45 + 15 Tutorial)	**60**

Text Book(s):

1.	Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, Butterworth Heinemann, 2019.
2.	Chandrupatla, T.R. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", International Edition, Pearson Education Limited, 2014.

Reference(s):

1.	David Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill, 2005
2.	Reddy. J.N., "An Introduction to the Finite Element Method", 4th Edition, Tata McGraw-Hill, 2018
3.	Seshu, P., "Text Book of Finite Element Analysis", PHI Learning Pvt. Ltd., NewDelhi, 2012.
4.	Cook, R.D., David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2004.
5.	https://nptel.ac.in/courses/112104193
6.	https://onlinecourses.nptel.ac.in/noc23_me63/preview

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction to numerical method	1
1.2	The role of FEM in numerical simulation & Procedure of FEM	1
1.3	Discretisation – elements and nodes, DoF	1
1.4	Ritz method – problems	2
1.5	Weighted Residual methods	2
1.6	Gaussian Elimination Methods	2
2.0	**One-Dimensional Problems**	
2.1	Discretization & Element types	1
2.2	Derive the shape function for 1D bar element.(Local, Natural and Global c.s)	1
2.3	Derive the element stiffness matrix for 1D bar element and truss elemet	1
2.4	Axial loading on rod-stepped bar – problems	1
2.5	Derive the element stiffness matrix for 1D truss element.	1
2.6	Two member truss structure – problems	2
2.7	Derive the element stiffness matrix for 1D heat transfer element	1
2.8	Heat conduction on two wall plate.	1
3.0	**Two Dimensional Scalar Variable Problems**	
3.1	Shape function of CST element,	1
3.2	Derive the shape function for CST element (natural and global c.s)	2
3.3	Derive the Strain-Displacement matrix for CST element	1
3.4	Strain-Displacement matrix problems	2
3.5	Strain-Displacement matrix for CST element – problems	2
3.6	Plane stress and plane strain	1
4.0	**Two Dimensional Vector Variable Problems**	
4.1	Axisymmetric conditions	1
4.2	Derive the shape function for axisymmetric element (natural and global c.s)	2
4.3	Derive the Strain-Displacement matrix for axisymmetric element	1
4.4	,Derive the element stiffness matrix for axisymmetric element	2
4.5	Problem on axisymmetric conditions	3
5.0	**Isoparametric Formulation**	
5.1	Natural co-ordinate systems – Isoparametric elements	1
5.2	Shape functions for iso parametric elements	1
5.3	Strain –Displacement matrix for four noded quadrilateral element	2
5.4	Higher order rectangular elements	1
5.5	Shape function for Higher order rectangular elements	1
5.6	Numerical integration	1
5.7	Gaussian Quadrature technique and Problems	2

Course Designer(s)

1. Mr.M.Prasath – prasathm@ksrct.ac.in

60 ME 603	Design of Mechanical Transmission Systems	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To apply the principles and procedure for the design of power transmission components.
- To apply the standard procedure available for design of transmission system terms.
- To learn to use standard data and catalogues.
- To select / design / manufacture drive systems for a wide variety of driven loads to a given performance specification.
- To design, manufacturing and quality assurance of selected power transmission components.

Pre-requisites

- Strength of Materials
- Design of Machine Elements

Course Outcomes

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

CO1	Select, design and analyze flexible drives.	Apply
CO2	Design of spur and Helical gears based on Lewis and Buckingham equation and gear life.	Apply
CO3	Design of bevel and Worm gears based on Lewis and Buckingham equation and gear life.	Apply
CO4	Design and analyze the multi speed gear box.	Apply
CO5	Design and analyze the frictional drives.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	1	-	-	-	1	2	2	1
CO2	3	3	3	3	1	-	-	1	-	-	-	1	3	2	1
CO3	3	3	3	3	1	-	-	1	-	-	-	1	3	2	1
CO4	3	3	3	3	-	-	-	1	-	-	-	1	2	1	1
CO5	3	3	3	3	-	-	-	1	-	-	-	1	2	2	1
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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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B.E - Mechanical Engineering

60 ME 603 – Design of Mechanical Transmission Systems

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

Selection of Flat Belts, V Belts and Chains* Selection of Flat Belts and Pulleys, Selection of V Belt and Pulleys, Wire Ropes and Pulleys, Selection of Transmission Chains and Sprockets. Design of Pulleys and Sprockets.	[9]
Design of Spur and Helical Gears* Speed Ratios and Number of Teeth – Force Analysis in Gears – Tooth Stresses – Dynamic Effects – Fatigue Strength – Factor of Safety – Gear Materials – Determining Dimensions of a Spur Gear Pair. Design of Helical Gears-Parallel Axis Helical Gear, Normal and Transverse Planes, Helix Angles, Equivalent Number of Teeth, Determining Dimension of Helical Gear Pair. **Hands on**: - Determination Of Gear Module in Spur Gear Drive - Solving Problems in Helical Gear Drive for Gear Module	[9]
Design Of Bevel and Worm Gears* Straight Bevel Gear: Tooth Terminology, Tooth Forces and Stresses, Equivalent Number of Teeth. Estimating The Dimensions of Pair of Straight Bevel Gears. Worm Gear: Merits and Demerits Terminology. Thermal Capacity, Materials-Forces and Stresses, Efficiency, Estimating the Size of The Worm Gear Pair. **Hands On**: - Calculation of Gear Module in Bevel Gear Drive - Finding The Solution of Gear Module in Worm Gear Drive	[9]
Design of Gearboxes* Geometric Progression – Standard Step Ratio – Ray Diagram, Kinematics Layout –Design of Sliding Mesh Gear Box – Design of Multi Speed Gear Box For Machine Tool Applications – Constant Mesh Gear Box – Speed Reducer Unit – Variable Speed Gear Box.	[9]
Design of Frictional Drives* Clutches – Role of Clutches, Positive and Gradually Engaged Clutches, Toothed Claw Clutches, Design of Single Plate and Multiple Plate Clutches, Variable Speed Drives, Types and Selection. Role of Brakes-Types of Brakes-Self Energizing and De-Energizing Brakes. Design Of Internally Expanding Shoe Brakes – Calculation of Heat Generation and Heat Dissipation in Brakes.	[9]
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill education private limited, 3rd Edition, 2010.
2. Richard G. Budynas, J.KeithNisbett, “Shigley’s Mechanical Engineering Design”, McGraw-Hill Education (India) P Ltd., 9th Edition, 2011.

Reference(s):

1. Khurmi R S., Gupta J K., “A Text book of Machine Design”, Eurasia Publishing house Pvt. Ltd., 14th Edition, 2005.
2. Juvinall R. C., Marshek K.M., “Fundamentals of Machine Component Design”, John Wiley & Sons, 4th Edition, 2011.
3. Norton R.L, “Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines”, McGraw-Hill Book co, 2008.
4. Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Co., 2011.
5. NPTEL video by IIT Kharagpur: https://archive.nptel.ac.in/courses/112/105/112105234/

Data book(s):

1. Design Data – Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam – Coimbatore, 2016.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Selection of Flat ,V belts and chains**	
1.1	Selection of flat belts and pulleys	2
1.2	Selection of V belt and pulleys	2
1.3	Wire ropes and pulleys	2
1.4	Selection of Transmission chains and Sprockets	2
1.5	Design of pulleys and sprockets	1
2.0	**Design of Spur and Helical Gears**	
2.1	Speed ratios and number of teeth	1
2.2	Force analysis in gears – Tooth stresses	1
2.3	Dynamic effects – Fatigue strength	1
2.4	Factor of safety – Gear materials	1
2.5	Determining dimensions of a spur gear pair	1
2.6	Design of helical gears-parallel axis helical gear	1
2.7	Normal and transverse planes, helix angles, equivalent number of teeth	2
2.8	Determining dimension of helical gear pair	1
3.0	**Design of Bevel and Worm Gears**	
3.1	Straight bevel gear: Tooth terminology	1
3.2	Tooth forces and stresses, equivalent number of teeth	1
3.3	Estimating the dimensions of pair of straight bevel gears	2
3.4	Worm Gear: Merits and demerits terminology	1
3.5	Thermal capacity, materials-forces and stresses, efficiency	2
3.6	Estimating the size of the worm gear pair	2
4.0	**Design of gearboxes**	
4.1	Geometric progression – Standard step ratio	1
4.2	Ray diagram, kinematics layout	1
4.3	Design of sliding mesh gear box	1
4.4	Design of multi speed gear box for machine tool applications	1
4.5	Constant mesh gear box	2
4.6	Speed reducer unit	2
4.7	Variable speed gear box	1
5.0	**Design of Frictional Drives**	
5.1	Clutches – role of clutches	1
5.2	Positive and gradually engaged clutches, toothed claw clutches	1
5.3	Design of single plate and multiple plate clutches	2
5.4	Variable speed drives, types and selection	1
5.5	Role of brakes-types of brakes-self energizing and de-energizing brakes	1
5.6	Design of internally expanding shoe brakes	2
5.7	Calculation of heat generation and heat dissipation in brakes	1

Course Designer(s)

1. Mr.B.Balaji – balajib@ksrct.ac.in
2. Dr.K.Raja – rajak@ksrct.ac.in
3. Dr.S.Jeyaprakasam – sjeyaprakasam@ksrct.ac.in

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60 ME 6P1	Heat Transfer Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To analyze the conduction heat transfers in composites materials.
- To study and analyze the concepts of free and forced convection heat transfer.
- To investigate the heat dissipation of elliptical fin using data acquisition system.
- To apply the laws of radiation principles to radiative heat transfer between different emissive surfaces.
- To study the performance of double pipe, and shell & tube heat exchangers

Pre-requisites

- Thermal Engineering, Heat and mass transfer

Course Outcomes

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

CO1	Calculate the thermal conductivity and heat transfer co efficient for composite materials	Apply
CO2	Measure the convective heat transfer co efficient by natural and forced convection.	Apply
CO3	Evaluate the heat dissipation of elliptical fin using data acquisition system.	Apply
CO4	Analyze the Stefan-Boltzmann constant and evaluate the emissivity of a test plate surface	Analyze
CO5	Analyze the performance of steam condenser and evaluate the effectiveness of heat exchangers	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	3	3	3	3	3	-	2	2	3	-
CO2	3	2	2	-	-	3	3	3	3	3	-	2	2	3	-
CO3	3	2	3	-	-	3	3	3	3	3	-	2	2	3	-
CO4	3	2	3	-	-	3	3	3	3	3	-	2	2	3	-
CO5	3	2	3	-	-	3	3	3	3	3	-	2	2	3	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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Tiruchengode - 637 215.

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 6P1 – Heat Transfer Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Determination of Thermal Conductivity of Insulation Materials Using Lagged Pipe Apparatus.
2. Determination of Heat Transfer Coefficient Using Composite Walls.
3. Determination of Temperature Distribution and Fin Efficiency Using Pin-Fin Apparatus.
4. Determination of Elliptical Fin Heat Dissipation Using Data Acquisition System.
5. Determination of Convective Heat Transfer Coefficient by Natural Convection Apparatus
6. Determination of Stefan-Boltzmann Constant by Stefan-Boltzmann Apparatus.
7. Determination of Emissivity of a Grey Surface Using Emissivity Measurement.
8. Determination of Efficiency of Steam Condenser Using Shell and Tube Heat Exchanger.
9. Determination of Effectiveness of Parallel Flow Heat Exchanger (Water –Water).
10. Determination of Effectiveness of Counter Flow Heat Exchanger (Water –Water).

Design Experiments:

1. Determination of critical heat flux by using critical heat flux apparatus
2. Effectiveness of parallel flow heat exchanger (water –Nanofluid).
3. Effectiveness of counter flow heat exchanger (water – Nanofluid).

Lab Manual

1.	Heat Transfer Laboratory Manual" by Mechanical Faculty Members

SDG 8 – Decent work and Economic Growth
SDG 9 – Industry Innovation and Infrastructure
SDG 12 – Responsible Consumption and Production

Course Designer(s)

1. Dr.D.Vasudevan – dvasudevan@ksrct.ac.in

BoS - Chairman
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Tiruchengode - 637 215.

60 ME 6P2	Analysis and Simulation Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To give exposure to software tools needed to analyze engineering problems.
- To impart knowledge on understanding the force, stress, deflection in mechanical components.
- To analyze thermal stress and heat transfer in mechanical components
- To analyze the vibration of mechanical components
- To solve one-dimensional problems using MATLAB Programming

Pre-requisites

- Strength of Materials, Finite Element Analysis

Course Outcomes

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

CO1	Analyze the force, stress, deflection in mechanical components.	Analyze
CO2	Analyze thermal stress and heat transfer in mechanical components	Analyze
CO3	Analyze the vibration of mechanical components	Analyze
CO4	Analyze the mechanisms of heat transfer modal and harmonic of varying engineeringproblems using the finite element method	Analyze
CO5	Solve one-dimensional problems using MATLAB Programming	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO2	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO3	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO4	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
CO5	3	3	3	3	3	-	-	3	3	3	-	-	3	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	25	12	50	50
Analyse	25	13	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 6P2 – Analysis and Simulation Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	1.5	60	40	100

List Of Experiments:

1. Force and Stress Analysis Using Link Elements in Trusses.
2. Stress and Deflection Analysis in Beams with Different Support Conditions.
3. Stress Analysis of Flat Plates.
4. Stress Analysis of Axis–Symmetric Components.
5. Thermal Stress and Heat Transfer Analysis of Plates.
6. Thermal Stress Analysis of Cylindrical Shells.
7. Vibration Analysis of Spring-Mass Systems.
8. Couple Field Analysis (Thermo – Structural Analysis)
9. Modal Analysis of Beams.
10. Harmonic Response of Structural Members.
11. MATLAB Programming for Solving Stepped Bar Problem Using 1D Bar Element
12. MATLAB Programming for Solving Beam Problem Using 1D Beam Element.

Lab Manual	
1.	Analysis and Simulation Laboratory Manual" by Mechanical Faculty Members

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

Course Designer(s)

1. Mr.M.Prasaath – mprasath@ksrct.ac.in

60 ME 6P3	Design Thinking and Product Development Laboratory	Category	L	T	P	Credit
		PC	0	0	2	1

Objectives

- Ideate and develop innovative solutions for the given problem statement
- Develop soft prototype and visualize user scenarios for early-stage product validation
- Develop medium and hard prototype, integrating technical, ergonomic, and aesthetic considerations
- Conduct testing, gather user feedback, and apply iterative design processes
- Document, publish and present their solution

Pre-requisites

- Design Thinking and Innovation Laboratory

Course Outcomes

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

CO1	Generate innovative solutions to address specific problem statements.	Apply
CO2	Create and evaluate soft prototype, including paper prototypes and storyboards, to test initial design concepts.	Create
CO3	Create medium and hard prototype using 3D modelling and printing, incorporating human factors and system design.	Create
CO4	Perform usability studies, analyze user feedback, and iterate their designs to finalize user-centered solutions.	Analyse
CO5	Prepare professional documentation, and deliver a comprehensive project report and presentation.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	2	3	3	3	3	3	-	3	3	2	3
CO2	3	3	3	-	-	-	-	3	3	3	-	-	3	2	3
CO3	3	3	3	3	3	-	-	3	3	3	-	-	3	2	3
CO4	3	3	3	3	3	3	3	3	3	3	-	3	3	2	3
CO5	3	-	-	-	-	-	-	3	3	3	3	-	3	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Review I (CO1)			Review II (CO2 & CO3)			Review III (CO4 & CO5)				(R1+R2+R3)	Internal Marks
Generating Creative ideas	Concept Maps and Evaluation	Presentation	Soft Prototyping	Hi-fidelity prototyping	Demonstration	User Studies & Feedback	Finalise solution	Presentation	Report	Total	
10	10	10	10	20	10	10	5	5	10	100	**60**

Report and Presentation (CO1, CO2, CO3, CO4 & CO5)				External Marks
Report	Presentation	Demonstration	Total	
50	30	20	100	**40**

Rev. No.1/w.e.f. 20.07.2025
Passed in BoS Meeting held on 13.06.2025
Approved in Academic Council Meeting held on 19.07.2025

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K.S.Rangasamy College of Technology – Autonomous R 2022								
B.E - Mechanical Engineering								
60 ME 6P3 – Design Thinking and Product Development Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	2	30	1	60	40	100

Ideation Generating Creative ideas - Idea Sketching, Brainstorming for Ideas, SCAMPER, Creativity and Lateral thinking- Concept Maps and Evaluation	[8]
Soft Prototyping Soft Prototyping - Paper Prototype (low-fidelity), Scenarios and Storyboarding, MVP (minimum Viable product).	[4]
Final Prototyping Medium Prototyping - Proof of Concept (PoC), Info Architecture, Experience Design- Human Factors / Ergonomics - Systems Mapping – high prototyping - 3D Modelling & Printing.	[6]
Usability Studies User Studies – Observation – Conversations - Think-aloud protocol – Feedback – Iterate - Finalise solution.	[8]
Publish the solution Publish the ideas: Journal Publication & Intellectual Property Rights–Prepare project report and present the final solution.	[4]
Total Hours:	30

Reference(s):

1.	NPTEL: Design Thinking and Innovation by Prof. Ravi Poovaiah, IDC School of Design, IIT Bombay. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview, https://dsource.in/dti.
2.	NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview.
3..	www.dsource.in , The Resource for Design by e-Kalpa Design Team,IDC, IIT Bombay, DoD, IIT Guwahati & NID, Bengaluru

SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.K.Raja – raja@ksrct.ac.in

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60 CG 0P5	Comprehension Test*	Category	L	T	P	Credit
		CG	0	0	2	1*

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.

Pre-requisites

- 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
CO4	Promote holistic approach to problem solving	Apply
CO5	Examine the competency of graduates in specific programme domain	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	1	2	2	3	-	3	2
CO2	3	3	2	2	-	-	-	-	1	2	2	3	-	3	3
CO3	3	3	2	2	-	-	-	-	1	2	2	3	-	3	3
CO4	3	3	2	2	-	-	-	-	1	2	2	3	-	3	2
CO5	3	3	2	2	-	-	-	-	1	2	2	3	-	3	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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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

SEVENTH 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 ME 701	Machine Learning	2	40	60	100	45	100
2	60 ME 702	Mechatronics and Robotics	2	40	60	100	45	100
3	60 ME 703	Operations Research	2	40	60	100	45	100
4	60 HS 003	Total Quality Management	2	40	60	100	45	100
5	60 ME E4*	Professional Elective – IV	2	40	60	100	45	100
6	60 AC 001	Research Skill Development	2	100	-	100	-	100
7	60 AB 00*	NCC/NSS/NSO/YRC/RRC/ Fine Arts[!]	2	50	50	100	45	100
PRACTICAL								
8	60 ME 7P1	Mechatronics Laboratory	3	60	40	100	45	100
9	60 ME 7P2	Project Work - Phase I	3	100	-	100	-	100
10	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 put a 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 theory End Semester Examination, 50 marks for theory cum practical End Semester Examination and 40 marks for Practical End Semester Examination.

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60 ME 701	Machine Learning	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To impart knowledge on artificial intelligence and deep learning in engineering applications
- To enlighten the students in the features of linear regression
- To introduce machine learning and supervised learning algorithms
- To learn the different machine learning algorithm
- To acquire the necessity and application of machine learning in design and manufacturing domain

Pre-requisites

- Statistics and Numerical Methods

Course Outcomes

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

CO1	Realize the necessity of artificial intelligence and deep learning in engineering application	Apply
CO2	Apply conservation laws to measure flow and estimate losses in pipelines for both laminar and turbulent conditions	Apply
CO3	Build supervised learning models	Apply
CO4	Infer knowledge on different machine learning algorithm for system design	Apply
CO5	Comprehend the machine learning concept in design and manufacturing application	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	2	-	-	-	-	-	2	2	2	1	2
CO2	3	3	3	2	3	-	-	-	-	-	2	3	2	1	2
CO3	2	3	3	3	3	-	-	-	-	-	3	2	2	1	2
CO4	3	2	3	3	3	-	-	-	-	-	3	2	3	2	2
CO5	3	2	3	3	3	-	-	-	-	-	3	2	3	2	2
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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E - Mechanical Engineering</td></tr>
<tr><td colspan="9">60 ME 701- Machine Learning</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Introduction to Machine Learning
Definition of Machine Learning – History Of Artificial Intelligence – Supervised Learning – Unsupervised Learning – Model Representation - Cost Function - Data Science – Hypothesis Spaces- Inductive Bias – Generalization - Artificial Intelligence and Deep Learning in Engineering Applications.</td><td>[9]</td></tr>
<tr><td colspan="8">Linear Regression
Parameter Learning - Gradient Descent for Linear Regression - Linear Algebra – Matrices and Vectors, Properties - Multivariate Linear Regression - Gradient Descent for Multiple Variables - Features and Polynomial Regression - Gradient Descent in Practice - Feature Scaling, Learning Rate.</td><td>[9]</td></tr>
<tr><td colspan="8">Supervised Learning
Introduction to Machine Learning – Linear Regression Models: Least Squares, Single & Multiple Variables, Bayesian Linear Regression, Gradient Descent, Linear Classification Models: Discriminant Function – Probabilistic Discriminative Model - Logistic Regression, Probabilistic Generative Model – Support Vector Machine, Decision Tree, Random Forests.
Hands on:
Calculation of Decision Boundaries for Logistic Regression Models.</td><td>[9]</td></tr>
<tr><td colspan="8">Machine Learning Algorithms
Random Forest Algorithm (Rfa) – Decision Tree – Bayesian Network, Applications – Support Vector Machine Algorithm (Svr) – Artificial Neural Networks (Ann) – Training Data, Hidden Layers, and Predicted Output- Evaluating A Learning Algorithm - Machine Learning System Design.
Hands on:
Evaluation Performance of Ann Models on Various Datasets and Tasks</td><td>[9]</td></tr>
<tr><td colspan="8">Applications of Machine Learning
Text Categorization (Spam Filtering) – Predictive Text Messaging – Optical Character Recognition – Machine Vision (Object Detection and Colour Identification) – Market Segmentation and Prediction – Locating the Position of End-Effector in Robotic Grasping – Predicting the Price of a Used Car – Dynamic Pricing Applications– Applications in Design and Manufacturing Domain.
Hands On:
Estimation and Implementation of an OCR System Using Image Processing Toolbox</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Tom M. Mitchell, “Machine Learning”, 1st Edition, McGraw Hill Education, New Delhi, 2017.</td></tr>
<tr><td>2.</td><td colspan="8">Oliver Theobald, “Machine Learning For Absolute Beginners: A Plain English Introduction”, 2nd Edition, Scatterplot Press, 2017.</td></tr>
<tr><td>3.</td><td colspan="8">Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">John D. Kelleher, “Fundamentals of Machine Learning for Predictive Data Anayltics (Algorithms, Worked Examples, and Case Studies)”, 1st Edition, The MIT Press, 2015.</td></tr>
<tr><td>2.</td><td colspan="8">Shai Ben-David and Shai Shalev-Shwartz, “Understanding Machine Learning: From Theory to Algorithms”, 1st Edition, Cambridge University Press, 2014.</td></tr>
<tr><td>3.</td><td colspan="8">Marc Peter Deisenroth, Aldo Faisal A., and Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge University Press, 2020.</td></tr>
<tr><td>4.</td><td colspan="8">Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, 1st Edition, Cambridge University Press, 2012.</td></tr>
<tr><td>5.</td><td colspan="8">Sebastain Raschka, Vahid Mirjalili , “Python Machine Learning”, Packt publishing, 3rd Edition, 2019.</td></tr>
</table>

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Machine Learning**	
1.1	History of Artificial Intelligence	1
1.2	Supervised Learning	1
1.3	Unsupervised Learning	2
1.4	Model Representation	1
1.5	Data Science	1
1.6	Artificial Intelligence and deep learning	2
1.7	Inductive bias	1
2.0	**Linear Regression**	
2.1	Parameter Learning	1
2.2	Gradient Descent for Linear Regression	2
2.3	Linear Algebra	1
2.4	Multivariate Linear Regression	1
2.5	Gradient Descent in Practice	1
2.6	Feature Scaling	1
2.7	Learning Rate	2
3.0	**Supervised Learning**	
3.1	Least squares, single & multiple variables	2
3.2	Bayesian linear regression	1
3.3	Gradient descent	1
3.4	Probabilistic discriminative model	1
3.5	Support vector machine	2
3.6	Decision Tree, Random forests	2
4.0	**Machine Learning Algorithms**	
4.1	Bayesian Network	1
4.2	Support Vector Machine Algorithm (SVR)	1
4.3	Artificial Neural Networks (ANN)	1
4.4	Training Data	1
4.5	Hidden Layers, and Predicted Output	1
4.6	Evaluating a Learning Algorithm	2
4.7	Machine Learning System Design	2
5.0	**Applications of Machine Learning**	
5.1	Text Categorization (spam filtering)	1
5.2	Market Segmentation and Prediction	2
5.3	Locating the Position of End-Effector in Robotic Grasping	1
5.4	Predictive Text Messaging	2
5.5	Machine Vision	1
5.6	Applications in Design and Manufacturing Domain	2

Course Designer(s)

1. Ms.S.Srinithi– srinithi@ksrct.ac.in

60 ME 702	Mechatronics and Robotics	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- Understand the fundamentals of mechatronics and robotics.
- Learn to design and control mechatronic systems.
- Gain hands-on experience with sensors, actuators, and microcontrollers.
- Know fundamental concepts of robotics system.
- Explore industrial applications of mechatronics and robotics

Pre-requisites

- Basics of electrical and electronics, Instrumentation system, control system

Course Outcomes

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

CO1	Interpret the key concepts and principles of mechatronics System	Remember
CO2	Design simple mechatronic systems that integrate mechanical, electrical, and Electronics components	Understand
CO3	Implements the performance of control strategies in mechatronics system	Analyze
CO4	Describe the key components of a robot system and their functions	Remember
CO5	Identify common types of sensors used in robotics and their applications	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	-	-	-	-	2	-	3	-	3	3
CO2	3	2	2	3	-	-	-	-	-	2	-	3	-	2	3
CO3	3	3	2	2	-	-	-	-	-	2	-	2	-	3	3
CO4	3	3	2	2	-	-	-	-	-	3	-	3	-	3	3
CO5	3	3	3	2	-	-	-	-	-	2	-	3	-	2	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	40	20	30
Apply	-	10	30
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 702- Mechatronics and Robotics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction to Mechatronics: Definition-Scope- Importance of Mechatronics-Evolution of Mechatronics- Importance and Applications of Mechatronics in Modern Engineering -Measurement Systems – Control Systems – Microprocessor Based Controllers.	[9]
Mechatronics Systems: Mechanical Components and Systems-Kinematics and Dynamics of Mechanical Systems. Mechanical Sensors and Actuators -Electrical Systems: -Basic Electrical Components – Resistors- Capacitors- Inductors-Dc and Ac Circuits. Sensors and Transducers-Electronic Systems:-Operational Amplifiers-Digital Electronics-Microcontrollers and Microprocessors.	[9]
System Models and Controllers Introduction to Control Systems-Feedback Control Systems-Continuous and Discrete Process Controllers – Control Mode – Two – Step Mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Programmable Logic Controllers - Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.	[9]
Introduction to Robotics Definition-Laws of Robot- Classification- Ethical Considerations in Robotics- Forward and Inverse Kinematics- Differential Kinematics- Dynamics of Manipulators And Mobile Robots- Grippers	[9]
Robot Sensors and Actuators Types of Sensors –Position-Velocity-Force-Actuators -DC Motors-Servos- Stepper Motor-Sensor Fusion And Calibration **Industrial Applications of Mechatronics and Robotics** Automated Manufacturing Systems-Robotic Assembly Lines-Autonomous Vehicles and Drones.	[9]
Total Hours:	**45**

Text Book(s):

1.	Bolton, W. “Mechatronics”, Pearson Education, 4th Edition, 2008
2.	Saeed B. Niku, “Introduction to Robotics: Analysis, systems, Application”, 2nd Edition, Pearson Education India, 2017.

Reference(s):

1.	Mechatronics', HMT Ltd., Tata McGraw Hill Publication Co. Ltd., New Delhi, 5th Edition, 2009
2.	Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2005.
3.	Ramachandran, K.P., Vijayaraghavan, G.K.and BalaSundaram, M.S. “Mechatronics: Integrated Mechanical Electronic System” Wiley India Pvt Ltd.
4.	Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint).
5.	https://onlinecourses.nptel.ac.in/noc21_me27
6.	https://onlinecourses.nptel.ac.in/noc21_me76/

SDG: 7 - Affordable and Clean Energy

SDG: 15– Life on land

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Mechatronics, Sensors and Transducers**	
1.1	Introduction to Mechatronics	2
1.2	Definition-Scope- Importance of Mechatronics	2
1.3	Importance and applications of mechatronics in modern engineering	2
1.4	Measurement systems	1
1.5	Control systems.	1
1.6	Microprocessor based controllers.	1
2.0	**Actuation Systems**	
2.1	Mechanical components and Systems.	2
2.2	Kinematics and dynamics of mechanical systems	1
2.3	Mechanical sensors and actuators	1
2.4	Basic electrical components –resistors- capacitors- inductors-DC and AC circuits	2
2.5	Sensors and transducers-Electronic Systems	1
2.6	Operational Amplifiers-Digital Electronics-Microcontrollers and microprocessors	2
3.0	**System Models and Controllers**	
3.1	Introduction to control systems-Feedback control systems-.	2
3.2	Continuous and discrete process Controllers	1
3.3	Control Mode ,Two – Step mode, Proportional Mode	2
3.4	Derivative Mode , Integral Mode	1
3.5	PID Controllers, Digital Controllers – Programmable Logic Controllers	2
3.6	Velocity Control, Adaptive Control, Digital Logic Control, Micro Processors Control.	1
4.0	**Introduction to Robotics**	
4.1	Definition, laws of robot	2
4.2	Classification, Ethical considerations in robotics	2
4.3	Forward and inverse kinematics	1
4.4	Differential kinematics	1
4.5	Dynamics of manipulators and mobile robots	1
4.6	Grippers	1
5.0	**Robot Sensors and Actuators**	
5.1	Types of sensors ,Position	2
5.2	Velocity, Force, Actuators	1
5.3	DC motors, servos	1
5.4	Stepper motor	1
5.5	Sensor fusion and calibration	1
5.6	Industrial Applications of Mechatronics and Robotics	1
5.7	Automated manufacturing Systems ,Robotic Assembly Lines	1
5.8	Autonomous vehicles and drones.	1

Course Designer(s)

1. Dr.M.Ravi-ravi@ksrct.ac.in

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Tiruchengode - 637 215.

60 ME 703	Operations Research	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To impart knowledge about Operations Research techniques and enable students to take effective engineering and managerial decisions.
- To train students to apply Operations Research techniques for the effective utilization of available resources in engineering and business.
- To equip students to find the optimum solution for transportation problems and assignment problems.
- To impart knowledge a-bout network models and train students to apply these concepts to solve the real-world problems.
- To train students to apply simulation techniques to solve Inventory and queuing problems

Pre-requisites

- Manufacturing Processes

Course Outcomes

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

CO1	Formulate and estimate the optimal solution for Linear Programming models	Apply
CO2	Apply transportation models and Assignment models to solve real world problems.	Analyze
CO3	Construct Networks and find optimum solution.	Apply
CO4	Apply Inventory models to solve inventory problems.	Analyze
CO5	Apply Queuing models to solve problems and analyze them using simulation techniques.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	3	1	-	-	-	-	-	3	2	1	3	3
CO2	2	3	3	3	3	-	-	-	-	-	3	3	3	2	-
CO3	3	3	2	3	1	-	-	-	-	-	2	3	1	-	-
CO4	3	3	3	2	2	-	-	-	-	-	2	3	2	-	2
CO5	3	2	3	2	2	-	-	-	-	-	3	2	2	-	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	10	10	20
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 703 - Operations Research								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Linear Programming Problems Or-Definition – Phases of Or - Models, Concept of Linear Programming Model-Development of Lp Models – Graphical Solution - Simplex Method - Big M Method - Two Phase Method, Introduction to Duality Theory.	[9]
Transportation Problems Transportation Problems- Balanced and Unbalanced Tp- Basic Feasible Solution, Optimal Solution by Modi Method - Degeneracy, Production Problems. Assignment Problems - Hungarian Method – Balanced and Unbalanced Assignment Problems - Problem With Assignment Restrictions-, Travelling Salesman Problem.	[9]
Network Models and Project Management Shortest Route Model- Minimal Spanning Tree Model - Maximum Flow Model – Project Network Construction –Network Logic - Fulkerson's Rule - Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) – Probability of Completing a Project in A Scheduled Date - Crashing of Project Networks.	[9]
Inventory Models Types of Inventory Models - Inventory Cost - Deterministic Inventory Models - Economic Order Quantity (Eoq) - Purchase and Production Models With and Without Shortages - Determination of Buffer Stock and Re-Order Levels - Eoq With Price Breaks - Multi Product Eoq Models – Abc, Ved&Sde Analysis In Inventory - Introduction to Stochastic Inventory Problems –Discrete Case And Continuous Case.	[9]
Queuing Theory and Simulation Queuing System - Terminologies of Queuing Problem - Applications of Queuing Model - Poisson Distribution and Exponential Distribution –Single Server Queuing Models – Simulation - Need for Simulation - Advantages ,Disadvantages and Applications of Simulation - Random Number Generation – Monte Carlo Technique- Inventory and Queuing Problems in Simulation.	[9]
Total Hours:	**45**

Text Book(s):

1.	Hamdy A. Taha, “Operation Research - An Introduction”, 9th Edition, Pearson India Education Services Pvt. Ltd., New Delhi, 2014.
2.	Panneerselvam, R., “Operations Research” 2nd edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2006.

Reference(s):

1.	Wayne L. Winston, “Operations Research – Applications and Algorithms”, 4th Edition, Cengage Learning India Private Limited, New Delhi, 2011.
2.	Frederick S. Hillier And Gerald J. Lieberman, “Introduction To Operations Research”, 9th Edition, McGraw Hill Publishing Co., New Delhi, 2011.
3.	Perm Kumar Gupta and Hira, D.S., “Operations Research”, S.Chand and Company Ltd., 2014.
4.	Srinivasan G, “Operations Research Principles and Applications”, 3rd Edition EEE PHI, 2017.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Linear Programming Problems**	
1.1	OR-definition	1
1.2	Phases of OR	1
1.3	Models, Concept of linear programming model	2
1.4	Development of LP models	2
1.5	Graphical solution	1
1.6	Simplex method - Big M method	1
1.7	Two phase method, Introduction to duality theory.	1
2.0	**Transportation Problems**	
2.1	Balanced and Unbalanced TP	1
2.2	Basic feasible solution, Optimal solution by MODI method	1
2.3	Degeneracy, Production problems	1
2.4	Assignment problems - Hungarian method	2
2.5	Balanced and Unbalanced assignment problems	1
2.6	Problem with assignment restrictions	1
2.7	Travelling salesman problem	2
3.0	**Network Models and Project Management**	
3.1	Shortest route model- Minimal spanning tree model	1
3.2	Maximum flow model – Project network construction	1
3.3	Network logic - Fulkerson's rule	1
3.4	Critical Path Method (CPM) and Project Evaluation	2
3.5	Review Technique (PERT)	1
3.6	Probability of completing a project in a scheduled date	1
3.7	Crashing of project networks.	2
4.0	**Inventory Models**	
4.1	Types of inventory models - Inventory cost	1
4.2	Deterministic Inventory models	1
4.3	Economic Order Quantity (EOQ)	2
4.4	Purchase and Production models with and without shortages	1
4.5	Determination of buffer stock and re-order levels, EOQ with price breaks	2
4.6	Introduction to Stochastic inventory problems –discrete case and continuous case.	1
4.7	Multi product EOQ models – ABC, VED&SDE analysis in inventory	1
5.0	**Queuing Theory and Simulation**	
5.1	Queuing system - terminologies of queuing problem	1
5.2	Applications of queuing model - Poisson distribution and exponential distribution	1
5.3	Single server queuing models – Simulation	1
5.4	Need for simulation - Advantages, disadvantages	1
5.5	applications of simulation	1
5.6	Random number generation	2
5.7	Monte Carlo technique	1
5.8	Inventory and Queuing problems in simulation.	1

Course Designer(s)

1. Mr. S. Karthikeyan – karthikeyan.s@ksrct.ac.in
2. Mr. C. Ramech - ramechc@ksrct.ac.in

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60 HS 003	Total Quality Management	Category	L	T	P	Credit
		HS	3	0	0	3

Objectives

- To facilitate the understanding of total quality management principles, tools and techniques
- To equip the students to apply the TQM principles, tools and techniques in manufacturing sectors
- To equip the students to apply the TQM principles, tools and techniques in service sectors
- To impart knowledge on quality management principles, tools, techniques and quality standards for real life applications
- To make the students understand the importance of standards in the quality assurance process and their impact on the final product

Pre-requisites

- NIL -

Course Outcomes

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

CO1	Recognize the need for quality concepts and its application in organizations.	Understand
CO2	Apply the TQM principles for survival and growth in world class competition.	Apply
CO3	Apply the traditional tools and new tools for quality improvement.	Apply
CO4	Apply the tools and techniques like quality circle, QFD, TPM and FMEA for qualityimprovement.	Apply
CO5	Apply QMS and EMS in organizations.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	2	3	3	3	3	3	-	3	3	2	-
CO2	3	2	-	-	2	3	3	3	3	3	-	3	-	2	-
CO3	-	3	-	-	-	2	2	-	-	3	-	-	3	-	-
CO4	-	3	-	-	3	2	2	3	2	-	-	3	-	3	-
CO5	3	-	-	-	3	3	-	3	2	2	-	-	2	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	40
Apply	30	30	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 HS 003 - Total Quality Management								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Content	Hours
Introduction to Fundamentals of Total Quality Management Introduction, Definitions of Quality, Need for Quality, Evolution of Quality, Dimensions of Quality, Product Quality and Service Quality; Basic Concepts of TQM, TQM Framework, Contributions of Deming, Juran and Crosby. Barriers to TQM; Quality Statements, Customer Focus, Customer Satisfaction, Customer Complaints, Customer Retention; Costs to Quality.	[9]
Total Quality Management Principles Tqm Principles; Leadership, Strategic Quality Planning; Quality Councils- Employee Involvement, Motivation; Empowerment; Team And Teamwork; Quality Circles, Recognition And Reward, Performance Appraisal; Continuous Process Improvement; Pdsa Cycle, Kaizen, 5s & 7s ; Supplier Partnership, Partnering, Supplier Rating And Selection.	[9]
TQM Management Tools and Techniques The Seven Traditional Tools of Quality; New Management Tools - Applications to Manufacturing, Service Sector, Statistical Fundamentals, Measures of Central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts, Process Capability, Concepts of Six Sigma, Bench Marking - Reasons to Benchmark, Benchmarking Process.	[9]
TQM Process Based Tools and Techniques Quality Circles, Quality Function Development (QFD), Taguchi Quality Loss Function; TPM- Concepts, Improvement Needs, Performance, Measures. FMEA- Stages, Types-Design FMEA And Process FMEA.	[9]
Quality Management System Introduction-Benefits of Iso Registration-Iso 9000 Series of Standards-Sector-Specific Standards - As 9100, Ts16949 And Tl 9000 - Iso 9001, Iso 9001:2008 Requirements-Implementation-Documentation-Internal Audits-Registration-Environmental Management System: Introduction—Iso 14000 Series Standards—Concepts Of Iso 14001—Requirements Of Iso 14001-Benefits Of Ems.	[9]
Total Hours:	**45**

Text Book(s):

1.	Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc.2003. (Indian reprint 2020). ISBN 81- 297-0260-6.
2.	Janakiraman, B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd. 2016.

Reference(s):

1.	James R. Evans, James Robert Evans, William M. Lindsay , “The Management and Control of Quality”, 8th Edition, South-Western, 2019.
2.	Joel.E. Ross, “Total Quality Management – Text and Cases”, 3rd Edition, Routledge, 2021.
3.	International 1996. 5. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 2019
4.	Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”,New Age 3rd Edition-2018

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Fundamentals of Total Quality Management**	
1.1	Introduction and Definition of Quality	1
1.2	Need and evolution of quality	1
1.3	Different Dimensions of Quality	1
1.4	Basic concepts of TQM and TQM framework	1
1.5	Deming, Juran and Crosby Philosophy of quality Management	1
1.6	Barriers to TQM Implementation	1
1.7	Quality Statements, Strategic Planning	1
1.8	Customer focus, customer satisfaction customer retention Techniques	1
1.9	Techniques for Quality Costs	1
2.0	**Total Quality Management Principles**	
2.1	Total Quality Management Principles	1
2.2	Strategic of quality planning and Quality councils	1
2.3	Motivation, Empowerment, Teams, Recognition and Reward	1
2.4	Performance Appraisal, Benefits, Continuous Process Improvement	1
2.5	Juran Trilogy, PDSA Cycle Continuous Process Improvement	1
2.6	5S, Kaizen, Continuous Process and Supplier Partnership	1
2.7	Partnering, sourcing, Supplier Selection	1
2.8	Supplier Rating, Relationship Development,	1
2.9	Basic Concepts, Strategy, Performance Measure.	1
3.0	**TQM Management Tools and Techniques**	
3.1	The seven traditional management tools of quality	1
3.2	The New management tools	1
3.3	Management tools applications to manufacturing	1
3.4	Management tools applications to service sector	1
3.5	Statistical Fundamentals in management tools	1
3.6	Normal Curve, Control Charts for variables and attributes	1
3.7	Concepts of six sigma principles	1
3.8	Benchmarking tools and Reasons to benchmark	1
3.9	Benchmarking process tools	1
4.0	**TQM Process based Tools and Techniques**	
4.1	Quality circles	2
4.2	Quality Function Deployment (QFD	1
4.3	house of Quality, QFD Process	2
4.4	Benefits, Taguchi Quality Loss Function	2
4.5	Total Productive Maintenance (TPM	1
4.6	Concept, Improvement Needs	1
4.7	Performance measuring tools	1
4.8	stages, types of FMEA	2
4.9	Process implementation of FMEA	1
5.0	**Quality Management System**	
5.1	Introduction-Benefits of ISO Registration	1
5.2	ISO 9000 Series of Standards- Sector-Specific Standards	2
5.3	AS 9100, TS16949 and TL 9000 - ISO 9001, ISO 9001:2008 requirements	1
5.4	Implementation-Documentation-Internal Audits	1
5.5	Registration-Environmental Management System	1
5.6	Introduction—ISO 14000 Series Standards	1
5.7	Concepts of ISO 14001	1
5.8	Requirements of ISO 14001-Benefits of EMS	1

Course Designer(s)

1. Dr.G.Mylsami - mylsamig@ksrct.ac.in

60 AC 001	Research Skill Development	Category	L	T	P	Credit
		AC	1	0	0	0

Objectives

- To identify research problems, formulate hypotheses, collect data and test hypotheses
- To prepare and submit quality manuscripts and understand peer review process
- To utilize software tools for effective manuscript preparation and visualization of research data
- To familiarize different journal metrics and author-level quality indicators
- To protect creative works, inventions, and branding elements using IPR

Pre-requisites

- Nil

Course Outcomes

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

CO1	Develop structured scientific approach to plan and execute research work	Apply
CO2	Understand the journal requirements to publish research findings effectively	Understand
CO3	Apply various software tools during the manuscript preparation	Apply
CO4	Select suitable journals to publish the work using different publication metrics	Analyse
CO5	Apply the appropriate form of IP protection to a specific invention or creation	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	-	2	2	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
CO5	-	-	2	2	-	-	-	3	3	3	-	3	2	-	-

3 - Strong; 2 - Medium; 1 – Some

Assessment Pattern

One review at end of the semester

Parameters	Weightage (Marks)
Research Problem Identification (Research gap, SDG, Objectives)	10
Literature Review preparation (Clarity, Number and quality of sources)	20
Patent Draft/ Manuscript Preparation (Structure, Content)	20
Use of software tools (Plagiarism, Reference Management, etc.,)	10
Journal Identification (Aim & scope of the journal, journal metrics)	10
Presentation & Viva voce	30
Total	**100**

Rev. No.0/w.e.f. 01.07.2024
Passed in BoS Meeting held on 21.05.2024
Approved in Academic Council Meeting held on 25.05.2024

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 AC 001 – Research Skill Development								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	1	0	0	15	0	100	-	100

Research - Scientific Approach* Types of Research - Identification and Clarification of The Problem – Problem Analysis - Formulating Hypothesis, Selection of Sample and Tools of Data Collection - Testing the Hypothesis - Conclusion	[3]
Manuscript Preparation* Structure of a Manuscript - Types of Manuscript - Graphical Abstract - Highlights - Literature Review - Citation - Reference Style - Plagiarism – Journal Selection - Peer Review Process	[3]
Research Toolkit* Software Tools for Writing Enhancement - Literature Review - Reference Management - Data Analysis and Visualization - Drawing - Plagiarism	[3]
Research Publication Metrics* Journal Index: Scopus - Web of Science - Sci - Ugc Care - Q Journal; Journal Metrics: Impact Factor, Cite Score; Quality Indicators: H-Index - I-10 Index - Citations	[3]
Intellectual Property Rights* Patents - Industrial Designs - Copyright - Trademarks - Geographical Indications - Trade Secrets	[3]
Total Hours:	**15**

Reference(s):

1.	Kothari, C.R. and Gaurav Garg, “Research Methodology: Methods and Techniques”, New Age International Publishers, 2023
2.	Chawla H S., “Introduction to Intellectual Property Rights”, CBS Publishers and Distributors Private Limited, 2019

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1	**Research - Scientific Approach**	
1.1	Types of Research - Identification and Clarification of the problem – Problem analysis - Formulating hypothesis	2
1.2	Selection of sample and tools of data collection - Testing the hypothesis - Conclusion	1
2	**Manuscript Preparation**	
2.1	Structure of a manuscript - Types of manuscript - Graphical abstract - Highlights	1
2.2	Literature Review	1
2.3	Citation - Reference style – Plagiarism, Journal selection - Peer review process	1
3	**Research Toolkit**	
3.1	Software Tools for Writing enhancement	1
3.2	Literature review, Reference management	1
3.3	Data analysis and visualization – Drawing, Plagiarism	1
4	**Research Publication Metrics**	
4.1	Journal Index: Scopus - Web of Science - SCI - UGC Care - Q Journal;	1
4.2	Journal Metrics: Impact Factor, Cite	1
4.3	ScoreQuality Indicators: h-index - i-10 index - citations	1
5	**Intellectual Property Rights**	
5.1	Patents	1
5.2	Industrial Designs - Copyright	1
5.3	Trademarks - Geographical Indications - Trade Secrets	1

Course Designer(s)

1. Dr.M.Kathirselvam - mkathirselvam@ksrct.ac.in

BoS - Chairman
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Tiruchengode - 637 215.

60 AB 001	**National Cadet Corps - Air Wing**	**Category**	**L**	**T**	**P**	**Credit**
		HS	**2**	**0**	**2**	**3**

Objectives

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

Pre-requisites

- 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	Knowledge
CO2	Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling	Knowledge
CO3	Illustrate various forces and moments acting on aircraft	Apply
CO4	Outline the concepts of aircraft engine and rocket propulsion	Apply
CO5	Design, build and fly chuck gliders/model airplanes and display static models	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	3	3	3	3	3	-	-	-	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	1	1	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	3
3 - Strong; 2 - Medium; 1 - Some															

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to ALL Branches								
60 AB 001 - NCC Air Wing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	2	0	2	60	3	50	50	100

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 themarch-Sidepace,Paceforwardandtotherear-Markingtime-Drillwitharms-Ceremonialdrill-Guardmounting.(WITH DEMONSTRATION)	[12]
Principles of Flight Laws of motion-Forces acting on aircraft- Bernoulli"s theorem-Stalling-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 modelling - 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 Book(s):	
1.	National Cadet Corps – A Concise handbook 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, New Delhi.
3.	"NCCOTA Precise", published by DGNCC, New Delhi.
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India whichincludes all K1 to K4 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. Itwillbeconverted to100 marks.

Course Designer(s)

1. Flt LtV.R.SADASIVAM- sadasivam@ksrct.ac.in

BoS - Chairman
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60 AB 002	National Cadet Corps - Army Wing	Category	L	T	P	Credit
		HS	2	0	2	3

Objectives

- 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.

Pre-requisites

- 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.	Apply
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	Apply
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to ALL Branches								
60 AB 002 - NCC Army Wing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	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).	[12]
Weapon Training Main Parts of a Rifle- Characteristics of .303 rifle- Characteristics of .22 rifle- loading and unloading – position and holdingsafety 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- Param Vir Chakra- Career in the Defence forces- Service tests and interviews.	[12]
Total Hours:	**60**

Text Book(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

Course Designer(s)

1. C T E Chandra Kumar – chandrakumar@ksrct.ac.in

60 ME 7P1	Mechatronics Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To explore the basics of automation using pneumatic and electro-pneumatic systems.
- To develop control logic using PLC programming for real-time industrial processes.
- To understand how to manage and control data using arrays and clusters in LabVIEW.
- To gain hands-on experience in using automation simulation tools for testing and validation.
- To apply automation knowledge in robotic control systems for pick-and-place and assembly tasks.

Pre-requisites

- Applied Hydraulics and Pneumatics

Course Outcomes

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

CO1	Design and simulate pneumatic and electro-pneumatic circuits for basic automation tasks.	Apply
CO2	Program and execute PLC ladder logic for controlling real-time industrial processes.	Apply
CO3	Create and handle the control logic using arrays and clusters in LabVIEW.	Apply
CO4	Apply automation concepts in practical situations, improving system efficiency and productivity.	Apply
CO5	Program and simulate robotic arms to perform basic pick-and-place and assembly operations.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3				2	3		2	3	2
CO2	3	3	3	3	2				2	3		2	2	2
CO3	3	3	3	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 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	-	-	-	-
Understand	-	-	-	-
Apply	50	25	50	50
Analyse	-	-	50	50
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="9">B.E – Mechanical Engineering</th></tr>
<tr><th colspan="9">60 ME 7P1-Mechatronics laboratory</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>0</td><td>0</td><td>4</td><td>60</td><td>2</td><td>60</td><td>40</td><td>100</td></tr>
</table>

List of Experiments:

1. Execution of electro pneumatic circuit.
2. Simulation of pneumatic circuit using automation studio software.
3. Design and Execution of Data Handling and Control Logic Using Arrays in LabVIEW.
4. Design and Execution of Data Handling and Control Logic Using Clusters and Structures in LabVIEW.
5. PLC-Based Gray Paint Spraying System.
6. Automation of Bottle Filling and Stamping Using PLC.
7. PLC-Based Automation of Material Handling System.
8. Design and Implementation of a Two-Level Elevator System with PLC.
9. PLC-Based Automatic Water Level Control System.
10. Robotic Manipulator Control for Pick-and-Place and Assembly Operations.

Lab Manual

1.	"Mechatronics Lab Manual", Department of Mechanical Engineering, KSRCT.

*SDG: 7 - Affordable and Clean Energy

**SDG: 15– Life on land

Course Designer(s)

1. Mr.M.Prasath - prasathm@ksrct.ac.in

60 ME 7P2	Project Work Phase - I	Category	L	T	P	Credit
		CG	0	0	4	2

Objectives

- To apply the knowledge/concepts acquired in the lower semesters to create/design/implement project relevant to the field of Mechanical Engineering
- To acquire collaborative skills through working in a team to achieve common goals.
- To search for related area in which the members are going to do their project.
- To identify right project work, acquiring knowledge on that area, making preliminary works towards phase II of the project work.
- To acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.

Pre-requisites

-Nil –

Course Outcomes

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

CO1	Survey the literature and market for availability of resources	Apply
CO2	Select the title and collect relevant information related with selected title	Apply
CO3	Collect the literature based on survey and do the partially design of the system	Apply
CO4	Carryout partial design of the system	Apply
CO5	Prepare and present the project report	Apply

Mapping with Programme Outcomes

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	3	3	3	3	3	-	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	-	3	3	3
CO3	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 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Review I (R1)			Review II (R2)		Review III (R3)			Total (R1+R2+R3)	Internal
Literature Survey	Topic Identification & Justification	Work Plan	Approach	Conclusion	Demo-Existing System	Presentation	Report	Total	
10	10	10	20	20	10	10	10	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 7P2 - Project Work Phase - I								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	100	--	100

- Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide.
- Problem should be selected.
- Students have to collect about 20 Papers related to their work.
- Report has to be prepared by the students as per the format.
- Preliminary implementation can be done If possible.

Internal Evaluation has to be done for 100 Marks.

*SDG 9 – Industry Innovation and Infrastructure

Rev. No.0/w.e.f. 01.07.2024
Passed in BoS Meeting held on 21.05.2024
Approved in Academic Council Meeting held on 25.05.2024

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2024-2025)

EIGHTH 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 ME E5*	Professional Elective - V	2	40	60	100	45	100
PRACTICAL								
2	60 ME 8P1	Project Work – Phase II	3	60	40	100	45	100
3	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 put a 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 theory End Semester Examination and 40 marks for Project End Semester Examination.

Rev. No.0/w.e.f. 01.07.2024
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60 ME 8P1	Project Work Phase - II	Category	L	T	P	Credit
		CG	0	0	16	8

Objectives

- To enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
- To have guidance for an every project team, by the faculty member of the concerned department.
- To receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide.
- To present in periodical seminars on the progress made in the project
- To produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

Pre-requisites

-Nil –

Course Outcomes

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

CO1	Make links across different areas of knowledge and to generate, develop and Evaluate ideas and information	Apply
CO2	Apply these skills to the project	Apply
CO3	Design the project work.	Apply
CO4	Model and fabricate the project work	Apply
CO5	Prepare and present the project work along with report.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	3	3	3	3	3	-	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	-	3	3	3
CO3	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 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Internal Assessment (60)					End Semester (40)
Items	**Review 1**	**Review 2**	**Review 3**	**Publication**	
Marks	**5**	**10**	**15**	**30**	**40**
	Total internal marks 60				

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K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME 8P1 - Project Work Phase - II								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	0	0	16	240	8	60	40	100

- Three Reviews Have to be Conducted by the Committee of Minimum of Three Members One of Which Should Be Their Project Guide.
- Progress Of Project has to be Monitored by The Project Guide and Committee Regularly.
- Each Review has to be Evaluated For 100 Marks.
- Attendance Is Compulsory for All Reviews. If A Student Fails to Attend Review for Some Valid Reasons, One More Chance May Be Given.
- Final Review Will Be Carried Out by The Committee That Consists of Minimum of Three Members One of Which Should Be Their Project Guide (If Possible Include One External Expert Examiner Within The College).

  The Project Report Should Be Submitted by The Students Around at The First Week of April.

*SDG 9 – Industry Innovation and Infrastructure

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60 ME E11	Design for Manufacture and Assembly	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To gain knowledge about Concept Generation, Evaluation and Embodiment Design.
- To impart the knowledge about Materials selection and to improve material technology.
- To understand the concept and design of Manufacturing Processes
- To provide knowledge about development of features for automatic assembly
- To learn how to manual assembly improve the quality

Pre-requisites

Manufacturing Processes

Course Outcomes

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

CO1	Identify the design factors and processes as per customer specifications	Apply
CO2	Evaluate the Properties of engineering materials and selection of materials	Apply
CO3	Apply the concept of DFM for casting, welding, forming and Powder Metallurgy.	Apply
CO4	Interpret the quality aspects of design for manufacture and assembly	Understand
CO5	Apply the DFM method for designing process and manual assembly	Apply

Mapping with Programme Outcomes

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-
CO2	3	2	3	3	3	2	-	-	-	-	-	3	2	3	-
CO3	3	3	3	3	3	3	-	-	-	-	-	3	3	2	-
CO4	3	3	3	2	2	2	-	-	-	-	-	2	2	3	-
CO5	3	3	3	3	3	3	-	-	-	-	-	3	3	2	-
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	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E11 - Design for Manufacturing and Assembly								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction Introduction Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Design Philosophy Steps In Design Process - General Design Rules for Manufacturability - Basic Principles of Design Ling for Economical Production.	[9]
Material Consideration* Properties of Engineering Materials, Selection of Materials, Selection of Shapes, Co-Selection of Materials and Shapes. Selection of Materials for Design – Developments in Material Technology.	[9]
Design For Manufacture** Selection of Manufacturing Processes, Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design For Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy, Design for Polymer Processing and Case-Studies.	[9]
Design for Assembly* Design for Assembly, Review of Assembly Processes, Design for Welding, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case Studies. Design And Development of Features for Automatic Assembly	[9]
Design of Manual Assembly* Design for Assembly Fits in the Design Process, General Design Guidelines for Manual Assembly- Classification System For Manual Handling - Classification System for Manual Insertion and Fastening- Effect of Part Symmetry on Handling Time - Effect of Part Thickness and Size on Handling Time - Effect of Weight on Handling Time.	[9]
Total Hours:	**45**

Text Book(s):

1.	Dieter G E, “Engineering Design - A Materials and Processing Approach”, 4th Edition, McGraw Hill, NY, 2018.
2.	Swift, K G and Booker, J D., “Process Selection: From Design to Manufacture”, 2nd Edition, Elsevier – London, 2019.

Reference(s):

1.	Rao, S S. “Engineering Optimization: Theory and Practice”, 4th Edition, John Wiley, NY, 2020.
2.	Boothroyd G, Dewhurst P and Knight W, “Product Design for Manufacture and Assembly, 3rd Edition, John Wiley, NY: Marcel Dekkar, 2018.
3.	Bralla J G, “Handbook of Product Design for Manufacture”, McGraw Hill, NY, 2019.
4.	Ashby M F and Johnson K, “Materials and Design - The Art and Science of Material Selection in Product Design”, 3 rd Edition, Butterworth-Heinemann, 2019.

**SDG 8 – Decent work and Economic Growth
*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction Need Identification and Problem Definition	1
1.2	Introduction Need Problem Definition	1
1.3	Concept Generation and Evaluation	2
1.4	Embodiment Design	1
1.5	Design philosophy steps in Design process	1
1.6	General Design rules for manufacturability	1
1.7	Basic principles of design Ling for economical production.	2
2.0	**Material Consideration**	
2.1	Properties of Engineering Materials	2
2.2	Selection of Materials	1
2.3	Selection of Shapes.	1
2.4	Co-selection of Materials and Shapes	2
2.5	Selection of materials for design	1
2.6	developments in material technology	2
3.0	**Design for Manufacture**	
3.1	Selection of Manufacturing Processes	1
3.2	Review of Manufacturing Processes	1
3.3	Design for Casting	1
3.4	Design for Bulk Deformation Processes	1
3.5	Design for Sheet Metal Forming Processes	2
3.6	Design for Machining	1
3.7	Design for Powder Metallurgy	1
3.8	Design for Polymer Processing and Case-Studies	1
4.0	**Design for Assembly**	
4.1	Design for Assembly	1
4.2	Review of Assembly Processes	1
4.3	Design for Welding	1
4.4	Design for Brazing and Soldering	1
4.5	Design for Adhesive Bonding	2
4.6	Design for Joining of Polymers	1
4.7	Design for Heat Treatment, Case Studies	1
4.8	Design and development of features for automatic assembly	1
5.0	**Design of Manual Assembly**	
5.1	Design for assembly fits in the design process	1
5.2	General design guidelines for manual assembly	1
5.3	Classification system for manual handling	1
5.4	Classification system for manual insertion and fastening	2
5.5	Effect of part symmetry on handling time	1
5.6	Effect of part thickness and size on handling time	2
5.7	Effect of weight on handling time.	1

Course Designer(s)

1. Dr. G.Venkatachalam – venkatachalam@ksrct.ac.in

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60 ME E12	Product Design for Manufacturing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn the fundamentals of product design and its principles.
- To identify and analyse the product design and development processes in manufacturing industry.
- To introduce the product design and the requirements of a good product.
- To apply the concept of design for manufacturing, assembly and environment.
- To learn the concepts of design for additive manufacturing.

Pre-requisites

Manufacturing Processes, Machining process

Course Outcomes

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

CO1	Recognise the knowledge on design principles for manufacturing.	Apply
CO2	Express knowledge on form design and forgings.	Understand
CO3	Interpret component design by considering machining.	Apply
CO4	Develop knowledge on component design by considering casting.	Understand
CO5	Discuss the design consideration principles of additive manufacturing	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	-	-	-	-	-	-	-	2	-	-	2
CO2	2	2	3	-	-	-	-	-	-	-	-	2	-	-	2
CO3	2	2	3	-	-	-	-	-	-	-	-	2	-	-	2
CO4	2	2	3	-	-	-	-	-	-	-	-	2	-	-	2
CO5	2	2	3	-	-	-	-	-	-	-	-	2	-	-	2

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	40
Understand	30	30	40
Apply	20	20	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E12 - Product Design for Manufacturing

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction General Design Principles for Manufacturability – Strength and Mechanical Factors, Mechanisms Selection, Evaluation Method, Process Capability – Feature Tolerances, Geometric Tolerances –Assembly Limits –Datum Features – Tolerance Stacks.	[9]
Factors Influencing Form Design Working Principle, Material, Manufacture, Design- Possible Solutions – Materials Choice – Influence of Materials on Form Design – Form Design of Welded Members, Forgings and Castings.	[9]
Component Design – Machining Consideration* Design Features to Facilitate Machining – Drills – Milling Cutters – Keyways – Doweling Procedures, Counter Sunk Screws – Reduction of Machined Area- Simplification by Separation – Simplification by Amalgamation – Design for Machinability – Design for Economy – Design for Clampability – Design for Accessibility – Design for Assembly.	[9]
Component Design – Casting Consideration* Redesign of Castings Based on Parting Line Considerations – Minimizing Core Requirements, Machined Holes, Redesign of Cast Members to Obviate Cores. Identification of Uneconomical Design – Modifying the Design- Computer Applications for Dfma.	[9]
Design for Additive Manufacturing** Introduction To AM, DfAM Concepts And Objectives, AM Unique Capabilities, Exploring Design Freedoms, Design Tools For AM, Part Orientation, Removal Of Supports, Hollowing Out Parts, Inclusion Of Undercuts And Other Manufacturing Constraining Features, Interlocking Features, Reduction Of Part Count In An Assembly, Identification Of Markings/ Numbers.	[9]
Total Hours:	**45**

Text Book(s):

1.	Boothroyd, G, Heartz and Nike, “Product Design for Manufacture”, 3^{rd} Edition, Marcel Dekker, New York, 2020.
2.	Kevien Otto, Kristin Wood, “Product Design”, 2^{nd} Edition, Indian Reprint, Pearson Education, 2021.

Reference(s):

1.	Boothroyd, G, “Design for Assembly, Automation and Product Design”, 2^{nd} Edition, Marcel Dekker, New York, 2020.
2.	Fixel, J. “Design for the Environment”, 2^{nd} Edition, McGraw-Hill International Edition, New York, 2019.
3.	Bralla, J G, “Design for Manufacture Handbook”, 2^{nd} Edition, McGraw-Hill International Edition, New York, 2018.
4.	Chitale, A.K, and Gupta, R.C., “Product Design and Manufacturing”, 3^{rd} Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2021.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	General design principles for manufacturability	2
1.2	strength and mechanical factors	1
1.3	mechanisms selection	1
1.4	evaluation method	1
1.5	Process capability	1
1.6	Feature tolerances	1
1.7	Geometric tolerances	1
1.8	Assembly limits –Datum features – Tolerance stacks	1
2.0	**Factors Influencing Form Design**	
2.1	Working principle, Material, Manufacture,	1
2.2	Design Possible solutions	1
2.3	Materials choice	1
2.4	Influence of materials on form design	1
2.5	form design of welded members	1
2.6	form design of forging	1
2.7	form design of castings	2
2.8	Mechanical properties of the prototype.	1
3.0	**Component Design – Machining Consideration**	
3.1	Design features to facilitate machining	1
3.2	drills – milling cutters – keyways	1
3.3	Doweling procedures, counter sunk screws	1
3.4	Reduction of machined area- simplification by separation.	2
3.5	simplification by amalgamation	1
3.6	Design for machinability	1
3.7	Design for economy – Design for clampability	1
3.8	Design for accessibility – Design for assembly.	1
4.0	**Design for Assembly**	
4.1	**Component Design – Casting Consideration**	
4.2	Redesign of castings based on Parting line considerations	2
4.3	Minimizing core requirements	1
4.4	machined holes	1
4.5	redesign of cast members to obviate cores	2
4.6	Identification of uneconomical design	1
4.7	Modifying the design	1
4.8	Computer Applications for DFMA	1
5.0	**Design for Additive Manufacturing**	
5.1	Introduction to AM, DFMA concepts and objectives	1
5.2	AM unique capabilities, exploring design freedoms,	1
5.3	Design tools for AM – Part Orientation, Removal of Supports	2
5.4	Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features	2
5.5	Interlocking Features, Reduction of Part Count in an Assembly	2
5.6	Identification of markings/ numbers.	1

Course Designer(s)

1. Dr S.Jeyaprakasam – sjeyaprakasam@ksrct.ac.in

60 ME E13	Composite Materials and Mechanics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the fundamentals of composite material and its mechanical behavior.
- To analyse the fiber reinforced Laminate design for different combinations of plies with different orientations.
- To design and analyse the laminates.
- To study the different methods of manufacturing the composite material.
- To analyse the characteristics of laminated flat plates.

Pre-requisites

- Fundamentals of composites
- Strength of Materials

Course Outcomes

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

CO1	Demonstrate the fundamentals of fibers, matrices and composites.	Apply
CO2	Derive Flat plate Laminate equations for different orientation of fiber.	Apply
CO3	Perform design calculations for the development of fiber reinforced matrices and FEM	Apply
CO4	Portray the various methods manufacturing processes involved in the fabrication of composite material.	Apply
CO5	Analyze the characteristics of laminated flat plates.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	2	2	-	-	-	-	2	3	-	2
CO2	2	2	2	2	-	2	2	-	-	-	-	2	3	-	2
CO3	2	2	2	2	-	2	2	-	-	-	-	2	3	-	2
CO4	2	2	2	2	-	2	2	-	-	-	-	2	3	-	2
CO5	2	2	2	2	-	2	2	-	-	-	-	2	3	-	2
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	30	30	30
Apply	20	20	30
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

BoS - Chairman
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E13 - Composite Materials and Mechanics

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction Basics of Fibers, Matrices and Composites: Definition – Need – General Characteristics, Applications. Fibers: Glass, Carbon, Ceramic and Aramid Fibers. Matrices: Polymer, Ceramic and Metal Matrices. Fiber Surface Treatments, Fillers and Additives.	[9]
Mechanics Definition of Stress and Moment Resultants. Strain Displacement Relations. Basic Assumptions of Laminated Anisotropic Plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation Of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination Of Lamina Stresses Within Laminates.	[9]
Design and Analysis* Failure Predictions, Laminate Design Consideration-Design Criteria-Design Allowable – Design Guidelines, Joint Design-Bolted and Bonded Joints, Design Examples: Design of a Tension Member – Design of a Compression Member – Design of A Beam-Design of a Torsional Member. Application of Finite Element Method (FEM) For Design and Analysis of Laminated Composites.	[9]
Manufacturing** Bag Molding – Compression Molding – Pultrusion – Filament Winding – Resin Film Infusion – Elastic Reservoir Molding – Tube Rolling – Quality Inspection Methods. Processing Of Metal Matrix Composites (MMC) – Diffusion Bonding – Stir Casting – Squeeze Casting.	[9]
Analysis of Laminated Flat Plates* Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies.	[9]
Total Hours:	**45**

Text Book(s):

1. Mallick P.K.,"Fiber Reinforced Composites: Materials, Manufacturing and Design", 3rd Edition, Taylor and Francis, 2008.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", DEStech Publications, Inc, 2009.

Reference(s):

1. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
2. Jones R.M, "Mechanics of Composite Materials", 3rd Edition, Mc Graw Hill Company, New York, 2006.
3. Chawla K.K., "Composite Materials", 3rd Edition, Springer Verlag, Boston, 2012.
4. Ever J. Barbero, "Introduction to Composite Materials Design", 2nd edition, CRC Press, 2011.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction**	
1.1	Basics of fibers, matrices and composites	1
1.2	General Characteristics and Applications of Fibers	2
1.3	Glass, Carbon, Ceramic and Aramid fibers	2
1.4	Matrices – Polymer, Ceramic and Metal Matrices	1
1.5	Characteristics of matrices	1
1.6	Fiber surface treatments	2
1.7	Fillers and Additives	1
2.0	**Mechanics**	
2.1	Definition of stress and Moment Resultants	1
2.2	Strain Displacement relations	1
2.3	Basic Assumptions of Laminated anisotropic plates	1
2.4	Laminate Constitutive Equations	1
2.5	Coupling Interactions and Balanced Laminates	1
2.6	Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates	1
2.7	Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests	2
2.8	Quasi-Isotropic Laminates	1
3.0	**Design**	
3.1	Failure Predictions	1
3.2	Laminate Design Consideration and Design criteria, Design allowable Design guidelines	1
3.3	Joint design-Bolted and Bonded Joints	1
3.4	Design Examples-Design of a tension member	2
3.5	Design of a compression member	1
3.6	Design of a beam and Design of a torsional member	1
3.7	Application of Finite element method (FEM) for design and analysis of laminated composites.	2
4.0	**Manufacturing**	
4.1	Bag molding process	1
4.2	Compression molding	1
4.3	Pultrusion and Filament winding	1
4.4	Resin film infusion – Elastic reservoir molding - Tube rolling	1
4.5	Quality inspection methods	2
4.6	Processing of metal matrix composites (MMC)	2
4.7	Diffusion bonding	1
4.8	Stir casting – Squeeze casting	1
5.0	**Analysis of Laminated Flat Plates**	
5.1	Equilibrium Equations of Motion	1
5.2	Energy Formulations	1
5.3	Static Bending Analysis	1
5.4	Buckling Analysis	2
5.5	Free Vibrations	2
5.6	Natural Frequencies	2

Course Designer(s)

1. Mr.U.Vivek– viveku@ksrct.ac.in

Rev. No.0/w.e.f. 30.12.2023
Passed in BoS Meeting held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

60 ME E14	Manufacturing Information System	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To introduce the students to the concepts of Agile Manufacturing Information Systems.
- To acquire theoretical knowledge in Data models system.
- To expose the students to the Designing Database.
- To study the various product and its structure process flow
- To interpret the Information System for Manufacturing

Pre-requisites

Manufacturing Processes

Course Outcomes

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

CO1	Explore the concept in agile manufacturing technique	Understand
CO2	Describe the wide data object trends in database	Understand
CO3	Formulate relation data bases concepts and principles	Understand
CO4	Describe the manufacturing constriction in database management	Understand
CO5	Describe the information system in product management systems	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	3	2	-	-	3	3	3	-	3	2	-
CO2	3	-	-	-	3	2	-	-	3	3	3	-	3	2	-
CO3	3	-	-	-	3	-	-	-	3	3	3	-	2	2	-
CO4	3	-	-	-	-	3	-	-	3	3	3	-	-	2	-
CO5	3	-	-	-	3	3	-	-	3	3	3	-	2	2	-

3 - Strong; 2 - Medium; 1 - Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	40
Understand	40	40	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E14 - Manufacturing Information System								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Introduction The Evolution of Order Policies, From MRP I To MRP II To ERP – Agile Manufacturing Information Systems, Manufacturing Database Integration.	[9]
Database Terminologies – Entities and Attributes – Data Models, Schema and Subschema - Data Independence – ER Diagram – UML Notation For Describing The Enterprise–Wide Data Objects Trends In Database.	[9]
Designing Database* Hierarchical Model – Network Approach- Relational Database Concepts, Principles, Keys,– Functional Dependency – Normalization Types – Relational Operations- Query Languages-Case Studies.	[9]
Manufacturing Consideration** The Product and Its Structure, Inventory and Process Flow – Shop Floor Control Data Structure and Procedure – Various Models – The Order Scheduling Module, Input/Output Analysis Module, And Stock Status Database – The Complete Iom Database.	[9]
Information System for Manufacturing* Parts Oriented Production Information System – Concepts and Structure – Computerized Production Scheduling, Online Production Control Systems, Computer Based Production Management System, Computerized Manufacturing Information System -RFID-Telecommunication– Case Study.	[9]
Total Hours:	**45**

Text Book(s):

1.	Sartori, L.G., “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 2019.
2.	Franjo Cecelja., “Manufacturing Information and Data Systems: Analysis, Design and Practice”, Butterworth-Heinemann, 2019.

Reference(s):

1.	Kevin Ake., “Information Technology for Manufacturing Reducing Costs and Expanding Capabilities”, St. Lucie Press, Washington, DC, 2014.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction**	
1.1	The Evolution of order policies	2
1.2	MRP II	1
1.3	MRP to MRP II to ERP	2
1.4	Agile Manufacturing Information Systems	2
1.5	Manufacturing Database Integration	2
2.0	**Database**	
2.1	Terminologies	1
2.2	Entities and attributes	1
2.3	Data models, schema and subschema	2
2.4	Data Independence – ER Diagram	1
2.5	UML notation for describing the enterprise	1
2.6	wide data objects	1
2.7	Trends in database	2
3.0	**Designing Database**	
3.1	Hierarchical model	1
3.2	Network approach	1
3.3	Relational Database concepts	1
3.4	principles, keys	1
3.5	Functional dependency	1
3.6	Normalization types	1
3.7	Relational operations, Query Languages	2
3.8	Case studies.	1
4.0	**Manufacturing Consideration**	
4.1	The product and its structure	1
4.2	Inventory and process flow	1
4.3	Shop floor control Data structure and procedure	1
4.4	Various models – the order scheduling module	1
4.5	Input/output analysis module	2
4.6	Stock status database	2
4.7	The complete IOM database	1
5.0	**Information System for Manufacturing**	
5.1	Parts oriented production information system	1
5.2	concepts and structure	1
5.3	Computerized production scheduling, online production control systems	2
5.4	Computer based production management system	1
5.5	computerized manufacturing information system	1
5.6	RFID-Telecommunication	2
5.7	Case study.	1

Course Designer(s)

a. Mr.P.Tamilarasu – tamilarasup@ksrct.ac.in

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

60 ME E15	Power Plant Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To describe the current energy scenario and basics of thermal power plant.
- To infer knowledge on working of nuclear power plant and hydro-electric power plant.
- To apply the concept of diesel power plant and gas turbine power plant.
- To utilize non-conventional energy sources in power plants.
- To apply the principles in power plant economics

Pre-requisites

- Thermal Engineering

Course Outcomes

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

CO1	Demonstrate the layout, construction and working of the thermal power plant.	Understand
CO2	Recognise the basic knowledge on nuclear processes and working of nuclear and hydro-electric power plants with their layouts.	Understand
CO3	Apply the working principle of gas and diesel power plants.	Apply
CO4	Illustrate the layout, construction and working of the non-conventional energy power plants.	Understand
CO5	Realise the various terminologies behind power plant economics and electricity cost estimation.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	3	3	3	-	-	-	-	3	3	-
CO2	3	3	-	-	-	3	3	3	-	-	-	-	2	3	-
CO3	3	2	-	-	-	3	3	3	-	-	-	-	2	3	-
CO4	3	3	-	-	-	3	3	3	-	-	2	2	3	3	-
CO5	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	20	20	20
Understand	40	30	60
Apply	-	10	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev. No.0/w.e.f. 30.12.2023
Passed in BoS Meeting held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS - Chairman
Mechanical Engineering (UG & PG)
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E15- Power Plant Engineering

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Energy Scenario and Steam Power Plant* Indian and Global Energy Scenario, -Environmental Issues of Present Day Power Generation.- Steam Power Plant-Layout Of Steam Power Plant – Selection Criteria – Fuel and Ash Handling Systems. Pulverisers –Stokers – Types– Dust Collectors and Cooling Towers	[9]
Nuclear And Hydro-Electric Power Plants* Nuclear Energy- Fuels and Nuclear Reactions –Radioactivity – Fission Process – Reaction Rates – Components and Layout of Nuclear Power Plant – Types of Reactors: Pressurized Water Reactor – Boiling Water Reactor – Fast Breeder Reactor – Radioactive Waste Disposal. Hydro-Electric Power Plant- Site Selection – Components and Layout – Advantages – Classification Of Turbines – Mini And Micro Hydro Plants.	[9]
Gas Turbine and Diesel Power Plant* Gas Turbine Power Plant: Gas Turbine Cycles - Thermodynamic Analysis of Cycles - Reheating - Regeneration and Intercooling - Layout of Gas Turbine Power Plant- Selection Criteria - Binary and Combined Cycle - IGCC. Diesel Power Plant: Layout –Types - Selection Criteria– Selection of Engine.	[9]
Non-Conventional Power Plants** Layout and Components: Magneto Hydro Dynamic (Mhd) Power Plant –Ocean Thermal Energy Conversion (Otec) – Tidal Power Generation –Wind Energy Power Generation – Solar Photo Voltaic (Spv) –Bio-Solar Cells – Solar Energy Harvesting Trees.	[9]
Power Plant Economics*** Power Plant Economics: Cost of Electric Energy – Load Duration Curves-Fixed and Operating Costs – Energy Rates – Types of Tariffs – Economics of Load Sharing - Comparison -Selection And Economics of Various Power Plants –Energy Auditing for Thermal Power Plant – Waste Heat Recovery Techniques.	[9]
Total Hours:	**45**

Text Book(s):

1.	Arora, S. C., and Domkundwar, S., “A course in Power Plant Engineering”, 8th Edition, Dhanpatrai Publications Ltd., New Delhi, 2016
2.	Rajput R.K, "Power Plant Engineering", 4th Edition, Laxmi Publications, New Delhi, 2012.

Reference(s):

1.	Rai, G.D. “Introduction to Power Plant Technology”, 11th reprint, Khanna Publishers, 2013
2.	Hegde, R K., “Power Plant Engineering”, 1st edition, Pearson education India, New Delhi, 2015.
3.	Rajput R.K., “Power Plant Engineering”, 4th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016.
4.	Nag, P K., “Power Plant Engineering”, 4th edition, Tata McGraw-Hill, New Delhi, 2014.
5.	https://onlinecourses.nptel.ac.in/noc20_me10/preview

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy
***SDG 8 – Decent work and Economic Growth

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Energy scenario and steam power plant**	
1.1	Indian and Global energy scenario	1
1.2	environmental issues of present day power generation	2
1.3	Steam power plant-Layout of steam power plant	2
1.4	Selection Criteria – Fuel and Ash Handling systems	1
1.5	Pulverisers	1
1.6	Stokers – Types	1
1.7	Dust collectors and cooling towers	1
2.0	**Nuclear and Hydel Power Plants**	
2.1	Nuclear Energy	1
2.2	Fuels and Nuclear reactions – Types of Reactors	1
2.3	Radioactivity – Fission Process – Reaction Rates	1
2.4	Diffusion Theory- Components and Layout of nuclear power plant	1
2.5	Pressurized Water Reactor	1
2.6	Boiling Water Reactor – Fast Breeder Reactor	1
2.7	Hydro-electric power plant- Site selection	2
2.8	Components and Layout – Advantages – Classification of turbines – Mini and micro hydel plants	1
3.0	**Gas Turbine and Diesel Power Plant**	
3.1	Gas Turbine Cycles	1
3.2	Thermodynamic Analysis of Cycles	1
3.3	Reheating - Regeneration and Intercooling	1
3.4	Layout of Gas Turbine Power Plant- Selection Criteria	2
3.5	Binary and Combined Cycle - IGCC	1
3.6	Diesel Power Plant: Layout –Types - Selection Criteria	1
3.7	Selection of Engine	2
4.0	**Non-Conventional Power Plants**	
4.1	Layout and components: Magneto Hydro Dynamic (MHD) power plant	1
4.2	Geothermal power generation, Dry steam	1
4.3	flash steam, and binary cycle	1
4.4	binary cycle – Ocean thermal energy conversion (OTEC)	1
4.5	Tidal power generation – Wind energy power generation	2
4.6	Solar photo voltaic (SPV)	1
4.7	Bio-solar cells	1
4.8	Solar energy harvesting trees.	1
5.0	**Power Plant Economics**	
5.1	Cost of Electric Energy	1
5.2	Load Duration Curves-Fixed and Operating Costs	1
5.3	Energy Rates – Types of Tariffs	1
5.4	Economics of Load Sharing	1
5.5	Comparison -Selection and Economics of Various Power Plants	1
5.6	Energy Auditing – Types	2
5.7	Energy Auditing for Thermal Power Plant	1
5.8	Waste Heat Recovery Techniques - Types.	1

Course Designer(s)

1. Dr.M.Gnanaseakran – gnanasekaran@ksrct.ac.in

60 ME E16	Reverse Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To apply the fundamental concepts and principles of reverse engineering in product design and development.
- To apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- To apply the concept and principles of material identification and process verification in reverse engineering of product design and development.
- To analyse the various legal aspect and applications of reverse engineering in product design and development.
- To understand about 3D scanning hardware & software operations and procedure to generate 3D model

Pre-requisites

Manufacturing Processes

Course Outcomes

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

CO1	Apply the fundamental concepts and principles of reverse engineering in product design and development	Apply
CO2	Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development	Apply
CO3	Apply the concept and principles of material identification and process verification in reverse engineering of product design and development	Apply
CO4	Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development	Apply
CO5	Analyse the various legal aspect Applications of reverse engineering in product design and development	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	3	-	-	-	-	-	-	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	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 - 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	30	30	20
Apply	20	20	40
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E - Mechanical Engineering</td></tr>
<tr><td colspan="9">60 ME E16- Reverse Engineering</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Introduction and Geometric Form
Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.</td><td>[9]</td></tr>
<tr><td colspan="8">Material Characteristics and Process Identification
Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification</td><td>[9]</td></tr>
<tr><td colspan="8">Data Processing
Statistical Analysis – Data Analysis – Reliability and The Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility.</td><td>[9]</td></tr>
<tr><td colspan="8">3D Scanning and Modelling
Introduction, Working Principle and Operations of 3D Scanners: Laser, White Light, Blue Light - Applications- Software for Scanning and Modelling: Types- Applications- Preparation Techniques for Scanning Objects- Scanning and Measuring Strategies - Calibration of 3D Scanner- Step By Step Procedure: 3D Scanning - Geometric Modelling – 3D Inspection- Case Studies.</td><td>[9]</td></tr>
<tr><td colspan="8">Industrial Applications
Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry. Case Studies and Solving Industrial Projects in Reverse Engineering. Legality: Patent – Copyrights –Trade Secret – Third-Party Materials</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Robert W. Messler, “Reverse Engineering: Mechanisms, Structures, Systems & Materials”, 1st Edition, McGraw-Hill Education, 2014</td></tr>
<tr><td>2.</td><td colspan="8">Wego Wang, “Reverse Engineering Technology of Reinvention”, CRC Press, 2011</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Scott J. Lawrence , “Principles of Reverse Engineering”, Kindle Edition, 2022</td></tr>
<tr><td>2.</td><td colspan="8">Kevin Otto and Kristin Wood, “Product Design: Techniques in Reverse Engineering and New Product Development”, Prentice Hall, 2001</td></tr>
<tr><td>3.</td><td colspan="8">Linda Wills, “Reverse Engineering”, Kluver Academic Publishers, 1996</td></tr>
<tr><td>4.</td><td colspan="8">Vinesh Raj and Kiran Fernandes, “Reverse Engineering: An Industrial Perspective”, Springer-Verlag London Limited 2008.</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure

BoS - Chairman
Mechanical Engineering (UG & PG)
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Tiruchengode - 637 215.

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction and Geometric Form**	
1.1	Definition – Uses – The Generic Process	1
1.2	Phases – Computer Aided Reverse Engineering	2
1.3	Surface Model Reconstruction	2
1.4	Solid Model Reconstruction	2
1.5	Dimensional Measurement	1
1.6	Prototyping	1
2.0	**Material Characteristics and Process Identification**	
2.1	Alloy Structure Equivalency	1
2.2	Phase Formation and Identification	1
2.3	Mechanical Strength – Hardness	1
2.4	Part Failure Analysis	1
2.5	Fatigue – Creep and Stress Rupture	1
2.6	Environmentally Induced Failure Material Specification	1
2.7	Composition Determination - Microstructure Analysis	2
2.8	Manufacturing Process Verification.	1
3.0	**Data Processing**	
3.1	Statistical Analysis – Data Analysis	2
3.2	Reliability and the Theory of Interference	1
3.3	Weibull Analysis – Data Conformity and Acceptance	2
3.4	Data Report – Performance Criteria	1
3.5	Methodology of Performance Evaluation	2
3.6	System Compatibility	1
4.0	**3D Scanning and Modelling**	
4.1	Introduction, working principle and operations of 3D scanners	1
4.2	Laser, White Light, Blue Light - Applications	1
4.3	Software for scanning and modelling	1
4.4	Types- Applications- Preparation techniques for Scanning objects	1
4.5	Scanning and Measuring strategies	1
4.6	Calibration of 3D Scanner	1
4.7	Step by step procedure	1
4.8	3D scanning, Geometric modelling – 3D inspection- Case studies	2
5.0	**Industrial Applications**	
5.1	Reverse Engineering in the Automotive Industry	1
5.2	Aerospace Industry; Medical Device Industry.	2
5.3	Case studies and Solving Industrial projects in Reverse Engineering	2
5.4	Legality: Patent, Copyrights	2
5.5	Trade Secret – Third-Party Materials	2

Course Designer(s)

1. Mr.M.Prasath – prasathm@ksrct.ac.in

60 HS 002	Engineering Economics and Financial Accounting	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To know about the economic principles underlying demand, supply, and market structure
- To understand the concept related to types of business organization and types of banking
- To know about concepts in financial accounting and capital budgeting
- To understand the different methods of pricing and appraisal of projects
- To know the application of break-even analysis in engineering projects

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Summarize the basic concepts of economics, demand, supply, and market structure	Understand
CO2	Interpret the forms of business organization and functions of commercial and central bank	Understand
CO3	Examine the basis of financial accounting and capital budgeting techniques	Analyse
CO4	Demonstrate the different types of pricing strategies and comprehensive project feasibility in diverse business	Apply
CO5	Demonstrate the break even analysis in engineering projects and business	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	2	3	-	3	-	-	-	3	2	3	3	3
CO2	-	-	-	-	-	2	2	-	-	-	3	3	-	3	-
CO3	-	-	2	3	-	-	-	-	-	-	3	-	2	2	-
CO4	2	-	-	3	-	2	-	-	-	-	-	3	3	3	2
CO5	3	3	3	3	-	-	2	2	-	-	2	2	3	2	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	40	10	30
Apply	-	20	30
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 HS 002 – Engineering Economics and Financial Accounting

Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Basic Economics Definition of Economics – Nature and Scope of Economics, Basic Concepts of Economics, Factors of Production - Definition of Demand – Law of Demand, Exception to Law of Demand, Factors Affecting Demand, Elasticity of Demand, Demand Forecasting – Definition of Supply – Factors Affecting Supply, Elasticity of Supply – Market Structure – Perfect Competition, Imperfect Competition – Monopoly, Duopoly, Oligopoly, And Bilateral Monopoly.	[9]
Organization and Business Financing* Forms of Business – Sole Proprietorship, Partnership, Joint Stock Company, Cooperative Organization, State Enterprise - Mixed Economy - Money and Banking – Kinds Of Banking, Functions of Commercial Banks And Central Bank – Definition Of Monetary Policy And Its Types – Types Of Financing - Short Term Borrowing, Long Term Borrowing - Internal Generation of Funds – External Commercial Borrowings.	[9]
Financial Accounting and Capital Budgeting The Balance Sheet and Related Concepts – The Profit and Loss Statement and Related Concepts – Financial Ratio Analysis – Definition of Working Capital – Types, Factors – Definition of Capital Budgeting - Techniques – Average Rate of Return, Payback Period, Net Present Value, Profitability Index Method And Internal Rate of Return.	[9]
Cost Analysis Types of Costing – Traditional Costing Approach - Activity Based Costing - Fixed Cost – Variable Cost – Marginal Cost – Cost Output Relationship In The Short Run And In Long Run – Pricing Practice – Full Cost Pricing – Marginal Cost Pricing – Going Rate Pricing – Bid Pricing – Pricing for a Rate Of Return – Project Appraisal - Appraisal Process, - Cost Benefit Analysis – Feasibility Reports –– Technical Feasibility, Economic Feasibility, Financial Feasibility, Managerial Feasibility, Operational Feasibility.	[9]
Break Even Analysis Basic Assumptions –Break-Even Chart – Profit Zone in Break-Even Chart, Loss Zone in Break-Even Chart, Angle of Incidence – Managerial Uses of Break-Even Analysis, Applications of Break-Even Analysis In Engineering Projects.	[9]
Total Hours:	**45**

Text Book(s):

1.	Khan M.Y., Jain P.K., “Financial Management”, 8rd Edition, McGraw Hill Education, 2018.
2.	Maheshwari K.L., Varshney R.L., “Managerial economics”, 22nd Edition, S Chand and Co., New Delhi, 2018.

Reference(s):

1.	Samuelson P.A., “Economics - An Introductory”, 16th Edition, New Age Publications, New Delhi, 2019.
2.	Barthwal R.R., “Industrial Economics - An Introductory”, 4th Edition, New Age Publications, New Delhi, 2021.
3.	Bhattacharyya S. K., John Deardon, “Accounting for Management Text and Cases”, 3rd Edition, S Chand Publication, 2018.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Basic Economics**	
1.1	Definition of economics – Nature and Scope of Economics	1
1.2	Basic Concepts of Economics, Factors of Production	1
1.3	Definition of Demand – Law of Demand	1
1.4	Exception to Law of Demand	1
1.5	Factors Affecting Demand, Elasticity of Demand	1
1.6	Demand Forecasting	1
1.7	Definition of Supply – Factors Affecting Supply, Elasticity of Supply	1
1.8	Market Structure – Perfect Competition, Imperfect Competition	1
1.9	Monopoly, Duopoly, Oligopoly, and Bilateral Monopoly	1
2.0	**Organization and Business Financing**	
2.1	Forms of Business – Sole Proprietorship, Partnership	1
2.2	Joint Stock Company, Cooperative Organization, State Enterprise	1
2.3	Mixed Economy - Money and banking	1
2.4	Kinds of Banking	1
2.5	Functions of Commercial Banks and Central Bank	1
2.6	Definition of Monetary Policy and its Types	1
2.7	Types of Financing	1
2.8	Short Term Borrowing, Long Term Borrowing	1
2.9	Internal Generation of Funds, External Commercial Borrowings	1
3.0	**Financial Accounting and Capital Budgeting**	
3.1	The Balance Sheet and Related Concepts	1
3.2	The Profit and Loss Statement and Related Concepts	1
3.3	Financial Ratio Analysis	2
3.4	Definition of Working Capital – Types, Factors	2
3.5	Definition of Capital Budgeting - Techniques	1
3.6	Average Rate of Return, Payback Period	1
3.7	Net Present Value, Profitability Index Method and Internal Rate of Return	1
4.0	**Cost Analysis**	
4.1	Types of Costing - Traditional Costing Approach - Activity Based Costing	1
4.2	Fixed Cost – Variable Cost – Marginal Cost	1
4.3	Cost Output Relationship in the Short Run and in Long Run	1
4.4	Pricing Practice – Full Cost Pricing	1
4.5	Marginal Cost Pricing, Going Rate Pricing	1
4.6	Bid Pricing, Pricing for a Rate of Return	1
4.7	Project Appraisal - Appraisal Process - Cost Benefit Analysis	1
4.8	Feasibility Reports -— Technical Feasibility, Economic Feasibility	1
4.9	Financial Feasibility, Managerial Feasibility, Operational Feasibility.	1
5.0	**Break Even Analysis**	
5.1	Basic Assumptions – Break-Even Chart	2
5.2	Profit Zone in Break-Even Chart, Loss Zone in Break-Even Chart	2
5.3	Angle of Incidence	1
5.4	Managerial Uses of Break-Even Analysis	2
5.5	Applications of Break-Even Analysis in Engineering Projects	2

Course Designer(s)

1. Mr.V.S.Vijayachander - vijayachander@ksrct.ac.in
2. Dr.E.kalaivani - kalaivanie@ksrct.ac.in

60 ME E21	Piping Design	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To know the fundamental of piping materials for petrochemical, water treatment and Bio diesel plant.
- To familiarize the students with the various elements and stages are involved in P&ID and PFD
- To impart knowledge on standards and practices in pipe fittings.
- To acquire the importance of piping design and its application
- To know the various types of insulation and their operation in pipeline transportation.

Pre-requisites

- Fluid Mechanics
- Heat and Mass Transfer

Course Outcomes

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

CO1	Explore the properties and behavior of piping materials	Understand
CO2	Apply principle of P&ID, PFD to measure flow and estimate losses in pipelines for both laminar and turbulent conditions	Apply
CO3	Formulate the relationship among the variables in a pipe fittings	Understand
CO4	Select and estimate the characteristics of piping design and its application	Analyze
CO5	Evaluate the performance characteristics of piping insulation	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	3	-	-	-	-	-	3	-	3	-	-
CO2	3	3	3	-	3	-	-	-	-	-	3	-	3	-	-
CO3	3	3	3	-	3	-	-	-	-	-	3	-	2	-	-
CO4	3	3	3	-	-	-	-	-	-	-	3	-	2	-	-
CO5	3	3	3	-	3	-	-	-	-	-	3	-	2	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	30	50	20	-	-	30	-
Apply	10	50	10	50	50	30	50
Analyse	-	-	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E21- Piping Design								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Introduction of Piping and Process Flow Diagram Importance Of Piping in Chemical Industry, Pipes & Tubing, Classification of Pipes, Pipe Codes and Specification (Pipe Line, Valve and Piping Isometrics Symbols). Pipe Sizing, Schedule Numbers, Desirable Properties of Piping Materials, Calculation of Pipe Diameter, Thickness, Equivalent Lengths, Etc., Single Liquid, Single Gas & Vapour Lines, Net Positive Suction Head (NPSH).	[6]
Piping And Instrumentation Diagrams (P&ID) P&ID, Stages of Development - Typical Stages - P&ID For Rotating and Static Pressure Vessels. Absorber, Evaporator and Its Working.	[6]
Pipe Fittings* Pipe Fittings: Advantages And Disadvantages. Criteria For Selection of Pipe Joints for Similar and Dissimilar Material-Valves Expansion Effects and Methods. Safety & Pressure Relieving Valves. Calculation Of Frictional Losses- Pressure Drop for Newtonian & Non-Newtonian Fluids.	[6]
Piping Design and Its Application** Design of Pipeline for Transportation of Crude Oil, Natural Gas and Sea Water. Empirical Correlations for Flow of Oil, Gasoline, Hydrocarbons - Piping for Cryogenic Materials - Piping Arrangements of Heat Exchanger, Reactor, Storage Vessel, Reboiler, Compressor, Pumps And Utility.	[6]
Piping Insulation* Piping Systems - Purpose-Insulation Materials and Its Selection Criteria. Principles of Heat Transfer to the Extent of Application to Heat Loss/Gain Through Bare Pipe Surfaces. Estimation of Critical Thickness of Insulation.	[6]
Practical: 1.Identify the Components of Ball, Gate, Butterfly and Globe Valve 2.Design a Simple PFD For a Water Treatment System 3.Create a P&ID For a Simple Water Treatment 4. Identify Components and Their Symbols for Pump, Filtration Unit, Chlorination Unit, Chemical Dosing Pump or Mixer Symbol. 5.Identify and Use Pipe Fittings in a Piping System Design 6.Design a Piping System for a Small Industrial Process 7. Understand Piping Systems, Insulation Materials, and Their Selection Criteria	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Dawande, S D., “Process Design of Equipment’s”, 7th Edition Central Techno Publications, 2015.
2.	Deutsch, D J., “Process piping systems”, Chemical Engineering Magazine.1st edition McGraw Hill, 2011.

Reference(s):

1.	Sahu, G K., “Handbook of Piping Design”, ,2nd edition New Age International Publisher, 2008
2.	Weaver, R, “Process Piping Design”, Vol. 1 and 2, , Gulf Publishing,1992
3.	Rase, H F., “Piping Design for process plants”, John Wiley, 1966.
4.	Littleton C.T, “Industrial Piping”, 2nd edition McGraw Hill1962.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 8 – Decent work and Economic Growth

Course Contents and Lecture Schedule		
S. No	**Topics**	**No. of hours**
1.0	**Introduction of Piping and Process Flow Diagram**	
1.1	Importance of piping in chemical industry Pipes & Tubing, Classification of pipes	1
1.2	Pipe codes and specification(piping symbols, line symbols, valve symbols, piping isometrics	1
1.3	Pipe sizing, Schedule numbers	1
1.4	Desirable properties of piping materials	1
1.5	Calculation of pipe diameter, thickness, equivalent lengths, etc., single liquid lines, single gas &vapour lines, NPSH	2
2.0	**Piping and Instrumentation Diagrams (P&ID)**	
2.1	P&ID objectives, Stages of development of P&ID	2
2.2	Typical stages of P&ID, P&ID for rotating and static pressure vessels	2
2.3	Process vessels Absorber, Absorber, Evaporator and its working	2
3.0	**Pipe fittings**	
3.1	Pipe fittings their advantages & disadvantages	1
3.2	Criteria for selection of pipe joints	1
3.3	Valves expansion effects and methods for reducing them	1
3.4	Safety valves & other pressure relieving devices	1
3.5	Calculation of frictional losses	1
3.6	Pressure drop for Newtonian & Non-Newtonian fluids.	1
4.0	**Piping Design and its Application**	
4.1	Design of pipeline for transportation of crude oil & for natural gas	1
4.2	Design of pipes in sea water	1
4.3	Empirical correlations for flow of oil, gasoline, hydrocarbons	1
4.4	Piping for cryogenic materials	1
4.5	Piping arrangements and factors considered in heat exchanger piping	1
4.6	Process &storage vessel piping Reboiler piping, piping for compressor Pumps, utility piping	1
5.0	**Piping insulation**	
5.1	Insulation for piping systems	1
5.2	Purpose of insulation. Insulation materials	1
5.3	Principles of heat transfer to the extent of application to heat loss/gain through bare pipe surfaces.	1
5.4	Critical thickness of insulation, estimating thickness of insulation	2
5.5	Optimum thickness of insulation	1
Practicals:		
1	Identify the components of Ball, Gate, Butterfly and Globe Valve	4
2	Design a Simple PFD for a Water Treatment System	6
3	Create a P&ID for a Simple Water Treatment	4
4	Identify Components and their Symbols for Pump, Filtration Unit, Chlorination Unit, Chemical dosing pump or mixer symbol.	4
5	Identify and Use Pipe Fittings in a Piping System Design	3
6	Design a Piping System for a Small Industrial Process	6
7	Understand Piping Systems, Insulation Materials, and Their Selection Criteria	3

Course Designer(s)

1. Dr.A.Murugesan – hodmech@ksrct.ac.in
2. Dr.D.Vasudevan – vasudevand@ksrct.ac.in
3. Mr.R.Prakash – prakashr@ksrct.ac.in

Rev. No.0/w.e.f. 30.12.2023
Passed in BoS Meeting held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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60 ME E22	Design of Jigs, Fixtures and Press Tools	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To apply the principles of locating and clamping elements for machining operations.
- To apply the design concepts of jigs and fixtures for various machining operations.
- To impart knowledge on capacity and layout selection of press for machining operations.
- To acquire design practice of dies for different forming process.
- To analyse the different sheet metal forming technique using computer aids.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Select the locating methods, clamping devices and design of jigs for automatic drill and rack and pinion.	Understand
CO2	Design and develop the jigs for given component in lathe, milling, grinding, planning and welding process	Analyze
CO3	Compute and select the capacities and tonnage of press for various processes and standard die sets for strip layout	Analyze
CO4	Design and develop the dies for blanking, piercing, bending, drawing, forging and extrusion operations	Analyze
CO5	Describe the sheet metal forming techniques and analyze using computer aids.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3
CO2	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3
CO3	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3
CO4	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3
CO5	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	20	-	10	-	-	30	-
Apply	10	50	20	50	50	30	50
Analyse	10	50	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E22- Design of Jigs, Fixtures and Press Tools								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Locating and Clamping Principles of Jigs AND Fixtures Tool Design Objectives - Production Devices - Inspection Devices - Materials Used IN Jigs and Fixtures - Basic Principle of Location - Analysis of Clamping Force.	[6]
Design Of Jigs and Fixtures* Drill Bushes - Classification of Jigs - Automatic Drill Jigs - Rack and Pinion Operated Jigs - Air Operated Jigs.General Principles of Boring, Lathe, Milling and Broaching Fixtures - Grinding, Planning and Shaping Fixtures, Assembly, Inspection and Welding Fixtures - Modular Fixtures. Maintenance.	[6]
Press Working Terminologies, Elements of Dies and Strip Layout* Press Working Terminology - Presses and Press Accessories - Computation of Capacities and Tonnage Requirements. Die Block - Die Shoe. Bolster Plate - Punch Plate – Punch Holder - Guide Pins and Bushes - Strippers - Knockouts - Stops - Pilots - Selection of Standard Die Sets. Calculations-Critical Spares Management.	[6]
Design And Development of Dies* Development Of Forming and Drawing Dies. Design Considerations in Forging, Extrusion, Casting and Plastic Dies.	[6]
Other Forming Techniques** Coining, Sizing. Recent Trends in Tool Design - Computer Aids for Sheet Metal Forming Analysis - Basic Introduction - Tooling for Numerically Controlled Machines - Setup Reduction for Work Holding - Single Minute Exchange of Dies - Poka Yoke.	[6]
Practical: 1) Study and prepare layout of locating methods and devices. 2) Study and prepare the layout for the principle of clamping and Its types. 3) Design and development of jigs for given component. 4) Design and development of fixtures for given component. 5) Design the elements progressive combination and compound dies. 6) Development of strip layout for the given component. 7) Design and development of dies for blanking and piercing operations. 8) Design and development of bending dies. 9) Study and prepare report on the bulging, swaging and embossing. 10) Study and prepare report on the curling, hole flanging, shaving and blanking.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Edward G Hoffman, “Jigs and Fixture Design”, 5th Edition, Thomson – Delmar Learning, Singapore, 2010.
2.	Donaldson. C, George H.L., Goold V C and Ghose J., “Tool Design”, 5th Edition, Tata McGraw-Hill, 2017.

Reference(s):

1.	Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2.	Joshi, P.H., “Jigs & Fixtures”, Third Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2010.
3.	Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
4.	“Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
5.	Design Data - Data Book of Engineers, PSG College of Technology, Kalaikathir Achchagam–Coimbatore, 2016.
6.	NPTEL Videos (1) https://www.youtube.com/watch?v=7yzvno4AvKw
7.	NPTEL Videos (2) https://www.youtube.com/watch?v=vOo2MCYPsm4

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Locating and Clamping Principles of Jigs and Fixtures**	
1.1	Tool Design Objectives	1
1.2	Production Devices	1
1.3	Inspection Devices-	1
1.4	Materials used in Jigs and Fixtures.	1
1.5	Basic Principle of Location.	1
1.6	Analysis of Clamping Force.	1
2.0	**Design of Jigs and Fixtures**	
2.1	Drill Bushes, Classification of Jigs and Automatic Drill Jigs	1
2.2	Rack and Pinion operated Jigs & Air operated Jigs.	1
2.3	General Principles of Boring, Lathe, Milling and Broaching Fixtures.	1
2.4	Grinding, Planning and Shaping Fixtures	1
2.5	Assembly, Inspection, Welding Fixtures	1
2.6	Modular Fixtures and Maintenance.	1
3.0	**Press Working Terminologies, Elements of Dies and Strip Layout**	
3.1	Press Working Terminology, Presses and Press Accessories	1
3.2	Computation of Capacities and Tonnage Requirements	1
3.3	Die Block, Die Shoe.	1
3.4	Bolster Plate, Punch Plate, Guide Pins , Bushes and Strippers	1
3.5	Knockouts , Stops, Pilots ,Selection of Standard Die Sets	1
3.6	Strip Layout, Calculations and Critical spares management	1
4.0	**Design and Development of Dies**	
4.1	Development of Forming and Drawing Dies	2
4.2	Design Considerations in Forging and Extrusion Dies	2
4.3	Design Considerations in Casting and Plastic Dies	2
5.0	**Other Forming Techniques**	
5.1	Coining, Sizing	1
5.2	Recent Trends in Tool Design	1
5.3	Computer Aids for Sheet Metal Forming Analysis	1
5.4	Basic Introduction - Tooling for Numerically Controlled Machines	1
5.5	Setup Reduction for Work Holding	1
5.6	Single Minute Exchange of Dies - Poka Yoke.	1
Practicals:		
1	Study and prepare layout of locating methods and devices.	3
2	Study and prepare the layout for the principle of clamping and Its types.	3
3	Design and development of jigs for given component.	3
4	Design and development of fixtures for given component.	3
5	Design the elements progressive combination and compound dies.	3
6	Development of strip layout for the given component.	3
7	Design and development of dies for blanking and piercing operations.	3
8	Design and development of bending dies.	3
9	Study and prepare report on the bulging, swaging and embossing.	3
10	Study and prepare report on the curling, hole flanging, shaving and blanking.	3

Course Designer(s)

1. Dr.P.S.Sampath – sampathps@ksrct.ac.in

61 ME E23	Additive manufacturing	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To understand the fundamentals, evolution, and workflow of Additive Manufacturing.
- To study the classifications, capabilities, and limitations of different AM systems.
- To learn DfAM principles for optimized part design and material usage.
- To explore various AM technologies including liquid, solid, and powder-based systems.
- To gain knowledge on rapid tooling and ensure safety in AM applications.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Learn rapid prototyping fundamentals and apply the techniques for developing prototypes	Understand
CO2	Apply DfAM principles for effective part design considering orientation, support, and material selection.	Apply
CO3	Analyze the working and parameters of different AM technologies.	Analyze
CO4	Analyze the process parameters and material behavior powder-based AM systems.	Analyze
CO5	Implement rapid tooling techniques and follow safety practices in industrial AM environments.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	3	-	-	3	3	-3	-	-	-	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	20	50	20	-	-	30	-
Apply	20	50	10	50	50	30	50
Analyse	-	-	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

61 ME E23- Additive Manufacturing

Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Introduction to Additive Manufacturing (AM) Definition, Terminology, Generic AM Process Chain, History of RPT Systems, Difference Between Additive Manufacturing and Subtractive Processes; Classifications of AM Systems – Information Workflow In AM.	[6]
Design for Additive Manufacturing Introduction to DfAM and its comparison with Design for Manufacturing (DfM), Design guidelines for AM – Material consideration, part orientation, support structure design, surface finish, minimum feature size, overall build time, build file preparation, machine setup.	[6]
Liquid Polymer and Solid Based Systems* Vat Photopolymerization Processes: Vector Scan, Mask Projection, Two-Photon Approach, Materials, Scan Patterns; Fused Deposition Modeling: Process Parameters, Influence of Process Parameters on Mechanical Properties of the Prototype.	[6]
Powder Based Systems** Powder Bed Fusion Processes: Powder production techniques, Selective Laser Melting, Selective Laser Sintering, Binder Jetting Process for Metals; Directed Energy Deposition Processes (DED): Laser-Based and Electron Beam-Based DED Processes, Process Parameters, Materials and Microstructures.	[6]
Rapid Tooling and Safety Aspects in AM Introduction To Rapid Tooling (Rt) - Direct and Indirect Tooling - Silicone Rubber Molding, Epoxy Tooling; Safety Aspects: Potential hazards of AM - Biological and environmental effects, Safety and precautions; Application: case studies for Aerospace, Defence, Automobile.	[6]
Practical: 1. Print the part with different infill densities and observe print time and material usage. 2. Print a part in multiple orientations to study support generation and ease of removal. 3. Print a part with region-wise variable infill densities to study material efficiency and strength. 4. Print a model using multiple layer structures to evaluate visual quality and build time impact. 5. Print a model using multiple infill densities to evaluate visual quality and build time impact. 6. Fabricate a model using multiple layer heights in a single print to study the impact on build time and visual quality. 7. Create internal lattice structures for weight reduction and analyze strength potential.	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Ian Gibson, David Rosen, Brent Stucker , “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2nd Edition, Springer, 2015.
2.	John O Milewski , “Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelery”, Springer, 2017.

Reference(s):

1.	Frank W. Liou, “Rapid Prototyping and Engineering Applications”, CRC Press, 2019.
2.	Jacobs P.F., “Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography”, McGraw-Hill, New York, 2010
3.	Wohlers Terry, “Wohlers Report 2014”, Wohlers Associates, 2014.
4.	Srivatsan T S and Sudarshan T S, “Additive Manufacturing: Innovations, Advances, and Applications”, CRC Press, 2015.
5.	NPTEL videos: Rapid Manufacturing – Course (nptel.ac.in)
6.	V Lab: Welcome to Virtual Labs – A MHRD Govt of india Initiative (vlabs.ac.in)

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

Rev. No.1/w.e.f. 20.07.2025

Passed in BoS Meeting held on 13.06.2025

Approved in Academic Council Meeting held on 19.07.2025

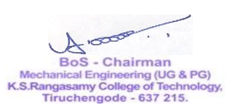
BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

S. No.	Topics	No. of hours
Course Contents and Lecture Schedule		
1.0	**Introduction to Additive Manufacturing (AM)**	
1.1	Definition and terminology	1
1.2	Generic AM process chain	1
1.3	History of AM systems	1
1.4	Difference between additive manufacturing and subtractive processes	1
1.5	Classifications of RP systems	1
1.6	Information workflow in AM	1
2.0	**Design for Additive Manufacturing**	
2.1	Introduction to DfAM and its comparison with Design for Manufacturing (DfM)	1
2.2	Design guidelines for AM – Material consideration, part orientation	1
2.3	Design guidelines for AM - support structure design, surface finish	1
2.4	Design guidelines for AM - minimum feature size, overall build time	1
2.5	Design guidelines for AM - build file preparation	1
2.6	Machine setup.	1
3.0	**Liquid polymer and Solid based systems**	
3.1	Vat photopolymerization processes.	1
3.2	Vector scan, mask projection, two-photon approach.	1
3.3	Materials and scan patterns.	1
3.4	Fused deposition modeling.	1
3.5	Process parameters, influence of process parameters.	1
3.6	Mechanical properties of the prototype.	1
4.0	**Powder based systems**	
4.1	Powder production techniques	1
4.2	Selective laser melting, selective laser sintering.	2
4.3	Binder jetting process for metals	1
4.4	Directed energy deposition processes (DED).	1
4.5	Laser-based and electron beam-based DED processes.	1
5.0	**Rapid Tooling and Safety Aspects in AM**	
5.1	Introduction to rapid tooling (RT) - Direct and Indirect tooling	1
5.2	Silicone rubber moulding, Epoxy tooling	1
5.3	Safety Aspects: Potential hazards of AM - Biological and environmental effects	1
5.4	Safety and precautions	1
5.5	Application: case studies for Aerospace, Defence, Automobile.	2
Practicals		
1	Print the part with different infill densities and observe print time and material usage.	4
2	Print a part in multiple orientations to study support generation and ease of removal.	4
3	Print a part with region-wise variable infill densities to study material efficiency and strength.	4
4	Print a model using multiple layer structures to evaluate visual quality and build time impact.	4
5	Print a model using multiple infill densities to evaluate visual quality and build time impact.	4
6	Fabricate a model using multiple layer heights in a single print to study the impact on build time and visual quality.	4
7	Create internal lattice structures for weight reduction and analyze strength potential.	4

Course Designer(s)

1. Mr.M. Prasath – prasathm@ksrct.ac.in

Rev. No.1/w.e.f. 20.07.2025
Passed in BoS Meeting held on 13.06.2025
Approved in Academic Council Meeting held on 19.07.2025



60 ME E24	Flexible Manufacturing System	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To acquire the role of flexible manufacturing systems (FMS) in manufacturing.
- To impart knowledge on processing stations and data base
- To learn the concept computer-controlled simulation software
- To demonstrate the concept of Group Technology
- To realize automatic manufacturing systems and factory of the future

Pre-requisites

- Manufacturing Process
- Machining Process

Course Outcomes

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

CO1	Explain the various products in the production system and interpret the scheduling system	Remember
CO2	Select appropriate type of computer control and software for the production system	Understand
CO3	Apply the various simulation techniques to FMS and use data base techniques	Apply
CO4	Describe the tool management technology and processing stations of Production system	Understand
CO5	Design the FMS installation philosophy and Characteristics for factory future	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	3	-	3	-	2	-	-	3	2
CO2	3	3	-	-	2	-	-	-	3	-	-	-	-	3	-
CO3	3	3	3	3	3	-	3	-	-	-	-	-	-	3	-
CO4	3	3	-	-	2	-	-	-	3	-	3	-	-	3	2
CO5	3	3	3	3	3	-	-	-	3	-	-	-	-	3	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	50	20	-	-	20	-
Understand	40	50	20	50	-	40	-
Apply	-	-	20	50	50	20	50
Analyse	-	-	-	-	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E24 – Flexible Manufacturing System								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Planning, Scheduling and Control of Flexible Manufacturing Systems* Limitations With Conventional Manufacturing - Introduction to FMS – Development of Manufacturing Systems –Benefits – Major Elements – Types of Flexibility – FMS Application and Flexibility – Knowledge Based Scheduling System - Computerized Production Scheduling System.	[6]
Computer Control and Software for Flexible Manufacturing Systems* Introduction – Composition of FMS – Hierarchy of Computer Control – Computer Control of Work Center and Assembly Lines – FMS Supervising Computer Control. Types Of Software – Specification and Selection – Trends	[6]
FMS Simulation and Data Base* Application Of Simulation – Model of An FMS – Simulation Software –Manufacturing Data Systems – Data Flow – CAD/CAM Considerations in Planning the FMS Data Base – FMS Database Systems – Planning for FMS Database and Distributed Systems In FMS	[6]
Group Technology and Processing Stations* Introduction – Matrix Formulation – Mathematical Programming Formulation – Graph Formulation – Knowledge Based System for Group Technology - Tool Management - Tool Magazine - Tool Preset – Identification - Tool Monitoring and Fault Detection – Routing - Production Planning and Control - Wash Station and Operation Description - Deburring Station and Operation Description - Importance of Cleaning and Deburring in Automated Manufacturing	[6]
FMS Installation and Factory of The Future* FMS Installation - FMS Implementation - FMS Application in Aerospace Industries, Sheet Metal Fabrication and Prismatic Component Production. FMS Development Towards Factories of the Future – Artificial Intelligence and Expert Systems in FMS – Design Philosophy and Characteristics for Future	[6]
Practical: 1. Facing and Chamfering Using Master Cam Design X5 Software. 2. Facing and Step Turning Using Master Cam Design X5 Software. 3. Turning And Profile Cutting Using Master Cam Design X5 Software. 4. Square Milling Using Art CAM Pro 9.1 Software. 5. Hexagonal Milling Using Art CAM Pro 9.1 Software. 6. To Study the Functions and Different Parts of Coordinate Measuring Machine. 7. To Create the Basics of Building a Simulation Model Using Flexsim Software. **Tools Used: Open Source -** Master Cam Design X5, Art CAM Pro 9.1, Flexsim	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Mikell P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, 4th edition, Pearson Education India Pvt. Ltd., Noida, India, 2015.
2.	Jha N.K., "Handbook of Flexible Manufacturing Systems" Academic Press Inc.1991.
Reference(s):	
1.	Jain K C., and Sanjay Jain, “Principles of Automation and Advanced Manufacturing Systems” 1st Edition, Khanna Publishers, New Delhi, 2004.
2.	Raouf, A. and Ben-Daya, M, “Flexible Manufacturing Systems: Recent Development”, Elsevier Science,1995.
3.	Kalpakjian S and Steven R Schmid, “Manufacturing engineering and technology”, 7th Edition, Pearson Education India Pvt. Ltd., Noida, India, 2014.
4.	Radhakrishnan P. and Subramanyan S., “CAD/CAM/CIM”, 4th edition, New Age International (P) Ltd., New Delhi, 2016.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1	**Planning, Scheduling and Control of Flexible Manufacturing Systems**	
1.1	Limitations with conventional manufacturing - Introduction to FMS	1
1.2	Development of manufacturing systems –benefits	1
1.3	Major elements – types of flexibility	1
1.4	FMS application and flexibility	1
1.5	Knowledge based scheduling system	1
1.6	Computerized production scheduling system.	1
2	**Computer Control and Software for Flexible Manufacturing Systems**	
2.1	Introduction – Composition of FMS	1
2.2	Hierarchy of computer control	1
2.3	Computer control of work center and assembly lines	1
2.4	FMS supervising computer control	1
2.5	Types of software	1
2.6	Specification and selection – trends	1
3	**FMS Simulation and Data Base**	
3.1	Application of simulation – Model of an FMS	1
3.2	Simulation software –Manufacturing data systems	1
3.3	Data flow – CAD/CAM considerations in planning the FMS data base	1
3.4	CAD/CAM considerations in planning the FMS data base	1
3.5	FMS database systems	1
3.6	Planning for FMS database and distributed systems in FMS	1
4	**Group Technology and Processing Stations**	
4.1	Introduction – matrix formulation – Mathematical Programming formulation	1
4.2	Graph Formulation – Knowledge based system for Group Technology	1
4.3	Tool Management - tool magazine - Tool preset - Identification	1
4.4	Tool monitoring and fault detection – routing - Production Planning and Control	1
4.5	Wash Station and Operation Description - Deburring Station and Operation Description	1
4.6	Wash Station and Operation Description Importance of Cleaning and Deburring in Automated Manufacturing	1
5	**FMS Installation and Factory of the Future**	
5.1	FMS Installation - FMS implementation	1
5.2	FMS application in aerospace industries	1
5.3	Sheet metal fabrication and prismatic component production	1
5.4	FMS development towards factories of the future	1
5.5	Artificial intelligence and Expert systems in FMS	1
5.6	Design Philosophy and Characteristics for Future	1
Practical:		
1.	Facing and Chamfering using Master cam Design X5 Software.	4
2.	Facing and Step Turning using Master cam Design X5 Software.	4
3.	Turning and Profile Cutting using Master cam Design X5 Software.	4
4.	Square Milling using Art CAM Pro 9.1 Software.	4
5.	Hexagonal Milling using Art CAM Pro 9.1 Software.	4
6.	To study the functions and different parts of Coordinate Measuring Machine.	5
7.	To create the basics of building a simulation model using FlexSim Software.	5

Course Designer(s)

1. Mr. C. Ramesh - rameshc@ksrct.ac.in

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60 ME E25	Internal Combustion Engines	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To study the various stages of combustion in SI engines and effect of abnormal combustion.
- To study the various stages of combustion in CI engines and combustion chamber.
- To Identifying the source of emission formation and control methods
- To study the alternative fuel resources and its utilization techniques in IC engines.
- To study the alternate combustion modes

Pre-requisites

- Thermal Engineering
- Automobile Engineering

Course Outcomes

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

CO1	Explain the various stages of combustion in SI engines.	Apply
CO2	Summarize the various stages of combustion in CI engines and role of combustion chamber for normal combustion	Understand
CO3	Identify the exhaust pollutants formation, control and measurement techniques.	Analyze
CO4	Categorize the alternative fuel resources for IC engine	Apply
CO5	Explain the alternate combustion modes	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	1	1	-	-	-	1	-
CO2	3	-	-	-	-	-	-	-	1	1	-	-	-	1	-
CO3	3	-	-	-	-	-	1	-	1	1	-	-	-	1	-
CO4	3	-	-	-	-	-	1	-	1	1	-	-	-	1	-
CO5	3	-	-	-	-	-	-	-	1	1	-	-	-	1	-
3 - Strong; 2 - Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	30	50	10	-	-	30	-
Apply	10	50	20	50	50	30	50
Analyse	-	-	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E25 - Internal Combustion Engines								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Spark Ignition Engines Stages of Combustion-Normal and Abnormal Combustion (Knock and Pre-Ignition), Factors Affecting Knock - Fuel Supply Systems – Ignition Systems - Air Motion - Combustion Chambers.	[6]
Compression Ignition Engines Stages of Combustion-Normal and Abnormal Combustion – Factors Affecting Knock.– Combustion Chambers – Types - Air Motion	[6]
Emission Formation and Control Sources and Formation of Carbon Monoxide, Unburnt Hydrocarbon, Oxides of Nitrogen, Smoke and Particulate Matter. Methods of Controlling Emissions - After Cylinder Treatment- SCR, LNT, DOC And DPF.	[6]
Alternative Fuels Alcohol Fuels, Hydrogen & Compressed Natural Gas - Properties, Suitability, Merits and Demerits – Utilization Methods - Engine Modifications.	[6]
Alternate Combustion and Data Acquisition System Stratified Charge Engine - Homogeneous Charge Compression Ignition (HCCI) – Premixed Charge Compression Ignition (PCCI) - Reactivity Controlled Compression Ignition (RCCI).	[6]
Practical: 1) Study the Fuel Spray Behavior of Diesel Fuel Injector. 2) Study the Performance and Emission Characteristics with And Without Exhaust Gas Recirculation in Diesel Engine. 3) Study The Exhaust Gas Analysis in Multi-Cylinder Diesel Engine with Different Speed Conditions. 4) Study the Thermo Physical Properties of Bio Diesel 5) Study the Performance and Emission Characteristics Biodiesel Operated Diesel Engine	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Ganesan, V., “Internal Combustion Engines”, 4th edition, Tata McGraw Hill Company, New Delhi, 2017..

Reference(s):

1.	John B. Heywood, “Internal Combustion Engine Fundamentals", 2nd edition, McGraw Hill Company, New Delhi, 2018.
2.	Gupta H.N., “Fundamentals of Internal Combustion Engines”, 2nd edition, Prentice Hall India Learning Private Limited, 2012.
3.	Ramalingam K.K., “Internal Combustion Engines Theory and Practice”, 3rd edition,Scitech Publications (India) Pvt.Ltd., Chennai, 2016
4.	NPTEL: Engine Combustion, Prof. B.P. Pundir , IIT Kanpur.

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1	**Spark Ignition Engines**	
1.1	Stages of combustion – normal combustion	1
1.2	Abnormal combustion : Cause and effect (Knock and Pre-ignition)	2
1.3	Factors affecting knock - fuel supply systems – Ignition systems	1
1.4	Combustion chambers : types, construction and air motion	2
2	**Compression Ignition Engines**	
2.1	Stages of combustion- normal combustion	1
2.2	Abnormal combustion : cause and effect	1
2.3	Factors affecting abnormal combustion	1
2.4	Combustion chambers : types, construction	2
2.5	Air motion	1
3	**Emission Formation and Control**	
3.1	Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter: Sources and Formation.	3
3.2	After cylinder treatment-, SCR, LNT, DOC and DPF.	3
4	**Alternative Fuels**	
4.1	Alcohol Fuels:properties, suitability, merits and demerits	1
4.2	Alcohol Fuels:utilization methods - engine modifications	1
4.3	Compressed Natural Gas:properties, suitability, merits and demerits	1
4.4	Compressed Natural Gas:utilization methods - engine modifications	1
4.5	Hydrogen:properties, suitability, merits and demerits	1
4.6	Hydrogen:utilization methods - engine modifications	1
5	**Alternate Combustion and Data Acquisition System**	
5.1	Stratified charge engine: construction, working principles, merits and demerits	2
5.2	Homogeneous charge compression ignition: construction, working principles, merits and demerits	1
5.3	Premixed charge compression ignition (PCCI): construction, working principles, merits and demerits	1
5.4	Reactivity Controlled Compression Ignition: construction, working principles, merits and demerits	2
Practical:		
1.	Study the fuel spray behavior of diesel fuel injector.	6
2.	Study the performance and emission characteristics with and without exhaust gas recirculation in diesel engine	6
3.	Study the exhaust gas analysis in multi-cylinder diesel engine with different speed conditions	6
4.	Study the thermo physical properties of bio diesel	6
5.	Study the performance and emission characteristics biodiesel operated diesel engine	6

Course Designer(s)

1. Dr.K.Raja –rajak@ksrct.ac.in

60 ME E26	Process Planning and Cost Estimation	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To recognize the traditional process planning and methods of computer aided process planning
- To impart knowledge on importance of estimation and costing
- To study the various elements of costs and depreciation methods
- To estimate the cost incurred for various manufacturing methods.
- To estimate the machining time for various manufacturing operations

Pre-requisites

- Nil -

Course Outcomes

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

CO1	Create a process plan for a given product	Analyze
CO2	Describe the importance ,objectives of cost estimation and costing	Understand
CO3	Explain the various cost components involved in cost estimation	Understand
CO4	Compute the job order cost for different types of shop floor.	Analyze
CO5	Calculate the machining time for various machining operations	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	3	3	-	-	3	3
CO2	3	3	3	-	-	-	-	-	-	3	3	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	3	3	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	3	3	-	-	3	3
CO5	3	3	3	-	-	-	-	-	-	3	3	-	-	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Model Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	20	-
Understand	20	-	20	-	-	30	-
Apply	10	50	10	50	50	30	50
Analyse	10	50	10	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E26 - Process Planning and Cost Estimation								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Content	Hours
Introduction to Process Planning * * Introduction-Types of Production – Importance of Process Planning -Methods of Process Planning- CAPP -Approaches of CAPP- Steps in Process Selection- Production Equipment and Tooling Selection- Process Parameters - Set Of Documents for Process Planning - Economics of Process Planning- Case Studies.	[6]
Introduction to Cost Estimation * * Estimating - Importance, Aims, Function of Estimating - Constituents of Estimation - Estimating Procedure - Costing - Aims of Costing - Costing Procedure - Methods of Costing - Advantages of Efficient Costing - Difference Between Estimating and Costing.	[6]
Elements Of Costs * * Introduction -Elements of Costs – Ladder of Cost - Material Cost - Determination of Direct Material Cost -Labour Cost - Determination of Direct Labour Cost- Over Heads - Classification of Overhead Expenses - Allocation of Overhead Expenses -Depreciation- Methods of Depreciation	[6]
Production Cost Estimation * * Estimation Of Different Types Of Jobs - Estimation Of Forging Shop, Estimation Of Welding Shop, Estimation Of Foundry Shop	[6]
Machining Time Calculation * * Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling ,Boring And Tapping - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.	[6]
Practical: 1. Perform the operations and estimate the machining time calculation on facing and step turning 2. Perform the operations and estimate the machining time calculation on step turning 3. Perform the operations and estimate the machining time calculation on turning ,knurling and thread cutting 4. Perform the operations and estimate the machining time calculation on drilling and tapping 5. Perform the operations and estimate the machining time calculation on cylindrical grinding **6.** Case study: Prepare the operation planning sheet for a given component	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Narang G B S. and Kumar, V., "Production and Costing", 4th Edition, Khanna Publishers, New Delhi 2013
2.	Banga T R., and Sharma, S C., "Mechanical Estimating and Costing Including Costing", 16th Edition, Khanna Publishers, New Delhi.2006

Reference(s):

1.	Adithan M and Pabla, B S., "Production Engineering Estimating and Costing", Konark Publishers Pvt. Ltd., New Delhi, 2007
2.	Chitale, A K., and Gupta, R C., "Product Design and Manufacturing", 6th Edition, Prentice Hall Pvt. Ltd., New Delhi, 2015.
3.	N Nanua Singh, "System approach to Computer Integrated Design and Manufacturing", Wiley publications, New Delhi, 2013.
4.	R Kesavan, C Ellanchezhian, B Vijaya Ramanath, Process Planning and cost estimation, New Age International, New Edtiion 2017
5.	Joseph G. Monks, "Operations Management, Theory & Problems", 2nd Edition, McGraw Hill Book Company, 2006.
6.	Hariprasad, "Mechanical Estimating and costing", Khartna Publishers, 2005.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1	**Introduction to Process Planning**	
1.1	Types of Production	1
1.2	Importance of process planning - Methods of process planning	1
1.3	CAPP -Approaches of CAPP	1
1.4	Steps in process selection - Production equipment and tooling selection	1
1.5	Set of documents for process planning	1
1.6	Economics of process planning- Case studies	1
2	**Introduction to Cost Estimation**	
2.1	Importance - Aims, function of estimating	1
2.2	Constituents of estimation	1
2.3	Estimating procedure	1
2.4	Costing - Aims of costing - Costing procedure	1
2.5	Methods of costing	1
2.6	Advantages of efficient costing - Difference between estimating and costing	1
3	**Elements of Costs**	
3.1	Introduction -Elements of costs- Ladder of cost	1
3.2	Material cost - Determination of direct material cost	1
3.3	Labour cost - Determination of direct labour cost	1
3.4	Over heads - Classification of overhead expenses	1
3.5	Allocation of overhead expenses	1
3.6	Depreciation - Methods of depreciation	1
4	**Production Cost Estimation**	
4.1	Estimation of Forging Shop - Forging process and operations	1
4.2	Problem solving	1
4.3	Estimation of Welding shop- Arc and Gas Welding process	1
4.4	Problem solving	1
4.5	Estimation of Foundry shop - Allowance in casting process	1
4.6	Problem Solving	1
5	**Machining Time Calculation**	
5.1	Estimation of Machining Time – Importance of Machine Time Calculation	1
5.2	Machining Time for Different Lathe Operations	1
5.3	Machining Time Calculation for Drilling ,Boring and Tapping	1
5.4	Machining Time Calculation for Milling	1
5.5	Machining Time Calculation for Shaping and planning	1
5.6	Machining Time Calculation for Grinding	1
Practical:		
1.	Perform the operations and estimate the machining time calculation on facing and step turning	4
2.	Perform the operations and estimate the machining time calculation on step turning	6
3.	Perform the operations and estimate the machining time calculation on turning ,knurling and thread cutting	6
4.	Perform the operations and estimate the machining time calculation on drilling and tapping	4
5.	Perform the operations and estimate the machining time calculation on cylindrical grinding	4
6.	Case study: Prepare the operation planning sheet for a given component	6

Course Designer(s)

1. Mr. S. Venkatesan -venkatesans@ksrct.ac.in

60 ME E27	Optimization Techniques in Design	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To impart knowledge about optimization techniques and enable students to take effective engineering and managerial decisions.
- To train and apply linear programming techniques suitable for engineering and business.
- To find the optimum solution for non-linear programming problems.
- To impart knowledge about geometric programming and optimum design for machine elements.
- To apply genetic algorithm techniques to engineering optimization problems.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Formulate an optimization problem	Understand
CO2	Form Linear Programming models and solve them	Understand
CO3	Apply algorithms for unconstrained and constrained optimization	Apply
CO4	Apply geometric programming technique and design for mechanical elements	Apply
CO5	Find the optimum solution using non-traditional optimization techniques	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	3	3	-	-	-	3	3	3	3	3	3	3
CO2	2	3	3	3	-	-	-	-	3	3	3	2	-	3	3
CO3	3	3	3	3	-	-	-	-	3	3	3	2	-	2	3
CO4	3	3	2	3	3	-	-	-	2	2	2	3	3	3	2
CO5	3	3	3	2	-	-	-	-	3	3	3	3	-	3	2
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	20	30
Apply	-	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E27- Optimization Techniques in Design

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Introduction Introduction to Optimization, Classification of Optimization Problems, Classical Optimization.	[9]
Linear Programming Simplex Method and Duality in Linear Programming, Sensitivity or Post-Optimality Analysis, Karmarkar's Methods.	[9]
Non-Linear Programming One Dimensional Minimization, Unconstrained and Constrained Minimization, Direct and Indirect Methods	[9]
Geometric Programming and Optimum Design Geometric Programming, Optimum Design of Mechanical Elements Like Beams, Columns, Gears, Shafts	[9]
Genetic Algorithms Introduction to Genetic Algorithms, Operators, Applications to Engineering Optimization Problems.	[9]
Total Hours:	**45**

Text Book(s):

1.	Rao Singiresu, S., "Engineering Optimization: Theory and Practice", New Age International (P) Limited, Publishers New Delhi, 2010.
2.	Deb Kalyanamoy., "Optimization for Engineering Design: Algorithms and Examples", Prentice Hall of India, Pvt. Ltd., New Delhi, 2009.

Reference(s):

1.	Johnson Ray, C., "Optimum Design of Mechanical Elements", John Wiley & Sons, New York, 1990.
2.	Goldberg, D.E., "Genetic Algorithms in Search, Optimization and Machine", Barnen, Addison-Wesley, New York, 2005.
3.	Duffin, R J., Peterson E L., and Zener, C., "Geometric Programming-Theory andApplications", Willey, New York, 2007.
4.	Arora, J S., "Introduction to Optimum Design", McGraw Hill, New York, 4th Edition,2012.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction to optimization	3
1.2	classification of optimization problems	3
1.3	classical optimization	3
2.0	**Linear Programming**	
2.1	Simplex method	3
2.2	Duality in linear programming	2
2.3	sensitivity or post-optimality analysis	2
2.4	Karmarkar’s methods	2
3.0	**Non-Linear Programming**	
3.1	One dimensional minimization	3
3.2	unconstrained minimization	2
3.3	constrained minimization	2
3.4	direct and indirect methods	2
4.0	**Geometric Programming and Optimum Design**	
4.1	Geometric programming	1
4.2	Optimum design of mechanical elements - beams	2
4.3	Optimum design of mechanical elements – columns	2
4.4	Optimum design of mechanical elements – gears	2
4.5	Optimum design of mechanical elements - shafts	2
5.0	**Genetic Algorithms**	
5.1	Introduction to Genetic Algorithms	1
5.2	Operators	2
5.3	Applications to engineering optimization problems	6

Course Designer(s)

1. Mr.S.Karthikeyan – karthikeyan.s@ksrct.ac.in

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60 ME E31	Advanced Mechanics of Materials	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn the concepts of theory of elasticity in three-dimensional stress system.
- To study the shear centre of various cross-sections and deflections in beams subjected to unsymmetrical bending.
- To learn the stresses in flat plates and curved members.
- To study torsional stress of non-circular sections.
- To learn the stresses in rotating members, contact stresses in point and line contact applications.

Pre-requisites

- Engineering mechanics
- Strength of materials

Course Outcomes

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

CO1	Apply the concepts of theory of elasticity in three-dimensional stress system.	Apply
CO2	Determine the shear centre of various cross-sections and deflections in beams subjected to unsymmetrical bending	Apply
CO3	Evaluate the stresses in flat plates and curved members.	Apply
CO4	Calculate torsional stress of non-circular sections.	Apply
CO5	Determine the stresses in rotating members, contact stresses in point and line contact applications.	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	2	-	3	-	-	-	-	3	3	2
CO2	3	3	3	3	-	2	-	3	-	-	-	-	3	3	2
CO3	3	3	3	3	-	2	-	3	-	-	-	-	3	3	2
CO4	3	3	3	3	-	2	-	3	-	-	-	-	3	3	2
CO5	3	3	3	3	-	2	-	3	-	-	-	-	3	3	2
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	30	30	30
Apply	20	20	30
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E31 – Advanced Mechanics of Materials

Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Elasticity Stress-Strain Relations and General Equations of Elasticity in Cartesian, Polar and Curvilinear Coordinates, Differential Equations of Equilibrium – Compatibility - Boundary Conditions Representation of Three - Dimensional Stress of a Tension Generalized Hook's Law - St. Venant's Principle	[9]
Shear Centre and Unsymmetrical Bending* Location of Shear Centre for Various Thin Sections - Shear Flows. Stresses and Deflections in Beams Subjected To Unsymmetrical Loading-Kern of a Section.	[9]
Stresses In Flat Plates and Curved Members* Circumference and Radial Stresses – Deflections - Closed Ring Subjected to Concentrated Load and Uniform Load - Chain Links and Crane Hooks. Solution of Rectangular Plates – Pure Bending Of Plates – Deflection – Uniformly Distributed Load – Various End Conditions.	[9]
Torsion of Non-Circular Sections* Torsion of Rectangular Cross Section - St.Venants Theory - Elastic Membrane Analogy - Prandtl's Stress Function - Torsional Stress in Hollow Thin Walled Tubes.	[9]
Stresses In Rotating Members and Contact Stresses* Radial And Tangential Stresses in Solid Disc and Ring of Uniform Thickness and Varying Thickness Allowable Speeds. Methods Of Computing Contact Stress-Deflection of Bodies in Point and Line Contact Applications. .	[9]
Total Hours:	**45**

Text Book(s):

1.	Arthur P Boresi, Richard J.Schmidt, “Advanced Mechanics of Materials”, Wiley India Pvt.Ltd. 2009.
2.	Hibbeler. R.C., “Mechanics of Materials”, Prentice-Hall, 2018.

Reference(s):

1.	Timoshenko and Goodier, "Theory of Elasticity", Tata McGraw Hill, 2010
2.	Robert D.Cook, Warren C.Young, "Advanced Mechanics of Materials", Prentice Hall, 1999.
3.	Srinath. L.S., “Advanced Mechanics of Solids”, Tata McGraw Hill, 2009.
4.	NPTEL video IIT Kharagpur: https://archive.nptel.ac.in/courses/112/101/112101095/#

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Elasticity**	
1.1	Stress-Strain relations	1
1.2	Equations of elasticity in Cartesian coordinates	1
1.3	Equations of elasticity in Polar coordinates	1
1.4	Equations of elasticity in curvilinear coordinates	1
1.5	Differential equations of equilibrium	1
1.6	Differential equations of equilibrium – compatibility	1
1.7	Boundary conditions representation of three - dimensional stress	1
1.8	Generalized hook's law	1
1.9	St. Venant's principle	1
2.0	**Shear Centre and Unsymmetrical Bending**	
2.1	Shear centre	1
2.2	Location of shear centre for various thin sections	2
2.3	Shear flows	1
2.4	Stresses in beams subjected to unsymmetrical loading-	2
2.5	Deflections in beams subjected to unsymmetrical loading-	2
2.6	Kern of a section	1
3.0	**Stresses in Flat Plates and Curved Members**	
3.1	Circumference and radial stresses & Deflections	2
3.2	Closed ring subjected to concentrated load and uniform load	1
3.3	Chain links and crane hooks	1
3.4	Solution of rectangular plates	1
3.5	Pure bending of plates & Deflection	2
3.6	Uniformly distributed load	1
3.7	Various end conditions	1
4.0	**Torsion of Non-Circular Sections**	
4.1	Torsion	1
4.2	Torsion of rectangular cross section	1
4.3	St.Venants theory	2
4.4	Elastic membrane analogy	1
4.5	Prandtl's stress function	2
4.6	Torsional stress in hollow thin-walled tubes	2
5.0	**Stresses in Rotating Members and Contact Stresses**	
5.1	Radial and tangential stresses in solid disc	1
5.2	Radial and tangential stresses in ring of uniform thickness	2
5.3	Radial and tangential stresses in ring of variable thickness	2
5.4	Methods of computing contact stress-deflection of bodies in point contact	2
5.5	Methods of computing contact stress-deflection of bodies in line contact	2

Course Designer(s)

1.Dr. M.Kathirselvam - mkathirselvam@ksrct.ac.in

60 ME E32	Bio-Mechanics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn the concepts of mechanics as apply to human movement, particularly those pertaining to exercise, sport, and physical activity.
- To apply the mechanical and anatomical principles that govern human motion.
- To identify and use engineering tools that are used to active muscle.
- To develop the ability to link the structure of the human body with its function from a mechanical perspective.
- Apply biomechanics principles to human joints and blood flow.

Pre-requisites

- Engineering mechanics
- Strength of materials

Course Outcomes

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

CO1	Demonstrate an understanding of basics of biomechanics, human tissues and their mechanical properties.	Apply
CO2	Analyse the mechanical properties of human tissues based on their design, purpose, and structure of the basic constituents.	Analyse
CO3	Recognize the active muscle and its sliding filament theory	Apply
CO4	Analyse and quantify linear and angular characteristics of motion.	Analyse
CO5	Analyse and assess different mobility problems in a joint	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	-	-	-	-	-	-	2	2	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	2	3	-
CO3	3	2	3	-	-	-	-	-	-	-	-	2	2	3	-
CO4	3	2	3	-	-	-	-	-	-	-	-	2	2	3	-
CO5	3	2	3	-	-	-	-	-	-	-	-	2	2	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	15	15	25
Apply	15	15	25
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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B.E - Mechanical Engineering

60 ME E32 – Bio Mechanics

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Introduction to Biomechanics Basic Terminology – Nine Fundamentals of Biomechanics, Nine Principles for Application of Biomechanics- Anatomical Description – Bio Composites for Spinal Implants, Bone Repair – Bio Compatibility of Bio Composites - Mechanical Properties of Soft Tissues, Bones and Muscles.	[9]
Biomechanics of Tissues and Structures of The Musculoskeletal System* Biomechanics of Bone, Biomechanics of Articular Cartilage, Tendons and Ligaments, Peripheral Nerves and Spinal Nerve Roots, Skeletal Muscle.	[9]
Biomechanics of Active Muscle* Muscle Force Production and Transmission, Functional Relations, History Effects in Muscle Mechanics, Hill's Model, Sliding Filament Theory.	[9]
Biomechanics Of Human Motion* Linear Kinematic and Kinetic Aspects of Human Movement, Angular Kinematic And Kinetic Aspects of Human Movement, Equilibrium And Human Moment, Biomechanics of Gait, Ergonomics, 3D Printing.	[9]
Biomechanics of Joints and Blood Flow* Knee, Hip, Foot and Ankle, Lumbar Spine, Cervical Spine, Shoulder, Elbow, Wrist and Hand. Implant Material. Introduction to Mechanics of Blood Flow.	[9]
Total Hours:	**45**

Text Book(s):

1.	Susan J Hall, "Basic Biomechanics", 6^{th} Edition, McGraw-Hill Education, New York, 2018.
2.	Jay D Humphrey and Sherry L Delange, "An Introduction to Biomechanics: Solids and Fluids, Analysis and Design", 2^{nd} Edition, London, Springer- Verlag, 2015.

Reference(s):

1.	Margareta Nordin, Victor H Frankel, "Basic Biomechanics of the Musculoskeletal System", 4^{th} Edition, Lippincott Williams and Wilkins, Philadelphia, 2012.
2.	Ozkaya, Nihat, Nordin Margareta, "Fundamentals of Biomechanics: Equilibrium, Motion and Deformation" 4^{th} Edition, Springer, NewYork, 2016.
3.	David A. Winter, "Biomechanics and Motor Control of Human Movement", 4^{th} Edition, John Wiley, New Jersy, 2020
4.	Luigi Ambrosio,"Biomedical Composites", Woodhead publishing Ltd., New Delhi, 2017
5.	NPTEL: https://onlinecourses.nptel.ac.in/noc23_bt04/preview

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Biomechanics**	
1.1	Basic Terminology – Nine Fundamentals of Biomechanics	1
1.2	Nine Principles for application of Biomechanics	1
1.3	Anatomical description – Bio composites for spinal implants, bone repair	2
1.4	Bio compatibility of Bio composites	2
1.5	Mechanical properties of soft tissues	2
1.6	Mechanical properties of bones and muscles.	1
2.0	**Biomechanics of Tissues and Structures of the Musculoskeletal System**	
2.1	Biomechanics of Bone	2
2.2	Biomechanics of Articular Cartilage	2
2.3	Tendons and Ligaments, Peripheral Nerves and Spinal Nerve Roots	3
2.4	Skeletal Muscle.	2
3.0	**Biomechanics of Active Muscle**	
3.1	Muscle force production and transmission	1
3.2	Functional relations	2
3.3	History effects in muscle mechanics	2
3.4	Hill's model	2
3.5	sliding filament theory	2
4.0	**Biomechanics of Human Motion**	
4.1	Linear kinematic and kinetic aspects of human movement	1
4.2	Angular kinematic aspects of human movement	1
4.3	Angular kinetic aspects of human movement	1
4.4	Equilibrium and human moment	1
4.5	Biomechanics of Gait	2
4.6	Ergonomics	2
4.7	3D Printing	1
5.0	**Biomechanics of Joints and Blood Flow**	
5.1	Knee, Hip, Foot and Ankle	1
5.2	Lumbar Spine	2
5.3	Cervical Spine, Shoulder, Elbow	2
5.4	Wrist and Hand. implant material	2
5.5	Introduction to mechanics of blood flow	2

Course Designer(s)

1. Dr.V.P.Arthanarieswaran – arthanarieswaran@ksrct.ac.in

60 ME E33	Welding Technology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the basics of gas and arc welding process
- To learn the welding techniques and application of resistance welding process
- To impart the knowledge on solid state welding process
- To acquire knowledge on advanced welding process
- To understand the design and testing of weldments

Pre-requisites

- Manufacturing Process
- Engineering Materials and Metallurgy

Course Outcomes

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

CO1	Demonstrate the principle of gas and arc welding process.	Understand
CO2	Relate the different types of resistance welding process and its applications	Apply
CO3	Demonstrate the different types of solid state welding process	Understand
CO4	Categorize and explain the advanced welding process	Understand
CO5	Design and analyze the characteristics of Weldments.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	2	2	-	-	-	-	2	3	-	-
CO2	2	2	2	2	-	2	2	-	-	-	-	2	3	-	-
CO3	2	2	2	2	-	2	2	-	-	-	-	2	3	-	-
CO4	2	2	2	2	-	2	2	-	-	-	-	2	3	-	-
CO5	2	2	2	2	-	2	2	-	-	-	-	2	3	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	20
Understand	30	40	30
Apply	20	-	30
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E33 – Welding Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Gas and Arc Welding Processes* Fundamental Principles - Air Acetylene Welding, Oxyacetylene Welding, Carbon Arc Welding, Shielded Metal Arc Welding, Submerged Arc Welding, Activated TIG And MIG Welding, Plasma Arc Welding and Electro Slag Welding Processes - Advantages, Electro Gas Welding-Limitations and Applications.	[9]
Resistance Welding Processes* Spot Welding, Seam Welding, Projection Welding, Resistance Butt Welding, Flash Butt Welding, Percussion Welding and High Frequency Resistance Welding Processes - Advantages, Limitations and Applications	[9]
Solid State Welding Processes* Cold Welding, Diffusion Bonding, Explosive Welding, Ultrasonic Welding, Friction Welding, Forge Welding, Roll Welding and Hot Pressure Welding Processes - Advantages, Limitations and Applications.	[9]
Advanced Welding Processes* Thermit Welding, Atomic Hydrogen Welding, Electron Beam Welding, Laser Beam Welding, Friction Stir Welding, Under Water Welding, Welding Automation in Aerospace, Nuclear and Surface Transport Vehicles	[9]
Design of Weld Joints, Weldability and Testing of Weldments** Basic Principles – Weld Symbols - Inspection Symbols - Residual Stress – Defects in Welding – Various Welded Joint Designs. Weldability: Aluminium, Copper and Stainless Steel. Destructive and Non-Destructive Testing of Weldments.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Parmer R.S., “Welding Engineering and Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2022.
2.	Parmer R.S., “Welding Processes and Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2012.
Reference(s):	
1.	Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.
2.	“Welding Hand Book”, 9th Edition, Vol - 2, American welding Society, Miami, Florida.
3.	Nadkarni S.V. “Modern Arc Welding Technology”, 2nd Edition, Oxford& IBH Publishers, New Delhi, 2005.
4.	Paulo Davim J, “Welding Technology”, Springer International Publishing, 2022
5.	NPTEL Video by Guwahati: https://archive.nptel.ac.in/courses/112/103/112103263/

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Gas and Arc Welding Processes**	
1.1	Fundamental principles - Air Acetylene welding	2
1.2	Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding,	2
1.3	Submerged arc welding, Activated TIG and MIG welding	2
1.4	Plasma arc welding and Electroslag welding processes	2
1.5	Electro Gas welding limitations and applications.	1
2.0	**Resistance Welding Processes**	
2.1	Spot welding, Seam welding	2
2.2	Projection welding, Resistance Butt welding	2
2.3	Flash Butt welding, Percussion welding	2
2.4	High frequency resistance welding processes	2
2.5	Advantages, limitations and applications.	1
3.0	**Solid State Welding Processes**	
3.1	Cold welding, Diffusion bonding	1
3.2	Explosive welding, Ultrasonic welding	2
3.3	Friction welding, Forge welding	2
3.4	Rollwelding and Hot pressure welding processes	2
3.5	Advantages, limitations and applications.	2
4.0	**Other Welding Processes**	
4.1	Thermit welding, Atomic hydrogen welding	2
4.2	Electron beam welding	1
4.3	Laser Beam welding, Under Water welding	2
4.4	Friction stir welding	2
4.5	Welding automation in aerospace, nuclear and surface transport vehicles	2
5.0	**Design of Weld Joints**	
5.1	Basic principles – Weld symbols inspection symbols	2
5.2	Residual stress – Defects in welding – Various welded joint designs.	3
5.3	Weldability of Aluminium, Copper and Stainless Steel	2
5.4	Destructive and Non-Destructive testing of weldments	2

Course Designer(s)

1. Dr. K. Mohan – mohank@ksrct.ac.in

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

60 ME E34	Renewable Sources of Energy	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To know the energy scenario and potential of renewable energy
- To learn the various solar energy technology and its applications
- To educate the various wind energy technology
- To explore the various bio-energy technology
- To provide knowledge about the recent trends in Hydrogen and Fuel Cells technology

.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Discuss the energy scenario and potential of renewable energy	Understand
CO2	Describe the various solar energy technology and its applications	Understand
CO3	Explain the various wind turbine technology	Understand
CO4	Explore the various bio-energy technology	Understand
CO5	Update their knowledge in the field of hydrogen and fuel cells technology	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	3	3	-	-	-	-	3	3	-
CO2	3	3	3	-	-	-	3	3	-	-	-	-	2	3	-
CO3	3	2	3	-	-	-	3	3	-	-	-	-	2	3	-
CO4	3	3	3	-	-	-	3	3	-	-	-	-	3	3	-
CO5	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	20	20	20
Understand	40	40	60
Apply	-	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E34 – Renewable Sources of Energy								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Content	Hours
Energy Scenario Indian Energy Scenario in Various Sectors — Domestic, Industrial, Commercial, Agriculture, Transportation and Others – Present Conventional Energy Status – Present Renewable Energy Status- Potential of Various Renewable Energy Sources-Global Energy Status-Per Capita Energy Consumption-Future Energy Plans.	[9]
Solar Energy* Solar Energy: Solar Radiation-Measurements of Solar Radiation and Sunshine - Solar Thermal Collectors –Flat Plate and Concentrating Collectors-Fundamentals Of Solar Photo Voltaic Conversion–Solar Pv Systems-Types-Design of a Standalone Solar Pv System - Solar Pv And Thermal Applications - Building Integrated Solar- Leadership In Energy Environment Design(Leed) Certification- Challenges - Economics.	[9]
Wind And Geo Thermal Energy* Wind Data and Energy Estimation – Betz Limit - Site Selection for Wind Farms – Characteristics - Wind Resource Assessment - Horizontal Axis Wind Turbine – Components - Vertical Axis Wind Turbine –Wind Turbine Generators and its Performance – Hybrid Systems – Environmental Issues - Applications. Geothermal Power Generation- Dry Steam, Flash Steam, And Binary Cycle.	[9]
Biomass Energy* Bio Resources–Bio Mass Direct Combustion–Thermo Chemical Conversion-Bio Chemical Conversion- Mechanical Conversion - Biomass Gasifier - Types - Cogeneration –- Carbonisation – Pyrolysis - Biogas Plants – Digesters –Biodiesel Production – Methanol and Ethanol Production – Applications.	[9]
Hydrogen And Fuel Cells** Hydrogen: Basic Properties- Production- Transformation of Hydrogen Energy - Hydrogen Economy. Fuel Cells: Operating Principle, Alkaline Fuel Cells (AFC), Phosphoric Acid Fuel Cells (PAFC), Polymer Electrolyte Membrane Fuel Cells (PEMFC), Specific Characteristics, Advantages, Disadvantages and Applications.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Rai, G. D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2020
2.	Sukhatme, S.P., “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2016

Reference(s):	
1.	Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 2012.
2.	Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 3rd Edition, 2015.
3.	Tiwari, G.N., “Solar Energy – Fundamentals Design, Modeling and applications”, Narosa Publishing House, New Delhi, 2013.
4.	Gary L.Johnson, “Wind Energy Systems”, Prentice Hall, New York, 2008
5.	NPTEL Video: https://onlinecourses.nptel.ac.in/noc24_ch26/preview

*SDG 7 – Affordable and Clean Energy
**SDG 12 – Responsible Consumption and Production

BoS - Chairman
Mechanical Engineering (UG & PG)
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Tiruchengode - 637 215.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Energy Scenario**	
1.1	Indian energy scenario in various sectors	1
1.2	domestic, industrial, commercial, agriculture, transportation and others	2
1.3	Present conventional energy status	2
1.4	Potential of various renewable energy sources	1
1.5	Global energy status	1
1.6	Percapita energy consumption-Future energy plans	2
2.0	**Solar Energy**	
2.1	Solar Radiation — Measurements of Solar Radiation and Sunshine	1
2.2	Solar Thermal Collectors	1
2.3	Flat Plate and Concentrating Collectors	1
2.4	Fundamentals of Solar Photo Voltaic Conversion	1
2.5	Solar PV Systems-Types-Design of a Standalone Solar PV System	1
2.6	Solar PV and Thermal Applications	1
2.7	Building Integrated Solar- Leadership in Energy Environment Design(LEED) Certification	2
2.8	Challenges - Economics	1
3.0	**Wind Energy**	
3.1	Wind data and energy estimation	1
3.2	Betz limit - Site selection for wind farms – characteristics	1
3.3	Wind resource assessment	1
3.4	Horizontal axis wind turbine – components	1
3.5	Vertical axis wind turbine	1
3.6	Wind turbine generators and its performance	2
3.7	Hybrid systems	1
3.8	Environmental issues - Applications.	1
4.0	**Biomass Energy**	
4.1	Bio resources	1
4.2	Biomass direct combustion–thermo chemical conversion	2
4.3	Biochemical conversion- mechanical conversion	1
4.4	Biomass gasifier - Types of biomass gasifiers	1
4.5	Cogeneration –- Carbonisation	1
4.6	Pyrolysis - Biogas plants – Digesters	1
4.7	Biodiesel production	1
4.8	Ethanol production - Applications	1
5.0	**Hydrogen and Fuel cells**	
5.1	Basic properties of hydrogen. Technologies of hydrogen production	1
5.2	Transformation of hydrogen energy - hydrogen economy	1
5.3	Fuel cells - operating principless	1
5.4	Alkaline Fuel cells (AFC), Phosphoric Acid Fuel cells (PAFC)	2
5.5	Polymer Electrolyte Membrane Fuel cells (PEMFC)	2
5.6	Specific characteristics, advantages and applications.	2

Course Designer(s)

1. Dr.M.Gnanaseakran – gnanasekaran@ksrct.ac.in
2. Dr.D.Vasudevan – vasudevand@ksrct.ac.in
3. Mr.R.Prakash – prakashr@ksrct.ac.in

60 ME E35	Logistics and Supply Chain Management	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To comprehend the stages of Logistics and Supply Chain Management system.
- To impart the knowledge of Sourcing decision and Network design of Logistics and Supply Chain Management system.
- To acquire the performances of each individual driver of Logistics and Supply Chain Management system.
- To exhibit role of Transportation in Logistics and Supply Chain Management system
- To recognize recent trends in Logistics and Supply Chain Management system

.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Outline of Logistics and supply chain Management in competitive strategy.	Understand
CO2	Characterize the warehousing and material handling of Logistics and Sourcing decision in supply chain management.	Understand
CO3	Measure the performance of the Logistics and Supply chain management system.	Apply
CO4	Demonstrate the role of Transportation in Logistics and Supply chain management system.	Apply
CO5	Describe the future trends in the Logistics and Supply chain management system.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	-	3	-	-	-	-	-	-	2	2	3	-
CO2	3	2	3	-	3	-	-	-	3	-	-	2	2	3	-
CO3	3	2	3	-	3	-	-	-	-	-	-	2	2	3	-
CO4	3	2	3	-	3	-	-	-	3	-	-	2	2	3	-
CO5	3	2	3	-	3	-	-	-	-	-	2	2	2	3	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	30	50
Apply	-	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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

Syllabus

<table>
<tr><td colspan="10" align="center">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="10" align="center">B.E - Mechanical Engineering</td></tr>
<tr><td colspan="10" align="center">60 ME E35 – Logistics and Supply Chain Management</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3" align="center">Hours/Week</td><td rowspan="2" align="center">Total Hours</td><td align="center">Credit</td><td colspan="3" align="center">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Introduction to Logistics and Supply Chain Management
Definition and Scope of Logistics – Functions & Objectives - Factors Influencing the Network Design, Framework for Network Design, Models For Facility Location And Capacity Allocation, Impact of Uncertainty on Network Design – Supply Chain Management: Evolution and Essentials - Structure of Supply Chain, Examples-Process Views-Decision Phases, and Issues - Aligning Supply Chain With Business Strategy –- Reverse Logistics.</td><td>[9]</td></tr>
<tr><td colspan="8">Sourcing Decision and Network Design*
Warehousing Functions – Types and Site Selection, Layout Design and Costing – Virtual Warehouse, Role of Material Handling in Logistics – Material Storage Systems - Supply Chain Configuration Design - Factors Involved – Sourcing -Regional Sourcing, Models for Strategic Alliances – Supplier Selection, Outsourcing and Procurement Process - Evaluation Using Simulation Models.</td><td>[9]</td></tr>
<tr><td colspan="8">Performance Measurement of Logistics and Supply Chain Management System*
Framework for Strategic Alliances – Third Party Logistics(3PL) – 3PL Issues and Requirements – Retailer – Supplier Partnerships – Issues in Retailer – Supplier Partnerships – Demand Forecasting-Collaborative Forecasting Models-Bullwhip Effect-Information Sharing - Aggregate Planning in Supply Chain - Strategies-Multi Echelon Inventory Planning-Models- Discounting- Risk Pooling.</td><td>[9]</td></tr>
<tr><td colspan="8">Transportation**
Transportation System Evolution – Infrastructure and Networks, Freight Management, Route Planning, Containerization – Design Considerations, Material and Cost, Packaging as Unitization – Consumer and Industrial Packaging and Pricing.</td><td>[9]</td></tr>
<tr><td colspan="8">Recent Trends in Logistics and Supply Chain Management System
E-Logistics Structure and Operation – Logistics Resource Management, Automatic Identification Technologies – Warehouse Simulation - Role of IT In Supply Chain -IT Infrastructure-Customer Relationship Management (CRM)-Supplier Relationship Management (SRM)-E-Business-Radio Frequency Identification (RFID) -Supply Chain Collaboration.</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Robert B Handfield, “Introduction To Supply Chain Management”, Pearson Publication, 2019. 5th Edition.</td></tr>
<tr><td>2.</td><td colspan="8">Bowersox & Closs, “Logistics Management”, McGraw-Hill Companies, 2017.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Sunil Chopra and Peter Meindl, “Supply Chain Management”, Strategy, Planning and Operation, Pearson publication, Edition 2018.</td></tr>
<tr><td>2.</td><td colspan="8">Mohanty, “Essentials of Supply Chain Management”, Jaico 2018, Publish house.</td></tr>
<tr><td>3.</td><td colspan="8">Raghuram G and Rangaraj N, “Logistics and Supply chain Management”, Macmillan India Limited, New Delhi, 2015.</td></tr>
<tr><td>4.</td><td colspan="8">Sople Vinod, “Logistics Management”, Pearson Education, 2014.</td></tr>
<tr><td>5.</td><td colspan="8">NPTEL videos : https://www.youtube.com/watch?v=A_0ParlzMjE</td></tr>
<tr><td>6.</td><td colspan="8">NPTEL videos: https://www.youtube.com/watch?v=y9NukpnN-ZQ</td></tr>
</table>

*SDG 8 – Decent work and Economic Growth

**SDG 11 – Sustainable Cities and Communities

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Logistics and Supply Chain Management**	
1.1	Definition and Scope of Logistics	1
1.2	Functions & Objectives	1
1.3	factors influencing the network design	1
1.4	framework for network design	1
1.5	models for facility location and capacity allocation	1
1.6	Impact of uncertainty on network design	1
1.7	Evolution of supply chain-essentials of SCM	1
1.8	structure of supply chain, examples-process views-decision phases	1
1.9	Issues - aligning supply chain with business strategy –- reverse logistics.	1
2.0	**Sourcing Decision and Network design**	
2.1	Warehousing Functions	1
2.2	Types and Site Selection, Layout Design and Costing	1
2.3	Virtual Warehouse, Role of Material Handling in Logistics	1
2.4	Material Storage Systems - Supply chain configuration design	1
2.5	Factors involved - sourcing,	1
2.6	Models for strategic alliances	1
2.7	Supplier selection,	1
2.8	Outsourcing and procurement process	1
2.9	Evaluation using simulation models.	1
3.0	**Performance Measurement of Logistics and Supply Chain Management System**	
3.1	Framework for strategic alliances	1
3.2	Third Party Logistics(3PL)	1
3.3	3PL issues and requirements	1
3.4	3PL issues and requirements – Retailer	1
3.5	Supplier Partnerships – Issues in Retailer	1
3.6	Supplier Partnerships – Demand forecasting	1
3.7	collaborative forecasting models-bullwhip effect-information sharing	1
3.8	Aggregate planning in supply chain	1
3.9	Strategies-multi echelon inventory planning-models- discounting- risk pooling	1
4.0	**Transportation**	
4.1	Transportation System Evolution	1
4.2	Infrastructure and Networks	1
4.3	Freight Management, Route Planning	1
4.4	Route Planning, Containerization	1
4.5	Design considerations, Material and Cost	1
4.6	Packaging as Unitization	2
4.7	Consumer and Industrial Packaging and pricing	2
5.0	**Recent Trends in Logistics and Supply Chain Management System**	
5.1	E-Logistics Structure and Operation	1
5.2	Logistics Resource Management	1
5.3	Automatic Identification Technologies	1
5.4	Warehouse Simulation	1
5.5	Role of IT in supply chain	1
5.6	IT infrastructure-CRM-SRM	1
5.7	e-business	1
5.8	RFID	1
5.9	Supply chain collaboration.	1

Course Designer(s)

1. Ramesh C - rameshc@ksrct.ac.in

60 ME E36	Plastic Manufacturing Processes	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the flow behavior of plastics
- To understand the product manufacturing process of extrusion and blow molding process.
- To understand the injection molding process.
- To familiarize the fabrication technique of thermoset plastics materials.
- To understand the thin material fabrication techniques

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Familiarize with various types of additives used for plastics and its mixing machinery	Apply
CO2	Acquaint of various parameters to operate injection molding machine.	Apply
CO3	Realize the application of different types of injection molds.	Apply
CO4	Gain knowledge of principle and process of extrusion, calendaring and blow moldingoperations	Apply
CO5	Aware of thermoforming, rotational molding and finishing, machining and welding of plastics	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	3	-	-	2	-	-	-	-	2	3	2	2
CO2	3	-	-	3	-	-	2	-	-	-	-	2	3	2	2
CO3	3	-	-	3	-	-	2	-	-	-	-	2	3	2	2
CO4	3	-	-	3	-	-	2	-	-	-	-	2	3	2	2
CO5	3	-	-	3	-	-	2	-	-	-	-	2	3	2	2
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	30	30	50
Apply	20	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus								
K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E36 – Plastic Manufacturing Processes								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Rheology and Melt Processing of Plastics* Flow Behavior – Flow Analysis for Power Law Fluid - Viscosity and Polymer Processing, Melt Flow Index, Capillary Rheometer -Thermal Behaviour, Crystallization, Orientation.	[9]
Extrusion Process and Blow Moulding* Extruder Components and Their Functions–Geometry & Various Types of Extruder Screws- Barrier Screws, Flow Analysis With Extruder, Two Stage, Vented Extruders;– Plastics Compounding And Its Machinery. Extrusion Of Pipes, Profiles, Films and Sheets – Co Extrusion – Blow Molding-Extrusion Blow Molding–Injection Blow Moulding–Stretch Blow Moulding–Wall Thickness and Parison Programming – Advanced Blow Moulding Techniques -Trouble Shooting	[9]
Injection Moulding of Plastics* Injection Unit, Clamping Unit–Specification for an Injection Moulding Machine- Injection Machine Ratings– Mould Filling - Mould Cooling - Components of an Injection Mould – Trouble Shooting In Injection Moulding Of Thermoplastics- Advanced Techniques - Gas and Water Assisted Injection Moulding - Structural Foam Moulding - Multi Coloured Moulding - Process Capability-Total Quality-SQC	[9]
Moulding of Thermosets* Thermosetting Compounds-Properties and Uses; Compression Molding-Preform and Preheating-Curing-Process Control; Transfer Molding-Integral and Auxiliary Mould-Process Control-Mould; Thermoset Injection Moulding	[9]
Thermoforming, Calendaring and Rotational Moulding* Thermo Forming Process–Vacuum Forming, Pressure Forming, Plug–Assisted Vacuum Forming– Billow Forming–Calendaring Process – PVC Sheeting Process - Rotational Molding – Materials , Process Control And Troubleshooting–Powder Coating Processes–Welding Of Plastics –Adhesive Bonding Of Plastics – Machining Of Plastics– Laser Marking – Pad Printing–Painting- Sintering.	[9]
Total Hours:	**45**

Text Book(s):

1.	Harold Belofsky, “Plastics product design and process engineering”, Hanser publishers,1995
2.	Tim A. Osswald, “Polymer Processing Fundamentals”, Hanser publishers, 1998

Reference(s):

1.	Walter – Michaeli, “Plastics Processing An Introduction”, Hanser, 1995.
2.	RubinI. “Hand book of Plastics Materials &Technology,” Wiley, Inter science, 1999.
3.	Crawford R.J, “Plastics Engineering”, 3rd Edition, Elsevier publications, 2005
4.	NPTEL videos : : https://www.youtube.com/watch?v=iUH_EdNNtDU
5.	NPTEL videos: https://www.youtube.com/watch?v=PYTiD0S-ixU

*SDG 9 – Industry Innovation and Infrastructure

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Tiruchengode - 637 215.

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Rheology and Melt Processing of Plastics**	
1.1	Introduction. Flow behavior	1
1.2	Flow analysis for Power law fluid	1
1.3	Viscosity and polymer processing,	2
1.4	Melt flow Index	1
1.5	Capillary Rheometer	1
1.6	Thermal Behaviour,	1
1.7	Crystallization, Orientation	2
2.0	**Extrusion Process and Blow Moulding**	
2.1	Extruder components and their functions	1
2.2	Geometry & various types of extruder screws	1
2.3	Barrier screws, flow analysis with extruder, two stage, vented extruders	1
2.4	Plastics compounding and its machinery	1
2.5	Extrusion of pipes, profiles, films and sheets, Co extrusion	1
2.6	Blow molding-Extrusion blow molding–Injection Blow moulding–Stretch Blow moulding	2
2.7	Wall thickness and parison programming	1
2.8	Advanced blow moulding techniques -trouble shooting	1
3.0	**Injection Moulding of Plastics**	
3.1	Injection unit, clamping unit	1
3.2	Specification for an injection moulding machine	1
3.3	Injection Machine ratings– mould filling - mould cooling - components of an injection mould	1
3.4	Trouble shooting in injection moulding of Thermoplastics	1
3.5	Advanced techniques - gas and water assisted injection moulding	2
3.6	Structural foam moulding - multi coloured moulding	2
3.7	Process capability-total quality-SQC	1
4.0	**Moulding of Thermosets**	
4.1	Thermosetting compounds-properties and uses	1
4.2	Compression molding-preform and preheating-	1
4.3	Curing-process control; transfer molding	2
4.4	Integral and auxiliary mould	2
4.5	Process control-mould;	1
4.6	Thermoset injection moulding	2
5.0	**Thermoforming, Calendaring and Rotational Moulding**	
5.1	Thermo Forming process–Vacuum forming, Pressure forming	1
5.2	Plug–assisted Vacuum forming– Billow forming, Calendaring Process	1
5.3	P VC sheeting process - Rotational molding	1
5.4	materials , process control and troubleshooting–Powder coating processes	2
5.5	Welding of plastics –Adhesive bonding of plastics – Machining of plastics	2
5.6	Laser marking – pad printing–painting- Sintering	2

Course Designer(s)

1. Dr.P.S.Sampath – sampathps@ksrct.ac.in

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

60 ME E37	Integrated Product Development	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Define, formulate, and analyze a problem	Analyze
CO2	Solve specific problems independently or as part of a team	Understand
CO3	Gain knowledge of the Innovation & Product Development process in the business context	Understand
CO4	Work independently as well as in teams	Apply
CO5	Manage a project from start to finish	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	2	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	30	30
Apply	20	20	30
Analyse	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E37- Integrated Product Development								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100

Basics of Product Development Global Trends Analysis and Product Decision - Social Trends - Technical Trends-Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development Methodologies - Product Life Cycle – Product Development Planning and Management	[9]
Requirements And System Design Requirement Engineering - Types of Requirements - Requirement Engineering - Traceability Matrix and Analysis - Requirement Management - System Design &Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design	[9]
Design and Testing Conceptualization - Industrial Design and User Interface Design - Introduction to Concept Generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics And Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing-Hardware Schematic, Component Design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification And Documentation.	[9]
Sustenance Engineering and End-of-Life (EOL) Support Introduction to Product Verification Processes and Stages - Introduction to Product Validation Processes and Stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EOL - Obsolescence Management – Configuration Management - EOL Disposal.	[9]
Business Dynamics – Engineering Services Industry The Industry - Engineering Services Industry - Product Development in Industry Versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development Processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-Offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.	[9]
Total Hours:	**45**

Text Book(s):

1.	Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
2.	John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

Reference(s):

1.	Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2.	Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3.	Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4.	Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of Product Development**	
1.1	Global Trends Analysis and Product decision	1
1.2	Social Trends - Technical Trends- Economical Trends	1
1.3	Environmental Trends - Political/Policy Trends	1
1.4	Introduction to Product Development Methodologies and Management	2
1.5	Overview of Products and Services - Types of Product Development	1
1.6	Overview of Product Development methodologies	1
1.7	Product Life Cycle	1
1.8	Product Development Planning and Management.	1
2.0	**Requirements and System Design**	
2.1	Requirement Engineering - Types of Requirements	1
2.2	Traceability Matrix and Analysis	2
2.3	Requirement Management	1
2.4	System Design &Modeling	2
2.5	Introduction to System Modeling - System Optimization	1
2.6	System Specification - Sub-System Design - Interface Design	2
3.0	**Design and Testing**	
3.1	Conceptualization - Industrial Design and User Interface Design	1
3.2	Introduction to Concept generation Techniques	1
3.3	Challenges in Integration of Engineering Disciplines	1
3.4	Concept Screening & Evaluation	1
3.5	Detailed Design - Component Design and Verification	1
3.6	Mechanical, Electronics and Software Subsystems	1
3.7	High Level Design/Low Level Design of S/W Program	1
3.8	Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing	1
3.9	Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation	1
4.0	**Sustenance Engineering and End-of-Life (EoL) Support**	
4.1	Introduction to Product verification processes and stages	1
4.2	Introduction to Product Validation processes and stages	1
4.3	Product Testing Standards and Certification - Product Documentation	2
4.4	Sustenance -Maintenance and Repair – Enhancements	2
4.5	Product EoL - Obsolescence Management	2
4.6	Configuration Management - EoL Disposal	1
5.0	**Business Dynamics – Engineering Services Industry**	
5.1	The Industry - Engineering Services Industry	1
5.2	Product Development in Industry versus Academia -The IPD Essentials	2
5.3	Introduction to Vertical Specific Product Development processes	1
5.4	Manufacturing/Purchase and Assembly of Systems	1
5.5	Integration of Mechanical, Embedded and Software Systems	1
5.6	Product Development Trade-offs	1
5.7	Intellectual Property Rights and Confidentiality	1
5.8	Security and Configuration Management.	1

Course Designer(s)

1. Mr.S.Karthick – skarthick@ksrct.ac.in

BoS - Chairman
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60 ME E41	Industrial Tribology	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To demonstrate a comprehensive understanding of tribology and its role in industrial applications.
- To apply principles of friction, wear, and lubrication to analyze and solve tribological problems in industrial systems.
- To evaluate lubrication techniques and select appropriate lubricants for specific industrial applications.
- To design tribological components, such as bearings and seals, considering material properties and operational conditions.
- To develop maintenance plans integrating tribological principles to enhance equipment reliability and performance

Pre-requisites

- Fluid Mechanics

Course Outcomes

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

CO1	Interpret the fundamental concepts and principles of tribology and its significance in industrial applications.	Understand
CO2	Apply the mechanisms of friction, wear, and lubrication in tribological systems and their impact on machine performance and longevity.	Apply
CO3	Evaluate different lubrication techniques, lubricants, and their applications in industrial machinery.	Apply
CO4	Evaluate the design considerations for bearings and other tribological components in various industrial systems.	Analyze
CO5	Apply tribological knowledge to develop maintenance strategies and improve reliability and performance of industrial equipment.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO5	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	30	20	30
Apply	20	20	30
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E41 - Industrial Tribology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction to Tribology Definition, Scope, and Importance, Basic Concepts - Friction, Wear, and Lubrication, Types of Tribological Systems and Applications In Industries, Role of Tribology in Engineering Design and Maintenance	[9]
Fundamentals Of Friction and Wear Laws of Friction, Mechanisms of Wear - Abrasive, Adhesive, Surface Fatigue, and Corrosive Wear Factors Influencing Friction and Wear - Material Properties, Surface Roughness, Load, Speed, and Environment Measurement Techniques for Friction and Wear: Tribometers, Wear Testers, and Surface Analysis Methods	[9]
Fundamentals of Lubrication Types of Lubricants (Fluid, Solid, And Semi-Solid), Lubrication Regimes (Boundary, Mixed, and Hydrodynamic) Lubricant Properties and Selection Criteria: Viscosity, Additives, Thermal Stability, and Compatibility Lubrication Systems: Circulating, Splash, Mist, AND Boundary Lubrication Systems Lubricant Application Methods and Equipment: Oil and Grease Lubrication, Centralized Lubrication Systems, and Automatic Lubrication Systems	[9]
Bearing Design and Tribological Systems Bearings and Bearing Materials: Types of Bearings (Plain, Ball And Roller), Bearing Materials Selection Criteria Bearing Failure Modes And Analysis Techniques Seals and Sealing Systems: Types of Seals (Mechanical, Hydraulic, and Lip Seals), Seal Materials, and Seal Performance Factors Tribological Systems In Machinery and Equipment: Gearboxes, Engines, Pumps, Compressors, and Hydraulic Systems.	[9]
Tribology In Maintenance and Reliability Engineering Maintenance Strategies for Tribological Systems: Preventive Maintenance, Predictive Maintenance, and Condition Monitoring Techniques – Introduction to Sensor-Based Monitoring Systems. Role of Tribology in Reliability Engineering: Improving Equipment Reliability, Availability, and Maintainability (RAM).	[9]
Total Hours:	**45**

Text Book(s):

1.	Basu, S.K., Sengupta, S.N. and Ahuja B.B., “Fundamentals of Tribology”, PHI Learning Pvt. Ltd., 2010.
2.	Shrivastava S.K., “Tribology in Industries”, S. Chand & Company Ltd., New Delhi, 2001.

Reference(s):

1.	Williams J, “Engineering Tribology”, Cambridge University Press, 2004.
2.	Majumdar B.C., “Introduction to Tribology of Bearings”, S. Chand & Company Ltd., New Delhi, 2011.
3.	Stachowiak, G.W. and A.W., “Batchelor Engineering Tribology”, Elsevier India Pvt. Ltd., New Delhi, 2018.
4.	Harris T.A., “Rolling Bearing Analysis”, John Wiley & Sons, Inc., New York, 2016.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Tribology**	
1.1	Definition, Scope, and Importance	2
1.2	Basic Concepts - Friction, Wear, and Lubrication,	2
1.3	Types of Tribological Systems and Applications in Industries	2
1.4	Role of Tribology in Engineering Design and Maintenance	3
2.0	**Fundamentals of Friction and Wear**	
2.1	Laws of Friction	2
2.2	Mechanisms of Wear - Abrasive, Adhesive, Surface Fatigue, and Corrosive Wear	2
2.3	Factors Influencing Friction and Wear	2
2.4	Material Properties, Surface Roughness, Load, Speed, and Environment	3
3.0	**Fundamentals of Lubrication**	
3.1	Types of Lubricants (Fluid, Solid, and Semi-Solid), Lubrication Regimes (Boundary, Mixed, and Hydrodynamic)	2
3.2	Lubricant Properties and Selection Criteria: Viscosity, Additives, Thermal Stability, and Compatibility	2
3.3	Lubrication Systems: Circulating, Splash, Mist, and Boundary Lubrication Systems	2
3.4	Lubricant Application Methods and Equipment: Oil and Grease Lubrication, Centralized Lubrication Systems, and Automatic Lubrication Systems	3
4.0	**Bearing Design and Tribological Systems**	
4.1	Bearings and Bearing Materials: Types of Bearings (Plain, Rolling, and Fluid Bearings)	2
4.2	Bearing Materials Selection Criteria Bearing Failure Modes and Analysis Techniques Seals and Sealing Systems	2
4.3	Types of Seals (Mechanical, Hydraulic, and Lip Seals), Seal Materials, and Seal Performance Factors	2
4.4	Tribological Systems in Machinery and Equipment: Gearboxes, Engines, Pumps, Compressors, and Hydraulic Systems	3
5.0	**Tribology in Maintenance and Reliability Engineering**	
5.1	Maintenance Strategies for Tribological Systems: Preventive Maintenance, Predictive Maintenance	2
5.2	Condition Monitoring Techniques	2
5.3	Introduction to sensor-based monitoring systems	2
5.4	Role of Tribology in Reliability Engineering: Improving Equipment Reliability, Availability, and Maintainability (RAM)	3

Course Designer(s)

1. Dr.K.Santhanam – santhanam@ksrct.ac.in

60 ME E42	Non-Destructive Evaluation of Materials	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To familiarize students with the fundamental principles and concepts of non-destructive evaluation techniques.
- To provide students with hands-on experience in performing and interpreting NDE tests.
- To enable students to analyze and evaluate materials for defects, discontinuities, and properties using NDE methods.
- To develop students' skills in selecting appropriate NDE techniques for specific materials and applications.
- To prepare students for careers in industries such as manufacturing, aerospace, automotive, and construction where NDE is essential for quality assurance and safety

Pre-requisites

- Engineering Materials and Metallurgy

Course Outcomes

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

CO1	Understand the basic principles and different types of defects that can be evaluated using NDE techniques.	Understand
CO2	Recognise the importance of Penetrant testing in NDT and the procedures involved.	Understand
CO3	Apply eddy current testing for detecting defects surface and interpret the results obtained from the thermographic technique	Apply
CO4	Perform and interpret ultrasonic testing and acoustic emission for detecting flaws and measuring material thickness.	Understand
CO5	Evaluate and interpret the results obtained in the Radiography.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	3	-	2	-	-	-	-	-	3	-	3	3
CO2	3	2	3	3	-	2	-	-	-	-	-	3	-	3	-
CO3	3	3	3	3	-	3	-	-	-	-	-	3	-	3	3
CO4	3	3	3	3	-	2	-	-	-	-	-	2	-	3	-
CO5	3	3	3	3	-	2	-	-	-	-	-	2	-	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	30	40
Apply	-	20	20
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E - Mechanical Engineering</td></tr>
<tr><td colspan="9">60 ME E42 - Non-Destructive Evaluation of Materials</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Overview of NDT and Visual Inspection
NDT Versus Mechanical Testing, Overview of the Non Destructive Testing Methods for The Detection of Manufacturing Defects As Well as Material Characterisation. Steps Involved In NDT, Relative Merits and Limitations, Various Physical Characteristics of Materials and Their Applications In NDT. Visual Inspection- Basic Principle, Optical Aids Used for Visual Inspection and Applications – Unaided and Aided.</td><td>[9]</td></tr>
<tr><td colspan="8">Surface Nde Methods
Liquid Penetrant Testing - Principles, Types and Properties of Liquid Penetrants, Developers, Advantages and Limitations of Various Methods, Preparation of Test Materials – Application of Penetrants to Parts, Removal of Excess Penetrants, Post Cleaning, Interpretation of Results - Selection Of Penetrant Method – Solvent Removable, Water Washable, Post Emulsifiable – Interpretation and Evaluation of Test Results. Magnetic Particle Testing - Theory of Magnetism, Inspection Materials Magnetisation Methods, Interpretation and Evaluation of Test Indications, Principles and Methods of Demagnetization, Residual Magnetism.</td><td>[9]</td></tr>
<tr><td colspan="8">Thermography and Eddy Current Testing
Thermography - Principles, Contact and Non-Contact Inspection Methods, Techniques for Applying Liquid Crystals, Advantages and Limitation - Infrared Radiation and Infrared Detectors, Instrumentations and Methods, Applications. Eddy Current Testing, Generation of Eddy Currents, Properties of Eddy Currents, Eddy Current Sensing Elements, Probes, Instrumentation, Types of Arrangement, Interpretation/Evaluation, Advantages, Limitations, Applications With Few Case Studies. .</td><td>[9]</td></tr>
<tr><td colspan="8">Ultrasonic Testing and Acoustic Emission
Ultrasonic Testing - Principle, Transducers, Transmission and Pulse - Echo Method, Straight Beam and Angle Beam, Instrumentation, Data Representation: A-Scan, B-Scan and C-Scan Displays, Pulse Generation, Signal Detection, Display and Recording Methods. Phased Array Ultrasound - Time of Flight Diffraction. Acoustic Emission Technique - Principle, AE Parameters, Applications - Case Studies.</td><td>[9]</td></tr>
<tr><td colspan="8">Radiography
Principle, Interaction of X-Ray with Matter, Imaging, X-Ray Source Generation and Properties – Industrial X-Ray Tubes Film and Film Less Techniques, Types And Use of Filters and Screens, Geometric Factors, Inverse Square, Law, Characteristics of Films - Graininess, Density, Speed, Contrast, Characteristic Curves, Penetrameters, Exposure Charts, Radiographic Equivalence. Fluoroscopy - Xero-Radiography, Computed Radiography, Computed Tomography, Applications With Few Case Studies.</td><td>[9]</td></tr>
<tr><td colspan="8">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Baldev Raj, Jayakumar T, Thavasimuthu M., “Practical Non-Destructive Testing”, Narosa Publishing House, 2015.</td></tr>
<tr><td>2.</td><td colspan="8">Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edn, New Age International Publishers, 2010.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, New Jersey, 2nd Edition, 2005</td></tr>
<tr><td>2.</td><td colspan="8">Gaussorgues G, “Infrared Thermography”, Chapman & Hall, University Press, Cambridge, 1994.</td></tr>
<tr><td>3.</td><td colspan="8">Charles, J. Hellier, “Handbook of Non-destructive evaluation”, McGraw Hill, New York 2001.</td></tr>
<tr><td>4.</td><td colspan="8">ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17</td></tr>
</table>

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Overview of NDT and Visual Inspection**	
1.1	NDT Versus Mechanical testing	1
1.2	Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation	2
1.3	Steps involved in NDT, Relative merits and limitations	2
1.4	Various physical characteristics of materials and their applications in NDT	1
1.5	Visual inspection- basic principle, optical aids used for visual inspection and applications	2
1.6	Unaided and aided inspection	1
2.0	**Surface NDE Methods**	
2.1	Liquid Penetrant Testing, Principles, types and properties of liquid penetrants	1
2.2	Developers, advantages and limitations of various methods	1
2.3	Preparation of test materials – Application of penetrants to parts, removal of excess penetrants,	1
2.4	Post cleaning, Interpretation of results	1
2.5	Selection of penetrant method – solvent removable, water washable, post emulsifiable	1
2.6	Theory of magnetism, inspection materials Magnetisation methods	1
2.7	Interpretation and evaluation of test indications	2
2.8	Principles and methods of demagnetization, Residual magnetism	1
3.0	**Thermography and Eddy Current Testing**	
3.1	Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals	2
3.2	Advantages and limitation - infrared radiation and infrared detectors	1
3.3	Instrumentations and methods, applications	1
3.4	Generation of eddy currents, Properties of eddy currents	2
3.5	Eddy current sensing elements, Probes, Instrumentation, Types of arrangement	2
3.6	Interpretation/Evaluation, advantages, Limitations, Applications	1
4.0	**Ultrasonic Testing and Acoustic Emission**	
4.1	Principle, Transducers, transmission and pulse - echo method	1
4.2	Straight beam and angle beam, instrumentation, Data representation: A-scan, B-scan and C-scan displays	1
4.3	Pulse generation, signal detection, display and recording methods.	1
4.4	Phased Array Ultrasound - Time of Flight Diffraction	1
4.5	Acoustic Emission Technique	2
4.6	Principle, AE parameters	2
4.7	Applications - Case studies	1
5.0	**Radiography**	
5.1	Principle, interaction of X-Ray with matter, imaging, X-ray source generation and properties	1
5.2	Industrial X-ray tubes film and film less techniques, types and use of filters and screens	1
5.3	Geometric factors, Inverse square, law, characteristics of films	1
5.4	Graininess, density, speed, contrast, characteristic curves	1
5.5	Penetrameters Exposure charts, Radiographic equivalence	1
5.6	Fluoroscopy - Xero-Radiography	2
5.7	Computed Radiography, Computed Tomography	1
5.8	Applications	1

Course Designer(s)

1. Mr. P. Tamilarasu – tamilarasup@ksrct.ac.in

60 ME E43	Production Planning and Control	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the various components and functions of production planning and control
- To improve the processes and procedures of method and work study
- To establish the procedures and standards to ensure the consistency and quality of the manufactured products.
- To optimize resources and scheduling of resources to meet production demand.
- To know the recent trends in Manufacturing requirement planning (MRP II) and Enterprise Resource Planning (ERP)

Pre-requisites

-NIL-

Course Outcomes

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

CO1	Interpret the PPC function in both manufacturing and service organizations.	Understand
CO2	Demonstrate the knowledge of Method study and work study	Understand
CO3	Interpret the role of production Planning and process planning activities in manufacturing and services.	Understand
CO4	Demonstrate various Scheduling procedures	Understand
CO5	Employ various inventory management techniques and apply in real manufacturing scenario	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	3	3	-	3	3	3
CO2	3	3	3	-	-	-	-	-	-	3	3	-	3	3	3
CO3	3	3	3	-	-	-	-	-	-	3	3	-	3	3	3
CO4	3	3	3	-	-	-	-	-	-	3	3	-	3	3	3
CO5	3	3	3	-	-	-	-	-	-	3	3	-	3	3	3
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	40	40	60
Apply	-	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E43 - Production Planning and Control

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction** Objectives and Benefits of Planning and Control-Functions of Production Control-Types of Production-Job-Batch and Continuous-Product Development and Design-Marketing Aspect-Functional Aspects-Operational Aspect- Durability and Dependability Aspect- Aesthetic Aspect. Profit Consideration-Standardization, Simplification, And Specialization-Break Even Analysis-Economics of a New Design.	[9]
Work Study** Method Study, Basic Procedure –Selection-Recording of Process-Critical Analysis, Development- Implementation-Micro Motion and Memo Motion Study-Work Measurement-Techniques Of Work Measurement- Time Study –Production Study – Work Sampling from Standard Data-Predetermined Motion Time Standards (PMTS)	[9]
Production Planning and Process Planning** Production Planning-Extending the Original Product Information-Value Analysis- Problems in Lack of Product Planning-Process Planning and Routing-Pre Requisite Information Needed For Process Planning-Steps In Process Planning-Quantity Determination in Batch Production-Machine Capacity, Balancing-Analysis of Process Capabilities in a Multi-Product System.	[9]
Production Scheduling* Production Control Systems-Loading and Scheduling-Master Scheduling-Scheduling Rules-Gantt Charts- Perpetual Loading-Basic Scheduling Problems-line of Balance-Flow Production Scheduling-Batch Production Scheduling-Product Sequencing-Production Control System-Periodic Batch Control-Material Requirement Planning Kanban-Dispatching-Progress Reporting and Expediting-Manufacturing Lead Time-Techniques For Aligning Completion Times And Due Dates.	[9]
Inventory Control and Recent Trends In PPC Inventory Control-Purpose of Holding Stock-Effect of Demand on Inventories-Ordering Procedures. Two Bin System-Ordering Cycle System-Determination of Economic Order Quantity and Economic Lot Size-ABC Analysis- Recorder Procedure-Introduction To Computer Integrated Production Planning Systems-Elements Of Just In Time (JIT) - Fundamentals Of Manufacturing Requirement Planning (MRP II) and Enterprise Resource Planning (ERP)	[9]
Total Hours:	**45**

Text Book(s):

1.	Martand Telsang, “Industrial Engineering and Production Management, S.Chand and Company, First edition,2018
2.	Jain K.C. & Agarwal L.N., "Production Planning Control & Industrial Management", 8th Edition, Khanna Publishers, New Delhi, Reprint 2019.

Reference(s):

1.	Samson Eilon, “Elements of production planning and control”, Universal book corpn.1984
2.	Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production/Operations Management”,8th Ed. John Wiley and Sons,2007.Ltd.,
3.	Nair N G, “Production and Operations Management”, Tata McGraw-Hill, 2019.
4.	Hajra Choudhury, S.K., Nirjhar Roy and Hajra Choudhury, A.K., “Production Management”, Media Promoters and Publishers Pvt.Ltd. 1998.
5.	Upendra Kachru., "Production and Operations Management – Text and Cases", 1st Edition, Excel Books, New Delhi, 2009.
6.	Web Link : https://nptel.ac.in/courses/112107143

*SDG 9 Industry, Innovation and Infrastructure

**SDG 12 Responsible consumption and production

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction**	
1.1	Objectives and benefits of planning and control	1
1.2	Types of production-job-batch and continuous	1
1.3	Product development and design	1
1.4	Marketing aspect-Functional Aspects-Operational aspect	1
1.5	Durability and dependability aspect-aesthetic aspect	1
1.6	Profit considerations	1
1.7	Standardization, Simplification, and specialization	1
1.8	Break even analysis	1
1.9	Economics of a new design.	1
2.0	**Work study**	
2.1	Method study, basic procedure	1
2.2	Selection-Recording of process-Critical analysis	1
2.3	Development- Implementation	1
2.4	Micro motion and memo motion study	1
2.5	Work measurement	1
2.6	Techniques off work measurement	1
2.7	Time study –Production study	1
2.8	Work sampling from standard data	1
2.9	Predetermined motion time standards.	1
3.0	**Production planning and process planning**	
3.1	Extending the original product information	1
3.2	Value Analysis	1
3.3	Problems in lack of product planning	1
3.4	Process Planning and routing	1
3.5	Pre requisite information needed for process planning	1
3.6	Steps in process planning	1
3.7	Quantity determination in batch production	1
3.8	Machine capacity, balancing	1
3.9	Analysis of process capabilities in a multi-product system	1
4.0	**Production Scheduling**	
4.1	Production control systems	1
4.2	Loading and scheduling-Master Scheduling	1
4.3	Scheduling rules-Gantt charts	1
4.4	Perpetual loading-Basic scheduling problems	2
4.5	Line of balance-Flow production scheduling	1
4.6	Batch production scheduling-Product Sequencing	1
4.7	Periodic batch control-Material requirement planning	1
4.8	Kanban-Dispatching-Progress reporting and expediting	1
4.9	Manufacturing lead time-Techniques for aligning completion times and due dates.	1
5.0	**Inventory control and recent trends in PPC**	
5.1	Purpose of holding stock	1
5.2	Effect of demand on inventories	1
5.3	Ordering procedures. Two bin systems	1
5.4	Ordering cycle system	1

5.5	Determination of Economic order quantity and economic lot size	1
5.6	ABC analysis- Recorder Procedure	1
5.7	Introduction to computer integrated production planning systems	1
5.8	Elements of JIT	1
5.9	Fundamentals of MRP II and ERP.	1

Course Designer(s)

1. Mr. S. Venkatesan -venkatesans@ksrct.ac.in

60 ME E44	Computational Fluid Dynamics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide a thorough background into basic computational fluid dynamics analysis.
- To acquire mathematical characteristics of partial differential equations.
- To comprehend the concepts of heat transfer problems
- To impart the knowledge of numerical techniques to the solution of fluid dynamics problems
- To evaluate the numerical experiments and carry out data analysis

Pre-requisites

- Fluid Mechanics and Fluid Machines
- Heat Transfer

Course Outcomes

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

CO1	Perceive and solve the governing equations numerically of boundary conditions for engineering problems.	Analyse
CO2	Perform the calculations for finite volume method to fluid flow problems.	Analyse
CO3	Evaluate the steady state heat transfer problems numerically and convection diffusion problem in 1D and 2D steady state condition.	Analyse
CO4	Identify the pressure viscous flow in incompressible flow analysis by use the finite difference method.	Analyse
CO5	Identify the turbulence model to engineering fluid flow problems with standard codes to develop the CFD models.	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	3	-	-	-	-	-	2	3	3	2	3
CO2	3	3	2	2	3	-	-	-	-	-	2	3	3	2	3
CO3	3	3	2	2	3	-	-	-	-	-	2	3	3	2	3
CO4	3	3	2	2	3	-	-	-	-	-	2	3	2	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	3	2	2	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	30
Apply	20	20	30
Analyse	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E44 - Computational Fluid Dynamics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Governing Equations and Boundary Conditions* Basics of Computational Fluid Dynamics– Governing Equations of Fluid Dynamics – Continuity, Momentum and Energy Equations - Physical Boundary Conditions – Classification: Initial and Boundary Conditions, Initial and Boundary Value Problems - Numerical Errors, Grid Independence Test.	[9]
Discretization Methods* Nature Of Numerical Methods - Method of Deriving Discretization Equations - Taylor Series Formulation – Variational Formulation - Method of Weighted Residuals - Control Volume - Formulation.	[9]
Heat Conduction, Convection and Diffusion* Steady One-Dimensional Conduction - Two and Three Dimensional Conduction- Steady One - Dimensional Convection And Diffusion - Discretization Equations for Two Dimensional Convection and Diffusion – Applications	[9]
Incompressible Fluid Flow * Governing Equations - Stream Function – Vorticity Method, Determination of Pressure for Viscous Flow - Computation Of Boundary Layer Flow - Finite Difference Approach – Applications.	[9]
Turbulence Models* Algebraic Models – One Equation Model, K-Є Models, High and Low Reynolds Number Models, Unsteady Turbulent Model – Applications. Prediction Of Fluid Flow and Heat Transfer Using Standard Codes.	[9]
Total Hours:	**45**

Text Book(s):

1.	Muralidhar K. and Sundararajan T, "Computational Fluid Flow and Heat Transfer ", 2nd Ed., Narosa Publishing House, New Delhi, 2014.
2.	Versteeg, H.K., and Malalasekera, W., “An Introduction to Computational Fluid Dynamics”, Pearson India 2nd edition, 2009.

Reference(s):

1.	Chung T J., Computational Fluid Dynamics, McGraw-Hill Education,Second revised edition, 2010.
2.	John F.Wendt, “Computational Fluid Dynamics”, Springer Publisher, 3rd edition, 2012.
3.	Patankar, S.V. “Numerical Heat Transfer and Fluid Flow”, Taylor & Francis group, 2015.
4.	Anderson D.A., Tannehill J.C., and Pletcher P.H., “Computational Fluid Mechanics and Heat Transfer”, CRC Press, 3rd edition, 2012.
5.	NPTEL videos: https://www.youtube.com/watch?v=aShONtHloUk&list=PLbRMhDVUMngcFmWiK1YBhAbsYo8mYvPKJ
6.	NPTEL videos: https://www.youtube.com/watch?v=3QFT7pGx03I

*SDG 9 Industry, Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Governing Equations and Boundary Conditions**	
1.1	Basics of computational fluid dynamics	1
1.2	Governing equations of fluid dynamics	2
1.3	Continuity, Momentum and Energy equations	1
1.4	Physical boundary conditions	1
1.5	Classification, Initial and boundary conditions	1
1.6	Initial and boundary value problems	1
1.7	Numerical errors	1
1.8	Grid independence test	1
2.0	**Discretization Methods**	
2.1	Nature of numerical methods	2
2.2	Method of deriving discretization equations	1
2.3	Taylor series formulation – Variational formulation	2
2.4	Method of weighted residuals	1
2.5	Control volume	1
2.6	Formulation	2
3.0	**Heat Conduction, Convection and Diffusion**	
3.1	Steady one-dimensional conduction	2
3.2	Two and Three dimensional conduction	2
3.3	Steady one - dimensional convection and diffusion	2
3.4	Discretization equations for two dimensional convection and diffusion	2
3.5	Applications	1
4.0	**Incompressible Fluid Flow**	
4.1	Governing Equations	1
4.2	Stream Function	1
4.3	Vorticity method	1
4.4	Determination of pressure for viscous flow	2
4.5	Computation of boundary layer flow	1
4.6	Finite difference approach	2
4.7	Applications	1
5.0	**Turbulence Models**	
5.1	Algebraic Models	1
5.2	One equation model,	1
5.3	K-Є models	2
5.4	High and Low Reynolds number models	1
5.5	Unsteady turbulent model	1
5.6	Applications	2
5.7	Prediction of fluid flow and heat transfer using standard codes	1

Course Designer(s)

1. Ramesh C - rameshc@ksrct.ac.in

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60 ME E45	Thermal Turbomachines	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To apply the working principles of different types of turbo machinery.
- To recognize the concept of centrifugal and axial flow compressors used in turbo machines.
- To explain the stages of combustion phenomenon in gas turbine engines.
- To recognize the concept of centrifugal and axial flow turbines used in turbo machines.
- To familiarize the working principles of various gas turbine engines and jet engines.

Pre-requisites

- Fluid Mechanics & Machinery
- Thermal Engineering

Course Outcomes

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

CO1	Analyze the fundamentals of energy transfer using velocity diagram.	Analyse
CO2	Comprehend the working principle of centrifugal and axial flow compressors.	Apply
CO3	Identify the combustion phenomena and flame stability.	Apply
CO4	Analyse the working principle of axial and radial flow turbines.	Analyse
CO5	Analyze the various gas turbine engines used in real time applications.	Analyse

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO3	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO4	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	1	1
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	10	10	20
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E45 - Thermal Turbomachines

Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Basic Concept of Turbo Machines Energy Transfer Between Fluid and Rotor Velocity Triangles for a Generalized Turbo Machine - Methods Of Representing Velocity Diagrams - Euler Turbine Equation and Its Different Forms - Degree of Reaction in Turbo-Machines – Various Efficiencies - Isentropic - Mechanical - Thermal - Polytrophic.	[9]
Centrifugal and Axial Flow Compressors Centrifugal Compressor - Components - Blade Types. Velocity Triangles - H-S Diagram, Stage Work. Slip Factor and Degree of Reaction. Performance Characteristics and Various Losses. Axial Flow Compressor - Construction Details. Work Done Factor. Velocity Triangles - H-S Diagram, Stage Work. Work Done Factor. Performance Characteristics, Efficiency and Stage Losses – Stalling and Surging.	[9]
Combustion Chamber Basics Of Combustion –Combustion Chamber Arrangements - Flame Stability - Fuel Injection Nozzles - Swirl for Stability - Cooling of Combustion Chamber – Combustion Process Simulation Studies.	[9]
Axial And Radial Flow Turbines Axial Flow Turbines - Types – Elements - Stage Velocity Diagrams - H-S Diagram, Stage Work - Impulse and Reaction Stages. Compounding Of Gas Turbines. Performance Coefficients and Losses. Radial Flow Turbines: Types – Elements - Stage Velocity Diagrams - H-S Diagram, Stage Work Performance Coefficients and Losses – Matching Comoponents	[9]
Gas Turbine and Jet Engine Cycles Gas Turbine Cycle Analysis - Simple, Reheater, Regenerator and Intercooler Cycles. Working Principles of Ramjet, Turbojet, Scarmjet and Pulsejet Engines - Cryogenics Liquid Engine Cycles – Thrust - Specific Impulse – SFC - Thermal and Propulsive Efficiencies	[9]
Total Hours:	**45**

Text Book(s):

1.	Khajuria P.R and Dubey S.P., “Gas Turbines and Propulsive Systems”, DhanpatRai Publications, 2014.
2.	Ganesan, V., “Gas Turbines”, 3rdedition, Tata Mc GrawHill company, New Delhi, 2012.

Reference(s):

1.	Cohen H, Rogers G F C and Saravanamuttoo H I H, “Gas Turbine Theory, 6th Edition, John Wiley & Co, 2009.
2.	Philip Hill and Carl Peterson C R, “Mechanics and Thermodynamics of Propulsion”, 2nd edition, Pearson Education India Pvt. Ltd., 1992.
3.	Jack Mattingly, “Elements of Gas Turbine Propulsion”, 1st Edition, McGraw Hill Company, New Delhi, 2005.
4.	Rolls Royce, “The Jet Engine”, 5th edition, Wiley Publications, 2015.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basic concept of Turbo machines**	
1.1	Energy transfer between fluid and rotor velocity triangles for a generalized turbo machine	1
1.2	Methods of representing velocity diagrams	1
1.3	Euler turbine equation and its different forms	2
1.4	Degree of reaction in turbo-machines	1
1.5	Isentropic efficiency	1
1.6	Mechanical efficiency	1
1.7	Thermal – Polytrophic efficiency	2
2.0	**Centrifugal and Axial Flow Compressors**	
2.1	Centrifugal Compressor - Components - blade types	1
2.2	Velocity triangles - h-s diagram	1
2.3	Slip factor and Degree of Reaction	1
2.4	Performance characteristics	1
2.5	Axial Flow Compressor - Construction details. Work done factor	1
2.6	Velocity triangles - h-s diagram, stage work. Work done factor	1
2.7	Performance characteristics, efficiency and stage losses	2
2.8	Stalling and Surging	1
3.0	**Combustion Chamber**	
3.1	Basics of combustion	1
3.2	Combustion chamber arrangements	3
3.3	Flame stability	1
3.4	Fuel injection nozzles	1
3.5	Swirl for stability	1
3.6	Cooling of combustion chamber	1
3.7	Combustion process simulation studies	1
4.0	**Axial and Radial Flow Turbines**	
4.1	Axial flow turbines - Types – Elements	1
4.2	Stage velocity diagrams - h-s diagram, stage work	1
4.3	Impulse and reaction stages	1
4.4	Compounding of turbines	1
4.5	Radial flow turbines: Types – Elements	1
4.6	Stage velocity diagrams	1
4.7	h-s diagram, stage work	1
4.8	Performance coefficients and losses	1
4.9	Matching components	1
5.0	**Gas Turbine and Jet Engine Cycles**	
5.1	Gas turbine cycle analysis - Simple	1
5.2	Reheater, Regenerator and Intercooler cycles	1
5.3	Working principles of Ramjet	1
5.4	Working principles of Turbojet	1
5.5	Working principles of Scarmjet	1
5.6	Working principles of Pulsejet	1
5.7	Cryogenics liquid engine cycles	1
5.8	Thrust - Specific impulse – SFC	1
5.9	Thermal and Propulsive efficiencies	1

Course Designer(s)

1. Dr.A.Murugesan – murugesana@ksrct.ac.in
2. Mr.R.Prakash – prakashr@ksrct.ac.in

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60 ME E46	Quality Control and Reliability Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To develop a knowledge on various quality concepts and statistical process control.
- To understand the application of control charts and its techniques.
- To apply the sampling procedure and standard sample plans.
- To develop a reliability concepts to improve the quality of products.
- To train the students to evaluate the reliability of a product or system

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Interpret the quality costs and apply statistical process control techniques.	Understand
CO2	Prepare control charts for quality control in manufacturing industries.	Apply
CO3	Apply sampling techniques for quality control.	Apply
CO4	Apply reliability concepts and solve reliability problems.	Apply
CO5	Analyze and estimate the reliability of a product or system.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
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	30	30	20
Apply	20	20	40
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E46 - Quality Control and Reliability Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Introduction and Statistical Process Control Introduction, Definition of Quality. Evolution of Quality: Inspection, Quality Control, Quality Assurance, Total Quality Management Concepts. Quality Costs- Economics of Quality– Quality Loss Function. Seven SPC Tools -Histogram, Check Sheets, Ishikawa Diagrams, Pareto, Scatter Diagrams, Control Charts And Flow Chart.	[9]
Control Charts Statistical Concepts in Quality, Control Chart for Attributes – P Chart and Np Chart, C And U Charts. Control Chart for Variables – X Chart, R Chart and S Chart. State Of Control and Process Out of Control Identification in Charts, Pattern Study and Process Capability Studies.	[9]
Acceptance Sampling Lot By Lot Sampling – Types – Probability Of Acceptance In Single, Double, Multiple And Sequential Sampling Techniques – O.C.Curves – Producers Risk And Consumers Risk. Aql, Ltpd, Aoql Concepts- Uses of Standard Sampling Plans.	[9]
Reliability Concept Fundamentals – Failure Rate, Failure Data Analysis. Bathtub Curve: Mortality Curves Concept of Burn –In Period, Useful Life and Wear Out Phase of a System. Mean Time Between Failures (Mtbf), Mean Time to Failure (Mttf). Hazard Rate – Failure Density and Conditional Reliability-Maintainability And Availability Problems.	[9]
Reliability Estimation System Reliability: Series, Parallel and Mixed Configurations, Reliability Improvement Techniques– Design for Reliability-System Safety-Analysis Of Down-Time-Repair Time Distribution – Redundancy Unit And Standby Redundancy- Fault Tree Analysis – Fmea Analysis, Optimization In Reliability – Product Design – Product Analysis – Product Development –Product Life Cycle.	[9]
Total Hours:	**45**

Text Book(s):

1.	Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons 2016.
2.	Michelle Vine, ‘Quality Assurance and Reliability Engineering’, Clanrye International Publisher, 2015.

Reference(s):

1.	Douglas.C. Montgomery, “Introduction to Statistical Quality Control”, 7 th edition, John Wiley 2012.
2.	Connor, P.D.T.O., “Practical Reliability Engineering”, 5th edition, Wiley India, 2012.
3.	Besterfield D.H., “Quality Control”, 8th edition, Prentice Hall, 2009
4.	Srinath. L.S., “Reliability Engineering”, 4th Edition Affiliated East West Press, 2011.

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Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction and Statistical Process Control**	
1.1	Introduction and Definition of Quality	1
1.2	Evolution of Quality	1
1.3	Quality costs	1
1.4	Economics of quality	1
1.5	Quality loss function	1
1.6	Histogram and Check sheets	1
1.7	Ishikawa diagrams	1
1.8	Pareto and Scatter diagrams	1
1.9	Control charts and flow chart	1
2.0	**Acceptance Sampling**	
2.1	Statistical concepts in quality	1
2.2	Control chart for attributes – p chart	1
2.3	np chart	1
2.4	C and U charts	1
2.5	Control chart for variables – X char	1
2.6	R chart	1
2.7	S chart	1
2.8	State of control and process out of control identification in charts	1
2.9	Pattern study and process capability studies	1
3.0	**Acceptance Sampling**	
3.1	Lot by lot sampling.	1
3.2	Single sampling	1
3.3	Double sampling	1
3.4	Multiple sampling	1
3.5	sequential sampling	1
3.6	O.C.curves – producers Risk and consumers Risk	1
3.7	AQL, LTPD and AOQL concepts and problems	2
3.8	Uses of standard sampling plans	1
4.0	**Reliability Concept**	
4.1	Fundamentals – Failure rate and failure data analysis	1
4.2	Bathtub curve	1
4.3	Mean Time Between Failures (MTBF)	1
4.4	Mean Time To Failure (MTTF)	1
4.5	Hazard rate – failure density problems	2
4.6	Conditional reliability	1
4.7	Maintainability- simple problems	1
4.8	Availability- simple problems	1
5.0	**Reliability Estimation**	
5.1	System reliability: Series, Parallel and Mixed configurations	1
5.2	Series, Parallel and Mixed configurations problems	1
5.3	Reliability improvement techniques	1
5.4	System safety-analysis of down-time	1
5.5	Repair time distribution – redundancy unit and standby redundancy	1
5.6	Fault tree analysis	1
5.7	FMEA analysis	1
5.8	Product design and analysis	1
5.9	Product development and Product life cycle	1

Course Designer(s)

1. Mr.P.Prakash-prakashp@ksrct.ac.in

Rev. No.0/w.e.f. 01.07.2024
Passed in BoS Meeting held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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60 ME E47	Micro and Precision Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn about the precision machine tools
- To learn about the macro and micro components.
- To understand handling and operating of the precision machine tools.
- To learn to work with miniature models of existing machine tools/robots and other instruments.
- To learn metrology for micro system

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Select suitable precision machine tools and operate	Understand
CO2	Apply the macro and micro components for fabrication of micro systems	Apply
CO3	Apply suitable machining process	Apply
CO4	Able to work with miniature models of existing machine tools/robots and other instruments	Apply
CO5	Apply metrology for micro system	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO4	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)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	30	30	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E - Mechanical Engineering</td></tr>
<tr><td colspan="9">60 ME E47- Micro and Precision Engineering</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Introduction to Microsystems
Design, and Material Selection, Micro-Actuators: Hydraulic, Pneumatic, Electrostatic/ Magnetic Etc. For Medical to General Purpose Applications. Micro-Sensors Based on Thermal, Mechanical, Electrical Properties; Micro-Sensors for Measurement of Pressure, Flow, Temperature, Inertia, Force, Acceleration, Torque, Vibration, and Monitoring of Manufacturing Systems.</td><td>[9]</td></tr>
<tr><td colspan="8">Fabrication Processes for Micro-Systems
Additive, Subtractive, Forming Process, Microsystems-Micro-Pumps, Micro- Turbines, Micro Engines, Micro-Robot, and Miniature Biomedical Devices</td><td>[9]</td></tr>
<tr><td colspan="8">Introduction to Precision Engineering
Machine Tools, Holding and Handling Devices, Positioning Fixtures for Fabrication/ Assembly of Microsystems. Precision Drives: Inch Worm Motors, Ultrasonic Motors, Stick- Slip Mechanism and Other Piezo-Based Devices</td><td>[9]</td></tr>
<tr><td colspan="8">Precision Machining Processes
Precision Machining Processes for Macro Components - Diamond Turning, Fixed and Free Abrasive Processes, Finishing Processes.</td><td>[9]</td></tr>
<tr><td colspan="8">Metrology for Micro Systems
Metrology for Micro Systems - Surface Integrity and its Characterization.</td><td>[9]</td></tr>
<tr><td colspan="8">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Davim, J. Paulo, ed. Microfabrication and Precision Engineering: Research and Development. Woodhead Publishing, 2017.</td></tr>
<tr><td>2.</td><td colspan="8">Gupta K, editor. Micro and Precision Manufacturing. Springer; 2017.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Dornfeld, D., and Lee, D. E., Precision Manufacturing, 2008, Springer.</td></tr>
<tr><td>2.</td><td colspan="8">H. Nakazawa, Principles of Precision Engineering, 1994, Oxford University Press.</td></tr>
<tr><td>3.</td><td colspan="8">Whitehouse, D. J., Handbook of Surface Metrology, Institute of Physics Publishing, Philadelphia PA, 1994.</td></tr>
<tr><td>4.</td><td colspan="8">Murthy.R.L, —Precision Engineering in Manufacturing‖, New Age International, New Delhi, 200.5</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Microsystems**	
1.1	Design, and material selection, micro-actuators	1
1.2	Hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications.	2
1.3	Micro-sensors based on Thermal, mechanical, electrical properties	1
1.4	Micro-sensors for measurement of pressure, flow, temperature	2
1.5	Micro-sensors for measurement of inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems	2
1.6	Measurement of vibration monitoring of manufacturing systems	1
2.0	**Fabrication Processes for Micro-Systems**	
2.1	Additive, subtractive, forming process,	3
2.2	Micro systems-Micro-pumps	2
2.3	Micro- turbines, micro engines	2
2.4	Micro-robot and miniature biomedical device	2
3.0	**Introduction to Precision Engineering**	
3.1	Machine tools, holding and handling devices	2
3.2	Positioning fixtures for fabrication/ assembly of microsystems	2
3.3	Precision drives: inch worm motors	2
3.4	Ultrasonic motors	1
3.5	Stick- slip mechanism and other piezo-based devices	2
4.0	**Precision Machining Processes**	
4.1	Precision machining processes for macro components	3
4.2	Diamond turning	2
4.3	Fixed and free abrasive processes	2
4.4	Finishing processes	2
5.0	**Metrology for Micro Systems**	
5.1	Metrology for micro systems	4
5.2	Surface integrity and its characterization	5

Course Designer(s)

1. Mr.S.Sakthivel – sakthivel_s@ksrct.ac.in

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

60 ME E51	Lean Manufacturing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the various tools for lean manufacturing.
- To learn Six Sigma through improve and control phases
- To examine the organizational and logistic elements crucial for successful lean implementation
- To explore the manufacturing and process control elements
- To understand and implement the metrics for measuring lean performance

Pre-requisites

- Manufacturing Processes

Course Outcomes

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

CO1	Describe the brief history of manufacturing approaches employed and the philosophyof lean production	Understand
CO2	Define Six Sigma principles and methodologies	Understand
CO3	Evaluate organizational and logistic elements for assess their impact on overall operational effectiveness.	Apply
CO4	Analyze manufacturing and process control elements	Analyze
CO5	Utilize metrics and performance measures	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	1	-	-	-	3	3	3	-	3	-	-
CO2	3	3	3	-	1	-	-	-	3	3	3	-	3	-	-
CO3	3	3	3	-	1	-	-	-	3	3	3	-	2	-	-
CO4	3	3	3	-	1	-	-	-	3	3	3	-	2	-	-
CO5	3	3	3	-	1	-	-	-	3	3	3	-	2	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	20	30
Apply	-	20	30
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev. No.0/w.e.f. 01.07.2024
Passed in BoS Meeting held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

BoS - Chairman
Mechanical Engineering (UG & PG)
K.S.Rangasamy College of Technology,
Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E51 - Lean Manufacturing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Lean Production Systems Evolution of Lean Manufacturing in Production System - Five Primary Elements - Tools and Techniques Applied to Eliminate Wastes – Value Stream Mapping (Vsm) – Symbols - Developing the Vsm - Current State Mapping - Future State Mapping.	[9]
Six Sigma Definition – Dmaic and Dmadv Deployment Models - Pareto Analysis - Critical to Quality Metrics – Kaizen - Sipoc - Analyzing the Source Of Variation-Cause and Effect Diagram – Correlation - Design Of Experiments. Improvement Decisions - Category Importance Weights- Fault Tree Analysis – Fmea - Visual Management.	[9]
Organizational and Logistic Element Organization Element: Communication Planning, Product-Focused Responsibility, Leadership Development, Workforce Preparation, Fault Tree Analysis. Logistics Element**:** Planning/Control Function, A, B, C Material Handling, Mix-Model Manufacturing.	[9]
Manufacturing And Process Control Element Manufacturing Flow Element: Product/Quantity Analysis, Process Mapping, Routing Analysis, Takt Time, Workload Balancing and One-Piece Flow, Cellular Manufacturing, Pull System and Kanban Sizing. Process Control Element: Single Minute Exchange of Dies, Poka-Yoke, Process Layout.	[9]
Metrics Element and Implementing Lean Dupont Model, Output-Based Measures, Process-Driven Measures, Goal Alignment Through Policy Deployment. Lean Implementation, Reconciling Lean with Other Systems –Advantages Of Lean Manufacturing - Lean And ERP- Lean With ISO 9001: 2015.	[9]
Total Hours:	**45**

Text Book(s):

1.	William M Feld, “Lean Manufacturing, Tools, Techniques and How To Use Them”, The St. Lucie Press/APICS Series on Resource Management, 2001.
2.	Devadasan S.R., Mohan Sivakumar V., Murugesh R. and Shalij P.R., “Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities”, Prentice Hall of India Learning Limited, New Delhi, 2012.

Reference(s):

1.	Ronald G. Askin & Jeffrey B. Goldberg, “Design and Analysis of Lean Production Systems”, John Wiley & Sons, 2003.
2.	Micheal Wader, “Lean Tools: A Pocket guide to Implementing Lean Practices”, Productivity and QualityPublishing Pvt Ltd, 2002.
3.	Askin R.G, Goldberg J.B, “Design and Analysis of Lean Production Systems”, John Wiley & Sons, NewYork, 2003.
4.	Jay Arthur, “Lean Six Sigma – Demystified”, Tata McGraw Hill Companies Inc, 2010.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Evolution of Lean Manufacturing in Production System	2
1.2	Five primary elements	2
1.3	Tools and techniques applied to eliminate wastes	2
1.4	Value Stream Mapping (VSM)	1
1.5	Developing the VSM	1
1.6	Current and Future state mapping	1
2.0	**Six Sigma**	
2.1	DMAIC and DMADV deployment models	1
2.2	Pareto analysis	1
2.3	Critical to quality metrics	1
2.4	Kaizen - SIPOC	1
2.5	Analysing the source of variation & cause and effect diagram	1
2.6	Design of experiments	1
2.7	Improvement decisions & category importance weights	2
2.8	Fault tree analysis & FMEA	1
3.0	**Organizational and Logistic Element**	
3.1	Communication planning	1
3.2	Product-focused responsibility	1
3.3	Leadership development	1
3.4	Workforce preparation	1
3.5	Fault Tree analysis	1
3.6	Planning/control function	1
3.7	A,B,C material handling	1
3.8	mix-model manufacturing	2
4.0	**Manufacturing and Process Control Element**	
4.1	Product/quantity analysis	1
4.2	Process mapping, routing analysis, takt time	1
4.3	Workload balancing and one-piece flow	2
4.4	Cellular manufacturing	1
4.5	Pull system and kanban sizing	2
4.6	Single minute exchange of dies	1
4.7	Poka-yoke.	1
5.0	**Metrics Element and Implementing Lean**	
5.1	DuPont model, output-based measures	1
5.2	Process-driven measures	1
5.3	Goal alignment through policy deployment	1
5.4	Lean implementation	1
5.5	Reconciling lean with other systems	1
5.6	Toyota production system	1
5.7	Advantages of Lean Manufacturing	1
5.8	Lean and ERP	1
5.9	Lean with ISO 9001: 2015.	1

Course Designer(s)

1. Mr. S. Karthikeyan – karthikeyan.s@ksrct.ac.in

60 ME E52	Precision Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To familiarize the students in the Science of Precision Engineering.
- To enhance the technical knowledge in precision machine element.
- To understand the concept of error control.
- To provide and enhance technical knowledge in precision manufacturing.
- To create the awareness among students about new trends in manufacturing and its precise control

Pre-requisites

- Engineering Metrology

Course Outcomes

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

CO1	Select suitable precision machine tools and operate	Understand
CO2	Apply the machine network elements to achieve precision in the components	Apply
CO3	Apply the principles of various error control and apply them in actual field	Apply
CO4	Work with precision manufacturing of existing machine tools/robots and other instruments	Understand
CO5	Apply metrology for micro machining	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO4	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)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	30	50
Apply	20	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E52 - Precision Engineering

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Fundamental of Precision Engineering Introduction – Precision, Accuracy & Smoothness – Need – Development of Overall Machining Precision Classes of Achievable Machining Accuracy-Precision Machining-High Precision Machining-Ultra Precision Machining-Application of Precision Machining-Materials for Tools And Machine Elements – Carbides – Ceramic, CBN & Diamond-Tool and Work Material Compatibility.	[9]
Precision Machine Element Introduction – Guide Ways – Drive Systems – Spindle Drive – Preferred Numbers – Rolling Elements – Hydrodynamic & Hydrostatic Bearings –Hybrid Fluid Bearings- Aero Static and Aero Dynamic Bearings-Hybrid Gas Bearings-Materials for Bearings.	[9]
Error Control Error – Sources – Static Stiffness – Variation of The Cutting Force – Total Compliance – Different Machining Methods – Thermal Effects – Heat Source – Heat Dissipation – Stabilization – Decreasing Thermal Effects – Forced Vibration on Accuracy – Clamping & Setting Errors – Control Errors Due To Locations – Principle of Constant Location Surfaces.	[9]
Precision Manufacturing Micro Machining Processes-Diamond Machining - Micro Engraving - Micro Replication Techniques Forming-Casting-Injection Moulding - Micro Embossing - Energy Assisted Processes Lbm, Ebm, Fib, Micro Electro Discharge Machining-Photolithography-Liga Process- Silicon Micro Machining-Wet and Dry Etching-Thin Film Deposition.	[9]
Micromachining Laser Optics, Laser Ablation, Heat Affected Zone and Laser Polymerisation. LIGA, S-LIGA Micro Welding: Micro Welding in Similar and Dissimilar Materials; Welding Processes Like Ultrasonic, EB, LB; Applications. Micro Casting: Casting Processes Like Vacuum, Semi-Solid State; Applications Processing of Integrated Circuits, Clean Rooms, Crystal Growing And Shaping of Wafers, Etching, Photo And Other Lithography Techniques, Impurity Introduction, Thermal Oxidation, CVD, Metallization.	[9]
Total Hours:	**45**

Text Book(s):

1.	Venkatesh V.C. and Izman S., ―Precision Engineering‖, Tata McGraw Hill, 2008.
2.	Murthy.R.L, ―Precision Engineering in Manufacturing‖, New Age International, New Delhi, 2005.

Reference(s):

1.	Nakazawa H., ―Principles of Precision Engineering‖, Oxford University Press, 1994
2.	Nakazawa H, Principles of Precision Engineering, 1994, Oxford University Press
3.	Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K
4.	Dornfeld, D., and Lee, D. E., Precision Manufacturing, 2008, Springer.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamental of Precision engineering**	
1.1	Introduction – Precision, Accuracy & Smoothness	1
1.2	Need – Development of overall machining	1
1.3	precision Classes of achievable machining Accuracy	1
1.4	Precision Machining-High precision Machining	2
1.5	Ultra precision Machining-application of precision machining	1
1.6	Materials for tools and machine elements – carbides – ceramic, CBN & diamond	2
1.7	Tool and work material compatibility	1
2.0	**Precision machine element**	
2.1	Introduction – Guide ways – Drive systems	2
2.2	Spindle drive – preferred numbers	1
2.3	Rolling elements – hydrodynamic bearings	1
2.4	Rolling elements – hydrostatic bearings	1
2.5	Hybrid fluid bearings	1
2.6	Aero static and aero dynamic bearings	1
2.7	Hybrid gas bearings-materials for bearings	2
3.0	**Error Control**	
3.1	Error – Sources – Static stiffness – Variation of the cutting force	1
3.2	total compliance – Different machining methods	1
3.3	Thermal effects – heat source – heat dissipation	2
3.4	Stabilization – decreasing thermal effects	1
3.5	forced vibration on accuracy – clamping & setting errors	2
3.6	Control errors due to locations	1
3.7	principle of constant location surfaces	1
4.0	**Precision Manufacturing**	
4.1	Micro machining processes-diamond machining	1
4.2	micro engraving - Micro replication techniques	1
4.3	forming-casting-injection moulding - micro embossing	2
4.4	Energy assisted processes LBM, EBM, FIB	2
4.5	Micro electro discharge machining-photolithography	1
4.6	LIGA process- Silicon micro machining	1
4.7	Wet and dry etching-thin film deposition	1
5.0	**Micromachining**	
5.1	Laser Optics, Laser Ablation	1
5.2	Heat Affected Zone and Laser Polymerisation	1
5.3	LIGA, S-LIGA Micro welding	1
5.4	Micro welding in similar and dissimilar materials	1
5.5	welding processes like ultrasonic, EB, LB applications	1
5.6	Micro casting: Casting processes like vacuum, semi-solid state	1
5.7	applications Processing of Integrated Circuits, Clean rooms, crystal growing	1
5.8	shaping of wafers, Etching, Photo and other lithography techniques	1
5.9	Impurity introduction, Thermal oxidation, CVD, Metallization	1

Course Designer(s)

1. Mr.S.Sakthivel – sakthivel_s@ksrct.ac.in

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60 ME E53	Energy Conservation in HVAC System	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To Understand and apply thermodynamic principles for energy conservation in HVAC systems.
- To Analyze heating and ventilation systems to minimize energy usage
- To Gain insight into energy-efficient motor technologies and factors affecting energy consumption within HVAC systems.
- To Examine air conditioning systems for energy conservation opportunities
- To Analyze heating and ventilation systems to minimize energy usage

Pre-requisites

- Thermodynamics
- Thermal Engineering

Course Outcomes

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

CO1	Define the fundamental thermodynamic principle	Understand
CO2	Determine the thermal properties and energy content of building materials.	Understand
CO3	Prepare the requirement of indoor environmental conditions based on standards	Apply
CO4	Analyze the duct design in heating and ventilation systems.	Analyze
CO5	Perform the cooling load calculations involved in air-conditioning systems.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	3	3	3	-	-	-	-	-	-	3	-
CO3	3	3	3	-	3	3	3	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	3	3	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	3	3	-	-	-	-	-	3	3	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	30	40
Apply	-	10	20
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

BoS - Chairman
Mechanical Engineering (UG & PG)
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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E53 - Energy Conservation in HVAC System								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Fundamentals of Thermodynamics Introduction To Energy Conservation – Second Law of Thermodynamics – Exergy Analysis – Reversibility and Irreversibility – Air Conditioning Systems and Cycles – Heat Pumps – Psychrometry.	[9]
Climates and Buildings Climate – Types - Factors That Determine Climate - Climatic Variations – Thermal Properties and Energy Content of Building Materials – Effect of Geographic Locations – Building Aesthetics and Infiltration.	[9]
Indoor Environmental Requirements Thermal Comfort – Ventilation and Air Quality – Air Conditioning Requirement –Energy Management Options – Energy Audit and Energy Targeting – Design Consideration in Different Climatic Conditions	[9]
Heating And Ventilation Systems Energy Conservation and Feasibility Analysis – Conventional Ventilation Systems – Constant Volume and Variable Volume Induction Systems – Indoor Air Quality – Duct Design and Installation	[9]
Air Conditioning Systems Energy Conservation in Air Handling Units – Fans - Air Condition Apparatus– Window Air Condition System – Central Air Condition System – Energy Efficient Motors – Cooling Load Estimation – Bypass Factor - Room Sensible Heat Factor – Grand Sensible Heat Factor – Effective Room Sensible Heat Factor.	[9]
Total Hours:	**45**

Text Book(s):

1.	Faye McQuiston, Jerald D.Paeker and Jeffrey D.Spitler, "Heating, Ventilating, and Air Conditioning", 6 th Edition, John Wiley & Sons Inc., Singapore, 2005.
2.	Shan K. Wang, "Hand Book of Air conditioning and Refrigeration", 2 nd Edition, McGraw-Hill, New York, 2000.

Reference(s):

1.	Michael E. Myers, P.E., LEED AP “HVAC Systems Design Handbook” Fifth Edition, New Delhi Copyright 2010
2.	Jan F. Kreider & Peter S. Curtiss, "Heating and Cooling of Buildings: Design for Efficiency", 2 nd Edition, CRC Press, New York, 2010
3.	ASHRAE Handbook, "HVAC Systems and Equipment 2011, HVAC Applications", ASHRAE Inc., Atlanta, 2019.
4.	Michael E. Myers, P.E., LEED AP “HVAC Systems Design Handbook” Fifth Edition, New Delhi Copyright 2010

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Tiruchengode - 637 215.

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Fundamentals of Thermodynamics**	
1.1	Introduction to Energy Conservation	1
1.2	Second Law of Thermodynamics	2
1.3	Exergy Analysis	1
1.4	Reversibility and Irreversibility	1
1.5	Air Conditioning Systems and Cycles	1
1.6	Heat pumps	2
1.7	Psychrometry	1
2.0	**Climates and Buildings**	
2.1	Climate, Types	1
2.2	Factors that Determine Climate	1
2.3	Darcy Climatic Variations equation	2
2.4	Thermal Properties and Energy Content of Building Materials	2
2.5	Effect of Geographic Locations	2
2.6	Building Aesthetics and Infiltration.	1
3.0	**Indoor Environmental Requirements**	
3.1	Thermal Comfort	1
3.2	Ventilation and Air Quality	2
3.3	Air Conditioning Requirement	2
3.4	Energy Management Options	2
3.5	Energy Audit and Energy Targeting	1
3.6	Design Consideration in Different Climatic Conditions.	1
4.0	**Heating and Ventilation Systems**	
4.1	Energy Conservation and Feasibility Analysis	1
4.2	Conventional Ventilation Systems	2
4.3	Constant Volume and Variable Volume Induction Systems	2
4.4	Indoor Air Quality	2
4.5	Duct Design and Installation.	2
5.0	**Air conditioning Systems**	
5.1	Energy Conservation in Air Handling Units	1
5.2	Fans - Air Condition Apparatus	1
5.3	Window Air Condition System	1
5.4	Central Air Condition System	1
5.5	Energy Efficient Motors	1
5.6	Cooling Load Estimation	1
5.7	Bypass Factor, Grand Sensible Heat Factor	1
5.8	Submersible pumps	1
5.9	Effective Room Sensible Heat Factor	1

Course Designer(s)

1. Dr..M.Gnanaseakran – gnanasekaran@ksrct.ac.in
2. Dr.D.Vasudevan – vasudevan@ksrct.ac.in
3. Mr.R.Prakash – prakashr@ksrct.ac.in

60 ME E54	Cryogenic Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the physical behavior of the materials at cryogenic temperature.
- To impart the concepts of Liquefaction systems.
- To acquire the construction and working principle of Cryogenic Refrigeration systems.
- To enhance knowledge of theoretical and modern technological aspects in Cryogenic Engineering.
- To correlate the theoretical principles with application oriented studies

Pre-requisites

- Thermodynamics
- Thermal Engineering
- Fluid Mechanics
- Heat and Mass Transfer

Course Outcomes

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

CO1	Analyze the mechanical properties of low temperatures materials, draw the schematic diagram and explain the gas liquefaction system.	Analyze
CO2	Identify and compare the liquefaction systems for Neon, Hydrogen and Helium.	Understand
CO3	Compare the gas separation, purification systems also distinguish between the air and gas separation.	Apply
CO4	Explain the cryogenic refrigeration systems, working media, solids, liquids and gases, outline the Cryogenic fluid storage and its transfer.	Apply
CO5	Recognize the concept of cryogenic fluids to gas, biological industries, LO_X in space, medicine and electronic industries.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	-	1	-	-	-	-	-	1	-	3	-
CO2	3	2	3	1	-	1	-	-	-	-	-	1	-	3	3
CO3	3	3	3	1	-	1	-	-	-	-	-	1	-	3	3
CO4	3	3	3	1	-	2	-	-	-	-	-	1	-	3	3
CO5	3	2	2	1	-	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	10	20	20
Apply	30	30	40
Analyse	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E54 - Cryogenic Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction to Cryogenic Systems Thermodynamics Principle of Cryogenic System-Mechanical Properties at Low Temperatures –Properties of Cryogenic Fluids. Gas Liquefaction: Minimum Work for Liquefaction –Methods to Produce Low Temperature: Linde Hampson System –Claude System -Linde Dual pressure System–Liquefaction Systems for Gases Other Than Neon, Hydrogen and Helium.	[9]
Liquefaction Systems Liquefaction Systems for Neon, Hydrogen and Helium Components of Liquefaction Systems-Magnetic Cooling, Magnetic Refrigeration Systems–Heat Exchangers –Compressors and Expanders –Expansion Valve –Losses for Real Machines.	[9]
Gas Separation and Purification Systems Gas Separation and Purification Systems –Properties of Mixtures –Principles of Mixtures –Principles of Gas Separation –Air Separation Systems and Safety in Handling of Cryogens-Cryogenic Instrumentation Pressure, Flow-Rate, Liquid-Level and Temperature Measurements	[9]
Cryogenic Refrigeration Systems Cryogenic Refrigeration Systems –Working Media –Solids, Liquids and Gases. Cryogenic Fluid Storage and Transfer –Cryogenic Storage Systems and Optimization of Tank Design –Insulation –Fluid Transfer Mechanisms –Cryostat –Cryo Coolers.	[9]
Applications Of Cryogenic Refrigeration Systems Applications –Space Technology –In-Flight Air Separation and Collection of LOX –Gas Industry –Biology –Medicine –Electronics-Nuclear Propulsions, Chemical Propulsions.	[9]
Total Hours:	**45**

Text Book(s):

1.	Thipse, S.S., “Cryogenics -A Text book”,1^{st} Edition, Narosa publishing house, New Delhi, March 2013.
2.	Randall F. Barron, "Cryogenics Systems", 2nd Edition, Oxford University Press, New York, 1985.

Reference(s):

1.	Mukhopadhyay, M., “Fundamentals of Cryogenic Engineering”, 2^{nd} Edition, PHI learning Pub., Delhi, 2014.
2.	White. G K., “Experimental Techniques in Low Temperature Physics”, 4^{th} Edition, Oxford Press, 2002.
3.	Robort Ackermann. “Cryogenic Regenerative Heat Exchangers”, 1^{st} Edition Plenum Press, 2013.
4.	Timmerhaus, Flynn, "Cryogenics Process Engineering", 1^{st} Edition, Plenum Press,New York,1989
5.	Fredrick J. Edeskutty and Watter F. Stewart “Safety in Handling of Cryogenic Fluids”, 1^{st} Edition, Plenum Press, 2012.

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Tiruchengode - 637 215.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Cryogenic Systems**	
1.1	Thermodynamics principle of cryogenic system-Mechanical Properties at low temperatures	2
1.2	Properties of cryogenic fluids. Gas Liquefaction: Minimum work for liquefaction –Methods to produce low temperature	2
1.3	Linde Hampson system –Claude system -Linde dual pressure system	2
1.4	Liquefaction systems for gases other than Neon, Hydrogen and Helium	3
2.0	**Liquefaction Systems**	
2.1	Liquefaction systems for Neon, Hydrogen and Helium Components of Liquefaction systems	2
2.2	Magnetic cooling, magnetic refrigeration systems–Heat Exchangers	2
2.3	Compressors and Expanders	2
2.4	Expansion valve –Losses for real machines	3
3.0	**Gas Separation and Purification Systems**	
3.1	Gas separation and purification systems –Properties of mixtures –Principles of mixtures	2
3.2	Principles of gas separation –Air separation systems and Safety in handling of cryogens	2
3.3	Cryogenic instrumentation Pressure, flow-rate	2
3.4	Liquid-level and temperature measurements	3
4.0	**Cryogenic Refrigeration Systems**	
4.1	Cryogenic Refrigeration Systems –Working media –Solids, Liquids and gases	2
4.2	Cryogenic fluid storage and transfer	2
4.3	Cryogenic storage systems and Optimization of tank design, Insulation –Fluid transfer mechanisms	2
4.4	Cryostat –Cryo Coolers	3
5.0	**Applications of Cryogenic Refrigeration Systems**	
5.1	Applications –Space technology	2
5.2	In-flight air separation and collection of LOX	2
5.3	Gas Industry –Biology –Medicine	2
5.4	Electronics-nuclear propulsions, chemical propulsions	3

Course Designer(s)

1. Dr.D.Vasudevan – vasudevan@ksrct.ac.in

60 ME E55	Maintenance Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To gain knowledge about functions of maintenance, organization for Maintenance and failure Statistics
- To impart the knowledge about overhaul and repair maintenance
- To understand the concept of maintenance Systems
- To provide knowledge about development of features for inspection Decisions
- To learn how to traditional approach in Spare Parts Management

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Identify the objectives and functions of maintenance	Apply
CO2	Evaluate the failure and preventive replacement	Analyse
CO3	Apply the concept of. maintenance Planning	Apply
CO4	Interpret the Optimal Inspection frequency	Apply
CO5	Apply the traditional approach to spares inventory	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	-
CO2	3	2	3	3	-	-	-	-	-	-	-	3	2	3	-
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	2	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	3	-
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	2	-
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	10	30	20
Apply	30	20	40
Analyse	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E55 - Maintenance Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction Objectives and Functions of Maintenance. Factors Influencing Plant Availability, Maintenance Control, Maintenance Strategies, Organization for Maintenance. Failure Statistics: Breakdown Time Distributions, Running-In Failures, Time Independent Failures, Wear-Out Failures, Failure Probability, Survival Probability and Age Specific Failure Rates.	[9]
Overhaul and Repair Meaning and Difference, Optimal Overhaul / Repair / Replace Maintenance Policy for Equipment Subject to Breakdown. Replacement Decisions: Deterministic and Stochastic Replacement Situations, Failure and Preventive Replacement, Optimal Interval Between Preventive Replacement of Equipment Subject to Breakdown, Group Replacement.	[9]
Maintenance Systems Fixed Time Maintenance, Condition Based Maintenance, Operate to Failure, Opportunity Maintenance, Design Out Maintenance, Total Productive Maintenance. Maintenance Planning: Establishing Maintenance Plan and Schedule, Illustrative Examples, Preventive Maintenance: Designing a Technically Sound Preventive Maintenance Program, Failure Data, Fmeca, Maintenance to Prevent Failures, Lubrication Program Development.	[9]
Inspection Decisions Optimal Inspection Frequency (For Maximization of Profit and Minimization of Downtime). Shut Down Planning Using Cpm & Pert.	[9]
Spare Parts Management Classification of Spares, Traditional Approach to Spares Inventory, Music-3d Approach to Spares Inventory, Optimum Number of Spares to Satisfy Given Service Level, Simulation Technique.	[9]
Total Hours:	**45**

Text Book(s):

1.	Dieter G E, “Engineering Design - A Materials and Processing Approach”, 4th Edition, McGraw Hill, NY, 2018.
2.	Swift, K G and Booker, J D., “Process Selection: From Design to Manufacture”, 2nd Edition, Elsevier – London, 2019.

Reference(s):

1.	Rao, S S. “Engineering Optimization: Theory and Practice”, 4th Edition, John Wiley, NY, 2020.
2.	Boothroyd G, Dewhurst P and Knight W, “Product Design for Manufacture and Assembly, 3rd Edition, John Wiley, NY: Marcel Dekkar, 2018.
3.	Bralla J G, “Handbook of Product Design for Manufacture”, McGraw Hill, NY, 2019.
4.	Ashby M F and Johnson K, “Materials and Design - The Art and Science of Material Selection in Product Design”, 3 rd Edition, Butterworth-Heinemann, 2019.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Maintenance Engineering**	
1.1	Objectives and Functions of maintenance	1
1.2	Factors influencing plant availability, Maintenance control	1
1.3	Maintenance Strategies, Organization for Maintenance	1
1.4	Failure Statistics: Breakdown time distributions	1
1.5	Running-in failures	1
1.6	Time independent failures	1
1.7	Wear-out failures, Failure Probability	1
1.8	Survival Probability	1
1.9	Age specific failure rates	1
2.0	**Overhaul and Repair:**	
2.1	Meaning and difference, optimal overhaul	2
2.2	Repair / Replace maintenance policy for equipment subject to breakdown.	2
2.3	Replacement Decisions: Deterministic and,	1
2.4	Stochastic replacement situations	1
2.5	failure and preventive replacement,	1
2.6	Optimal Interval between preventive replacements of equipment subject to breakdown	2
2.7	Group replacement	1
3.0	**Maintenance Systems:**	
3.1	Fixed time maintenance, Condition based Maintenance	1
3.2	Operate to failure, Opportunity Maintenance.	1
3.3	Design out maintenance, Total Productive Maintenance.	1
3.4	Maintenance Planning: Establishing maintenance plan and schedule	2
3.5	Illustrative examples, Preventive Maintenance	1
3.6	Designing a Technically sound preventive maintenance program	1
3.7	Failure data, FMECA, Maintenance to prevent failures	1
3.8	lubrication program development	1
4.0	**Inspection Decisions:**	
4.1	Optimal Inspection frequency	2
4.2	maximization of profit and minimization of downtime	3
4.3	Shut down planning using CPM	2
4.4	Shut down planning using PERT	2
5.0	**Spare Parts Management:**	
5.1	Classification of spares	2
5.2	Traditional approach to spares inventory	2
5.3	MUSIC-3D Approach to spares inventory	2
5.4	Optimum number of spares to satisfy given service level	2
5.5	Simulation technique	1

Course Designer(s)

1. Dr.G.Venkatachalam – venkatachalam@ksrct.ac.in

60 ME E56	Industrial Safety Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To impart knowledge on fundamentals of safety engineering.
- To forefront the safety management practices.
- To stress the importance of safe operating practices in industries.
- To give deep insight into occupational health and safety practices followed in industries.
- To relate the legislations pertaining to industrial safety

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Comprehend the history, safety organization and functions of safety organization.	Understand
CO2	Investigate accidents and document accident reports.	Apply
CO3	Follow safety norms adhering to engineering industry including fire fighting and first aid.	Understand
CO4	Identify occupational health and hygiene issues at industries.	Understand
CO5	Summarize the legislations and standards pertaining to occupational safety, health and environment.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	3	3	3	-	2	3	2	1	2	3	-
CO2	1	2	3	-	3	3	3	-	2	3	1	1	2	2	-
CO3	1	1	2	-	2	2	2	-	2	2	2	1	3	2	-
CO4	3	3	3	1	2	2	2	1	2	3	2	1	3	1	-
CO5	1	1	3	2	2	3	3	-	3	3	1	1	3	2	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	20
Understand	30	40	50
Apply	20	-	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME E56 - Industrial Safety Engineering

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Safety Management Introduction-Key Concepts, Terminologies of Safety-History and Development of Industrial Safety-Formation of Factories Act and Safety Council-Safety and Productivity-Safety and Reliability-Safety Policy-Safety Organization, Safety Committee, Safety Budget- Safety Training. Role Of Management and Government in Industrial Safety.	[9]
Accident Prevention Definition and Theories-Accident-Injury- -Near Miss-Theories and Principles of Accident Causation-Principle of Accident Prevention- Unsafe Act and Conditions – Human Error Analysis and Safety-Cost of Accidents-Accident Reporting and Investigation – Reportable and Non-Reportable Accidents- Accident Indices.	[9]
Safety In Engineering Industries Hazard, Risk, General Safety Rules- Hazard Identification Techniques - Housekeeping – Standard Operating Procedures - Machine Guarding - Types and Its Application- Benefits of Good Guarding Systems. Safety in Welding and Gas Cutting - General Safety Consideration in Material Handling - Manual Handling - Mechanical Handling - Ergonomic Consideration in Material Handling. Safety in Use of Electricity- Fire Triangle -Classes of Fire - Fire Fighting Equipments – First Aid.	[9]
Occupational Health and Industrial Hygiene Toxicity, Exposure Limits and Levels, Lethal Dose and Concentration -LD50, LC50-MSDS - Types of Hazards- Exposure, Acute Effect, Chronic Effect- Routes of Entry: Dose- Response Relationship- Occupational Diseases, - Control Measures - Industrial Hygiene -Functional Units and Activities of Occupational Health Services, Pre-Employment and Post-Employment Medical Examinations –Exposure Monitoring - Stress, Fatigue.	[9]
Safety Regulation and Certifications Pollution Act - Factories Act 1948 And Tamil Nadu Factories Rules 1950 – ISO 9001, ISO 14001, OHSAS 18001 And Integrated Management System – ISO 45001. Electrical Safety Act and Rules 2003 – Hazards and Control Measures.	[9]
Total Hours:	**45**

Text Book(s):

1.	John V Grimaldi and Rollin H Simonds, “Safety Management”, All India Traveller Book Seller, 5th Edition, New Delhi, 2001.
2.	Roger L Brauer, “Safety and Health for Engineers”, Wiley, Third Edition, 2016

Reference(s):

1.	Deshmukh. L M , “Industrial Safety Management: Hazard Identification and Risk control”, 6th Edition, Tata Mcgraw Hill, New Delhi, 2010
2.	Phillip E Hagan, John F. Montgometry, James T.O ’Reilly “Accident Prevention Manual for business and Industry”, 13th Edition, National Safety Council, Chicago, 2009.
3.	“The Factories Act 1948”, Madras Book Agency, Chennai, 28th Edition, 2017
4.	Heinrich, H.W., “Industrial Accident Prevention”, 5th Edition, McGraw-Hill, California, 1980.
5.	NPTEL link: https://archive.nptel.ac.in/courses/110/105/110105094/

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Safety Management**	
1.1	Introduction-Key concepts, terminologies of safety-History	1
1.2	Development of industrial safety	1
1.3	Formation of factories act and safety council	1
1.4	Safety and productivity, Safety and reliability	1
1.5	Safety and reliability, safety policy,	1
1.6	Safety organization, safety committee	1
1.7	Safety budget, safety training.	2
1.8	Role of management and government in industrial safety	1
2.0	**Accident Prevention**	
2.1	Definition and theories, Accident, injury, near miss, theories	1
2.2	Principles of accident causation	1
2.3	Principle of accident prevention	1
2.4	Unsafe act and conditions	1
2.5	Human error analysis and safety	1
2.6	Cost of accidents	1
2.7	Accident reporting and investigation	1
2.8	Reportable and non-reportable accidents	1
2.9	Accident indices	1
3.0	**Safety in Engineering Industries**	
3.1	Hazard, risk, general safety rules and Hazard identification Techniques	1
3.2	Housekeeping and Standard operating procedures	1
3.3	Machine guarding, types and its application, benefits of good guarding systems	1
3.4	Safety in welding and gas cutting	1
3.5	General safety consideration in material handling and manual handling, mechanical handling	1
3.6	Ergonomic consideration in material handling	1
3.7	Safety in use of electricity and Fire triangle	1
3.8	Classes of fire, Firefighting equipments and First aid.	2
4.0	**Occupational Health and Industrial Hygiene**	
4.1	Toxicity, exposure limits and levels, Lethal Dose and Concentration	1
4.2	LD50,LC50 and MSDS	1
4.3	Types of hazards and exposure, acute effect, chronic effect	1
4.4	Routes of entry: dose,response relationship, occupational diseases	2
4.5	Control measures, Industrial hygiene , functional units and activities of occupational health services	1
4.6	Functional units and activities of occupational health services	1
4.7	Pre- employment and post-employment medical examinations	1
4.8	Exposure monitoring and stress, fatigue.	1
5.0	**Safety Regulation and Certifications**	
5.1	Pollution Act - Factories Act 1948	1
5.2	Tamil Nadu Factories Rules 1950	1
5.3	ISO 9001, ISO 14001, OHSAS 18001	1
5.4	Integrated Management System	1
5.5	ISO 45001	1
5.6	Electrical safety act and rules 2003	2
5.7	Hazards and control measures.	2

Course Designer(s)

1. M.Sanjay-sanjaym@ksrct.ac.in

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60 ME E57	Quality Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To developing a clear knowledge in the basics of various quality concepts.
- To facilitate the students in understanding the application of control charts and its techniques.
- To develop thespecialcontrolproceduresforserviceandprocessorientedindustries.
- To analyse and understand the process capability study.
- To develop the acceptance sampling procedures for incoming raw material.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Control the quality of processes using control charts for variables in manufacturing industries	Apply
CO2	Control the occurrence of defective product and the defects in manufacturing companies	Apply
CO3	Control the occurrence of defects in services.	Apply
CO4	Analyse and understand the process capability study	Analyse
CO5	Develop the acceptance sampling procedures for incoming raw material	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	-	-	-	-	-	2	-	-	-	-	3	-
CO2	-	3	3	-	3	3	-	-	3	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	3	-	-	-	3	-	-
CO4	3	-	2	-	3	-	-	-	-	-	-	-	3	-	-
CO5	-	2	-	-	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	30	20	20
Apply	20	20	40
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E57- Quality Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Introduction Quality Dimensions–Quality Definitions–Inspection-Quality Control–Quality Assurance–Quality Planning-Quality Costs–Economics of Quality– Quality Loss Function.	[9]
Control Charts Chance and Assignable Causes of Process Variation, Statistical Basis of the Control Chart, Control Charts for Variables -X, R and S Charts, Attribute Control Charts-P, Np, C and U – Construction and Application.	[9]
Special Control Procedures Warning and Modified Control Limits, Control Chart for Individual Measurements, Multi-Vari Chart, *X* Chart with a Linear Trend, Chart for Moving Averages and Ranges, Cumulative-Sum and Exponentially Weighted Moving Average Control Charts.	[9]
Statistical Process Control Process Stability, Process Capability Analysis Using a Histogram or Probability Plots and Control Chart. Gauge Capability Studies, Setting Specification Limits.	[9]
Acceptance Sampling The Acceptance Sampling Fundamental, OC Curve, Sampling Plans for Attributes, Simple, Double, Multiple and Sequential, Sampling Plans for Variables, Mil-Std-105dandmil-Std-414e&Is2500 Standards.	[9]
Total Hours:	**45**

Text Book(s):

1.	Ugene.E, Grant.L, Richard S, Leavenworth, “Statistical Quality Control”, Tata McGraw Hill New, Delhi, 2017.
2.	Jeff Tian, “Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement", Wiley-IEEE Computer Society Press, 2005.

Reference(s):

1.	Douglas C Montgomery, “Introduction to Statistical Quality Control”, John Wiley Publication, 7th Edition, 2012.
2.	Phadko, “Quality Engineering Using Robust Design, Pearson, 2013.
3.	Kan S H, “Metrics and Models in Software Quality Engineering”, Pearson, 2013.
4.	Krishnaiah, K., “Applied Statistical Quality control and Improvement”, PHI, 2014

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Quality Dimensions–Quality definitions	2
1.2	Inspection-Quality contro	2
1.3	Quality Assurance–Quality planning	2
1.4	Quality costs	1
1.5	Economics of quality	1
1.6	Quality loss function	1
2.0	**Control charts**	
2.1	Chance and assignable causes of process variation	2
2.2	Statistical basis of the control chart	2
2.3	Control charts for variables X , R and S charts	2
2.4	Attribute control charts - p, np, c and u	2
2.5	Construction and application	1
3.0	**Special Control Procedures**	
3.1	Warning and modified control limits	1
3.2	Control chart for individual measurements	2
3.3	Multi-vari chart, X chart with a linear trend	2
3.4	Chart for moving averages and ranges	2
3.5	Cumulative-sum and exponentially weighted moving average control charts	2
4.0	**Statistical Process Control**	
4.1	Process stability	1
4.2	Process capability analysis using a Histogram	2
4.3	Process capability analysis using a probability plots and control chart	3
4.4	Gauge capability studies	2
4.5	Setting specification limits	1
5.0	**Acceptance Sampling**	
5.1	The acceptance sampling fundamental	1
5.2	OC curve, sampling plans for attributes	2
5.3	Simple, double, multiple and sequential, sampling plans for variables	4
5.4	MIL-STD-105DandMIL	1
5.5	STD-414E&IS2500 standards	1

Course Designer(s)

1. 1. Mr.S Sakthivel - sakthivel_s@ksrct.ac.in

BoS - Chairman
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Tiruchengode - 637 215.

60 ME E58	Surface Engineering	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the fundamentals of surface features and different types of friction associated with metals and non-metals
- To study the different types of wear mechanism and its standard measurement.
- To study the different types of corrosion and its preventive measures
- To study the different types of surface properties and surface modification techniques
- To study the various types of materials used in the friction and wear applications

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Describe the fundamentals of surface features and different types of friction associated with metals and non-metals	Understand
CO2	Analyze the different types of wear mechanism and its standard measurement.	Analyze
CO3	Analyze the different types of corrosion and its preventive measures	Analyze
CO4	Analyze the different types of surface properties and surface modification techniques	Analyze
CO5	Analyze the various types of materials used in the friction and wear applications	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	3	3	3	-	-	-	2	-	-	-	2	-	3	-
CO2	3	3	3	2	-	-	-	3	-	-	-	3	3	3	-
CO3	-	3	3	3	-	-	-	3	-	-	-	3	3	3	-
CO4	-	3	3	3	-	-	-	3	-	-	-	3	3	3	-
CO5	-	-	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	10	10	20
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME E58- Surface Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Surfaces and Friction Basics of Surfaces Features – Roughness Parameters – Surface Measurement - Cause of Friction- Laws of Friction – Static Friction – Rolling Friction – Stick-Slip Phenomenon - Friction Properties of Metal and Non-Metals – Friction in Extreme Conditions – Thermal Considerations in Sliding Contact.	[9]
Wear Laws of Wear - Types of Wear Mechanism – Wear Debris Analysis - Theoretical Wear Models - Wear of Metals and Nonmetals – International Standards in Friction and Wear Measurements.	[9]
Corrosion Introduction – Types of Corrosion – Factors Influencing Corrosion – Testing of Corrosion – In-Service Monitoring, Simulated Service, Laboratory Testing – Prevention of Corrosion – Material Selection, Alteration of Environment, Design, Cathodic and Anodic Protection, Corrosion Inhibitors.	[9]
Surface Treatments Surface Properties – Hydrophobic – Super Hydrophobic – Hydrophilic - Surface Metallurgy –Surface Coating Techniques – Pvd – Cvd – Physical Cvd – Ion Implantation – Surface Welding – Thermal Spraying – Laser Surface Hardening and Alloying - New Trends in Coating Technology – Dlc – Cnc – Thick Coatings – Nano-Engineered Coatings – Other Coatings, Corrosion Resistant Coatings	[9]
Engineering Materials Introduction – High and Low Friction Materials - Advanced Alloys – Super Alloys, Titanium Alloys, Magnesium Alloys, Aluminium Alloys, and Nickel Based Alloys – Ceramics – Polymers – Biomaterials – Bio Tribology - Nano Tribology.	[9]
Total Hours:	**45**

Text Book(s):

1.	Stachowiak G.W .and Batchelor, A.W. “Engineering Tribology”, Butterworth-Heinemann, 2005
2.	Basu, S.K., Sengupta S.N. and Ahuja, B.B., “Fundamentals of Tribology”, Prentice Hall of India, 2005.

Reference(s):

1.	Fontana G., “Corrosion Engineering”, McGraw Hill, 1985
2.	Rabinowicz.E., “Friction and Wear of materials”, John Willey &Sons,1995
3.	Williams J.A., “Engineering Tribology”, Oxford University Press, 1994.
4.	Joseph R. Davis, Corrosion: Understanding the Basics, ASM International, 2000

SDG 9 – Industry Innovation and Infrastructure

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Tiruchengode - 637 215.

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Surfaces and Friction**	
1.1	Basics of surfaces features – Roughness parameters	1
1.2	Surface measurement - Cause of friction	2
1.3	Laws of friction – Static friction – Rolling Friction	1
1.4	Stick-slip Phenomenon	1
1.5	Friction properties of metal and non-metals	2
1.6	Friction in extreme conditions	1
1.7	Thermal considerations in sliding contact	1
2.0	**Wear**	
2.1	Laws of Wear - Types of Wear mechanism	2
2.2	Wear debris analysis	1
2.3	Theoretical wear models	2
2.4	Wear of metals and nonmetals	2
2.5	International standards in friction and wear measurements	2
3.0	**Corrosion**	
3.1	Introduction – Types of corrosion	3
3.2	Factors influencing corrosion – Testing of corrosion	2
3.3	In-service monitoring, Simulated service	2
3.4	Laboratory testing – Prevention of Corrosion	2
3.5	Material selection, Alteration of environment	
3.6	Design, Cathodic and Anodic Protection	
3.7	Corrosion inhibitors	
4.0	**Surface Treatments**	
4.1	Surface properties – Hydrophobic – Super hydrophobic – Hydrophilic - surface metallurgy	2
4.2	Surface coating Techniques – PVD – CVD – Physical CVD	1
4.3	Ion implantation – Surface welding	1
4.4	Thermal spraying – Laser surface hardening and alloying	1
4.5	New trends in coating technology	1
4.6	DLC – CNC – Thick coatings	1
4.7	Nano-engineered coatings	1
4.8	Other coatings, Corrosion resistant coatings	1
5.0	**Engineering Materials**	
5.1	Introduction – High and low friction materials	1
5.2	Advanced alloys – Super alloys	1
5.3	Titanium alloys, Magnesium alloys	1
5.4	Aluminium alloys, and Nickel based alloys	2
5.5	Ceramics – Polymers – Biomaterials	2
5.6	Bio Tribology	1
5.7	Nano Tribology	1

Course Designer(s)

1. Dr.S.Jeyaprakasam – sjeyaprakasam@ksrct.ac.in

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Tiruchengode - 637 215.

60 ME L01	Direct Digital Manufacturing	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications
- .To learn the fundamentals of the various types of software used in Additive Manufacturing technology.
- To acquire knowledge on vat polymerization processes
- To impart knowledge on solid based material extrusion processes.
- To be familiar powder bed fusion and material extrusion processes.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Recognize the development of AM technology in various businesses and developing opportunities.	Understand
CO2	Apply the concepts of rapid prototyping in product design and development	Apply
CO3	Select the suitable liquid based rapid prototyping system for a specific application	Understand
CO4	Select the suitable solid based rapid prototyping system for a specific application	Understand
CO5	Select the suitable powder based rapid prototyping system for a specific application	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	3	-	-	3	3	3	-	3	-	-	3
CO3	3	3	-	-	3	-	-	3	3	3	-	3	-	-	3
CO4	3	2	-	-	3	-	-	3	3	3	-	3	-	-	3
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3 - Strong; 2 - Medium; 1 - Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	30	40	60
Apply	10	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME L01 - Direct Digital Manufacturing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Introduction Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain- ASTM/ISO 52900 Classification – Benefits. Applications: Building Printing - Bio Printing - Food Printing- Electronics Printing. Business Opportunities and Future Directions – Case Studies: Automobile, Aerospace, Healthcare.	[9]
Design for Additive Manufacturing (DFAM)* Concepts and Objectives - AM Unique Capabilities - Part Consolidation – Topology Optimization- Generative Design - Lattice Structures - Multi-Material Parts and Graded Materials - Data Processing: CAD Model Preparation - AM File Formats: STL-Problems With STL- AMF Design For Part Quality Improvement: Part Orientation - Support Structure - Slicing - Tool Path Generation – Design Rules for Extrusion Based AM.	[9]
Liquid Based RP Systems* Stereo Lithography Apparatus (SLA): Principle, Photo Polymers, Post Processes, Process Parameters, Machine Details, Advantages. Solid Ground Curing (SGC): Principle, Process Parameters, Process Details, Machine Details, Limitations. Solid Creation System (SCS): Principle, Process Parameters, Process Details, Machine Details, Applications.	[9]
Solid Based RP Systems* Fusion Deposition Modeling (FDM): Principle, Raw Materials, BASS, Water Soluble Support System, Process Parameters, Machine Details, Advantages and Limitations. Laminated Object Manufacturing (LOM): Principle, Process Parameters, Process Details, Advantages and Limitations. Solid Deposition Manufacturing (SDM): Principle, Process Parameters, Process Details, Machine Details, Applications.	[9]
Powder Based RP Systems* Selective Laser Sintering (SLS): Principle, Process Parameters, Process Details, Machine Details, Advantages and Applications. 3-Dimensional Printers (3DP): Principle, Process Parameters, Process Details, Machine Details, Advantages and Limitations. Laser Engineered Net Shaping (LENS): Principle, Process Details, Advantages and Applications.	[9]
Total Hours:	**45**

Text Book(s):

1.	Chua.C.K. Leong K.F. and Lim C.S., “Rapid prototyping: Principles and Applications”, World scientific, New jersey, 2017.
2.	Pham D.T. and Dimov S.S, “Rapid Manufacturing”, Springer -Verlag, London, 2011.

Reference(s):

1.	Amitabha Ghosh, “Rapid Manufacturing a brief Introduction”, Affiliated East West Press, New Delhi, 2019.
2.	Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2017.
3.	Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
4.	Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000
5.	NPTEL videos: https://archive.nptel.ac.in/courses/112/103/112103306/

*SDG 9 – Industry Innovation and Infrastructure

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Tiruchengode - 637 215.

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction**	
1.1	Overview - Need - Development of Additive Manufacturing (AM) Technology	1
1.2	Rapid Prototyping- Rapid Tooling - Rapid Manufacturing	1
1.3	Additive Manufacturing. AM Process Chain	2
1.4	ASTM/ISO 52900 Classification - Benefits	1
1.5	Applications: Building Printing - Bio Printing	1
1.6	Food Printing- Electronics Printing	1
1.7	Business Opportunities and Future Directions	1
1.8	Case studies: Automobile, Aerospace, Healthcare.	1
2.0	**Design for Additive Manufacturing (DFAM)**	
2.1	Concepts and Objectives - AM Unique Capabilities	1
2.2	Part Consolidation – Topology Optimization	1
2.3	Generative design - Lattice Structures	1
2.4	Multi-Material Parts and Graded Materials	1
2.5	Data Processing: CAD Model Preparation	1
2.6	AM File formats: STL-Problems with STL	1
2.7	AMF Design for Part Quality Improvement: Part Orientation - Support Structure	1
2.8	Slicing - Tool Path Generation	1
2.9	Design rules for Extrusion based AM	1
3.0	**Liquid based RP systems**	
3.1	Stereo Lithography Apparatus (SLA): Principle	1
3.2	Photo polymers, Post processes, Process parameters, Machine details, Advantages	1
3.3	Solid Ground Curing (SGC): Principle	2
3.4	Process parameters, Process details, Machine details, Limitations.	1
3.5	Solid Creation System (SCS): Principle	2
3.6	Process parameters, Process details, Machine details, Applications	2
4.0	**Solid based RP systems**	
4.1	Fusion Deposition Modeling (FDM): Principle- Raw materials, BASS	2
4.2	Water soluble support system, Process parameters, Machine details, Advantages and limitations	1
4.3	Laminated Object Manufacturing (LOM): Principle, Process parameters	2
4.4	Process details, Advantages and limitations	1
4.5	Solid Deposition Manufacturing (SDM): Principle, Process parameters.	2
4.6	Process details, Machine details, Applications	1
5.0	**Powder based RP systems**	
5.1	Selective Laser Sintering (SLS): Principle, Process parameters	2
5.2	Process details, Machine details, Advantages and applications	2
5.3	3-Dimensional Printers (3DP): Principle, Process parameters	2
5.4	Process details, Machine details, Advantages and limitations	1
5.5	Laser Engineered Net Shaping (LENS): Principle, Process details, Advantages and applications.	2

Course Designer(s)

1. Mr.M.Prasath – prasathm@ksrct.ac.in

60 ME L02	Product Design and Development	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To know the importance of product marketing, process development and product management.
- To develop new product ideation and identification of customer requirements.
- To apply the principle of concept generation, testing and validation of new concepts.
- To impart knowledge on branding, quality with technical standards of new product.
- To acquire the principle of packaging and launching of new product in the market

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Recognise the product development fundamentals and the process.	Understand
CO2	Develop new product ideation, identification of customer requirements and selection of ideas.	Understand
CO3	Apply the principle of concept generation, testing and validation of new concepts.	Apply
CO4	Apply the technical standards with quality for branding new product.	Apply
CO5	Apply the principle of packaging and promote new strategy in launching new product in the market.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	2	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	20	10	20
Understand	40	30	50
Apply	-	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME L02 - Product Design and Development								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Product Development Fundamentals and Process Product Marketing Importance: Relevance of Costumer Centric Businesses-Value Generation-Product Idea and Product Concept-Strategic and Tactical Planning in Marketing. Technological Innovation and Entrepreneurship - ‘S’ Curve with New Products -Types and Importance - Key Success Factors - Reasons for Failure. New Product Process Development: Reduction of Products Lifecycles-Time to Market-Product Development Process-Stage-Gate Process-Product Lifecycle Management (PLM). New Products Management: Organization And Structure-Global Vision of the Development Process. Product Policy and Guidelines-Mission-Product Portfolio Analysis-Generic Business Strategies-Growing Strategies. New Product and New Market.	[9]
Product Ideation and Opportunity Seeking* Blue Ocean Strategy: Six Ways to Explore New Market Creation- ERIC Matrix; Creativity and Innovation-The Creative Process-Problem Solving-Brakes and Blocks to Creativity; Origin of Ideas, Sources of Opportunities-Creatives Techniques-Rational and Intuitive Techniques. Identification of Needs: Needs and Desires-Usage Habits and Attitude Study-Matrix of Attributes Importance Versus Customers-Evaluations-Creating Customers Value Proposition; Selection of Ideas: Screening of Ideas-Methods to Select the Best Ideas.	[9]
Concept Creation, Testing and Validation* Development of a Concept: The Process of Pursuit Value-Importance of Discovering Insights-Empathy Map-Development of Positioning Concepts-Key Benefits Types for Concept Creation. Concept and Product Testing: Market Research - Concept Test-Product Testing-Concept and Use Test. Market Attractiveness Analysis: Strategic Validation of the Opportunity and Attractiveness of the Market-Market Attractiveness Matrix Versus Competitive Position or IE Matrix. Validation of Market Attractiveness-Market Size Studies, Estimations and Sales Forecast-Methods for New Products Demand Forecasting-Qualitative Break Down Methodology for New Products.	[9]
Branding, Quality with Technical Specifications** Brand Identity and Intellectual Property: Intellectual Property Right and Brand Naming-Brand Management, Brand Identity Vs. Brand-Image-Brand Strategies for a Portfolio of Products and Line Extensions. Technical Standards, Product Quality Specifications and Sustainability-Product Quality and Sustainable Designing-Technical Specifications Norms-Matrix of The Houses of Quality: Integrating Customer Requirements in the Design.	[9]
Packaging and Launching Strategies** Packaging: Components and Functionalities of a Package-Types of Packages-Package Impact in the Ecology-Packaging Technologies and Trends-Development of a Package Prototype. Introduction and Launching: Consumer Buying Behavior for Innovations-Diffusion of Innovation and Adoption Curve-Blocks and Risks to New Product Adoption-Launching Methods and Strategies for a new Product Introduction-Sales Promotions.	[9]
Total Hours:	**45**

Text Book(s):

1.	Karl,T.Ulrich and Steven, D. Eppinger,“Product Design and Development”, McGraw Hill, 2019.
2.	Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.

Reference(s):

1.	Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.
2.	Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
3.	Pugh S., “Total Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing, 1991.
4.	Rosenthal S., “Effective Product Design and Development”, Business One, 1992.
5.	NPTEL videos: https://onlinecourses.nptel.ac.in/noc21_me83/preview

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*SDG 9 – Industry Innovation and Infrastructure
**SDG 8 – Decent work and Economic Growth

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Product Development Fundamentals and Process**	
1.1	Product Marketing Importance: Relevance of Costumer Centric Businesses-Value Generation	1
1.2	Product Idea and Product Concept-Strategic and Tactical Planning in Marketing. Technological Innovation and Entrepreneurship	1
1.3	'S' Curve with New Products -Types and Importance - Key Success Factors - Reasons for Failure	2
1.4	New Product Process Development: Reduction of Products Lifecycles-Time to Market	1
1.5	Product Development Process-Stage-Gate Process-Product Lifecycle Management (PLM)	1
1.6	New Products Management: Organization and Structure-Global Vision of the Development Process.	1
1.7	Product policy and guidelines-Mission-Product portfolio analysis-Generic Business Strategies	1
1.8	Growing Strategies -New Product and New Market	1
2.0	**Product ideation and Opportunity seeking**	
2.1	Blue Ocean Strategy: Six ways to explore new market creation	1
2.2	ERIC matrix; Creativity and Innovation-The Creative Process-Problem Solving	1
2.3	Brakes and Blocks to Creativity; Origin of Ideas, sources of opportunities	1
2.4	Creatives techniques-Rational and intuitive techniques	1
2.5	Identification of Needs: Needs and Desires-Usage Habits and Attitude Study	1
2.6	Matrix of Attributes Importance versus Customers	1
2.7	Evaluations-Creating Customers Value Proposition	1
2.8	Selection of Ideas: Screening of Ideas	1
2.9	Methods to Select the Best Ideas	1
3.0	**Concept Creation, Testing and Validation**	
3.1	Development of a Concept: the process of pursuit value-Importance of discovering Insights	1
3.2	Empathy Map-Development of Positioning Concepts	1
3.3	Key Benefits types for Concept Creation. Concept and Product Testing	1
3.4	market research - Concept Test-Product Testing-Concept and Use Test.	1
3.5	Market Attractiveness Analysis: Strategic Validation of the Opportunity and Attractiveness of the Market	1
3.6	Market Attractiveness Matrix versus Competitive Position or IE Matrix	1
3.7	Validation of Market Attractiveness-Market Size Studies	1
3.8	Estimations and Sales Forecast-Methods for New Products Demand Forecasting	1
3.9	Qualitative Break Down methodology for new Products	1
4.0	**Branding, Quality with Technical Specifications**	
4.1	Brand Identity and Intellectual Property: Intellectual Property Right and Brand Naming	2
4.2	Brand Management, Brand Identity vs. Brand-Image	1
4.3	Brand Strategies for a portfolio of products and line extensions	2
4.4	Technical Standards, Product Quality Specifications and Sustainability	1
4.5	Product quality and Sustainable Designing.	1
4.6	Technical specifications Norms-Matrix of the Houses of Quality	1
4.7	Integrating customer requirements in the design.	1
5.0	**Packaging and Launching Strategies**	
5.1	Packaging: Components and functionalities of a Package	1
5.2	Types of Packages-Package impact in the Ecology	1

5.3	Packaging Technologies and Trends-Development of a package prototype.	2
5.4	Introduction and Launching: Consumer Buying Behavior for Innovations	1
5.5	Diffusion of Innovation and Adoption Curve-Blocks and risks to new product adoption	2
5.6	Launching Methods and Strategies for a New Product Introduction	1
5.7	Sales Promotions to accelerate introduction	1

Course Designer(s)

1. Dr.A.Kumaravel – kumaravel@ksrct.ac.in
2. Dr.S.Jeyapraksam- sjeyaprakasam@ksrct.ac.in

60 ME L03	Composite Materials and Processing	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To impart knowledge of various types of composites and its advantages and needs.
- To understand the various types of fiber materials and its applications for making Composites.
- To understand the knowledge of various resins materials used in processing of composites
- To understand various process for manufacturing composites
- To understand the basic destructive and non-destructive testing of composites

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Analyze various types of composites and its advantages and needs	Analyze
CO2	Analyze various types of fiber materials and its applications for making Composites	Analyze
CO3	Analyze various resins materials used in processing of composites	Analyze
CO4	Analyze various process for manufacturing composites	Analyze
CO5	Apply basic destructive and non-destructive testing of composites	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	-	-	-	-	-	-	-	-	3	3	-	3	3
CO2	2	3	-	-	-	-	-	-	-	-	3	3	-	3	3
CO3	3	2	-	-	-	-	-	-	-	-	3	3	-	3	3
CO4	3	2	-	-	-	-	-	-	-	-	3	3	-	2	2
CO5	3	3	-	-	-	-	3	-	-	-	2	2	-	2	2
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	10	10	20
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Tiruchengode - 637 215.

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME L03 - Composite Materials and Processing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Introduction and Additives Introduction – Advantages, Characteristics, of Composites – Classification – Particulate, Fibrous, Laminated, and Hybrid Composites, Additives for Composites - Catalysts - Accelerators – Coupling Agents - Fillers - Toughening Agents	[9]
Matrix Materials* Classification -Matrix Resins - Unsaturated Polyester - Vinyl Ester - Epoxy- Phenol Formaldehyde - Urea Formaldehyde - Melamine Formaldehyde Resin - Properties and Applications	[9]
Reinforcement Materials* Fibre Reinforcements - Glass – Types - Csm – Surface Mats - Performs - Woven and Non-Woven Fabrics - Carbon - Aramid Fibre - Boron Fibres - Natural Fibres – Cellulose.	[9]
Processing Techniques** Dmc, Smc and Prepregs - Hand and Spray Layup - Rtm - Bag - Autoclave - Centrifugal and Compression Molding Processes - Filament Winding - Pultrusion Sandwich Construction	[9]
Testing Testing of Composites – Standards -Tensile, Impact, Compression and Flexural Strength- Non Destructive Testing for Composites - Application of FRP Products.	[9]
Total Hours:	**45**

Text Book(s):

1.	Vinay Kumar Patel, Rishi Kant, Pankaj Singh Chauhan and Shantanu Bhattacharya, “Trends in Fabrication of Polymers and Polymer Composites”, AIP Publishing, 2022
2.	Sabu Thomas, Joseph Kuruvilla, Sant Kumar Malhotra, Koichi Goda, Meyyarappallil Sadasivan Sreekala, Polymer Composites, Wiley-VCH Verlag GmbH & Co. KGaA, 2012

Reference(s):

1.	Md Rezaur Rahman, Advances in Sustainable Polymer Composites, Woodhead Publishing Series in Composites Science and Engineering, 2020
2.	Sanjay Mavinkere Rangappa, Suchart Siengchin, Jyotishkumar Parameswaranpillai, Klaus Friedrich, “Tribology of Polymer Composites: Characterization, Properties, and Applications”, Elsevier Series on Tribology and Surface Engineering, 2020
3.	Donald F. Adams, Leif Carlsson A Carlsson, R. Byron Pipes Experimental Characterization of advanced composite materials, Third Edition, CRC Press, 2002.
4.	M.C.Gupta and A.P.Gupta, Polymer Composites, New Age International Publishers, 2007.
5.	NPTEL videos: https://archive.nptel.ac.in/courses/112/104/112104229/

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction and Additives**	
1.1	Introduction – Advantages, Characteristics, of composites	1
1.2	Classification – particulate, fibrous, laminated, and hybrid composites	2
1.3	Additives for Composites	2
1.4	Catalysts - Accelerators	1
1.5	Coupling Agents - Fillers	1
1.6	Toughening Agents	2
2.0	**Matrix Materials**	
2.1	Classification -Matrix Resins	1
2.2	Unsaturated Polyester - Vinyl Ester	2
2.3	Epoxy- Phenol Formaldehyde- Urea Formaldehyde	2
2.4	Melamine Formaldehyde Resin	2
2.5	Properties and Applications	2
3.0	**Reinforcement Materials**	
3.1	Fibre Reinforcements - Glass – Types	1
3.2	CSM – Surface Mats - Performs	2
3.3	Woven and Non-Woven Fabrics	2
3.4	Carbon - Aramid Fibre.	2
3.5	Boron Fibres - Natural Fibres – Cellulose.	2
4.0	**Processing Techniques**	
4.1	DMC, SMC and Prepregs	2
4.2	Hand and Spray Layup	1
4.3	Resin Transfer Moulding	1
4.4	Bag moulding	1
4.5	Centrifugal and Compression Molding Processes	2
4.6	Filament Winding	1
4.7	Pultrusion Sandwich Construction	1
5.0	**Testing**	
5.1	Testing of Composites	1
5.2	Standards	2
5.3	Tensile, Impact, Compression and Flexural Strength	2
5.4	Non Destructive testing for Composites	2
5.5	Application of FRP Products.	2

Course Designer(s)

1. Dr.P.S.Sampath – sampathps@ksrct.ac.in
2. Dr S.Jeyaprakasam@ksrct.ac.in

60 ME L04	Reliability Engineering	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To impart knowledge about statistical quality control and reliability concepts to students.
- To acquire the methods and characteristics of sampling.
- To impart knowledge on design of reliability process.
- To equip the students to analyze the reliability of a product or system.
- To train the students to evaluate the reliability of a product or system

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Analyze quality costs and apply statistical process control techniques.	Analyze
CO2	Identify the consumer's and producer's risk in sampling	Understand
CO3	Determine and analyze the reliability process.	Analyze
CO4	Apply reliability concepts and solve reliability problems.	Apply
CO5	Analyze and estimate the reliability of a product or system.	Analyze

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	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	10	10	20
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME L04 - Reliability Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Statistical Process Control Introduction:-Definition of Quality, Evolution of Quality: Inspection, Quality Control, Quality Assurance, Total Quality Management Concepts, Chance Causes, Assignable Causes, Customer-Orientation: Internal & External Customer Concept, Quality Costs-Prevention; Appraisal And Failure Costs. Analysis Techniques for Quality Costs, Seven Spc Tools -Histogram, Check Sheets, Ishikawa Diagrams, Pareto, Scatter Diagrams, Control Charts and Flow Chart.	[9]
Acceptance Sampling* Lot-By-Lot Sampling – Types – Probability of Acceptance in Single - Double - Multiple Sampling Techniques – O.C. Curves – Producer's Risk and Consumer's Risk. (Acceptable Quality Limit) Aql - Lot Tolerance Percent Defective (Ltpd) - Average Outgoing Quality Limit (Aoql) Concepts-Standard Sampling Plans for Aql and Ltpd - Uses of Standard Sampling Plans.	[9]
Design for Reliability** Reliability Design Process, System Effectiveness, Economic Analysis and Life Cycle Cost, Reliability Allocation, Design Methods, Parts AND Material Selection, Derating, Stress Strength and Analysis, Failure Analysis, Identification Determination of Causes, Assessments of Effects, Computation of Criticality Index, Corrective Action, System Safety-Analysis of Down-Time-Repair Time Distribution.	[9]
Reliability Concepts Reliability Engineering - Fundamentals – Failure Rate, Failure Data Analysis, Bathtub Curve, Mortality Curves Concept of Burn –In Period, Useful Life and Wear out Phase of a System, Mean Time Between Failures (Mtbf), Mean Time to Failure (Mttf), Hazard Rate – Failure Density and Conditional Reliability-Maintainability and Availability – Simple Problems.	[9]
Reliability Improvement System Reliability: Series, Parallel and Mixed Configurations, Reliability Improvement Techniques, Use of Pareto Analysis – Design for Reliability – Redundancy Unit and Standby Redundancy- Fault Tree Analysis – Fmea Analysis, Optimization In Reliability – Product Design – Product Analysis – Product Development –Product Life Cycle.	[9]
Total Hours:	**45**

Text Book(s):

1.	Patrick D Connor, Practical Reliability Engineering, Wiley, 2012.
2.	Srinath. L.S., "Reliability Engineering", 4th Edition Affiliated East West Press, 2011.

Reference(s):

1.	Connor, P.D.T.O., "Practical Reliability Engineering", 5th edition, Wiley India, 2012.
2.	Charles E Ebling, An Introduction to Reliability and Maintainability Engineering, Overseas Press,2011
3.	David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth-Heinemann, 2011
4.	NPTEL video:https://youtu.be/uutg8jKrL9w

*SDG 9 – Industry Innovation and Infrastructure
**SDG 8 – Decent work and Economic Growth

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Statistical Process Control**	
1.1	Introduction:-Definition of quality, Evolution of Quality	1
1.2	Inspection, Quality Control, Quality assurance, Total quality management concepts	2
1.3	chance causes, assignable causes, Customer-Orientation	2
1.4	Internal & External Customer Concept, Quality costs- Prevention	1
1.5	Appraisal and Failure costs. Analysis techniques for quality costs,	1
1.6	Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams	1
1.7	Pareto, Scatter diagrams, Control charts and flow chart	1
2.0	**Acceptance Sampling**	
2.1	Lot-by-Lot Sampling – Types	1
2.2	Probability of Acceptance in Single – Double sampling	2
2.3	Multiple Sampling Techniques	1
2.4	O.C. Curves – Producer's Risk and Consumer's Risk. (Acceptable Quality Limit) AQL	2
2.5	Lot Tolerance Percent Defective (LTPD) - Average Outgoing Quality Limit (AOQL) Concepts	1
2.6	Standard Sampling Plans for AQL and LTPD	1
2.7	Uses of Standard Sampling Plans.	1
3.0	**Design For Reliability**	
3.1	Reliability design process, system effectiveness	1
3.2	economic analysis and life cycle cost, reliability allocation	1
3.3	design methods, parts and material selection	2
3.4	derating, stress strength and analysis, failure analysis	2
3.5	identification determination of causes, assessments of effects	1
3.6	computation of criticality index, corrective action	1
3.7	System safety-analysis of down-time-Repair time distribution.	1
4.0	**Reliability Concepts**	
4.1	Reliability engineering - fundamentals – Failure rate	2
4.2	failure data analysis, Bathtub curve	1
4.3	Mortality curves concept of burn –in period	1
4.4	useful life and wear out phase of a system	1
4.5	Mean Time Between Failures (MTBF), Mean Time To Failure (MTTF),	2
4.6	hazard rate – failure density and conditional reliability	1
4.7	Maintainability and availability – simple problems.	1
5.0	**Reliability Improvement**	
5.1	System reliability: Series, Parallel and Mixed configurations	1
5.2	Reliability improvement techniques, use of Pareto analysis	1
5.3	design for reliability – redundancy unit and standby redundancy	2
5.4	fault tree analysis – FMEA analysis	2
5.5	Optimization in reliability – Product design.	1
5.6	Product analysis – Product development –Product life cycle	2

Course Designer(s)

1. Mr.P.Prakash – prakashp@ksrct.ac.in
2. Mr.M.Prasath- prasathm@ksrct.ac.in

60 ME L05	Logistics Management	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To learn the need and importance of logistics in product flow.
- To infer the working knowledge on theories of logistics and competitive strategy.
- To enhance the knowledge in logistics function including performance measurement, costs, transportation and packaging
- To learn the current challenges faced by logistics professionals.
- To develop Logistics Resource Management and Automatic Identification Technologies

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Outline the logistics in competitive strategy	Understand
CO2	Apply the concept of warehousing and material handling equipment systems in logistics management	Apply
CO3	Describe the Internal and External Performance Measurement in logistics management.	Understand
CO4	Outline the time and cost in freight management.	Understand
CO5	Describe Logistics Resource Management and, Automatic Identification Technologies.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	2	-	3	3	3	3	-	-	2	-	3	3	3
CO2	-	-	2	-	3	3	3	3	-	-	2	-	3	3	3
CO3	-	-	2	-	3	3	3	3	-	-	2	-	3	3	3
CO4	-	-	2	-	3	3	3	3	-	-	2	-	3	3	3
CO5	-	-	2	-	3	3	3	3	-	-	2	-	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	20	20
Understand	30	40	60
Apply	20	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Mechanical Engineering

60 ME L05 - Logistics Management

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Introduction to Logistics and Network Design Definition and Scope of Logistics – Functions & Objectives, Customer Value Chain – Factors Influencing the Network Design, Framework for Network Design, Models for Facility Location and Capacity Allocation, Impact of Uncertainty on Network Design.	[9]
Warehousing and Materials Handling, Material Handling Equipment and Systems* Warehousing Functions – Types and Site Selection, Layout Design and Costing – Virtual Warehouse, Role of Material Handling in Logistics – Material Storage Systems – Principles, Benefits, Methods – Automated Material Handling.	[9]
Strategic Alliances and Performance Measurement Framework for Strategic Alliances – Third Party Logistics(3PL) – 3PL Issues and Requirements – Retailer –Supplier Partnerships – Issues in Retailer – Supplier Partnerships – Distributor Integration – Types and Issues of Distributor Integration – Internal and External Performance Measurement – Logistics Audit.	[9]
Transportation and Packaging* Transportation System Evolution – Infrastructure and Networks, Freight Management , Route Planning, Containerization – Design Considerations, Material and Cost, Packaging as Unitization – Consumer and Industrial Packaging.	[9]
Current Trends E-Logistics Structure and Operation – Logistics Resource Management, Automatic Identification Technologies – Warehouse Simulation, Reverse Logistics - Global Logistics , Strategic Logistics Planning.	[9]
Total Hours:	**45**

Text Book(s):

1.	Sople Vinod V, “Logistics Management – The Supply Chain Imperative”, Pearson Education, 2014
2.	Ailawadi C Sathish and Rakesh Singh, “Logistics Management”, Prentice Hall India, 2012

Reference(s):

1.	Coyle, “The Management of Business Logistics”, Thomson Learning, 2014
2.	Bloomberg David J, “Logistics”, Prentice Hall India, 2014
3.	Simchi – Levi Davi, Kaminsky Philip and Simchi-Levi Edith, “Designing and Managing the Supply Chain”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.
4.	Musgrave Adam, “Transportation and Logistics Management”, Global Vision Publishing, 2013.
5.	NPTEL Video link: https://archive.nptel.ac.in/courses/110/106/110106045/

*SDG 8 – Decent work and Economic Growth

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Logistics and Network Design**	
1.1	Definition and Scope of Logistics – Functions & Objectives	1
1.2	Customer Value Chain – factors influencing the network design	2
1.3	framework for network design	2
1.4	models for facility location and capacity allocation	2
1.5	Impact of uncertainty on network design	2
2.0	**Warehousing and Materials Handling, Material Handling Equipment and Systems**	
2.1	Warehousing Functions – Types and Site Selection	2
2.2	Layout Design and Costing – Virtual Warehouse	2
2.3	Role of Material Handling in Logistics	1
2.4	Material Storage Systems – Principles, Benefits	2
2.5	Methods – Automated Material Handling.	2
3.0	**Strategic Alliances and Performance Measurement**	
3.1	Framework for strategic alliances	1
3.2	Third Party Logistics(3PL) – 3PL issues and requirements	2
3.3	Retailer –Supplier Partnerships	1
3.4	Issues in Retailer – Supplier Partnerships	1
3.5	Distributor Integration – Types and issues of Distributor Integration	1
3.6	Internal and External Performance Measurement	2
3.7	Logistics Audit.	1
4.0	**Transportation and Packaging**	
4.1	Transportation System Evolution	1
4.2	Infrastructure and Networks, Freight Management	2
4.3	Route Planning, Containerization	1
4.4	Design considerations, Material and Cost	2
4.5	Packaging as Unitization	1
4.6	Consumer and Industrial Packaging	2
4.7	Maintainability and availability – simple problems.	1
5.0	**Current Trends**	
5.1	E-Logistics Structure and Operation	2
5.2	Logistics Resource Management	1
5.3	Automatic Identification Technologies	2
5.4	Warehouse Simulation	1
5.5	Reverse Logistics - Global Logistics	1
5.6	Strategic logistics Planning	2

Course Designer(s)

1. Mr.C.Ramesh – rameshc@ksrct.ac.in

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60 ME L06	Power Generation Engineering	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To describe the current energy scenario and basics of thermal power plant.
- To infer knowledge on working of nuclear power plant.
- To infer knowledge on working of hydro power plant.
- To apply the concept of diesel and gas turbine power plant.
- To utilize renewable energy sources in power plants

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Demonstrate the layout, construction and working of the components inside a thermal power plant	Understand
CO2	Recognise the basic knowledge on nuclear processes and working of nuclear power plants with their layouts	Understand
CO3	Recognise the basic knowledge on hydro power generation processes and working of various types of hydro turbines	Understand
CO4	Apply the working principle of gas and diesel power plants	Apply
CO5	Illustrate the layout, construction and working of the components inside renewable energy power plants.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	3	3	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	3	3	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	3	3	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	3	3	-	-	-	2	2	-	3	-
CO5	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	20	20	20
Understand	40	30	60
Apply	-	10	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME L06 - Power Generation Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Energy Scenario and Thermal Power Plant* Indian and Global Energy Scenario, -Environmental Issues of Present Day Power Generation- Thermal Power Plant-Layout of Thermal Power Plant – Selection Criteria – Coal and Ash Handling Systems. Pulverisers –Stokers – Types– Electrostatic Precipitator (ESP) and Cooling Towers	[9]
Nuclear Power Plant* Nuclear Energy- Fuels and Nuclear Reactions – Types of Reactors - Radioactivity – Fission Process – Reaction Rates – Diffusion Theory- Components and Layout of Nuclear Power Plant – Pressurized Water Reactor – Boiling Water Reactor – Fast Breeder Reactor – Radioactive Waste Disposal.	[9]
Hydroelectric Power Plant** Hydro-Electric Power Plant- Site Selection – Components and Layout – Classification of Turbines – Working Principle of Pelton Turbine – Francis Turbine – Kaplan Turbine Advantages – Mini and Micro Hydel Plants.	[9]
Gas Turbine and Diesel Power Plant* Gas Turbine Power Plant: Gas Turbine Cycles - Thermodynamic Analysis of Cycles - Reheating - Regeneration and Intercooling - Layout of Gas Turbine Power Plant-Selection Criteria - Binary and Combined Cycle - IGCC. Diesel Power Plant: Layout – Types - Selection Criteria– Applications and Advantages.	[9]
Non-Conventional Power Plants** Layout and Components: Magneto Hydro Dynamic (Mhd) Power Plant – Geothermal Power Generation, Dry Steam, Flash Steam, and Binary Cycle – Ocean Thermal Energy Conversion (Otec) – Tidal Power Generation – Wind Energy Power Generation – Solar Photo Voltaic (Spv) –Bio-Solar Cells – Solar Energy Harvesting Trees.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Arora, S. C., and Domkundwar, S., “A course in Power Plant Engineering”, 8th Edition, Dhanpatrai Publications Ltd., New Delhi, 2016
2.	Rajput R.K, "Power Plant Engineering", 5th Edition, Laxmi Publications, New Delhi, 2016.
Reference(s):	
1.	Rai,G.D. “Introduction to Power Plant Technology”, 11th reprint, Khanna Publishers, 2013
2.	Hegde, R K., “Power Plant Engineering”, 1st edition, Pearson education India, New Delhi, 2015.
3.	Rajput R.K., “Power Plant Engineering”, 4th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016.
4.	Nag, P K., “Power Plant Engineering”, 4th edition, Tata McGraw-Hill, New Delhi, 2014.
5.	NPTEL Video link: https://archive.nptel.ac.in/courses/112/107/112107291/

*SDG 9 – Industry Innovation and Infrastructure

**SDG 7 Affordable and clean energy

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Energy scenario and steam power plant**	
1.1	Indian and Global energy scenario	1
1.2	environmental issues of present day power generation	2
1.3	Thermal power plant-Layout of thermal power plant	2
1.4	Selection Criteria – coal and Ash Handling systems	1
1.5	Pulverisers	1
1.6	Stokers – Types	2
1.7	Electrostatic precipitator(ESP) and cooling towers	1
2.0	**Nuclear Power Plants**	
2.1	Nuclear Energy	1
2.2	Fuels and Nuclear reactions – Types of Reactors	1
2.3	Radioactivity – Fission Process – Reaction Rates	1
2.4	Diffusion Theory- Components and Layout of nuclear power plant	2
2.5	Pressurized Water Reactor	1
2.6	Boiling Water Reactor	1
2.7	Fast Breeder Reactor	1
2.8	Radioactive waste disposal.	1
3.0	**Hydro-electric Power Plant**	
3.1	Site selection	1
3.2	Components and Layout	1
3.3	Classification of turbines - Advantages	1
3.4	Working principle of Pelton turbine	1
3.5	Francis turbine	1
3.6	Kaplan turbine	1
3.7	and BulP turbine	1
3.8	Mini and micro hydel plants	1
3.9	Comparison between pelton wheel and Kaplan turbine	1
4.0	**Gas Turbine and Diesel Power Plant**	
4.1	Gas Turbine Cycles	1
4.2	Thermodynamic Analysis of Cycles	1
4.3	Reheating - Regeneration and Intercooling	2
4.4	Layout of Gas Turbine Power Plant- Selection Criteria	1
4.5	Binary and Combined Cycle - IGCC	2
4.6	Diesel Power Plant: Layout –Types - Selection Criteria	1
4.7	Application and advantages.	1
5.0	**Non-Conventional Power Plants**	
5.1	Layout and components: Magneto Hydro Dynamic (MHD) power plant	1
5.2	Geothermal power generation, Dry steam	1
5.3	flash steam, and binary cycle	1
5.4	binary cycle – Ocean thermal energy conversion (OTEC)	1
5.5	Tidal power generation – Wind energy power generation	2
5.6	Solar photo voltaic (SPV)	1
5.7	Bio-solar cells	1
5.8	Solar energy harvesting trees.	1

Course Designer(s)

1. Dr.A.Murugesan-murugesana@ksrct.ac.in
2. Dr.M.Gnanaseakran – gnanasekaran@ksrct.ac.in

60 ME L07	Green Energy Sources	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To know the energy scenario and potential of renewable energy
- To learn the various solar energy technology and its applications
- To educate the various wind energy technology
- To explore the various bio-energy technology
- To provide knowledge about the ocean and geothermal technologies.

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Discuss the energy scenario and potential of renewable energy	Understand
CO2	Describe the various solar energy technology and its applications	Apply
CO3	Explain the various wind turbine technology	Understand
CO4	Explore the various bio-energy technology	Understand
CO5	Discuss the ocean and geothermal technologies.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	3	3	-	-	-	-	3	3	-
CO2	3	3	3	-	-	-	3	3	-	-	-	-	2	3	-
CO3	3	2	-	-	-	-	3	3	-	-	-	-	2	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)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	30	40	60
Apply	10	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Mechanical Engineering								
60 ME L07 - Green Energy Sources								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV/V/VI	3	0	0	45	3	40	60	100

Energy Scenario Energy Scenario in India — Domestic, Industrial, Commercial, Agriculture, Transportation and Others – Present Conventional Energy Status – Present Green Energy Status- Potential of Various Green Energy Sources-Global Energy Status-Per Capita Energy Consumption-Future Energy Plans.	[9]
Solar Energy* Solar Energy: Solar Radiation-Measurements of Solar Radiation and Sunshine - Solar Thermal Collectors –Flat Plate and Concentrating Collectors-Fundamentals of Solar Photo Voltaic Conversion–Solar Pv Systems-Types-Design of a Standalone Solar Pv System - Solar Pv and Thermal Applications - Building Integrated Solar-Leadership in Energy Environment Design (Leed) Certification- Challenges - Economics.	[9]
Wind Energy* Wind Data and Energy Estimation – Betz Limit - Site Selection for Wind Farms – Characteristics - Wind Resource Assessment - Horizontal Axis Wind Turbine – Components - Vertical Axis Wind Turbine –Wind Turbine Generators and its Performance – Hybrid Systems – Environmental Issues - Applications.	[9]
Biomass Energy* Bio Resources–Bio Mass Direct Combustion–Thermo Chemical Conversion-Bio Chemical Conversion- Mechanical Conversion - Biomass Gasifier - Types - Cogeneration –- Carbonisation – Pyrolysis - Biogas Plants – Digesters –Biodiesel Production – Ethanol and Methanol Production - Applications	[9]
Ocean and Geothermal Energy* Small Hydro - Tidal Energy — Wave Energy — Open and Closed OTEC Cycles — Limitations — Geothermal Energy – Geothermal Energy Sources - Types of Geothermal Power Plants – Applications- Environmental Impact.	[9]
Total Hours:	**45**

Text Book(s):

1.	Rai, G.D. “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2020
2.	Sukhatme, S.P. “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2016

Reference(s):

1.	Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 2012
2.	Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 3rd Edition, 2015.
3.	Tiwari, G.N. “Solar Energy – Fundamentals Design, Modeling and applications”, Narosa Publishing House, New Delhi, 2013.
4.	Gary L.Johnson, “Wind Energy Systems”, Prentice Hall, New York, 2008
5.	NPTEL Video link: https://onlinecourses.nptel.ac.in/noc22_ch27/preview

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Energy scenario**	
1.1	Energy scenario in India	1
1.2	domestic, industrial, commercial, agriculture, transportation and others	2
1.3	Present conventional energy status	2
1.4	Potential of various green energy sources	1
1.5	Global energy status	1
1.6	Per capita energy consumption-Future energy plans - Future energy plans	2
2.0	**Solar Energy**	
2.1	Solar Radiation — Measurements of Solar Radiation and Sunshine	1
2.2	Solar Thermal Collectors	1
2.3	Flat Plate and Concentrating Collectors	1
2.4	Fundamentals o fSola rPhoto Voltaic Conversion	1
2.5	Solar PVSystems-Types-Design of a Standalone Solar PV System	1
2.6	Solar PV and Thermal Applications	1
2.7	Building Integrated Solar- Leadership in Energy Environment Design(LEED) Certification	2
2.8	Challenges - Economics	1
3.0	**Wind Energy**	
3.1	Wind data and energy estimation	1
3.2	Betz limit - Site selection for wind farms – characteristics	1
3.3	Wind resource assessment	1
3.4	Horizontal axis wind turbine – components	1
3.5	Vertical axis wind turbine	1
3.6	Wind turbine generators and its performance	2
3.7	Hybrid systems	1
3.8	Environmental issues - Applications.	1
4.0	**Biomass Energy**	
4.1	Bio resources	1
4.2	Biomass direct combustion–thermochemical conversion	1
4.3	Biochemical conversion- mechanical conversion	1
4.4	Biomass gasifier - Types of biomass gasifiers	1
4.5	Cogeneration –- Carbonisation	1
4.6	Pyrolysis - Biogas plants – Digesters	1
4.7	Biodiesel production	1
4.8	Ethanol and methanol production - Applications	2
5.0	**Ocean and Geothermal Energy**	
5.1	Small hydro - Tidal energy — Wave energy	2
5.2	Open and closed OTEC Cycles	1
5.3	Limitations	1
5.4	Geothermal energy – Geothermal energy sources	1
5.5	Types of geothermal power plants – Applications- Environmental impact.	2
5.6	Applications- Environmental impact.	2

Course Designer(s)

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