

# **K. S. Rangasamy College of Technology**

**(Autonomous)**



## **CURRICULUM**

**of**

## **B.E. Mechanical Engineering**

**(For the batch admitted in 2023– 2024)**

**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 ENGINEERING

### 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 PROGRAMME OUTCOMES (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	PO												PSO		
			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	3	3	2	3							2		3	
		Engineering Physics	3	3	2	2			3	3		2		2	2	2	
		Chemistry for Mechanical Sciences	3	2	2	2.3	2.5	1.5	1.8	1				2	2.3	2.2	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	2.6	2.5	2.6			2	3	3	2	2	2	2	2.2	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	3	2.6	2.4	2.6							2	3	2	
		C Programming	3	3	3		3				2	2		2	3	3	
		Engineering Drawing	3	2.8	3		3			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 (தமிழரும் தொழில்நுட்பமும்)							3	3		2		3			
		Fabrication and Reverse Engineering Laboratory	3	3	2.8	2.5	3	2.3	2.3	2.2	3	2.7	2	3	3	1	2
		C Programming Laboratory	3	3	3		3				2	2		2	3	3	
		Career Skill Development - I								2	3	3	2	3		2	2
		Internship#															
II	III	Statistics and Numerical Methods	3	3	3	2.6	2.6							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	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
		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
		Professional Elective -I														
		Open Elective – I														
		Start-ups & Entrepreneurship	2.8	2.6	3	2.4	2.2	2.5	1.7	1.8	1.3	2.0	2.2	2.4	2.7	2.8
		NCC/NSS/NSO/YR C/RRC/Fine Arts%														
		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
		Career Skill Development - IV								2	3	3	2	3		2
		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
		Design of Mechanical Transmission Systems	3	3	3	3	1			1				1	2.4	1.8
		Professional Elective – II														
		Professional Elective – III														
		Open Elective - II														
		NCC/NSS/NSO/YR C/RRC/Fine Arts%														
		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
		Mini-project														
		Comprehension Test	3	3	2	2					1	2	2	3		3
		Internship#														

# K. S. RANGASAMY COLLEGE OF TECHNOLOGY

## Credit Distribution for B.E (MECH) Programme –2023 –2024 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	3	-	-	-	-	-	19	11.58
3	ES	5	15	3	-	-	-	-	-	23	14.02
4	PC	-	-	17	23	15	15	11	-	81	49.39
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 I	AC II	-	-
<b>Total</b>		<b>19</b>	<b>21</b>	<b>23</b>	<b>23</b>	<b>21</b>	<b>24</b>	<b>22</b>	<b>11</b>	<b>164</b>	<b>100</b>

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 – COMPREHENSION 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.

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215  
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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	4	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	4	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.	60 MA 007	Statistics and Numerical Methods	BS	4	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.	60 ME 001	Engineering Drawing	ES	6	2	0	4	4	-NIL-
3.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2	-NIL-
4.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2	-NIL-
5.	60 ME 004	Engineering Mechanics	ES	4	3	1	0	4	-NIL-
6.	60 EE 001	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3	-NIL-
7.	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2	-NIL-
8.	60 EE 004	Electrical Drives and Control	ES	3	3	0	0	3	Basic Electrical and Electronics Engineering
9.	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	4	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.	60 ME 406	Applied Hydraulics and Pneumatics	PC	4	2	0	2	3	Fluid Mechanics
12.	60 ME 4P1	Strength of Materials and Fluid Machinery Laboratory	PC	4	0	0	4	2	Strength of Materials, Fluid Mechanics
13.	60 ME 4P2	Manufacturing and Machining Processes Laboratory	PC	4	0	0	4	2	Computer Integrated Machining Processes
14.	60 ME 501	Automobile Engineering	PC	4	2	0	2	3	Thermal Engineering
15.	60 ME 502	Dynamics of Machines	PC	4	3	1	0	4	Kinematics of Machines
16.	60 ME 503	Design of Machine Elements	PC	4	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 601	Heat and Mass Transfer	PC	3	3	0	0	3	Thermodynamics, Thermal Engineering
20.	60 ME 602	Mechatronics and Robotics	PC	3	3	0	0	3	Kinematics of Machines, Dynamics of Machines



21.	60 ME 603	Design of Mechanical Transmission Systems	PC	4	3	1	0	4	Design of Machine Elements
22.	60 ME 6P1	Heat Transfer Laboratory	PC	4	0	0	4	2	Thermal Engineering Laboratory
23.	60 ME 6P2	Mechatronics Laboratory	PC	4	0	0	4	2	Applied Hydraulics and Pneumatics
24.	60 ME 701	Machine Learning	PC	3	3	0	0	3	Mathematics
25.	60 ME 702	Finite Element Analysis	PC	4	3	1	0	4	Mathematics
26.	60 ME 703	Operations Research	PC	3	3	0	0	3	Mathematics
27.	60 ME 7P1	Analysis and Simulation Laboratory	PC	4	0	0	4	2	Mathematics

### PROFESSIONAL ELECTIVES (PE)

#### SEMESTER V, PROFESSIONAL ELECTIVE I

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 ME E11	Additive manufacturing	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 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	Design for Manufacture and Assembly	PE	4	2	0	2	3	Manufacturing Techniques,
4.	60 ME E24	Computational Fluid Dynamics	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	Production Planning and Control	PE	4	2	0	2	3	Statistics

### 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

### 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	Process Planning and Cost Estimation	PE	3	3	0	0	3	Machining Process
4.	60 ME E44	Flexible Manufacturing System	PE	3	3	0	0	3	Manufacturing Process
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

### 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-

### 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	Start-ups & Entrepreneurship	MC	2	2	0	0	0	-NIL-

### AUDIT COURSES (AC)

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

### 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-

### CAREER GUIDANCE COURSES (CG)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-requisite
1.	60 CG 0P1	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
1.	60 AB 001	National Cadet Corps (Air Wing)	HS	4	2	0	2	3	-NIL-
2.	60 AB 002	National Cadet Corps (Army Wing)	HS	4	2	0	2	3	-NIL-

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE -637215**  
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**COURSES OF STUDY**

(For the candidates admitted from 2023-2024 onwards)

**SEMESTER I**

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.		Induction Programme	-	-	-	-	-	0
<b>THEORY</b>								
2.	60 EN 001	Professional English – I	HS	3	1	0	2	2
3.	60 MA 001	Matrices and Calculus	BS	4	3	1	0	4
4.	60 PH 001	Engineering Physics	BS	3	3	0	0	3
5.	60 CH 001	Chemistry for Mechanical Sciences	BS	3	3	0	0	3
6.	60 EE 001	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
7.	60 GE 001	Heritage of Tamils (தமிழர் மரபு) &	GE	1	1	0	0	1&
<b>PRACTICALS</b>								
8.	60 CP 0P1	Physics and Chemistry Laboratory	BS	4	0	0	4	2
9.	60 EE 0P1	Basic Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2
<b>Total</b>				<b>25</b>	<b>14</b>	<b>1</b>	<b>10</b>	<b>19</b>

Heritage of Tamils& additional 1 credit is offered and not accounted for CGPA.

**I to VII semester**

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

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

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

**I to VIII semester**

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

**SEMESTER II**

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY</b>								
1.	60 EN 002	Professional English – II	HS	3	1	0	2	2
2.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	4	3	1	0	4
3.	60 CS 001	C Programming	ES	3	3	0	0	3
4.	60 ME 001	Engineering Drawing	ES	6	2	0	4	4
5.	60 ME 004	Engineering Mechanics	ES	4	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\$
<b>PRACTICALS</b>								
8.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2
9.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2
10.	60 CG 0P1	Career Skill Development – I	CG	2	0	0	2	1*
<b>Total</b>				<b>33</b>	<b>15</b>	<b>2</b>	<b>16</b>	<b>21</b>

Tamils and Technology\$ additional 1 credit is offered and not accounted for CGPA.

### SEMESTER III

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY</b>								
1.	60 MA 007	Statistics and Numerical Methods	BS	4	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 <sup>1</sup>	MC	3	3	0	0	3 <sup>1</sup>
<b>PRACTICALS</b>								
10.	60 EE 0P4	Electrical Drives and Control Laboratory	ES	4	0	0	4	2
11.	60ME 3P1	Computer Aided Machine Drawing Laboratory	PC	4	0	0	4	2
12.	60 CG 0P2	Career Skill Development - II	CG	2	0	0	2	1*
13	60 CG 0P6	Internship <sup>#</sup>	CG	-	-	-	-	3 <sup>#</sup>
<b>Total</b>				<b>32</b>	<b>21</b>	<b>1</b>	<b>10</b>	<b>23</b>

UHV<sup>1</sup> - 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
<b>THEORY</b>								
1.	60 ME 401	Fluid Mechanics and Fluid Machines	PC	4	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.	60 ME 406	Applied Hydraulics and Pneumatics	PC	4	2	0	2	3
7.	60 OE L1*	Open Elective – I	OE	3	3	0	0	3
<b>PRACTICALS</b>								
8.	60 ME 4P1	Strength of Materials and Fluid Machinery Laboratory	PC	4	0	0	4	2
9.	60 ME 4P2	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 <sup>#</sup>	CG	-	-	-	-	1/2/3 <sup>#</sup>
<b>Total</b>				<b>33</b>	<b>20</b>	<b>1</b>	<b>12</b>	<b>26</b>

### SEMESTER V

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY</b>								
1.	60 ME 501	Automobile Engineering	PC	4	2	0	2	3
2.	60 ME 502	Dynamics of Machines	PC	4	3	1	0	4
3.	60 ME 503	Design of Machine Elements	PC	4	3	1	0	4
4.	60 ME E1*	Professional Elective -I	PE	3	3	0	0	3
5.	60 ME L2*	Open Elective – II	OE	3	3	0	0	3
6.	60 MY 003	Start-ups & Entrepreneurship	MC	2	2	0	0	0
7.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts <sup>1</sup>	HS	4 <sup>1</sup>	2 <sup>1</sup>	0	2 <sup>1</sup>	3 <sup>1</sup>
<b>PRACTICALS</b>								
8.	60 ME5P1	Thermal Engineering Laboratory	PC	4	0	0	4	2
9.	60 ME5P2	Metrology and Dynamics Laboratory	PC	4	0	0	4	2
10.	60 CG 0P4	Career Skill Development - IV	CG	2	0	0	2	1*
11.	60 CG 0P6	Internship <sup>#</sup>	CG	-	-	-	-	3 <sup>#</sup>
<b>Total</b>				<b>30</b>	<b>16</b>	<b>2</b>	<b>12</b>	<b>21</b>

### SEMESTER VI

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY</b>								
1.	60 ME 601	Heat and Mass Transfer	PC	3	3	0	0	3
2.	60 ME 602	Finite Element Analysis	PC	4	3	1	0	4
3.	60 ME 603	Design of Mechanical Transmission Systems	PC	4	3	1	0	4
4.	60 ME E2*	Professional Elective – II	PE	3	3	0	0	3
5.	60 ME E3*	Professional Elective – III	PE	3	3	0	0	3
6.	60 ME L3*	Open Elective - III	OE	3	3	0	0	3
7.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts <sup>1</sup>	HS	4 <sup>1</sup>	2 <sup>1</sup>	0	2 <sup>1</sup>	3 <sup>1</sup>
<b>PRACTICALS</b>								
8.	60 ME 6P1	Heat Transfer Laboratory	PC	4	0	0	4	2
9.	60 ME 6P2	Analysis and Simulation Laboratory	PC	4	0	0	4	2
10.	60 ME 6P3	Mini-project <sup>^</sup>	PC	-	-	-	-	1 <sup>^</sup>
11.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*
12.	60 CG 0P6	Internship <sup>#</sup>	CG	-	-	-	-	1/2/3 <sup>#</sup>
<b>Total</b>				<b>30</b>	<b>18</b>	<b>2</b>	<b>10</b>	<b>24</b>

NCC/NSS/NSO/YRC/RRC/Fine Arts<sup>1</sup> - 3 additional credit is offered and not accounted for CGPA calculation

Comprehension Test\* - one additional credit is offered and not accounted for CGPA calculation.

Mini-project<sup>^</sup> - 1 additional credit is offered and not accounted for CGPA calculation

### SEMESTER VII

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY</b>								
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 Methodology - I	AC	1	1	0	0	0
7.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts <sup>!</sup>	HS	4 <sup>!</sup>	2 <sup>!</sup>	0	2 <sup>!</sup>	3 <sup>!</sup>
<b>PRACTICALS</b>								
8.	60 ME 7P1	Mechatronics Laboratory	PC	4	0	0	4	2
9.	60 ME 7P2	Project Work - Phase I	CG	4	0	0	4	2
10.	60 CG 0P6	Internship <sup>#</sup>	CG	-	-	-	-	1/2/3 <sup>#</sup>
<b>Total</b>				<b>24</b>	<b>16</b>	<b>0</b>	<b>8</b>	<b>19</b>

NCC<sup>!</sup> - Course can be waived with 3 credits in VII semester or offered as extra 3 credits.

NSS/NSO/YRC/RRC/Fine Arts<sup>!</sup> 3 extra credits not accounted for CGPA

### SEMESTER VIII

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
<b>THEORY</b>								
1.	60 ME E5*	Professional Elective – V	PE	3	3	0	0	3
2.	60 AC 002	Research Methodology - II	AC	1	1	0	0	0
<b>PRACTICALS</b>								
3.	60 ME 8P1	Project Work – Phase II	CG	16	0	0	16	8
4.	60 CG 0P6	Internship <sup>#</sup>	CG	-	-	-	-	1/2/3 <sup>#</sup>
<b>Total</b>				<b>20</b>	<b>4</b>	<b>0</b>	<b>16</b>	<b>11</b>

**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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**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 from 2023-2024 onwards)

**FIRST 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 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	60 GE 001	Heritage of Tamils (தமிழர் மரபு)	2	100	-	100	-	-
PRACTICAL								
7	60 CP 0P1	Physics and Chemistry Laboratory	3	60	40	100	45	100
8	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 the award of terminal examination marks.



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

### Prerequisite

Basic knowledge of reading and writing in English.

### Course Outcomes

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

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

### Mapping with Programme Outcomes

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


### Assessment Pattern

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

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## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
Professional English I								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	2	45	2	40	60	100
<b>Introduction to Fundamentals of Communication</b> <b>Listening:</b> General information-specific details-conversation: introduction to classmates – audio / video (formal & informal). <b>Speaking:</b> Self Introduction; Introducing a friend; conversation - politeness strategies. <b>Reading:</b> Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. <b>Writing:</b> Writing letters – informal and formal – basics and format orientation <b>Language Focus:</b> Present Tenses; word formation (affixes); synonyms, antonyms and contronyms, and phrasal verbs; abbreviations & acronyms (as used in technical contexts).								[9]
<b>Narration and Summation</b> <b>Listening:</b> Podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities. <b>Speaking:</b> Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews. <b>Reading:</b> Biographies, travelogues, newspaper reports, excerpts from literature, and travel & technical blogs. <b>Writing:</b> Paragraph writing, short report on an event (field trip etc.). <b>Language Focus:</b> Past tenses and prepositions; One-word substitution.								[9]
<b>Description of a process / product</b> <b>Listening:</b> Listen to a product and process descriptions; advertisements about products or services <b>Speaking:</b> Picture description; giving instruction to use the product; presenting a product. <b>Reading:</b> Advertisements, gadget reviews and user manuals. <b>Writing:</b> Definitions; instructions; and product /process description. <b>Language Focus:</b> Imperatives; comparative adjectives; future tenses. Homonyms; and Homophones, discourse markers (connectives & sequence words)								[9]
<b>Classification and Recommendations</b> <b>Listening:</b> TED Talks; scientific lectures; and educational videos. <b>Speaking:</b> Small Talk; Mini presentations <b>Reading:</b> Newspaper articles and Journal reports <b>Writing:</b> Note-making / Note-taking; recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode) <b>Language Focus:</b> Articles; Pronouns -Possessive & Relative pronouns; ; subject-verb agreement; collocations.								[9]
<b>Expression</b> <b>Listening:</b> Debates/ discussions; different viewpoints on an issue; and panel discussions. <b>Speaking:</b> Group discussions, debates & role plays. <b>Reading:</b> Editorials; and opinion blogs. <b>Writing:</b> Essay Writing (Descriptive or narrative). <b>Language Focus:</b> Punctuation; Compound Nouns; simple, compound & complex sentences. Cause & effect expressions.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Textbook(s):</b>								
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							
<b>Reference(s):</b>								
1.	Paul Emmerson and Nick Hamilton, 'Five Minute Activities for Business English', Cambridge University							

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	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
3.	Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, 'A Course Book on Technical English' Scitech Publications (India) Pvt. Ltd. 2020

#### SDG- 04- Quality Education


#### Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
<b>1</b>	<b>Introduction to Fundamentals of Communication</b>	
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 contronyms, and affixes	1
1.9	phrasal verbs; abbreviations & acronyms	1
<b>2</b>	<b>Narration and Summation</b>	
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
<b>3</b>	<b>Description of a process / product</b>	
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
<b>4</b>	<b>Classification and Recommendations</b>	
4.1	Listening to TED Talks and educational videos	1
4.2	Listening to scientific lectures	1

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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	<b>Expression</b>	
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
	<b>Total</b>	<b>45</b>

#### Course Designer(s)

1. Dr.A.Palaniappan - [palaniappan@ksrct.ac.in](mailto:palaniappan@ksrct.ac.in)

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.	Remember, Understand Apply
CO2	Apply the concepts of differentiation in solving various Engineering problems..	Remember, Understand, Apply
CO3	Obtain Jacobians and maxima and minima of functions of two variables.	Remember, Understand, Apply
CO4	Employ various methods in solving differential equations	Remember, Understand, Apply
CO5	Apply different techniques to evaluate definite and indefinite integrals.	Remember, Understand, Apply

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 MA 001- Matrices and Calculus								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT, AI&DS, AI&ML								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100
<b>Matrices</b> Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem-Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by an Orthogonal transformation - Nature of quadratic form - Applications: Stretching of an elastic membrane.								[9+3]
<b>Differentiation</b> Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Successive Differentiation-Leibnitz's theorem- <b>Applications: Maxima and Minima of functions of one variable*.</b>								[9+3]
<b>Functions of Several Variables</b> Partial differentiation - Homogeneous functions and Euler's theorem - Jacobians - Taylor's series for functions of two variables - <b>Applications: Maxima and minima of functions of two variables - Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers*.</b>								[9+3]
<b>Differential Equations</b> 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.								[9+3]
<b>Integration</b> 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.								[9+3]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Grewal B.S, "Higher Engineering Mathematics", 44 <sup>th</sup> Edition, Khanna Publishers, Delhi, 2017.							
2	Kreyszig Erwin, "Advanced Engineering Mathematics", 10 <sup>th</sup> Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.							
<b>Reference(s):</b>								
1.	Dass H.K, "Higher Engineering Mathematics", 3 <sup>rd</sup> (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.							
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1 <sup>st</sup> 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",10 <sup>th</sup> Edition, Laxmi Publications (P) Ltd. 2016.							

**\*SDG: 4 – Quality Education**

## Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
<b>1</b>	<b>Matrices</b>	
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	Tutorial	2
1.6	Orthogonal transformation of a symmetric matrix to diagonal form	1
1.7	Reduction of quadratic form to canonical form by Orthogonal transformation	1
1.8	Nature of quadratic form	1
1.9	Stretching of an elastic membrane	1
1.10	Tutorial	2
<b>2</b>	<b>Differentiation</b>	
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	Tutorial	2
2.6	Leibnitz's theorem	1
2.7	Maxima and minima of functions of one variable	2
2.8	Tutorial	2
<b>3</b>	<b>Functions of Several Variables</b>	
3.1	Partial differentiation	1
3.2	Homogeneous functions and Euler's theorem	1
3.3	Jacobians	2
3.4	Tutorial	2
3.5	Taylor's series for functions of two variables	1
3.6	Maxima and minima of functions of two variables	1
3.7	Lagrange's Method of Undetermined Multipliers	2
3.8	Tutorial	2
<b>4</b>	<b>Differential Equations</b>	
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	Tutorial	2
4.4	Differential equations with variable coefficients: Cauchy's form of linear equations	2
4.5	Differential equations with variable coefficients: Legendre's form of linear equations	2
4.6	Method of variation of parameters	1
4.7	Tutorial	2

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<b>5</b>	<b>Integration</b>	
5.1	Definite and Indefinite integrals	1
5.2	Substitution rule	1
5.3	Techniques of Integration: Integration by parts	1
5.4	Integration of rational functions by partial fraction	1
5.5	Tutorial	2
5.6	Integration of irrational functions	1
5.7	Improper integrals	1
5.8	Hydrostatic force.	1
5.9	Pressure, moments and centres of mass.	1
5.10	Tutorial	2
	<b>Total</b>	<b>60</b>

### Course Designer(s)

1. Dr.C.Chandran - [cchandran@ksrct.ac.in](mailto:cchandran@ksrct.ac.in)
2. Mr. G.Mohan - [mohan@ksrct.ac.in](mailto:mohan@ksrct.ac.in)

### List of MATLAB Programmes:

1. Introduction to MATLAB.
2. Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank.
3. Solution of system of linear equations.
4. Compute of Eigen values and Eigen vectors of a Matrix.
5. Solve first and second order ordinary differential equations.
6. Compute Maxima and Minima of a function of one variable.



60 PH 001	Engineering Physics Common to Mech & MCT	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	Comprehend the basics of crystallography and its importance for varied materials properties	Understand, Apply & Analyse
CO2	Assess the fundamentals of optics, laser technology and apply the concepts in industry	Understand & Apply
CO3	Impart the knowledge on magnetic properties of materials and their applications in sensors	Understand & Apply
CO4	Interpret the properties of advanced materials and nanomaterials for potential applications	Apply & Analyse
CO5	Recognize the next generation energy device and its applications in electric vehicles	Understand & Apply

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

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

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Evaluate	0	0	0	0
Create	0	0	0	0

### Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 PH 001– Engineering Physics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	C	ES	Total
I	3	0	0	4	3	40	60	100
<b>Crystal Physics*</b> 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]
<b>Optics and Laser Technology*</b> <b>Optics:</b> 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. <b>Laser:</b> Theory of laser - characteristics -Einstein’scoefficients-populationinversion-Nd-YAGlaser,CO <sub>2</sub> laser - Applications of lasers in industry: Drilling, welding, cutting micro machining, measurement of long distances and IR Thermography.								[9]
<b>Magnetic Materials and Dielectric Materials*</b> <b>Magnetic Materials:</b> Origin of magnetic moment-Bohrmagnetron – Classification of magnetic materials – Domain theory-Hysteresis-soft and hard magnetic materials- Applications-Giant Magneto Resistance ( <i>GMR</i> ). <b>Dielectric Materials:</b> Polarization-Electronic, ionic, orientational and space charge – Frequency and Temperature dependence of polarization-Break down mechanisms –Applications of dielectrics in Capacitor and Transformer.								[9]
<b>Advanced Materials and Nanotechnology*</b> <b>Advanced Materials:</b> Metallic glasses-preparation properties and applications-Shape memory alloys (SMA) -characteristics, properties of NiTi alloy applications. <b>Nano Technology:</b> 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]
<b>Next Generation Energy Device**</b> 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]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	M.N.Avadhanulu, P.G.Kshirsagar, TVS Arun Murthy, “A Text Book of Engineering Physics”, S.Chand Publications, NewDelhi, 2022.							
2	H.K.Malik, A.K.Singh “Engineering Physics ”McGraw Hill Education Private Limited, NewDelhi							
3	D.R.Joshi“ Engineering Physics ”McGraw Hill Education Private Limited, New Delhi.2010							
<b>Reference(s):</b>								
1.	S.O. Pillai “A Textbook of Engineering Physics”, New Age International (P) Limited, New Delhi, 2014. B. R. Puri, L.R. Sharma, and S. P. Madan. Principles of Physical Chemistry: Vishal Publishing Company. Gumber Market, Old Railway Road, Jalandhar							
2.	B.B.Laud “Lasers and Non-Linear Optics” New Age International Publications, NewDelhi, 2015 B.S. Bahl, G.D. Tuli. Arun Bahl. Essentials of Physical Chemistry. S.Chand and Company, Ltd. New Delhi.							

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3.	S. Rajagopal, R. Pulapparambil Vallikkattil, M. Mohamed Ibrahim, D.G.Velev, Electrode Materials for Supercapacitors in Hybrid Electric Vehicles: Challenges and Current Progress. Condens. Matter 2022, 7, 6. <a href="https://doi.org/10.3390/condmat7010006">https://doi.org/10.3390/condmat7010006</a>
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\* **SDG:4- Quality Education**

\*\* **SDG:7 – Affordable and sustainable energy**


### Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	<b>Crystal physics</b>	
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	<b>Optics and Laser Technology</b>	
2.1	<b>Optics:</b> 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	<b>Laser:</b> Theory of laser - characteristics.	1
2.6	Einstein's coefficients- Population inversion	1
2.7	Nd-YAG laser, CO <sub>2</sub> laser	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	<b>Magnetic and Dielectric Materials</b>	
3.1	<b>Magnetic Materials:</b> Origin of magnetic moment-Bohr magneton	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	<b>Dielectric Materials:</b> Polarization-Electronic, ionic, orientational and space charge	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	<b>Advanced Materials and Nano Technology.</b>	
4.1	<b>Advanced Materials:</b> Metallic glasses-preparation, properties and applications	2
4.2	Shape memory alloys (SMA) -characteristics, properties of NiTi alloy applications	2
4.3	<b>Nano Technology:</b> 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

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4.6	Mechanical reinforcement & Sensors	1
5.0	<b>Next Generation Energy Device</b>	
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
2. Dr. M. Malarvizhi
3. Mr.S. Vanchinathan
4. Dr.P. Suthanthira Kumar

60 CH 001	Chemistry for Mechanical Sciences (Common to Mechanical and Mechatronics)	Category	L	T	P	Credit
		BS	3	0	0	3

### Objectives

- To help the learners, analyze the hardness of water and its removal.
- To endow an overview corrosion and its control.
- To rationalize the types of engineering materials.
- To analyze the concepts of advanced materials and its applications.
- To recall the basics of fuel and combustion technique.

### Pre-requisite

-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.	Understand, Apply & Analyse
CO2	Understand the concept of electrochemistry, corrosion and its control	Understand & Apply
CO3	Deduce the application of protective coatings	Apply
CO4	Interpret the principles of sensors in various applications.	Apply & Analyse
CO5	Recognize the types of batteries and fuel cells.	Understand

### Mapping with Programme Outcomes


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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

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

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## Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 CH 001- Chemistry for Mechanical Sciences								
(Common to Mechanical and Mechatronics)								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100
<b>Water Technology*</b> Introduction – Commercial and industrial uses of water - hardness - types – estimation of hardness by EDTA method- Internal conditioning (colloidal, phosphate, calgon and carbonate conditioning methods) – external conditioning (Zeolite process, demineralization process) - Desalination methods (Reverse Osmosis and Electro dialysis). Flash evaporation.								[7]
<b>Electrochemistry and Corrosion***</b> 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).								[10]
<b>Protective Coatings***</b> 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 – electro phoretic painting in automotive industry, technology of electro priming – Electrochemical etching for conductors and semiconductors – Electroforming – Electro winning of Aluminium – Anodizing of Aluminium.								[9]
<b>Chemical Sensors***</b> Sensors – Chemical Sensors – Characteristics – Elements and Characterization - Potentiometric Sensors - Amperometric Sensors – Sensors Based on Electrochemical Methods – Electrochemical Biosensors – Optical Biosensors : Enzyme Sensors – Bio affinity Sensors - DNA Sensors. Chemical Sensors as Detectors and Indicators: Indicators for Titration Processes – Separation Methods. Nano technology in chemical sensors.								[10]
<b>Energy Storage Devices** *** *****</b> 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]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	O.G. Palanna “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2017.							
2.	Jain. P.C. and Monica Jain, “A Text book of Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 16 <sup>th</sup> edition, 2015.							
<b>Reference(s):</b>								
1.	Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 14 <sup>th</sup> edition 2015.							
2.	Dara. S.S, “A Text Book of Engineering Chemistry”, S Chand & co. Ltd., 2014.							
3.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.							
4.	Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi. 2nd 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.	Topic	No. of hours
1.0	<b>Water Technology</b>	
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 & Demineralization process)	1
1.6	Desalination methods (Reverse Osmosis and Electrodialysis)	1
1.7	Flash Evaporation	1
2.0	<b>Electrochemistry and Corrosion</b>	
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	2
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	<b>Protective Coatings</b>	
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 – electro phoretic 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	<b>Chemical Sensors</b>	
4.1	Sensors – Chemical Sensors - Characteristics	1
4.2	Elements and Characterization	1
4.3	Potentiometric Sensors, Amperometric Sensors	1
4.4	Sensors Based on Electrochemical Methods	1
4.5	Electrochemical Biosensors	1
4.6	Optical Biosensors : Enzyme Sensors – Bio affinity Sensors	1
4.7	DNA Sensors. Chemical Sensors as Detectors and Indicators	1
4.8	Indicators for Titration Processes	1
4.9	Separation Methods. Nano technology in chemical sensors.	2
5.0	<b>Energy Storage Devices</b>	

5.1	Reversible and Irreversible Cells – Batteries - Types of Batteries.	2
5.2	Fabrication and Working of Alkaline Battery	1
5.3	Lead-Acid Battery	1
5.4	Ni-Cd-Lithium Ion Batteries	1
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
2. Dr.B.SRIVIDYA
3. Dr.K.PRABHA
4. Dr.S.MEENACHI
5. Mr.K.TAMILARASU
6. Ms.D.KIRTHIGA



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-requisite

-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.	Remember, Understand and Apply
CO2	Acquire knowledge on different electrical machines and select suitable machines for industrial applications.	Remember, Understand and Analyze
CO3	Recognize the significance of various components of low voltage electrical installations and create awareness on electrical safety.	Remember, Understand
CO4	Realize the operation and characteristics of semiconductor devices.	Remember, Understand and Analyze
CO5	Understand the operating principles of measuring instruments and choose suitable instrument for measuring the parameters.	Remember, Understand

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination(Marks)
	1	2	
Remember	10	20	30
Understand	20	25	30
Apply	20	10	30
Analyse	10	5	10
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 EE 001 - Basic Electrical and Electronics Engineering								
Common to CSE, IT, AIDS, AIML, MECH, MCT, BT, FT and CIVIL Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	3	3	40	60	100
<b>Electrical Circuits</b> 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								[10]
<b>Electrical Machines*</b> 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.								[10]
<b>Electrical Installations*</b> 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]
<b>Analog Electronics</b> Introduction to Semiconductor Materials– PN Junction Diodes, Zener Diode –Characteristics and Applications – Bipolar Junction Transistor-Biasing and Configuration (NPN) - <b>Regulated power supply unit, switched mode power supply*</b> .								[8]
<b>Measurements and Instrumentation</b> 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- <b>CT and PT, DSO- Block diagram- Data acquisition*</b> .								[8]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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

## Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	<b>Electrical Circuits</b>	
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	2
1.4	Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform	2

Rev. No.1/w.e.f. 02.01.2024

Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

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
<b>2</b>	<b>Electrical Machines</b>	
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	1
2.6	Types and Applications	1
2.7	Construction, Working principle and Applications of Transformer	1
2.8	Construction, Working principle and Applications of Three phase Alternator	1
2.9	Construction, Working principle and Applications of Synchronous motor	1
2.10	Construction, Working principle and Applications of Three Phase Induction Motor	1
<b>3</b>	<b>Electrical Installations</b>	
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
<b>4</b>	<b>Analog Electronics</b>	
4.1	Introduction to Semiconductor Materials	1
4.2	Characteristics and Applications of PN Junction Diodes	1
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
<b>5</b>	<b>Measurements and Instrumentation</b>	
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
5.9	DSO- Block diagram- Data acquisition	1
	<b>Total</b>	<b>45</b>

#### Course Designer(s)

1. Mr.S.Srinivasan - [srinivasan@ksrct.ac.in](mailto:srinivasan@ksrct.ac.in)
2. Ms.R.Radhamani - [radhamani@ksrct.ac.in](mailto:radhamani@ksrct.ac.in)
3. Ms.S.Jaividhya - [jaividhya@ksrct.ac.in](mailto:jaividhya@ksrct.ac.in)
4. Dr.S.Gomathi - [gomathi@ksrct.ac.in](mailto:gomathi@ksrct.ac.in)
5. Mr.T.Prabhu - [prabhut@ksrct.ac.in](mailto:prabhut@ksrct.ac.in)

60 GE 001	Heritage of Tamils <sup>&amp;</sup> (Common to all Branches )	Category	L	T	P	Credit
		GE	1	0	0	1 <sup>&amp;</sup>

### 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-requisite

-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

CO	PO												PSO		
	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-Low

### Assessment Pattern

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

## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 GE 001- Heritage of Tamils <sup>&amp;</sup>								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1	100	-	100
<b>Language and Literature</b> 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]								
<b>Heritage - Rock Art Paintings to Modern Art – Sculpture</b> 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]								
<b>Folk and Martial Arts</b> Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyilattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.								
[3]								
<b>Thinai Concept of Tamils</b> 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]								
<b>Contribution of Tamils to Indian National Movement and Indian Culture</b> 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]								
<b>Total Hours</b>								15
<b>Text Book(s):</b>								
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).							
2.	கணிதத்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).							
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).							
4.	பொருதை - 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 GE 001	தமிழர் மரபு	Category	L	T	P	Credit
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	(அனைத்து துறைகளுக்கும் பொதுவானது)	GE	1	0	0	1*
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#### பாடத்தின் நோக்கங்கள்:

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

#### முன்கூட்டிய துறைசார் அறிவு

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

CO	PO												PSO		
	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-Low

#### Assessment Pattern

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

## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 GE 001- தமிழர் மரபு								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	1	0	0	15	1	100	-	100
<b>மொழி மற்றும் இலக்கியம்:</b> 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 பெளத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.								
<b>மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை-சிற்பக் கலை:</b> 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.								
<b>நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:</b> தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.								
<b>தமிழர்களின் திணைக் கோட்பாடுகள்:</b> 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.								
<b>இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:</b> இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.								
<b>Total Hours</b>								15
<b>Text Book(s):</b>								
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.	பொருறை - 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-requisite

-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	Recall the knowledge of 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

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

3- Strong; 2-Medium; 1-Low

### Physics Laboratory (B.E CIVIL, MECH & MCT)

### List of Experiments

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

### Course Designer(s)

1. Dr. V.Vasudevan
2. Mr.S. Vanchinathan
3. Dr. P.Suthanthira kumar

### Chemistry Laboratory

Rev. No.1/w.e.f. 02.01.2024

Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

**(B.E CIVIL, MECH & MCT)**

**List of Experiments**

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

**Course Designer(s)**

1. Dr.T.A.SUKANTHA
2. Dr.B.SRIVIDHYA
3. Dr.K.PRABHA
4. Dr.S.MEENACHI

60 EE 0P1	<b>Basic Electrical and Electronics Engineering Laboratory</b> (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

### 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	Calculate the three-phase power measurement.	Apply
CO3	Analyze experimentally the load characteristics of electrical machines.	Analyze
CO4	Analyze the characteristics of basic electronic devices.	Analyze
CO5	Calibrate the measuring devices.	Analyze

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### 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](mailto:srinivasan@ksrct.ac.in)
2. Ms.R.Radhamani - [radhamani@ksrct.ac.in](mailto:radhamani@ksrct.ac.in)
3. Ms.S.Jaividhya - [jaividhya@ksrct.ac.in](mailto:jaividhya@ksrct.ac.in)
4. Dr.S.Gomathi - [gomathi@ksrct.ac.in](mailto:gomathi@ksrct.ac.in)
5. Mr.T.Prabhu - [prabhut@ksrct.ac.in](mailto:prabhut@ksrct.ac.in)

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

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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.

(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

### SCHEME OF EXAMINATIONS

(For the candidates admitted from 2023-2024 onwards)

#### 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	60 ME 001	Engineering Drawing	2	50	50	100	45	100
5	60 EE 001	Engineering Mechanics	2	40	60	100	45	100
6	60 MY 001	Environmental Studies and Climate Change	2	100	-	100	-	-
7	60 GE 002	Tamils and Technology (தமிழரும் தொழில் நுட்பமும்)	2	100	-	100	-	-
PRACTICAL								
8	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	3	60	40	100	45	100
9	60 CS 0P1	C Programming Laboratory	3	60	40	100	45	100
10	60 CG 0P1	Career Skill Development – I	-	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 the award of terminal examination marks.

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

### Objective

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

### Pre-requisite

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

### Course Outcomes

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

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

### Mapping with Programme Outcomes

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

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	10
Apply (Ap)	20	20	40
Analyse (An)	30	30	50
Create (Cr)	0	0	0
Total	60	60	100

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## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 EN 002 Professional English II								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P			CA	ES	Total
II	1	0	2	45	2	40	60	100
<b>Making Comparisons</b> <b>Listening:</b> Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) <b>Speaking:</b> Marketing a product, persuasive speech techniques. <b>Reading:</b> Reading advertisements, user manuals and brochures. <b>Writing:</b> Professional emails, Email etiquette - compare and contrast essay. <b>Language Focus:</b> mixed tenses, prepositional phrases, same words used in different contexts and discourse markers								[9]
<b>Expressing Causal Relations in Speaking and Writing</b> <b>Listening:</b> Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects. <b>Speaking:</b> Describing and discussing the reasons of accidents or disasters based on news reports. <b>Reading:</b> longer technical texts– cause and effect essays, and letters / emails of complaint, <b>Writing:</b> Writing responses to complaints <b>Language Focus:</b> Active Passive Voice transformations, Infinitive and Gerunds – Word Formation (Noun-Verb-Adj-Adv), Adverbs.								[9]
<b>Problem Solving</b> <b>Listening:</b> Listening to / watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. <b>Speaking:</b> Group Discussion (based on case studies), - techniques and Strategies. <b>Reading:</b> Case Studies, excerpts from literary texts, news reports etc. <b>Writing:</b> Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay <b>Language Focus:</b> Error correction; If conditional sentences - Compound Words, Sentence Completion.								[9]
<b>Reporting of Events and Research</b> <b>Listening:</b> Listening Comprehension based on new report and documentaries – <b>Speaking:</b> Interviewing, presenting oral reports, Mini presentations on select topics. <b>Reading:</b> Newspaper articles. <b>Writing:</b> Recommendations, Transcoding, Accident Report, Precis writing and Summarising, and Plagiarism <b>Language Focus:</b> Reported Speech – Modals - Conjunctions- use of Prepositions								[9]
<b>The Ability to put Ideas or Information Coherently</b> <b>Listening:</b> Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance). <b>Speaking:</b> Participating in role plays, virtual interviews, making presentations with visual aids <b>Reading:</b> excerpts of interview with professionals <b>Writing:</b> Job / Internship application – Cover letter & Résumé <b>Language Focus:</b> Numerical Adjectives, question types: Wh/ Yes or No/ and Tags; Relative Clauses - Idioms.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Textbook(s):</b>								
1.	'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020							

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2.	Norman Lewis, ' <i>Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book</i> ', Penguin Random House India, 2020
<b>Reference(s):</b>	
1.	Raman. Meenakshi, Sharma. Sangeeta, ' <i>Professional English</i> '. Oxford university press. New Delhi. 2019
2.	Arthur Brookes and Peter Grundy, ' <i>Beginning to Write: Writing Activities for Elementary and Intermediate Learners</i> ', Cambridge University Press, New York, 2003
3.	Prof. R.C. Sharma & Krishna Mohan, ' <i>Business Correspondence and Report Writing</i> ', Tata McGraw Hill & Co. Ltd., New Delhi, 2001
4.	V.N. Arora and Laxmi Chandra, ' <i>Improve Your Writing</i> ', Oxford University Press, New Delhi, 2001

#### SDG- 04- Quality Education

#### Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
<b>1</b>	<b>Making Comparisons</b>	
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
<b>2</b>	<b>Expressing Causal Relations in Speaking and Writing</b>	
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
<b>3</b>	<b>Problem Solving</b>	
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
<b>4</b>	<b>Reporting of Events and Research</b>	
4.1	Listening Comprehension	1
4.2	Interviewing and presenting oral reports	1

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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	<b>The Ability to put Ideas or Information Coherently</b>	
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
	<b>Total</b>	<b>45</b>

#### Course Designer(s)

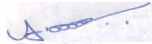
1. Dr.A.Palaniappan - [palaniappan@ksrct.ac.in](mailto:palaniappan@ksrct.ac.in)

60 MA 003		Category	L	T	P	Credit
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	<b>Integrals, Partial differential Equations and Laplace Transform</b>	<b>BS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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### 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-requisite

-NIL-

### Course Outcomes

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

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

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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## Syllabus

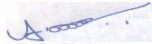
K.S. Rangasamy College of Technology – Autonomous R 2022								
60 MA 003 - Integrals, Partial differential Equations and Laplace Transform								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100
<b>Multiple Integrals</b> Double integration – Cartesian and polar co-ordinates – Change of order of integration – Area as double integral – Triple integration in Cartesian co-ordinates – Change of variables - Cartesian to polar co-ordinates and Cartesian to Cylindrical co-ordinates.								[9+3]
<b>Vector Calculus*</b> Introduction - Gradient of a scalar point function –Directional derivative – Angle of intersection of two surfaces – Divergence and curl (excluding vector identities) – Solenoidal and irrotational vectors – Application : Green's theorem in the plane – Gauss divergence theorem -Stokes' theorem (statement only) .								[9+3]
<b>Analytic Functions and Integrals</b> Analytic function – Necessary and Sufficient conditions (statement only)-Properties – Harmonic function – Construction of an analytic function – Cauchy's Integral theorem (statement only) – Cauchy's integral formula – Classification of singularities – Application: Cauchy's residue theorem.								[9+3]
<b>Partial Differential Equations*</b> Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Non-Linear partial differential equations of first order – Lagrange's linear equations – Application: Homogeneous Linear partial differential equations with constant coefficients.								[9+3]
<b>Laplace Transform</b> Conditions for existence – Transforms of elementary functions – Basic properties - Derivatives and integrals of transforms - Initial and final value theorem – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Application: Solution of second order ordinary differential equations with constant co-efficients.								[9+3]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Grewal B.S, "Higher Engineering Mathematics", 44 <sup>th</sup> Edition, Khanna Publishers, Delhi, 2017.							
2	Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.							
<b>Reference(s):</b>								
1.	Dass H.K, "Higher Engineering Mathematics", 3 <sup>rd</sup> (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.							
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1 <sup>st</sup> 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", 10 <sup>th</sup> Edition, Laxmi Publications (P) Ltd, 2016.							

\*SDG: 4 – Quality Education

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## Course Contents and Lecture Schedule

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

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4.7	Tutorial	2
<b>5</b>	<b>Laplace Transform</b>	
5.1	Conditions for existence	1
5.2	Transforms of elementary functions	1
5.3	Basic properties	1
5.5	Derivatives and integrals of transforms, Initial and final value theorem	1
5.6	Tutorial	1
5.7	Transform of periodic functions	2
5.8	Inverse Laplace transform	1
5.9	Convolution theorem (excluding proof)	1
5.10	Application: Solution of second order ordinary differential equation with constant coefficient.	1
5.11	Tutorial	2
	<b>Total</b>	<b>60</b>

### Course Designer(s)

1. Dr. C. Chandran – [cchandran@ksrct.ac.in](mailto:cchandran@ksrct.ac.in)
2. Dr. K. Prabakaran – [prabakaran@ksrct.ac.in](mailto:prabakaran@ksrct.ac.in)

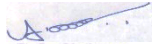
### List of MATLAB Programmes:

1. Evaluating double and triple integrals.
2. Area as double integral.
3. Volume as triple integral.
4. Plotting and visualizing single variable functions.
5. Plotting and visualizing functions of two and three variables.
6. Evaluating Gradient, divergence and curl.
7. Evaluating Laplace & Inverse Laplace transforms.
8. Applying Laplace transform techniques to solve differential equations

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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-requisite

-Nil-

### Course Outcomes

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

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

### Mapping with Programme Outcomes

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

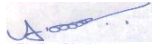
### Assessment Pattern

Cognitive Levels	Continuous Assessment Tests		End Semester Examination(Marks)
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	40	40	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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

## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 CS 001 – C Programming								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100
<b>Basics of C, I/O, Branching and Loops*</b> 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]
<b>Arrays and Strings*</b> Arrays: One Dimensional Arrays - Two Dimensional Arrays – Matrix Manipulation - Character arrays – Strings: String Manipulation with and without String Handling Functions.								[7]
<b>Functions and Pointers*</b> 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]
<b>Structures, Unions, Enumerations, Typedef and Preprocessors*</b> 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]
<b>File Handling*</b> File: Streams –Reading and Writing Characters - Reading and Writing Strings - File System functions – File Manipulation-Sequential access - Random Access Files – Command Line arguments.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
1.	E.Balagurusamy, “Programming in ANSI C”, Seventh Edition, Tata McGraw Hill Edition, New Delhi, 2016.							
2.	Brian W. Kernighan and Dennis M. Ritchie, “C Programming Language”, Prentice-Hall.							
3.	Reema Thareja, “Computer Fundamentals and Programming in C”, Second Edition, Oxford Higher Education, 2016.							
4.	K N King, “C Programming: A Modern Approach”, Second Edition, W.W. Norton, New York, 2008.							

\*SDG: 4- Quality Education

## Course Contents and Lecture Schedule

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

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1.7	Iteration and loops	2
1.8	Writing and evaluation of conditionals and consequent branching	1
<b>2</b>	<b>Arrays and Strings</b>	
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
<b>3</b>	<b>Functions and Pointers</b>	
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
<b>4</b>	<b>Structures, Unions, Enumerations, Typedef and Preprocessors</b>	
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
<b>5</b>	<b>File Handling</b>	
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
<b>Total Hours</b>		<b>45</b>


#### Course Designer(s)

1. Dr.P.Kaladevi - [kaladevi@ksrct.ac.in](mailto:kaladevi@ksrct.ac.in)

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60 ME 001	Engineering Drawing	Category	L	T	P	Credit
		ES	2	0	4	4

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

### Pre-requisite

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

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low


### 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	0	0	0
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

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60 ME 001- Engineering Drawing								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	2	0	4	90	4	50	50	100
<b>Introduction to Engineering Drawing and Plane Curves*</b> 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								[6+12]
<b>Orthographic Projection*</b> 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								[6+12]
<b>Projection of Solids*</b> Projections of simple solids: prism, pyramid, cylinder and cone (Axis of solid inclined to both HP and VP).								[6+12]
<b>Sections of solids and Development of surfaces*</b> 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								[6+12]
<b>Isometric Projection and Introduction to AutoCAD*</b> 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.								[6+12]
<b>Total Hours(Lecture=30 Hours + Practice=60 Hours)</b>								<b>90</b>
<b>Text Book(s):</b>								
1.	Bhatt N.D., —Engineering DrawingII, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2019							
2.	Basant Agarwal and C.M.Agarwal., “Engineering Drawing”, McGraw Hill Education, 2013.							
<b>Reference(s):</b>								
1.	Shah M.B., Rana B.C., and V.K.Jadon., —Engineering DrawingII, Pearson Education, 2011.							
2.	Natarajan K.V., —A Text Book of Engineering GraphicsII, 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

## Course contents and lecture schedule

S. No	Topic	No. of Hours
<b>1</b>	<b>Introduction to Engineering Drawing and Plane Curves</b>	
1.1	Use of drawing instruments	1
1.2	BIS conventions and specifications – Size, layout and folding of drawing sheets	1
1.3	Lettering and dimensioning -Drawing sheet layouts - Title block - Line types	2
1.4	Scales: plain, diagonal and vernier scales	2
1.5	Construction of ellipse	1
1.6	Construction of parabola	2
1.7	Construction hyperbola by eccentricity method	1
1.8	Practice class for ellipse, parabola and hyperbola	2

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1.9	Construction of rectangular hyperbola	2
1.10	Construction of cycloids	1
1.11	Construction of epicycloids and hypocycloids	2
1.12	Practice class for cycloids and hypocycloids	1
<b>2</b>	<b>Orthographic Projection</b>	
2.1	Introduction to orthographic projections	2
2.2	Planes of projection	2
2.3	Projection of points	1
2.4	Projection of lines inclined to both planes	2
2.5	Projection of planes	2
2.6	Projection of planes Inclined to both planes	2
2.7	Conversions of pictorial views to orthographic views	3
2.8	Practice class for pictorial views to orthographic views	2
2.9	Practice class for pictorial views to orthographic views	2
<b>3</b>	<b>Projection of Solids</b>	
3.1	Projections of simple solids: prism	2
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	3
3.6	Axis of solid inclined to both HP and VP	5
<b>4</b>	<b>Sections of solids and Development of surfaces</b>	
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
4.7	Auxiliary Views - Draw the sectional orthographic views of geometrical solids	2
4.8	Draw the sectional orthographic views of objects from industry	2
4.9	Development of surfaces of Right solids Prism	2
4.10	Development of surfaces of Right solids Pyramid	2
4.11	Development of surfaces of Right solids Cylinder and Cone	2
<b>5</b>	<b>Isometric Projection and Introduction to AutoCAD</b>	
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
5.6	Isometric projections of simple solids: Cone	2
5.7	Isometric projections of frustum	2
5.8	Isometric projections of truncated solids	2
5.9	Combination of two solid objects in simple vertical positions	2
	<b>Total Hours</b>	<b>90</b>

#### Course Designer(s)

1. Dr.G.Venkatachalam-[venkatachalam@ksrct.ac.in](mailto:venkatachalam@ksrct.ac.in)

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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-requisite

-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.	Understand & Apply
CO2	Apply basic knowledge of scientific concepts to solve real-world problems.	Understand & Apply
CO3	Calculate the properties of surfaces and solids using various theorems.	Understand & Apply
CO4	Determine the effect of frictional forces and the dynamic forces exerted in the particle.	Understand & Apply
CO5	Analysis of rigid body dynamics and calculation of member forces in the rigid body.	Understand & Apply

### Mapping with Programme Outcomes

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

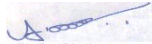
### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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## Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 ME 004 - Engineering Mechanics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100
<b>Basics and Statics of Particles*</b> 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. <b>Vector operations*</b> 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+3]
<b>Equilibrium of Rigid Bodies*</b> 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+3]
<b>Properties of Surfaces and Solids*</b> 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.								[9+3]
<b>Friction*</b> Frictional force–Laws of Coloumb friction–Simple contact friction–Ladder friction-Rolling resistance–Ratio of tension in belt. <b>Dynamics of Particles*</b> Displacement, Velocity, acceleration and their relationship–Relative motion -Projectile motion in horizontal plane– Newton's law–Work Energy Equation – Impulse and Momentum.								[9+3]
<b>Elements of Rigid Body Dynamics*</b> Translation and Rotation of Rigid Bodies: Velocity and acceleration–General Plane motion: Crank and Connecting rod mechanism.								[9+3]
<b>Total Hours= 45 +15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3 <sup>rd</sup> Edition, 2017.							
2	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 11 <sup>th</sup> Edition, 2016.							
<b>Reference(s):</b>								
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.							
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,							
5.	James M. Gere and Timoshenko, "Mechanics of Materials", CBS Publisher, New Delhi, 6 <sup>th</sup> Edition, 2012							

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## Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
<b>1</b>	<b>Basics and Statics Of Particles</b>	
1.1	Introduction, Units and Dimensions, Laws of Mechanics	1
1.2	Principle of transmissibility, Lamé'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
<b>2</b>	<b>Equilibrium of Rigid Bodies</b>	
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
<b>3</b>	<b>Properties of Surfaces and Solids</b>	
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
<b>4</b>	<b>Friction &amp; Dynamics of Particles</b>	
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

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4.10	Tutorial	2
<b>5</b>	<b>Elements of Rigid Body Dynamics</b>	
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
	<b>Total</b>	<b>60</b>

### **MAT LAB exercises**

1. Determination of centroid for standard geometries
2. Determination of moment of inertia of the standard geometries
3. Measure of frictional force in block, ladder and belts
4. Estimation of velocity and acceleration of particles/rigid body by Newton's law and work energy equation

### **Course Designer(s)**

1. Mr.S.KARTHICK      -[skarthick@ksrct.ac.in](mailto:skarthick@ksrct.ac.in)

60 MY 001	Environmental Science and Climate Change	Category	L	T	P	Credit
		MC	3	0	0	0

### Objectives

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

### Pre-requisite

-Nil-

### Course Outcomes

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

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

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

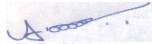
### Assessment Pattern

Bloom's Category	Continuous Assessment Tests		Model Examination
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	30	30	20
Analyze	30	30	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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## Model Titles for Case Study

1. Environmental impacts of quarry industries in MelurTaluk.
2. A study on impacts of tanneries on ground water and soil quality in Bhavani, Erode district.
3. Effect of pharmaceutical industry on groundwater quality in oikaraipatty village, AlagarKovil.
4. Solid waste and waste water management in KSR hostel.
5. Environmental effect of Kudankulam atomic power plant.
6. Case study on effect of Sterlite industry
7. Effect of textile wastes in Tiruppur and Karur District.
8. Segregation of waste and its recycling by Pallipalayam Municipality at Nammakal
9. Effect of fire work waste on atmosphere in Sivakasi region.
10. Effect of noise pollution waste on atmosphere in Sivakasi region.

## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
60 MY 001– Environmental Science and Climate Change								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	2	0	0	30	0	100	-	100
<b>Pollution and its impact on climate change*</b>								
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. <u>Activity</u> : Study of carbon emission nearby place or industry								[6]
<b>Integrated Waste Management**</b>								
Waste - Types and classification. Principles of waste management (5R approach) - Swachh Bharat Abhiyan – Commercial waste, plastic waste, domestic waste, e-waste and biomedical waste - risk management: Collection, segregation, treatment and disposal methods. Waste water treatment- ASP <u>Activity</u> : Analysis and design of waste management systems, prepare a model / project -wealth from waste.								[6]
<b>Sustainable development practices<sup>s</sup></b>								
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. <u>Activity</u> : Select a topic and analyze the value of sustainable development.								[6]
<b>Environment and Agriculture<sup>ss</sup></b> : Organic farming – bio-pesticides- composting, bio composting, vermi-composting, roof gardening and irrigation. Waste land reclamation. Climate resilient agriculture. Green auditing <u>Activity</u> : Prepare a green auditing report on energy, water etc								
[6]								[6]
<b>Geo-science in natural resource management</b>								
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). <u>Activity</u> : Prepare the report using IT tool								[6]
[6]								[6]
<b>Total Hours</b>								30
<b>Text Book(s):</b>								
1.	Anubha Kaushik , C P Kaushik. Perspectives In Environmental Studies, New Age International publishers; Sixth edition (1 January 2018)							

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Reference(s):	
1.	G.Tyler Miller Environmental Science 14th Edition Cengage Publications, Delhi, 2013
2.	Gilbert M.Masters and Wendell P. Ela,"Environmental Engineering And Science", Phi Learning Private Limited, 3rd Edition,2015
3.	Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 2000

\*SDG 13 – Climate Action

\*\*SDG 6 Clean water and Sanitation

\$SDG 7 Affordable and Clean Energy

\*\*SDG 3 – Good Health and Well Being

### Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	<b>Pollution and its impact on climate change</b>	
1.1	Pollution: Sources and impacts of air pollution – green house effect- Global warming- climate change - ozone layer depletion - acid rain	2
1.2	Climate change on various sectors: Agriculture, forestry and ecosystem. – climate change mitigation and adaptation	1
1.3	Action plan on climate change - IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes	1
2.0	<b>Integrated Waste Management</b>	
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	<b>Sustainable development practices</b>	
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	<b>Environment and Agriculture</b>	
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	<b>Geo-science in natural resource management</b>	
5.1	Data base software in environment information, Digital image processing applications in forecasting	2
5.2	GPS, Remote Sensing and Geographical Information System (GIS)	1
5.3	World wide web (www), Environmental information system (ENVIS)	1
Total		30

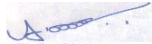
### Course Designer(s)

1. Dr.T.A.SUKANTHA – sukantha@ksrct.ac.in
2. Dr.K.PRABHA – prabhak@ksrct.ac.in
3. Dr.S.MEENACHI – meenachi@ksrct.ac.in

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

60 GE 002	Tamils and Technology (Common to all Branches )	Category	L	T	P	Credit
		GE	1	0	0	1 <sup>\$</sup>

### 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

CO	PO												PSO		
	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-Low

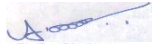
### Assessment Pattern

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	0	0	0
Evaluate	0	0	0
Create	0	0	0

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## Syllabus

K. S. Rangasamy College of Technology – Autonomous R 2022								
60 GE 002- Tamils and Technology								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P			CA	ES	Total
II	1	0	0	15	1	100	00	100
<b>Weaving and Ceramic Technology*</b> Weaving Industry during Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.								[3]
<b>Design and Construction Technology*</b> 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]
<b>Manufacturing Technology*</b> 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]
<b>Agriculture and Irrigation Technology*</b> 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]
<b>Scientific Tamil and Tamil Computing*</b> 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]
<b>Total Hours</b>								<b>15</b>
<b>Text Book(s):</b>								
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.	பொருதை - 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 <sup>s</sup>

**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**

CO	PO												PSO		
	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-Low

**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	0	0	0
Evaluate	0	0	0
Create	0	0	0

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K. S. Rangasamy College of Technology – Autonomous R 2022								
60 GE 002 - தமிழரும் தொழில்நுட்பமும்								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	1	0	0	15	1		100	00
<b>நெசவு மற்றும் பானைத் தொழில்நுட்பம்:</b> சங்ககாலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம்-கருப்பு சிவப்புபாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.								[3]
<b>வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:</b> 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 தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இங்கோ-சாரோசெனிக் கட்டிடக் கலை.								[3]
<b>உற்பத்தித்தொழில்நுட்பம்:</b> 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]
<b>வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்:</b> அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுமித் தூம்பின் முக்கியத்துவம்-கால்நடை பராமரிப்பு - கால்நடைகளுக்கான வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டையஅறிவு - அறிவுசார் சமூகம்.								[3]
<b>அறிவியல் தமிழ் மற்றும் கணித்தமிழ்</b> அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்புசெய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.								[3]
<b>Total Hours</b>								<b>15</b>
<b>Text Book(s):</b>								
1.	தமிழக வரலாறு-மக்களும் பண்பாடும் கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).							
2.	கணித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).							
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).							
4.	பொருளை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு).							
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).							

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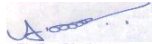
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils 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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 BoS - Chairman  
 Mechanical Engineering (UG & PG)  
 K.S.Rangasamy College of Technology,  
 Tiruchengode - 637 215.

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

### Objectives

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

### Pre-requisite

-Nil-

### Course Outcomes

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

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

### Mapping with Programme outcomes

CO	PO												PSO		
	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	1	2
CO2	3	3	3		3	2		2	3	3		3	3	1	2
CO3	3	3	3		3	2	2	2	3	3	2	3	3	1	2
CO4	3	3	3	2	3	3	2	3	3			3	3	1	2
CO5	3	3	3	3	3	2	2	2	3	2	2	3	3	1	2

3- Strong; 2-Medium; 1-Low

### Syllabus

#### Performs of Power Tools\*

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

#### Carpentry Process\*

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

#### Sheet Metal and Filling Process\*

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

#### Welding Process\*

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

#### Plumbing Process\*

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

**Residential house wiring\***

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

**Electronic Circuit wiring\***

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

**Assembling and dismantling of Electronics Machines\***

Iron box, Induction stove, Water heater, Mixer, Table fan, Ceiling fan

**Study Exercises**

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

**Computer Hardware Study Exercises**

Identify internal components of computer - Assemble and dismantle desktop computer systems

\*SDG 9 – Industry Innovation and Infrastructure

## List of Experiments

### 1. Fitting of Wall mounting Parts using Power Tools

- a) Drilling in different Walls and Materials
- b) Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with Clamps.

### 2. Making of Wooden model using the Carpentry Process

- a) T / Cross Joint
- b) Mortise and Tenon Joint / different joints

### 3. Making of Metal Model

- a) Making of Components using Sheet Metal Process
- b) Mating of Components using the Filling Process

### 4. Fabrication of Welded model

### 5. Repair and Maintenance of Pipe Fitting for Home Applications

- a) Assembly of GI pipes/PVC and Pipe Fitting
- b) Cutting of Threads in GI pipes by thread Cutting Dies


### 6. Assembling and dismantling of

- a) Iron box
- b) Induction stove
- c) Water heater
- d) Mixer
- e) Table fan
- f) Ceiling fan

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Tiruchengode - 637 215.



**7. Design and Execution of Residential house wiring**

- a) 1 BHK
- b) 2 BHK

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

- a) 1 BHK
- b) 2 BHK

**9. Design and fabrication of domestic LED lamps**

- a) Circuit designing (calculation of components)
- b) PCB fabrication
- c) Soldering

**10. Assembling of Audio Amplifiers**

- a) Connecting USB/Bluetooth MP3 player board
- b) Connecting Volume controllers
- c) Connecting bass & treble filter boards
- d) Connecting Surround and sub-woofer filter board

**Study Exercises**

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

**Course Designer(s)**

- 1. Mr.S Sakthivel - [sakthivel\\_s@ksrct.ac.in](mailto:sakthivel_s@ksrct.ac.in)
- 2. Dr. D Sri Vidya - [srividhya@ksrct.ac.in](mailto:srividhya@ksrct.ac.in)
- 3. Mr. K.Raguvaran – [raguvaran@ksrct.ac.in](mailto:raguvaran@ksrct.ac.in)

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

### Objective

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

### Pre-requisite

-NIL-

### Course Outcomes

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

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

### Mapping with Programme Outcomes

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

### 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](mailto:kaladevi@ksrct.ac.in)

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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

### Prerequisite

Basic knowledge of reading and writing in English.

### Course Outcomes

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

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

### Mapping with Programme Outcomes

CO	PO												PSO		
	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-Low

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## Syllabus

K.S.Rangasamy College of Technology– Autonomous R 2022								
Career Skill Development - I								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	2	25	1*	100	--	100
<b>Listening</b> Listening for general information-specific details - audio / video (formal & informal) - Listen to podcasts/ TED talks/ anecdotes / stories / event narration / documentaries and interviews with celebrities - Listen to a product and process descriptions, advertisements about products or services.								[5]
<b>Speaking</b> Self-Introduction; Introducing a friend; conversation - politeness strategies - Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews - Picture description; giving instruction to use the product; presenting a product - Small Talk; Mini presentations - Group discussions, debates & role plays.								[5]
<b>Reading</b> Loud reading vs Silent reading, Skimming & Scanning of passages, reading brochures (technical context), social media messages relevant to technical contexts and emails - Biographies, travelogues, newspaper reports and travel & technical blogs - Advertisements, gadget reviews and user manuals - Newspaper articles and Journal reports - Editorials; and opinion blogs								[5]
<b>Writing</b> Writing letters – informal and formal – basics and format orientation - paragraph texting, short report on an event (field trip etc.) - Definitions; instructions; and product /process description - Note-making / Note-taking; recommendations; transferring information from non-verbal (charts, graphs to verbal mode) - Essay texting								[5]
<b>Verbal Ability I</b> Reading Comprehension (MCQs) – Cloze Test - Sequencing of sentences – Summarizing and paraphrase – Error Detection – Spelling Test – Sentence Improvement - Preposition								[5]
<b>Total Hours</b>								25
<b>Reference(s):</b>								
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	Topic	No. of Hours
<b>1</b>	<b>Listening</b>	
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
<b>2</b>	<b>Speaking</b>	

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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	<b>Reading</b>	
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	<b>Writing</b>	
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	<b>Verbal Ability</b>	
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
	<b>Total</b>	<b>25</b>

#### Course Designer(s)

1. Dr.A.Palaniappan - [palaniappan@ksrct.ac.in](mailto: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 from 2023-2024 onwards)

**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	-	-
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	-	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 the award of terminal examination marks.

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

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

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

## Syllabus

K.S.Rangasamy College of Technology– Autonomous R2022								
60 MA 007- Statistics and Numerical Methods								
Common to Mech, MCT and Civil								
Semester	Hours/Week			Totalhrs	Credit	MaximumMarks		
	L	T	P		C	CA	ES	Total
III	3	2	0	60	4	40	60	100
<b>Probability and Random Variables</b> Axioms of probability - Conditional probability - Baye's theorem - Random variable - Expectation - Probability mass function - Probability density function - Moment generating function.								[9]
<b>Standard Distributions and Testing of Hypothesis*</b> 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.								[9]
<b>Empirical Statistics</b> 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.								[9]
<b>Solutions of Equations and Eigen Value Problem</b> 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.								[9]
<b>Interpolation and Numerical Integration</b> <b>Lagrange's and Newton's divided difference interpolation (unequal intervals)** - Newton's forward and backward interpolation (equal intervals)**</b> - Two point and three point Gaussian quadrature - Trapezoidal, Simpson's 1/3 and 3/8 rule (single integral).								[9]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Books:</b>								
1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.							
2.	V. K. Kapoor and S.C.Gupta , “Fundamentals of Mathematical Statistics “, Sultan Chand & sons 12th Edition, New Delhi, 2020.							
<b>Reference(s):</b>								
1.	Veerarajan,T., “Probability, Statistics and Random Processes (with Queueing Theory and Queueing Networks)”, Tata McGraw-Hill 4th Edition, New Delhi, 2015.							
2.	Johnson R.A and Gupta C.B., “Miller and Freund's Probability and statistics for Engineers”, 11th Edition, PearsonEducation,Asia,2011.							
3.	Kandasamy P.,Thilakavathy K. And Gunavathy K.,“Numerical Methods”,3 <sup>rd</sup> Edition,S.Chand andCo.,New Delhi, 2003.							
4.	Faires, J.D. and Burden, R., “Numerical Methods”, Brookes / Cole (Thomson Publications), 4th Edition, New Delhi. 2011.							

\*SDG:4 Quality Education,

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

## Course Contents and Lecture Schedule

S.No	Topic	No.ofHours
1	<b>Probability and Random Variables</b>	
1.1	Axioms of probability	1
1.2	Conditional probability	1
1.3	Baye's theorem	1
1.4	Tutorial	2
1.5	Random variable	1
1.6	Expectation	1
1.7	Probability mass function	1

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1.8	Probability density function	1
1.9	Moment generating function	1
1.10	Tutorial	2
<b>2</b>	<b>Standard Distributions and Testing of Hypothesis</b>	
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	Tutorial	2
2.6	F test	1
2.7	Chi- square test	1
2.8	Test for Independency	1
2.9	Goodness of fit.	1
2.10	Tutorial	2
<b>3</b>	<b>Empirical Statistics</b>	
3.1	Mean, Median and Mode	1
3.2	Range, Quartile deviation	1
3.3	Standard deviation	1
3.4	Tutorial	2
3.5	Pearson's co-efficient of skewness	1
3.6	Bowley's co-efficient of skewness	1
3.7	Measures of skewness	1
3.8	correlation	2
3.9	Tutorial	2
<b>4</b>	<b>System of Equations and EigenValue Problem</b>	
4.1	Newton Raphson method	1
4.2	Gauss elimination method	1
4.3	Gauss Jordan method	1
4.4	Gauss Jacobi method	1
4.5	Tutorial	2
4.6	Gauss Seidel method	1
4.7	Matrix inversion by Gauss Jordan method	1
4.8	Eigen values of a matrix by power method	1
4.9	Tutorial	2
<b>5</b>	<b>Interpolation and Numerical Integration</b>	
5.1	Lagrange's interpolations	1
5.2	Newton's divided difference interpolations	2
5.3	Tutorial	2
5.4	Newton's forward and backward difference interpolations	2
5.5	Two and three point Gaussian quadratures	2
5.6	Single integration using Trapezoidal and Simpson's 1/3 and 3/8 rules	2
5.7	Tutorial	2

#### **List of MATLAB Programs:**

1. Calculate the standard parameters by using Binomial distribution.
2. Determine the Measures of central tendency.
3. Compute the measures of dispersion.
4. Solve the Equation by using Gauss Seidel method.
5. Numerical integration using Trapezoidal and Simpson's rules.
6. Compute eigen values and eigen vectors by using power method

#### **Course Designer(s)**

1. Dr.C.Chandran - [cchandran@ksrct.ac.in](mailto:cchandran@ksrct.ac.in)

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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

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

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		End Sem Examination(Marks)
	1	2	
Remember	10	20	20
Understand	20	30	30
Apply	30	10	10
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE 004– Electrical Drives and Control								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100
<b>Introduction of Electrical Drives*</b> 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]
<b>Drive Motor Characteristics*</b> 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]
<b>Solid State Speed control of DC Drives*</b> 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]
<b>Solid State Speed Control of AC Drives*</b> 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]
<b>Introduction to Electric Traction**</b> 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]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Gopal.K.Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House, 2 <sup>nd</sup> 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.							
<b>Reference(s):</b>								
1.	Vedam Subrahmanyam, “Electric Drives Concepts and Applications” Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2011.							
2.	M.D.Singh and K.B. Khanchandani, “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.							
	R. K.Rajput, “Utilisation of Electrical Power”, Laxmi Publications (P) Ltd, 2018.							

\*SDG 7 – Clean and Affordable Energy

\*\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	<b>Introduction of Electrical Drives</b>	
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

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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
<b>2</b>	<b>Drive motor characteristics</b>	
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
<b>3</b>	<b>Solid State Speed control of DC drives</b>	
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
<b>4</b>	<b>Solid State Speed Control of AC drives</b>	
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
<b>5</b>	<b>Introduction to Electric Traction</b>	
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
	<b>Total</b>	<b>45</b>

#### Course Designer(s)

1. Dr.R.Balamurugan – [balamurugan@ksrct.ac.in](mailto:balamurugan@ksrct.ac.in)

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

### Mapping with Programme Outcomes

CO	PO												PSO		
	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-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		End Sem Examination(Marks)
	1	2	
Remember	20	20	50
Understand	30	30	30
Apply	05	05	10
Analyse	05	05	10
Evaluate	0	0	0
Create	0	0	0
Total	60	60	100

## Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022								
60 ME 301- Engineering Materials and Metallurgy								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100
<b>Constitution of Alloys and Phase Diagrams*</b> 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]
<b>Ferrous and Non-ferrous Metals*</b> 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]
<b>Heat Treatment*</b> 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]
<b>Non Metallic Materials and other Engineering Materials**</b> 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 fluoro ethylene (PTFE), Thermo set polymers – Urea and Phenol formaldehydes –Nylon, Engineering Ceramics – Properties and applications of Al <sub>2</sub> O <sub>3</sub> , SiC, Si <sub>3</sub> N <sub>4</sub> , PSZ and SIALON – intermetallics- Composites- Matrix and reinforcement Materials applications of Composites - Nano composites, Bio-degradable Materials.								[9]
<b>Testing of Engineering Materials and Deformation Mechanisms*</b> 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 Izod and charpy, fatigue and creep failure mechanisms. Metallography - Preparation of specimen, Metallurgical microscope and Scanning Electron Microscope.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
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” 2 <sup>nd</sup> Edition, Tata McGraw-Hill Companies Inc., New Delhi, 2013.							
<b>Reference(s):</b>								
1.	Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, 7 <sup>th</sup> Edition, Prentice Hall of India Private Limited, 2010.							
2.	Raghavan.V, “Materials Science and Engineering: A First Course”, 6 <sup>th</sup> Edition, Prentice Hall of India Pvt.Ltd., New Delhi, 2019.							
3.	William D. Callister, “Material Science and Engineering: An Introduction”, 5 <sup>th</sup> Edition Wiley India Pvt Ltd, New Delhi, 2016.							
4.	Sina Ebnesajjad. “Handbook of Biopolymers and Biodegradable Plastics: Properties, Processing and Applications”. 1 <sup>st</sup> Edition, Elsevier, Amsterdam, Netherlands, 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	<b>Constitution of Alloys and Phase Diagrams</b>	
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	<b>Ferrous and Non-Ferrous Metals</b>	
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	<b>Heat Treatment</b>	
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	<b>Non-Metallic Materials and other Engineering Materials</b>	
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 methacrylate (PMMA), - Polyethylene terephthalate (PET), Polycarbonate (PC), Poly tetra fluoro ethylene (PTFE)	1
4.4	Thermo set polymers	1
4.5	Ceramics – Properties and applications of Al <sub>2</sub> O <sub>3</sub> , SiC, Si <sub>3</sub> N <sub>4</sub> , 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	<b>Testing of Engineering Materials and Deformation Mechanisms</b>	
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](mailto: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	Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.	Remember/Understand/Apply
CO2	Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.	Remember/Understand/Apply
CO3	Calculate slope and deflection in beams using different methods.	Remember/Understand/Apply
CO4	Apply basic equation of torsion in designing of shafts and helical springs	Remember/Understand/Apply
CO5	Analyse thin and thick shells for applied pressures	Remember/Understand/Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	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-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100



## Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022								
60 ME 302- Strength of Materials								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100
<b>Stress, Strain and Deformation of Solids*</b> 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]
<b>Transverse Loading on Beams and Stresses in Beam*</b> 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]
<b>Deflection of Beams*</b> Elastic curve – Double integration method - Area moment method- Macaulay's method - Conjugate beam method for computation of slope and deflection of determinant beams.								[9]
<b>Torsion*</b> 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]
<b>Thin Cylinders, Spheres and Thick Cylinders*</b> 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 - Lamé’s theory.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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	Topic	No. ofHours
<b>1</b>	<b>Stress, Strain and Deformation of Solids</b>	
1.1	Rigid bodies and deformable solids	1
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
<b>2</b>	<b>Transverse Loading on Beams and Stresses in Beam</b>	
2.1	Beams, Types & Transverse loading on beams	1

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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
<b>3</b>	<b>Deflection of Beams</b>	
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
<b>4</b>	<b>Torsion</b>	
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
<b>5</b>	<b>Thin Cylinders, Spheres And Thick Cylinders</b>	
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
	<b>Total Hours</b>	<b>45</b>

#### Course Designer(s)

1. Dr. K. Santhanam -[santhanam@ksrct.ac.in](mailto: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.	Remember, Understand & Apply
CO2	Solve the problems by applying the second law of thermodynamics	Remember, Understand & Apply
CO3	Apply the thermodynamic properties of pure substances using steam table	Remember, Understand & Apply
CO4	Distinguish the behavior of real & ideal gases and derive the thermodynamic relations	Remember, Understand & Apply
CO5	Apply the psychrometric concepts in air conditioning processes	Remember, Understand & Apply

### Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Exam	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022								
60 ME 303- Thermodynamics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100
<b>Basics, Zeroth and First Law of Thermodynamics*</b> 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]
<b>Second Law of Thermodynamics and Entropy*</b> 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]
<b>Properties of Pure Substances*</b> 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]
<b>Thermodynamic Mathematical Relations*</b> Thermodynamic Relations - Exact Differentials - TdS Equations - Difference and Ratio of Heat Capacities - Maxwell’s Equations - Clausius-Clapeyron Equation - Joule-Kelvin Coefficient.								[9]
<b>Psychrometry**</b> Properties of Atmospheric Air - Psychrometric Chart - Psychrometric Processes - Sensible Heating - Sensible Cooling - Cooling and Dehumidification - Heating and Humidification - Adiabatic Mixing - Evaporative Cooling.								[9]
<b>Total Hours</b>								<b>45</b>
<b>TextBook(s):</b>								
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							
<b>Reference(s):</b>								
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”, 6 <sup>th</sup> Edition, John Wiley and Sons, 2003.							
3.	Holman,J.P., “Thermodynamics”, 4 <sup>th</sup> Edition, McGraw-Hill Publications, 1995.							
4.	Rajput, R.K., “A Textbook of Engineering Thermodynamics, 4 <sup>th</sup> Edition, Laxmi Publications, 2010.							

\*SDG 4 – Quality Education

\*\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
<b>1</b>	<b>Basic Concepts and First Law of Thermodynamics</b>	<b>9</b>
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

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<b>2</b>	<b>Second Law of Thermodynamics</b>	<b>9</b>
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
<b>3</b>	<b>Properties of Pure Substances</b>	<b>9</b>
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
<b>4</b>	<b>Thermodynamic Mathematical Relations</b>	<b>9</b>
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
<b>5</b>	<b>Psychrometry</b>	<b>9</b>
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
	<b>Total</b>	<b>45</b>

#### Course Designer(s)

1. Dr.M.Gnanasekaran – [gnanasekaran@ksrct.ac.in](mailto:gnanasekaran@ksrct.ac.in)
2. Mr.R.Prakash - [prakashr@ksrct.ac.in](mailto: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	Re/Un/Ap
CO2	Compare different metal joining processes.	Re/Un/Ap
CO3	Summarize various hot working and cold working methods of metals.	Re/Un/Ap
CO4	Explain various sheet metal making processes.	Re/Un/Ap
CO5	Acquire knowledge on Smart manufacturing	Re/Un/Ap

### Mapping with Programme Outcomes

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

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	50	50
Understand	30	20	30	30
Apply	10	10	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022								
60 ME 304- Manufacturing Techniques								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100
<b>Metal Casting Processes*</b> 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]
<b>Metal Joining Processes**</b> 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]
<b>Metal Forming Processes**</b> 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]
<b>Sheet Metal Processes**</b> 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]
<b>Introduction to Smart Manufacturing*</b> 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]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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
<b>1</b>	<b>Metal Casting Processes</b>	
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
<b>2</b>	<b>Metal Joining Processes</b>	
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
<b>3</b>	<b>Metal Forming Processes</b>	
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
<b>4</b>	<b>Sheet Metal Processes</b>	
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
<b>5</b>	<b>Introduction to Smart Manufacturing</b>	
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
	Total Hours	45

#### Course Designer(s)

1. Dr.G.Venkatachalam-[venkatachalam@ksrct.ac.in](mailto: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 complementarity 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

CO	PO												PSO		
	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-Low

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Semester Examination(Marks)
	1	2		
Remember	10	10	20	No End Semester Examination
Understand	10	10	20	
Apply	20	20	30	
Analyse	20	20	30	
Evaluate	0	0	0	
Create	0	0	0	
Total	60	60	100	

## Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022								
60 MY 002- Universal Human Values								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3*	100	--	100
<b>Introduction to value Education*</b> 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]
<b>Harmony in the Human Being**</b> 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]
<b>Harmony in the Family and Society**</b> 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]
<b>Harmony in the Nature/Existence***</b> 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]
<b>Implications of the Holistic Understanding***</b> 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]
<b>Total Hours</b>								<b>45</b>
<b>TextBook(s):</b>								
1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2 <sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1							
2	Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2 <sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2							
<b>Reference(s):</b>								
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

## Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	<b>Introduction to Value Education</b>	
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

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Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

1.9	Outcome of Human Education and Method to fulfill the basic human aspirations	1
<b>2</b>	<b>Harmony In The Human Being</b>	
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
<b>3</b>	<b>Harmony in the Family and Society</b>	
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
<b>4</b>	<b>Harmony in the Nature / Existence</b>	
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
<b>5</b>	<b>Implications of the Holistic Understanding</b>	
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
	<b>Total</b>	<b>45</b>

#### Course Designer(s)

1. Dr.G.Vennila - [vennila@ksrct.ac.in](mailto:vennila@ksrct.ac.in)
2. Dr.K.Raja - [rajak@ksrct.ac.in](mailto:rajak@ksrct.ac.in)

Rev. No.1/w.e.f. 02.01.2024

Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

60 EE 0P4	Electrical Drives and Controls 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

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

### 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](mailto:balamurugan@ksrct.ac.in)

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

CO	PO												PSO		
	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	3	3
CO4	3				3			2	3	3	2	2	2	2	3
CO5	3	3			3	2			2	2	3	2	2	2	3

3- Strong; 2-Medium; 1-Low

### 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

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Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

Preparation of part modeling and assembly drawing of machine components using CAD software\*\*

1. Cotter joint
2. Knuckle joint
3. Protected flange coupling
4. Universal coupling
5. Plummer block
6. Bushed bearing
7. Swivel bearing
8. Connecting rod (I/C engine)
9. Screw jack (Bottle type)
10. Machine vice

\*SDG 4 – Quality Education

\*\*SDG 9 – Industry Innovation and Infrastructure

#### Course Designer(s)


1. Dr.G.Mylsami – [mylsamig@ksrct.ac.in](mailto:mylsamig@ksrct.ac.in)

60 CG 0P2	Career Skill Development - II	Category	L	T	P	Credit
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Rev. No.1/w.e.f. 02.01.2024

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.

		<b>CG</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1*</b>
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## 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

CO	PO												PSO		
	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-Low

## Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 CG 0P2- Career Skill Development - II								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
III	0	0	2	30	1*	100		--
<b>Listening</b> 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]



<b>Speaking</b> 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]
<b>Reading</b> 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]
<b>Writing</b> Professional emails, Email etiquette - compare and contrast essay - Writing responses to complaints Precis writing, Summarizing and Plagiarism- Job / Internship application – Cover letter & Résume.		[6]
<b>Verbal Ability II</b> Reading Comprehension (Inferential fillups) – Spotting Errors – Verbal Analogies – Theme Detection – Change of Voice – Change of Speech – One word substitution		[6]
<b>Total Hours</b>		<b>30</b>
<b>Text Book(s):</b>		
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	Topic	No. of Hours
<b>1</b>	<b>Listening</b>	
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
<b>2</b>	<b>Speaking</b>	
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
<b>3</b>	<b>Reading</b>	
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
<b>4</b>	<b>Writing</b>	
4.1	Professional emails, Email etiquette	1

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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	<b>Verbal Ability II</b>	
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
	<b>Total</b>	<b>25</b>

### Course Designer(s)

1. Dr.A.Palaniappan - [palaniappan@ksrct.ac.in](mailto: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 from 2023-2024 onwards)

**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	60 ME 406	Applied Hydraulics and Pneumatics	2	50	50	100	45	100
PRACTICAL								
7	60ME4P1	Strength of Materials and Fluid Machinery Laboratory	3	60	40	100	45	100
8	60 ME4P2	Manufacturing and Machining Processes Laboratory	3	60	40	100	45	100
9	60 CG 0P2	Career Skill Development - III	-	100	-	100	-	-
10	60 CG 0P6	Internship <sup>#</sup>	-	-	-	-	-	-

\*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 the award of terminal examination marks.

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	Remember, Understand & Apply
CO2	Apply conservation laws to measure flow and estimate losses in pipelines for both laminar and turbulent conditions	Remember, Understand & Apply
CO3	Formulate the relationship among the variables in a fluid phenomenon	Remember, Understand & Apply
CO4	Select and estimate the characteristics of hydraulic turbine	Remember, Understand & Apply
CO5	Evaluate the performance characteristics of different hydraulic pumps	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		3				3	3	3		3		
CO2	3	3	3		3				3	3	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	Continuous Assessment Tests(Marks)		Model Examination Marks	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME 401- Fluid Mechanics and Fluid Machines								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	40	60	100
<b>Fluid Properties and Flow Characteristics</b> 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								[12]
<b>Flow Through Pipes and Boundary Layer</b> 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.								[12]
<b>Dimensional Analysis and Model Studies</b> Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem- Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.								[12]
<b>Turbines*</b> 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**.								[12]
<b>Pumps*</b> 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.								[12]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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.	S K Som; Gautam Biswas and S Chakraborty, “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
<b>1.0</b>	<b>Fluid properties and flow characteristics</b>	
1.1	Properties of fluids	1
1.2	Fluid statics- Pressure Measurements	2
1.3	Buoyancy and floatation	2

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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
<b>2.0</b>	<b>Flow through pipes and boundary layer</b>	
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
<b>3.0</b>	<b>Dimensional analysis and model studies</b>	
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
<b>4.0</b>	<b>Turbines</b>	
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
<b>5.0</b>	<b>Pumps</b>	
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
3. Dr.S.Jeyaprakasam– sjeyaprakasam@ksrct.ac.in

### List of MATLAB exercises:

1. Evaluation of the various properties of fluids
2. Estimation of fluid flow by continuity and Bernoulli's equation
3. Calculation of velocity and pressure variation in flow through pipes
4. Performance assessment of pumps and turbines.

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

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination (Marks)	End Sem Examination(Marks)
	1	2		
Remember	20	20	20	20
Understand	40	40	80	80
Apply	0	0	0	0
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100



## Syllabus

K.S.Rangasamy College of Technology – AutonomousR2022								
60 ME 402- Machining Processes								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100
<b>Fundamentals Of Metal Cutting*</b> 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]
<b>Turning Machines*</b> 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]
<b>Machine Tools*</b> 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]
<b>Abrasive Processes and Gear Cutting*</b> 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]
<b>CNC Machines**</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Kaushish, J.P., “Manufacturing Processes,” PHI Learning Ltd, New Delhi, 4 <sup>th</sup> Edition 2018.							
2	Rajput, R.K., “A Textbook of Manufacturing Technology”, Laxmi publications (P) ltd, 2 <sup>nd</sup> Edition 2015.							
<b>Reference(s):</b>								
1.	Jain R.K., “Production Technology,” Khanna Publishers, 19 <sup>th</sup> Edition 2021							
2.	Rao P N, “Manufacturing Technology”, Tata McGraw Hill Publishing Co. Ltd., Volume 1, New Delhi, 4 <sup>th</sup> Edition, 2018							
3.	Serope Kalpakjian Steven R. Schmid,” Manufacturing, Engineering and Technology”, SI 6 <sup>th</sup> Edition -II, Pearson Education, 2020							
4.	Mikell P. Groover, “Principles of Modern Manufacturing”, SI Version 5 <sup>th</sup> 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	Topic	No. of Hours
1	<b>Fundamentals of Metal Cutting</b>	
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
<b>2</b>	<b>Turning Machines</b>	
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
<b>3</b>	<b>Machine Tools</b>	
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
<b>4</b>	<b>Abrasive Processes and Gear Cutting</b>	
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
<b>5</b>	<b>CNC Machines</b>	
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
<b>Total hours</b>		<b>45</b>

### 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 Machinery	Category	L	T	P	Credit
		PC	3	0	0	3

### Objectives

- To impart the knowledge of basics of mechanisms
- 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-requisite

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.	Remember, Understand & Apply
CO2	Compute velocity and acceleration in simple mechanisms.	Remember, Understand & Apply
CO3	Develop CAM profiles based on follower motion, types and position.	Remember, Understand & Apply
CO4	Solve problems on gears and gear trains.	Remember, Understand & Apply
CO5	Evaluate friction in machine elements.	Remember, Understand & Apply

### Mapping with Programme Outcomes

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

3- Strong;2-Medium;1-Some

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 ME 403 & Kinematics of Machines								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100
<b>Basics of Mechanisms*</b> 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]
<b>Kinematics of Mechanisms*</b> 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.								[9]
<b>Cam Mechanisms*</b> 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								[9]
<b>Gears and Gear Trains*</b> Law of toothed gearing – Involute 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.								[9]
<b>Friction in Machine Elements*</b> 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.								[9]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Bansal R.K and Brar.J S, “A Textbook of Theory of Machines”, Laxmi Publication (P) Ltd., New Delhi, 5 <sup>th</sup> Edition, 2023.							
2	Uicker JJ, Pennock GR, Shigley JE. “Theory of Machines and Mechanisms”, Oxford University Press, New York, 5 <sup>th</sup> Edition, 2017.							
<b>Reference(s):</b>								
1.	Rattan, S.S, “Theory of Machines”, Tata McGraw-Hill, 5 <sup>th</sup> Edition, 2019.							
2.	Rao JS, and Dukkupati. RY., “Mechanism and Machine Theory”, Reprint, New Age International, New Delhi, 2 <sup>nd</sup> Edition, 2014.							
3.	Ghosh. A and Mallick, A.K., “Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 3 <sup>rd</sup> Edition 2006.							
4.	Khurmi RS, and Gupta JK., “Theory of machines”, S.Chand & Company Ltd., New Delhi, 14 <sup>th</sup> Edition, 2014.							

\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S.No.	Topics	No.ofhours
1.0	<b>Basics of Mechanisms</b>	
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

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1.7	Straight line generators	1
2.0	<b>Kinematics of Linkage Mechanisms</b>	
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	<b>Kinematics of Cam Mechanisms</b>	
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	<b>Gears and Gear Trains</b>	
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	<b>Friction in Machine Elements</b>	
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](mailto:santhanamk@ksrct.ac.in)

### MAT LAB exercises

1. MATLAB programming for evaluation velocity and acceleration in simple mechanisms
2. MATLAB programming for Modeling Contact Forces in a Cam Follower
3. MATLAB programming for Model a Compound Gear Train
4. MATLAB programming for Fundamental Friction Clutch

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	Remember, Understand & Apply
CO2	Demonstrate the operation of steam boiler and its components	Remember, Understand & Apply
CO3	Analyze the shapes and maximum discharge of the steam nozzle and recognize the functions of steam turbines	Remember, Understand & Apply
CO4	Identify the various problems in single stage and multistage air compressors	Remember, Understand & Apply
CO5	To impart the knowledge of refrigeration and air-conditioning and its components	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3				3		3	3		
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)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	20	20
Understand (Un)	20	20	30	30
Apply (Ap)	30	30	50	50
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

## Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 ME 404 - Thermal Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100
<b>Gas Power Cycles and Internal Combustion Engines*</b> 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.								[9]
<b>Steam Boilers*</b> Classification of steam boilers - fire tube, water tube, low pressure and high-pressure boiler - super-critical boiler - Boiler mountings and accessories.								[9]
<b>Steam Nozzles and Steam turbines**</b> Nozzles and its shapes, Friction in a nozzle, Maximum discharge through a nozzle.Introduction - Classification of steam turbines - compounding- velocity diagrams for turbines								[9]
<b>Air Compressor**</b> 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]
<b>Refrigeration and Air Conditioning**</b> 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.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Rajput, R.K.“Thermal Engineering”, 11 <sup>th</sup> Edition, Laxmi Publications (P) Ltd., New Delhi, 2020.							
2.	Yunus A. Cengel, Michael A. Boles, and Mehmet Kanoglu. “Thermodynamics: An Engineering Approach”. 9 <sup>th</sup> Edition, McGraw Hill Education Pvt. Ltd.New Delhi, 2019.							
<b>Reference(s):</b>								
1.	Ballaney P.L., “Thermal Engineering”. 25 <sup>th</sup> Edition, Khanna Publisher, New Delhi, 2018.							
2.	Kothandaraman C.P., Domkundwar S, Domkundwar. A.V., “A course in thermal Engineering", 5 <sup>th</sup> Edition, Dhanpat Rai & sons, 2016.							
3.	Khurmi, R.S and Guptha, J K, “A Textbook of Thermal Engineering”, 15 <sup>th</sup> Edition, S.Chand publisher, 2013.							
4.	Moran, M.J and Shapiro, H.N., “Fundamentals of Engineering Thermodynamics” 8 <sup>th</sup> 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
<b>1.0</b>	<b>Gas Power Cycles &amp; Internal Combustion Engines</b>	
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

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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
<b>2</b>	<b>Steam Boilers</b>	
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
<b>3.0</b>	<b>Steam Nozzles and Steam turbines</b>	
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
<b>4.0</b>	<b>Air Compressor</b>	
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
<b>5.0</b>	<b>Refrigeration and Air Conditioning</b>	
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
2. Dr.D.Vasudevan- vasudevand@ksrct.ac.in.
3. Dr.M.Gnanasekaran – gnanasekaran@ksrct.ac.in

#### List of MATLAB exercises:

1. Performance assessment of vapour compression and vapour absorption system
2. Calculating efficiency of Otto cycle by Matlab Simulink



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

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3		3			3			3		3	3		
CO2	3	3		3			3			3		3	3		
CO3	3	3		3			3			3		3	3		
CO4	3	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)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	20	20
Understand (Un)	20	20	30	30
Apply (Ap)	30	30	50	50
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 ME 405 Engineering Metrology								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100
<b>Basics of Metrology*</b> 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.								9
<b>Measurement of Linear and Angular Dimensions*</b> 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.								9
<b>Form Measurement*</b> 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.								9
<b>Measurement of Power, Flow and Temperature*</b> 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.								9
<b>Advances in Metrology*</b> 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.								9
<b>Total Hours</b>								45
<b>Text Book(s):</b>								
1.	Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2018.							
2.	Jain R.K. “Engineering Metrology”, Khanna Publishers, 2018.							
<b>Reference(s):</b>								
1.	Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.							
2.	John H. Lienhard V Thomas G. Beckwith, Roy D. Marangoni “Mechanical Measurements”, Pearson Education, 2020							
3.	Ammar Grous, J “Applied Metrology for Manufacturing Engineering”, Wiley-ISTE, 2011							
4.	Raghavendra N.V. and Krishnamurthy. L., “Engineering Metrology and Measurements,” Oxford University Press, 2013.							

\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
1	<b>Basics of Metrology</b>	
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

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1.6	Precision and Accuracy	1
1.7	Errors in Measurements	1
1.8	Calibration of measuring instruments	1
1.9	ISO Standards	1
<b>2</b>	<b>Measurement of Linear and Angular Dimensions</b>	
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
<b>3</b>	<b>Form Measurement</b>	
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
<b>4</b>	<b>Measurement of Power, Flow and Temperature</b>	
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
<b>5</b>	<b>Advances in Metrology</b>	
5.1	Basic concept of lasers, Advantages of lasers	1
5.2	Laser Scan Micrometer	1
5.3	Laser Interferometers	1
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
	<b>Total hours</b>	<b>45</b>

#### Course Designer(s)

1. S.Venkatesan- [venkatesans@ksrct.ac.in](mailto:venkatesans@ksrct.ac.in)

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

### Objectives

- To impart understanding of the operating principles of fluid power systems.
- To apply the working principles of hydraulic actuators and control components.
- To apply the working principles of pneumatic power system and its components.
- To design and develop the fluid power circuit design methods and its applications.
- To solve the trouble shooting methods in fluid power systems.

### Pre-requisite

-NIL-

### Course Outcomes

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

CO1	Apply the working principles of fluid power systems and hydraulic pumps.	Remember, Understand, Apply
CO2	Identify suitable hydraulic actuators and motors for different applications.	Remember, Understand, Apply
CO3	Apply the working principles of pneumatic circuits system and its components.	Remember, Understand, Apply
CO4	Design fluid power circuit for given applications.	Understand, Apply, Analyze, Create
CO5	Identify various troubles shooting methods in fluid power systems.	Remember, Understand, Apply

### Mapping with Programme Outcomes

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

3- Strong;2-Medium;1-Some

### Assessment Pattern

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

## Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 ME 406 - Applied Hydraulics and Pneumatics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	2	0	2	60	3	50	50	100
<b>Fluid Power Systems and Hydraulic Pumps*</b> 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 and Selection of pumps- Problems.								[9]
<b>Hydraulic Actuators and Control Components*</b> 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 and Proportional valves – applications. <b>Hands on Session:</b> 1. Assembling of hydraulic components for basic Hydraulic circuit.								[12]
<b>Pneumatic and Electro Pneumatic Systems*</b> Introduction - Properties of air, Compressors – types - construction details, Filter - Regulator and Lubricator unit, Pneumatic actuators- single cylinder and multi cylinder circuits. <b>Electro Pneumatic System – Elements – Ladder diagram – Timer circuits, Introduction to fluidics and pneumatic logic circuits*</b> . <b>Hands on Session:</b> 1. Assembling of pneumatic components for basic Pneumatic circuit.								[12]
<b>Fluid Power Circuit Design*</b> Regenerative circuits, Deceleration circuits, Sequencing circuits, Automatic cylinder reciprocation circuit, Cascade method, Accumulators - types and circuits - Intensifier circuits - Air-over oil. <b>Hands on Session:</b> 1. Assembling of pneumatic components for Meter in & Meter out circuit 2. Assembling of pneumatic components for Synchronizing circuit.								[15]
<b>Trouble Shooting and Applications</b> <b>Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic system**.</b> Design of hydraulic circuits for Drilling, Surface grinding, Press and Forklift applications-Low cost Automation – Hydraulic and Pneumatic power packs.								[12]
<b>Total Hours:60 (Lecture Hour: 45; Hands on Training:15)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Srinivasan. R., “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 3 <sup>rd</sup> edition, 2019.							
2	Anthony Esposito, “Fluid Power with Applications”, Pearson Education Asia Delhi, New Delhi, 7th Edition, 2015.							
<b>Reference(s):</b>								
1.	Jagadeesha T, “Hydraulics And Pneumatics”, Dreamtech Press, New Delhi, 2019.							
2.	Majumdar S.R., “Pneumatic Systems, Principles and Maintenance” Tata McGraw Hill education, 2017.							
3.	IlangoSivaraman, “Introduction to Hydraulics and Pneumatics”, PHI Learning, New Delhi, 3 <sup>rd</sup> Edition, 2017.							
4	Andrew Parr, “Hydraulics and Pneumatics-Technicians and Engineers Guide”, Jaico Pub., Chennai, 2011.							
5	NPTEL video link: <a href="https://youtu.be/4IPzA5vhFYA">https://youtu.be/4IPzA5vhFYA</a>							

\* SDG 8 – Decent work and Economic Growth

\*\* SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S. No	Topic	No.of Hours
1	<b>Fluid power systems and Hydraulic Pumps</b>	
1.1	Introduction to fluid power	1

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1.2	Advantages and applications of fluid power systems	1
1.3	Types of fluid power system	1
1.4	Pascal's law and its applications	1
1.5	Fluid power symbols	1
1.6	Hydraulic pump classification	2
1.7	Pump Performance	1
1.8	Selection of pumps	1
<b>2</b>	<b>Hydraulic Actuators and Control Components</b>	
2.1	Cylinders – types construction and applications	2
2.2	Telescopic cylinders	1
2.3	Hydraulic motors -types and construction	2
2.4	Direction control valves	1
2.5	Flow control valves	1
2.6	Pressure control valves	1
2.7	Servo and Proportional valves – applications.	1
2.8	Assembling of hydraulic components for basic Hydraulic circuit	3
<b>3</b>	<b>Pneumatic and Electro Pneumatic Systems</b>	
3.1	Properties of air and Compressors types	1
3.2	Compressors - construction details	1
3.3	Filter - Regulator and Lubricator unit	1
3.4	Pneumatic actuators- single cylinder circuits	1
3.5	Multi cylinder circuits	2
3.6	Electro Pneumatic System – Elements	1
3.7	Ladder diagram	1
3.8	Timer circuits-Problems	2
3.9	Introduction to fluidics and pneumatic logic circuits.	1
3.10	Assembling of Pneumatic components for basic Pneumatic circuit	3
<b>4</b>	<b>Fluid Power Circuit Design</b>	
4.1	Regenerative circuits	1
4.2	Deceleration circuits	1
4.3	Sequencing circuits	1
4.4	Automatic cylinder reciprocation circuit	1
4.5	Cascade method	2
4.6	Intensifier circuits - Air-over oil.	1
4.7	Assembling of pneumatic components for Meter in & Meter out circuit	3
4.8	Assembling of pneumatic components for Synchronizing circuit.	3
<b>5</b>	<b>Trouble Shooting and Applications</b>	
5.1	Installation	1
5.2	Selection and Maintenance	1
5.3	Trouble Shooting and Remedies in Hydraulic and Pneumatic system	2
5.5	Design of hydraulic circuits for Drilling and surface grinding	3
5.6	Press and Forklift applications	2
5.7	Low-cost Automation	1
5.8	Hydraulic and Pneumatic power packs	2
	<b>Total</b>	<b>60</b>

#### Course Designer(s)

1. Dr.M.Gnanasekaran– [gnanasekaran@ksrct.ac.in](mailto:gnanasekaran@ksrct.ac.in)
2. Dr.S.Gopalakrishnan- [sgopalakrishnan@ksrct.ac.in](mailto:sgopalakrishnan@ksrct.ac.in)
3. Mr.P.Prakash – [pprakash@ksrct.ac.in](mailto:pprakash@ksrct.ac.in)

#### Simulation Software

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- Automation Studio - Cascade Method; Speed Control circuits; Regenerative circuits

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-requisite

- 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	Apply
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	Apply

### Mapping with Programme outcomes

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
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

- a) Tension test on mild steel rod  
b) Double shear test on mild steel rod
- a) Torsion test on mild steel rod  
b) Deflection test on simply supported beam
- Hardness test on metal (Rockwell and Brinell hardness)
- Tension and Compression test on helical spring
- Impact test on metal (Charpy and Izod test)

#### Fluid Machinery Laboratory

- (a) Determination of coefficient of discharge of a venturimeter  
(b) Determination of friction factor for flow through pipes
- (a) Determination of metacentric height  
(b) Determination of forces due to impact of jet on a fixed plate
- Characteristics of centrifugal pumps
- Characteristics of reciprocating pump
- Characteristics of Pelton wheel turbine

#### Lab Manual

1.	"Strength of Materials and Fluid Machinery Laboratory Manual" by Mechanical Faculty Members
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SDG 4 – Quality Education

## Course Designer(s)

- Dr.M.Gnanasekaran - gnanasekaran@ksrct.ac.in
- Dr.S.Jeyaprakasam – sjeyaprakasam@ksrct.ac.in



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, drilling and 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.

### 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	R/U
CO2	Demonstrate the use of operation manuals for the lathes as well as any necessary materials and equipment associated with the lathe.	R/U
CO3	Machine a dovetail, keyway in shaper machine and horizontal milling machine,	R/U
CO4	Perform grinding operation in cylindrical grinding, surface grinding and Centerless grinding machine	R/U
CO5	Understand CNC machining and uses, and applications of CNC program.	R/U

### Mapping with Programme Outcome

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
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
<b><u>LIST OF EXPERIMENTS</u></b> <ol style="list-style-type: none"> <li>1. Preparing green sand moulds with cast patterns.</li> <li>2. a) External thread cutting and Grooving circular parts using lathe machine. b) Cutting force calculation using dynamometer in lathe machine</li> <li>3. Knurling and Taper Turning on circular parts using lathe machine.</li> <li>4. Milling –Hexagonal Heads on circular parts using Milling machine.</li> <li>5. Cutting spur gear using milling machine.</li> <li>6. a) Machining of external splines using slotting machine. b) Drilling and Tapping using Radial drilling machine.</li> <li>7. Generating gears using gear hobbing machine.</li> <li>8. Machining of Square and V-block using Shaping machine.</li> <li>9. Grinding components using Surface/ Cylindrical /Centerless grinding machine</li> <li>10. CNC - Stock Removal using CNC Turning machine.</li> <li>11. CNC - Stock Removal using CNC Milling machine</li> </ol>								
<b>Lab Manual</b>								
1.	"Manufacturing Technology I Laboratory Manual" by Mechanical Faculty Members							

SDG 12 Responsible Consumption and Production

## Course Designer(s)

1. Dr.G. Venkatachalam-[venkatachalam@ksrct.ac.in](mailto:venkatachalam@ksrct.ac.in)
2. Mr.S.Venkatesan-[venkatesans@ksrct.ac.in](mailto:venkatesans@ksrct.ac.in)

60 CG 0P3	Career Skill Development - III	Category	L	T	P	Credit
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Rev. No.1/w.e.f. 02.01.2024

Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

		<b>CG</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1*</b>
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## 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-requisite

-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

CO	PO												PSO		
	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	

## Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 CG 0P3 & Career Skill Development - III								
Semester	Hours/Week			Total hrs	Credit C	Maximum Marks		
	L	T	P			CA	ES	Total
IV	0	0	2	25	1*	100	00	100
<b>Logical Reasoning</b> Analogies - Alpha and numeric series - Number Series - Coding and Decoding - Blood Relations - Coded Relations - Order and Ranking – odd man out - Direction and distance								[5]
<b>Quantitative Aptitude – Part 1</b> Number system - Squares & cubes - Divisibility - Unit digits - Remainder Theorem - HCF & LCM - Geometric and Arithmetic progression - Surds & indices								[5]
<b>Critical Reasoning</b> Syllogism - Statements and Conclusions, Cause and Effect, Statements and Assumptions - identifying Strong Arguments and Weak Arguments – Cause and Action -Data sufficiency								[5]

<b>Quantitative Aptitude – Part 2</b> Average - Ratio and proportion – Ages – Partnership– Percentage - Profit & loss – Discount - Mixture and Allegation		[5]
<b>Quantitative Aptitude – Part 3</b> Time & Work - Pipes and cistern – Time, Speed & distance - Trains - Boats and Streams - Simple interest and Compound interest		[5]
<b>Total Hours:</b>		<b>25</b>
<b>Reference(s):</b>		
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, 6 <sup>th</sup> edition, 2016	
3.	Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education 2020	
4.	Anne Thomson, 'Critical Reasoning: A Practical Introduction' Lexicon Books, 3 <sup>rd</sup> edition, 2022. Warsaw	

SDG 4 – Quality Education

SDG 8 – Decent work and Economic growth

SDG 9 – Industry, innovation and Infrastructure

#### Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
<b>1</b>	<b>Logical Reasoning</b>	
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
<b>2</b>	<b>Quantitative Aptitude – Part 1</b>	
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
<b>3</b>	<b>Critical Reasoning</b>	
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
<b>4</b>	<b>Quantitative Aptitude – Part 2</b>	
4.1	Average - Ratio and proportion	1
4.2	Ages – Partnership	1
4.3	Percentage	1
4.4	Profit & loss	1
4.5	Discount - Mixture and Allegation	1
<b>5</b>	<b>Quantitative Aptitude – Part 3</b>	
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
<b>Total</b>		<b>25</b>

#### Course Designer(s)

1. R. Poovarasana - [poovarasana@ksrct.ac.in](mailto:poovarasana@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 from 2023-2024 onwards)

**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	50	50	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 ME L1*	Open Elective – I	2	40	60	100	45	100
6	60 MY 003	Start-ups & Entrepreneurship	2	100	-	100	-	-
7	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts <sup>#</sup>	-	50	50	100	-	-
PRACTICAL								
8	60 ME5P1	Thermal Engineering Laboratory	3	60	40	100	45	100
9	60 ME5P2	Metrology and Dynamics Laboratory	3	60	40	100	45	100
10	60 CG 0P4	Career Skill Development-IV	-	100	-	100	-	-
11	60 CG 0P6	Internship <sup>#</sup>	-	-	-	-	-	-

\*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 the award of terminal examination marks.

60 ME 501	Automobile Engineering	Category	L	T	P	Credit
		PC	2	0	2	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 braking 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.	Remember & Understand
CO2	Summarize the battery, ignition, starting and emission control systems and BS VI norms of an automobile	Remember & Understand
CO3	Distinguish the working of different types of transmission systems tyres and its inner elements.	Remember & Understand
CO4	Illustrate the working of steering, suspension and electronics in braking systems	Remember & Understand
CO5	Discuss the benefits and challenges of electric, hybrid and autonomous vehicles.	Remember & Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	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		2			2

3- Strong;2-Medium;1-Some

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Examination (Marks)	End Sem Examination(Marks)
	1	2		
Remember	20	20	34	34
Understand	40	40	66	66
Apply	0	0	0	0
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME 501 - Automobile Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	2	60	3	50	50	100
<b>Vehicle Structure and Electronics in Engine Systems*</b> 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. <b>Hands on Session:</b> -Identify the parts of Chassis and frame								[10]
<b>Electrical and Emission control system</b> Battery-Types (lead acid and lithium ion) and Construction – Starting and Charging system – lighting system. <b>Vehicle pollutants and its effect - Emission control system for SI &amp; CI engine (Catalytic Converter &amp; Exhaust Gas Recirculation) -Emission norms in India – Bharat Stage VI**.</b> <b>Hands on Session:</b> -Check the condition of lead acid battery -Do the circuit connection of Starting, Charging system and lighting system.								[10]
<b>Transmission Systems*</b> 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. <b>Hands on Session:</b> -Identify the parts of friction clutch and manual gear box -Identify the parts of Hotchkiss Drive system -Identify the parts of differential and rear axle drive.								[15]
<b>Steering, Suspension and Braking Systems*</b> 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). <b>Hands on Session:</b> -Do the wheel alignment and balancing -Identify the parts of steering linkages and manual gear box. -Identify the parts of hydraulic and MacPherson strut suspension system.								[15]
<b>Electric and Autonomous Vehicles***</b> 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								[10]
<b>Total Hours: (Lecture – 30 Hours; Hands on Session-30 Hours)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Kirpal Singh, "Automobile Engineering", 14 <sup>th</sup> Edition, Volume I & II, Standard Publishers Distributor, New Delhi, 2021.							
2.	Crouse W. H., Anglin D. L., “Automotive Mechanics”, 10 <sup>th</sup> Edition, McGraw Hill Education Private Limited, New Delhi, 2017							
<b>Reference(s):</b>								
1.	Technical Teacher's Training Bhopal, “Automobile Engineering”, 1 <sup>st</sup> Edition, McGraw Hill Education Private Limited, New Delhi, 2017.							
2.	Rajput R.K., "A Text book of Automobile Engineering", 2 <sup>nd</sup> Edition, Laxmi Publication, New Delhi, 2017..							
3.	Jain K.K. and Asthana R.B., “Automobile Engineering”, Tata McGraw Hill Publishers, New Delhi, 6 <sup>th</sup> Edition, 2002.							
4.	NPTEL: Fundamentals of Automotive Systems, <a href="https://archive.nptel.ac.in/courses/107/106/107106088/">https://archive.nptel.ac.in/courses/107/106/107106088/</a> Prof. C.S.Shankar Ram. IIT Madras.							

\*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
<b>1.0</b>	<b>Vehicle Structure and Electronic Engine Systems</b>	
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
<b>2.0</b>	<b>Electrical and Emission control system</b>	
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 Converter & Exhaust Gas Recirculation)	1
2.6	Emission norms in India – Bharat Stage VI	1
<b>3.0</b>	<b>Transmission Systems</b>	
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
<b>4.0</b>	<b>Steering, Brakes and Suspension Systems</b>	
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	1



	Traction Control (TC).	
<b>5.0</b>	<b>Electric and Autonomous Vehicles</b>	
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
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](mailto:-rajak@ksrct.ac.in)

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.	Remember, Understand & Apply
CO2	Evaluate the principle of static and dynamic balancing to solve the problems related to unbalancing of revolving and reciprocating masses.	Remember, Understand & Apply
CO3	Apply the concepts of free vibrations to evaluate natural frequency of given system.	Remember, Understand & Apply
CO4	Apply the forced vibrations principles to evaluate the frequency of forced vibrations.	Remember, Understand & Apply
CO5	Apply the principle of governors and effect of gyroscopic couple for speed control and stability.	Remember, Understand & Apply

### Mapping with Programme Outcomes

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

3- Strong;2-Medium;1-Some

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME 502- Dynamics of Machines								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100
<b>Force analysis*</b> 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.								[12]
<b>Balancing*</b> 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.								[12]
<b>Free vibrations*</b> 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.								[12]
<b>Forced vibrations*</b> Step–input forcing–harmonic forcing–periodic forcing–magnification factor–vibration isolation and transmissibility.								[12]
<b>Governors and Gyroscopic Couple**</b> Functions of Governors–gravity controlled and spring-controlled governor characteristics. Stability–Hunting and Isochronism. Gyroscopic couple–Gyroscopic effects on aero planes, ships and automobiles.								[12]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Uicker J J, Pennock G R, Shigley J E. “Theory of machines and mechanisms” Oxford University Press, New York, 5 <sup>th</sup> edition, 2017.							
2	Bansal R K, Brar J S. “A textbook of theory of machines (in S.I. units)” Laxmi publications, New Delhi, 6 <sup>th</sup> edition, 2023.							
<b>Reference(s):</b>								
1.	Rao J S, and Dukkipati. R Y., “Mechanism and Machine Theory”, Reprint, New Age International, New Delhi, 2 <sup>nd</sup> Edition, 2014.							
2.	Rattan S S., “Theory of Machines”, Tata McGraw–Hill Publishing Co. Ltd., New Delhi, 4 <sup>th</sup> Edition, 2014.							
3.	Amitabh Ghosh and Malik, A K., “Theory of Mechanisms and Machines”, Reprint, Affiliated East West Press Pvt. Ltd., 3 <sup>rd</sup> Edition, 2011.							
4.	Thomas Bevan, “The Theory of Machines”, Pearson Education Ltd., 3 <sup>rd</sup> Edition, 2010.							
5.	NPTEL video by IIT Kanpur: <a href="https://archive.nptel.ac.in/courses/112/104/112104114/">https://archive.nptel.ac.in/courses/112/104/112104114/</a>							

\*SDG 9 – Industry Innovation and Infrastructure

\*\*SDG 8 – Decent work and Economic Growth

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Force analysis</b>	
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
<b>2.0</b>	<b>Balancing</b>	
2.1	Static and dynamic balancing	1

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Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

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
<b>3.0</b>	<b>Free vibrations</b>	
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
<b>4.0</b>	<b>Forced vibrations</b>	
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
<b>5.0</b>	<b>Governors and Gyroscopic Couple</b>	
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](mailto:santhanam@ksrct.ac.in)

#### List of MATLAB exercises:

1. Engine force analysis
2. Balancing of rotating masses
3. Evaluation of Natural frequency
4. Evaluation of frequency of forced vibrations
5. Evaluation of mean speed of governors

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	Remember, Understand & Apply
CO2	Design of shafts and couplings	Remember, Understand & Apply
CO3	Apply the concepts of design of temporary and permanent joints.	Remember, Understand & Apply
CO4	Design of energy storing elements and engine components.	Remember, Understand & Apply
CO5	Select the bearings, seals and gaskets.	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3										3	3
CO2	3	3	3	3								3	3	3	3
CO3	3	3	3	3	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)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

K.S. Rangasamy College of Technology – Autonomous R 2022								
60 ME 503 – Design of Machine Elements								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100
<b>Fundamental Concepts in Design*</b> 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								[12]
<b>Design of shafts and Couplings**</b> Shafts and Axles – Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and Splines – Rigid and flexible couplings.								[12]
<b>Design of Temporary and Permanent Joints**</b> Threaded fasteners: Design of bolted joints including eccentric loading. Knuckle joints, Cotter joints Welded joints, riveted joints for structures – theory of bonded joints.								[12]
<b>Design of Energy Storing Elements and Engine components**</b> 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.								[12]
<b>Design of Bearings**</b> 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. <b>Note: Use of approved Design Data book is permitted for examination.</b>								[12]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill education Pvt. Ltd., 5 <sup>th</sup> Edition, 2020.							
2	Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 10 <sup>th</sup> Edition, Tata McGraw-Hill , 2015.							
<b>Reference(s):</b>								
1.	Khurmi R S.,Gupta J K., “A Text book of Machine Design”, Eurasia Pub. House Pvt. Ltd., 14 <sup>th</sup> Ed., 2005.							
2.	Norton R.L, “Design of Machinery”, McGraw-Hill Book co, 3 <sup>rd</sup> Edition, 2004.							
3.	Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine component Design”,6 <sup>th</sup> 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, 5 <sup>th</sup> Edition, 2011.							
6.	NPTEL video IIT Kharagpur:: <a href="https://archive.nptel.ac.in/courses/112/105/112105124/">https://archive.nptel.ac.in/courses/112/105/112105124/</a>							
<b>Data Book(s):</b>								
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

**List of MATLAB Programmes applied for the following tutorial topics:**

1. Determination of efficiency and length in Welded joints and Riveted joints
2. Solving problems in Helical spring and Leaf spring
3. Determination of Flywheel considering stresses
4. Solving problems in Journal bearing and Rolling contact bearings

**Course Contents and Lecture Schedule**

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Fundamental Concepts in Design</b>	
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
<b>2.0</b>	<b>Design of shafts and Couplings</b>	
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
<b>3.0</b>	<b>Design of Temporary and Permanent Joints</b>	
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
<b>4.0</b>	<b>Design of Energy Storing Elements and Engine components</b>	
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
<b>5.0</b>	<b>Governors and Gyroscopic Couple</b>	
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](mailto:sakthivel_s@ksrct.ac.in)

Rev. No.1/w.e.f. 02.01.2024

Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023

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

### Objectives

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

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

### Mapping with Programme Outcomes

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

3- Strong;2-Medium;1-Some

### Assessment Pattern

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



## Syllabus

K.S. Rangasamy College of Technology – Autonomous R2022								
60 MY 003 – Startups and Entrepreneurship								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	0	30	-	100	--	100
<b>Introduction to Entrepreneurship &amp; Entrepreneur</b> Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship. The Entrepreneur: Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system.								[6]
<b>Business Opportunity Identification and Preparing a Business Plan*</b> Business ideas, methods of generating ideas, and opportunity recognition, Idea Generation Process, Feasibility study, preparing a Business Plan: Meaning and significance of a business plan, components of a business plan.								[6]
<b>Innovations**</b> Innovation and Creativity – Introduction, Innovation in Current. Environment, Types of Innovation, School of Innovation,Analysing the Current Business Scenario, Challenges of Innovation, Steps of Innovation Management, Experimentationin Innovation Management, Participation for Innovation, Co-creation for Innovation, Proto typing to Incubation. BlueOcean Strategy-I, Blue Ocean Strategy-II. Marketing of Innovation, Technology Innovation Process.								[6]
<b>Financing and Launching the New Venture**</b> Importance of new venture financing, types of ownership, venture capital, types of debt securities, determining idealdebt-equity mix, and financial institutions and banks. Launching the New Venture: Choosing the legal form of new venture, protection of intellectual property, and formation of the new venture.								[6]
<b>Managing Growth and Rewards in New Venture**</b> Characteristics of high growth new ventures, strategies for growth, and building the new ventures. Managing Rewards: Exit strategies for Entrepreneurs, Mergers and Acquisition, Succession and exit strategy, managing failures– bankruptcy.								[6]
<b>Total Hours:</b>								<b>30</b>
<b>Text Book(s):</b>								
1.	Stephen Key, “One Simple Idea for Startups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company” 1 <sup>st</sup> Edition, Tata Mc Graw hill Company, New Delhi, 2013.							
2	Charles Bamford and Garry Bruton, “Entrepreneurship: The Art, Science, and Process for Success”, 2 <sup>nd</sup> Edition, Tata Mc Grawhill Company, New Delhi, 2016.							
<b>Reference(s):</b>								
1.	Philip Auerswald, “The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy”, Oxford University Press, 2012.							
2.	Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, “Entrepreneurial Finance: Strategy, Valuation and Deal Structure, Stanford Economics and Finance”, 2011							
3.	Edward D. Hess, “Growing an Entrepreneurial Business: Concepts and Cases”, Stanford Business Books, 2011							
4.	Howard Love, “The Start-Up J Curve: The Six Steps to Entrepreneurial Success”, Book Group Press, 2011.							

\*SDG 12 – Responsible Consumption and Production

\*\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

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

## Course Designer(s)

1. Dr.N.Tiruvankadam - tiruvankadam@ksrct.ac.in

60 ME 5P1	Thermal Engineering Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

### 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-requisite

- 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	Apply
CO5	Demonstrate the working principles of steam turbine and steam generator	Apply

### Mapping with Programme outcomes

CO	PO												PSO		
	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															

K.S.Rangasamy College of Technology – Autonomous R2022								
60 ME 5P1 – Thermal Engineering Laboratory								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	4	60	2	60	40	100
<b>List of Experiments</b> <ol style="list-style-type: none"> <li>(a) Draw the Valve timing diagram of CI Engine (b) Determination of flash point and fire point of fuels. (c) Determination of viscosity of lubricating oil by Redwood and Saybolt viscometer</li> <li>Performance Test on 4 - Stroke Diesel Engine.</li> <li>Heat Balance Test on 4-Stroke Diesel Engine.</li> <li>Morse Test on Multi-Cylinder Petrol Engine.</li> <li>Determination of frictional power of a diesel engine by retardation test.</li> <li>Measurement of engine emission and smoke using exhaust gas analyser and smoke meter</li> <li>Performance test on two stage reciprocating air-compressor</li> <li>Performance test on air-conditioning test rig</li> <li>Performance test on vapour compression refrigeration test rig</li> <li>Performance and energy balance test on a steam generator and steam turbine</li> </ol>								
<b>Design Experiments :</b> <ol style="list-style-type: none"> <li>Determine the flash point, fire point, kinematic viscosity and absolute viscosity for alternative fuels at different temperature 40°C, 50°C and 60°C</li> <li>Determination of p-θ diagram and heat release characteristics of an CI engine for alternative fuel.</li> </ol>								
<b>Lab Manual</b>								
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)

- Dr.D.Vasudevan – [dvasudevan@ksrct.ac.in](mailto:dvasudevan@ksrct.ac.in)

60 ME 5P2	Metrology and Dynamics Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

### 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-requisite

- 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.	Apply
CO5	Evaluate the natural frequency of free vibrations and estimate the transmissibility ratio using vibrating table	Apply

### Mapping with Programme outcomes

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
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	4	60	2	60	40	100
<b><u>List of Experiments</u></b> <ol style="list-style-type: none"><li>1. Calibration and use of measuring instruments – Vernier caliper, micrometer, dial gauge and vernier height gauge – using gauge blocks.</li><li>2. Measurement of various dimensions of the given component using profile projector.</li><li>3. Measurement of angle and pitch by using tool maker's microscope.</li><li>4. Measurement of taper angle using sine bar.</li><li>5. Measurement of major and effective diameter of screw thread using 2 wire methods.</li><li>6. Measurement of Temperature using transducers. (Thermo couple, RTD, Thermistor, Semiconductor).</li><li>7. Calculate the moment of inertia of connecting rod by oscillation method.</li><li>8. Determination of natural frequency and critical speed of given shaft.</li><li>9. Determination of natural frequency of given spring mass system.</li><li>10. Determination of natural frequency and deflection of free beam.</li><li>11. Determination of torsional frequency of a single rotor system.</li><li>12. Determination of transmissibility ratio using vibrating table.</li></ol>								
<b>Lab Manual</b>								
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. Dr.K.Santhanam – [santhanam@ksrct.ac.in](mailto:santhanam@ksrct.ac.in)
2. Mr. P.Tamilarasu – [tamilarasup@ksrct.ac.in](mailto:tamilarasup@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-requisite

- 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

CO	PO												PSO		
	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								
Career Skill Development – IV								
Common to All Branches								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	2	30	1*	100	00	100
<b>Verbal &amp; Analytical Reasoning</b> Seating Arrangements – Analytical Reasoning (PUZZELS) – Machin input and output – Coded Inequality – Eligibility Test								[6]
<b>Quantitative Aptitude – Part – 4</b> Permutation and Combination – Probability – Quadratic equation – Geometry – Clock – Calendar – Logarithmic								[6]
<b>Non-Verbal Reasoning</b> Series Completion of Figures – Classification – Courting of figure – Figure matrix – Embedded Figure – Complete Figure – Paper Cutting and Folding – Mirror images and Water Images								[6]

<b>Quantitative Aptitude – Part – 5</b> 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]
<b>Data Interpretation and Analysis</b> Data interpretation Based on text – Data interpretation Based on Tabulation, Pie chart, Bar graph, And Line graph – Venn Diagram - Data sufficiency		[6]
<b>Total Hours</b>		<b>30</b>
<b>Reference(s):</b>		
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, 6 <sup>th</sup> edition, 2016	
3.	Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education (2020)	
4.	Anne Thomson, 'Critical Reasoning: A Practical Introduction' Lexicon Books, 3 <sup>rd</sup> edition, 2022. Warsaw	

SDG 4 – Quality Education

SDG 8 – Decent work and Economic growth

SDG 9 – Industry, innovation and Infrastructure

### Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
<b>1</b>	<b>Verbal &amp; Analytical Reasoning</b>	
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
<b>2</b>	<b>Quantitative Aptitude – Part – 4</b>	
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
<b>3</b>	<b>Non-Verbal Reasoning</b>	
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
<b>4</b>	<b>Quantitative Aptitude – Part – 5</b>	
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
<b>5</b>	<b>Data Interpretation and Analysis</b>	
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
<b>Total</b>		<b>30</b>

### Course Designer(s)

1.R. Poovarasana- [poovarasana@ksrct.ac.in](mailto:poovarasana@ksrct.ac.in)

Rev. No.1/w.e.f. 02.01.2024

Passed in BoS Meeting held on 24.11.2023

Approved in Academic Council Meeting held on 23.12.2023



**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 from 2023-2024 onwards)

**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	61 ME E3*	Professional Elective – III	2	40	60	100	45	100
6	60 MEL2*	Open Elective - II	2	40	60	100	45	100
7	60 AB 00 <sup>#</sup>	NCC/NSS/NSO/YRC/RRC/Fine Arts <sup>#</sup>	2	100	-	100	-	-
PRACTICAL								
8	60 ME6P1	Heat Transfer Laboratory	3	60	40	100	45	100
9	60 ME6P2	Analysis and Simulation Laboratory	3	60	40	100	45	100
10	60 ME 6P3	Mini-project <sup>&amp;</sup>	-	-	-	-	-	-
11	60 CG 0P5	Comprehension Test*	-	100	-	100	-	-
12	60 CG 0P6	Internship <sup>#</sup>	-	-	-	-	-	-

\*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 the award of terminal examination marks.

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.	Remember, Understand & Apply
CO2	Assess the convection phenomena and determine the heat transfer rate in free and forced convection.	Remember, Understand & Apply
CO3	Determine the heat transfer rate in radiation using shape factor algebra and electrical analogy.	Remember, Understand & Apply
CO4	Demonstrate the concept of phase change heat transfer and heat exchangers using LMTD and NTU approach.	Remember, Understand & Apply
CO5	Develop solutions for combined heat and mass transfer problems.	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Exam	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	20	20
Apply	30	30	60	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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Passed in BoS Meeting held on 24/11/2023

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME 601 – Heat and Mass Transfer								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Conduction Heat Transfer*</b> 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]
<b>Convection Heat Transfer*</b> 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]
<b>Radiation Heat Transfer*</b> Basic laws of radiation – Black body radiation – Grey body radiation – Shape factor algebra – Electrical analogy – Radiation shields.								[9]
<b>Phase Change Heat Transfer and Heat Exchangers*</b> 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]
<b>Mass Transfer*</b> Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion - Equimolar Counter Diffusion – Convective Mass Transfer – Convective Mass Transfer Correlations <b>(Use of Approved Heat and Mass Transfer Data Book are permitted)</b>								[9]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Sachdeva R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publishers, 5 <sup>th</sup> edition, 2022.							
2	Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", Wiley, Eighth Edition, 2020.							
<b>Reference(s):</b>								
1.	Rajput R.K., "Heat and mass Transfer", S.Chand Publishers, 7 <sup>th</sup> edition, 2018.							
2.	Holman J.P., "Heat Transfer", Tata McGraw-Hill company, 10 <sup>th</sup> edition, 2017.							
3.	Kothandaraman C.P. "Fundamental of Heat and Mass Transfer", New age International Publishers, New Delhi, 4 <sup>th</sup> Edition, 2012.							
4.	Nag. P.K, "Heat and Mass Transfer" Tata McGraw-Hill, 3 <sup>rd</sup> Edition, 2015.							
5.	Nptel Video: <a href="https://youtu.be/YGvD5HPI3uw?si=sBfc8fd8F5Du406H">https://youtu.be/YGvD5HPI3uw?si=sBfc8fd8F5Du406H</a>							
<b>Data book(s):</b>								
1.	Kothandaraman, C.P., Subramanyam. S., "Heat and Mass Transfer Data Book" New age International Publishers, New Delhi, 9 <sup>th</sup> Edition, 2018.							
2.	Khurmi. R.S "Steam Tables" S.Chand Publishers, 2012.							

\* SDG 12 – Responsible Consumption and Production

## Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
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<b>1</b>	<b>Conduction Heat Transfer</b>	<b>9</b>
1.1	Basic Concepts – Fourier's Law of Conduction	1
1.2	Three Dimensional Heat Conduction Equation in Cartesian Coordinate System	1
1.3	1D Steady State Heat Conduction through Plane Wall	1
1.4	1D Steady State Heat Conduction through Plane Cylinder	1
1.5	1D 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
<b>2</b>	<b>Convection Heat Transfer</b>	<b>9</b>
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
<b>3</b>	<b>Radiation Heat Transfer</b>	<b>9</b>
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
<b>4</b>	<b>Phase Change Heat Transfer and Heat Exchangers</b>	<b>9</b>
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
<b>5</b>	<b>Mass Transfer</b>	<b>9</b>
5.1	Basic Concepts	2
5.2	Diffusion Mass Transfer – Fick's Law of Diffusion	2
5.3	Equimolar Counter Diffusion	2
5.4	Convective Mass Transfer	2
5.5	Convective Mass Transfer Correlations	1
	<b>Total</b>	<b>45</b>

#### Course Designer(s)


1. Mr.R.Prakash – [prakashr@ksrct.ac.in](mailto:prakashr@ksrct.ac.in)

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

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

## 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.	Understand & Apply
CO2	Formulate 1D elements and apply them to solve structural and thermal problems.	Understand & Apply
CO3	Implement the formulation techniques to solve 2D structural and thermal problems using triangular elements	Understand & Apply
CO4	Develop the stiffness matrices for axisymmetric element and solve structural problems.	Understand & Apply
CO5	Formulate the iso-parametric elements to solve complex problem with irregular geometries.	Understand & Apply

## Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3										3	
CO2	3	3	3	3	3			3	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)		Model Exam	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

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K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME 602 – Finite Element Analysis								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	40	60	100
<b>Introduction</b> 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.								[12]
<b>One-Dimensional Problems*</b> 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								[12]
<b>Two Dimensional Scalar Variable Problems*</b> 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.								[12]
<b>Two Dimensional Vector Variable Problems*</b> Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body Constitutive matrices and Strain displacement matrices – Stress calculations – Plate and shell elements.								[12]
<b>Isoparametric Formulation*</b> 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.								[12]
<b>Total Hours (45 + 15 Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Rao, S.S., “The Finite Element Method in Engineering”, 6 <sup>th</sup> Edition, Butterworth Heinemann, 2019.							
2	Chandrupatla, T.R. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, International Edition, Pearson Education Limited, 2014.							
<b>Reference(s):</b>								
1.	David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGrawHill, 2005							
2.	Reddy. J.N., “An Introduction to the Finite Element Method”, 4 <sup>th</sup> 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”, 4 <sup>th</sup> Edition, Wiley Student Edition, 2004.							
5.	<a href="https://nptel.ac.in/courses/112104193">https://nptel.ac.in/courses/112104193</a>							
6.	<a href="https://onlinecourses.nptel.ac.in/noc23_me63/preview">https://onlinecourses.nptel.ac.in/noc23_me63/preview</a>							

\*SDG 9 – Industry Innovation and Infrastructure

### Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	Introduction	

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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
<b>2</b>	<b>One-Dimensional Problems</b>	
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 element	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
<b>3</b>	<b>Two Dimensional Scalar Variable Problems</b>	
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
<b>4</b>	<b>Two Dimensional Vector Variable Problems</b>	
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
<b>5</b>	<b>Isoparametric Formulation</b>	
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
	<b>Total</b>	<b>45</b>

### Course Designer(s)

1. Mr.M.Prasath – [prasathm@ksrct.ac.in](mailto:prasathm@ksrct.ac.in)

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

### Objectives

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- 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.	Remember, Understand & Apply
CO2	Design of spur and Helical gears based on Lewis and Buckingham equation and gear life.	Remember, Understand & Apply
CO3	Design of bevel and Worm gears based on Lewis and Buckingham equation and gear life.	Remember, Understand & Apply
CO4	Design and analyze the multi speed gear box.	Remember, Understand & Apply
CO5	Design and analyze the frictional drives.	Remember, Understand & Apply

#### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination Marks	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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60 ME 603 – Design of Mechanical Transmission Systems								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	2	0	60	4	40	60	100
<b>Selection of Flat belts, V belts and chains*</b> 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]
<b>Design of Spur and Helical Gears*</b> 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.								[9]
<b>Design of Bevel and Worm Gears*</b> 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.								[9]
<b>Design of gearboxes*</b> 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]
<b>Design of Frictional Drives*</b> 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]
<b>Total Hours: 45 + 15 (Tutorial)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill education private limited, 3 <sup>rd</sup> Edition, 2010.							
2	Richard G. Budynas, J.KeithNisbett, “Shigley’s Mechanical Engineering Design”, McGraw-Hill Education (India) P Ltd., 9 <sup>th</sup> Edition, 2011.							
<b>Reference(s):</b>								
1.	Khurmi R S., Gupta J K., “A Text book of Machine Design”, Eurasia Publishing house Pvt. Ltd., 14 <sup>th</sup> Edition, 2005.							
2.	Juvinal R. C., Marshek K.M., “Fundamentals of Machine Component Design”, John Wiley & Sons, 4 <sup>th</sup> 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: <a href="https://archive.nptel.ac.in/courses/112/105/112105234/">https://archive.nptel.ac.in/courses/112/105/112105234/</a>							
<b>Data book(s):</b>								
1.	Design Data– Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam – Coimbatore, 2016.							

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## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Selection of Flat ,V belts and chains</b>	
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
<b>2.0</b>	<b>Design of Spur and Helical Gears</b>	
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
<b>3.0</b>	<b>Design of Bevel and Worm Gears</b>	
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
<b>4.0</b>	<b>Design of gearboxes</b>	
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
<b>5.0</b>	<b>Design of Frictional Drives</b>	
5.1	Clutches – role of clutches	1
5.2	Positive and gradually engaged clutches, toothed claw clutches	1

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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


#### List of MATLAB exercises:

1. Determination of gear module in Spur gear drive
2. Solving problems in Helical gear drive for gear module
3. Calculation of gear module in Bevel gear drive
4. Finding the solution of gear module in Worm gear drive

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

50 ME 6P1	Heat Transfer Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

### 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-requisite

- 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	Apply
CO5	Analyze the performance of steam condenser and evaluate the effectiveness of heat exchangers	Apply

### Mapping with Programme outcomes

CO	PO												PSO		
	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															

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 ME 6P1 – Heat Transfer Laboratory								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	0	0	4	60	2	60	40	100
<b>List of Experiments</b> <ol style="list-style-type: none"> <li>Determination of thermal conductivity of insulation materials using lagged pipe apparatus.</li> <li>Determination of heat transfer coefficient using composite walls.</li> <li>Determination of temperature distribution and fin efficiency using pin-fin apparatus.</li> <li>Determination of elliptical fin heat dissipation using data acquisition system.</li> <li>Determination of convective heat transfer coefficient by natural convection apparatus</li> <li>Determination of Stefan-Boltzmann constant by Stefan-Boltzmann apparatus.</li> <li>Determination of emissivity of a grey surface using emissivity measurement.</li> <li>Determination of efficiency of steam condenser using shell and tube heat exchanger.</li> <li>Determination of effectiveness of Parallel flow heat exchanger (water –water).</li> <li>Determination of effectiveness of Counter flow heat exchanger (water –water).</li> </ol> <b>Design Experiments:</b> <ol style="list-style-type: none"> <li>Determination of critical heat flux by using critical heat flux apparatus</li> <li>Effectiveness of parallel flow heat exchanger (water –Nanofluid).</li> <li>Effectiveness of counter flow heat exchanger (water – Nanofluid).</li> </ol>								
<b>Lab Manual</b>								
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)

- Dr.D.Vasudevan – vasudevand@ksrct.ac.in

50 ME 6P2	Analysis and Simulation Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

### 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-requisite

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

### Mapping with Programme outcomes

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
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	4	60	2	60	40	100
<b><u>List of Experiments</u></b>								
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.								
<b>Lab Manual</b>								
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)

- Mr.M.Prasaath – [mprasath@ksrct.ac.in](mailto:mprasath@ksrct.ac.in)

60 CG 0P5	Comprehension Test*	Category	L	T	P	C	CA	ES	Total
Semester VI		CG	0	0	2	1*	100	-	100

### Objectives

- To evaluate the knowledge gained in core courses relevant to the programme of study.
- To assess the technical skill in solving complex engineering problems.

### Prerequisite

Fundamental knowledge in all core subjects.

### Course Outcomes

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

CO1	Infer knowledge in their respective programme domain.	Apply
CO2	Attend interviews for career progression	Apply
CO3	Exhibit professional standards to solve engineering problems	Apply
CO3	Promote holistic approach to problem solving	Apply
CO5	Examine the competency of graduates in specific programme domain	Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	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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 Mechanical Engineering (UG & PG)  
 K.S.Rangasamy College of Technology,  
 Tiruchengode - 637 215.



60 ME E11	Additive Manufacturing	Category	L	T	P	Credit
		PE	3	0	0	3

### Objectives

- To study the fundamental theory behind RP process.
- To acquire the basic concept of rapid prototyping systems for polymers.
- To define and explain the significance of metal additive manufacturing in product development.
- To expose the process selection and applications of RP process
- To convert design concepts into digital models suitable for rapid prototyping.

### Pre-requisites

Nil

### Course Outcomes

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

CO1	Learn rapid prototyping fundamentals and the various techniques for developing prototypes	Remember, Understand
CO2	Understand and apply fundamentals of rapid prototyping techniques for polymers.	Remember, Understand
CO3	Use appropriate RP technique Metal Additive Manufacturing	Remember, Understand
CO4	Understand and gain experience with the process of prototyping- design, build, evaluate, iterate	Remember, Understand & Apply
CO5	Expose the skills on programming and software knowledge of RPT.	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3							2						2
CO2	3	3			1				2			3			2
CO3	3	3			1							2			2
CO4	3	3			1							2			2
CO5	3	3			1				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)
	1	2		
Remember	30	30	40	40
Understand	30	20	40	40
Apply	0	10	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E11 – Additive Manufacturing								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
<b>Introduction to Rapid Prototyping (RP)</b> Definition, terminology, generic RP process chain, history of RPT systems, difference between RP and subtractive processes; classifications of RP systems – information workflow in RP – impact of RP on product development – reverse engineering. Engineering – digitization techniques – model construction.								[9]
<b>RP Processes for Polymers*</b> Vat photopolymerization processes: Vector scan, mask projection, two-photon approach, materials, scan patterns; Sheet lamination processes: Bond-Then-Form processes, Form-Then-Bond processes, materials; Fused deposition modeling: Process parameters, influence of process parameters on mechanical properties of the prototype.								[9]
<b>Metal Additive Manufacturing*</b> Ultrasonic additive manufacturing: Working principle, process parameters, microstructures and mechanical properties; Powder bed fusion processes: Electron beam melting, 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.								[9]
<b>RP Process Selection and Applications**</b> Selection methods for a part: Decision theory, approaches to determining feasibility, challenges in selection; Applications: Automotive industries, aerospace industries, foundry and casting technologies, mold and die making applications, medical applications.								[9]
<b>Post-Processing and Software for RP**</b> Post-processing: Support material removal, surface texture improvements, aesthetic improvements, property enhancement using thermal and non-thermal techniques; Design for additive manufacturing; Software for RP and case studies using RP software.								[9]
<b>Total Hours</b>								45
<b>Text Book(s):</b>								
1.	Ian Gibson, David Rosen, Brent Stucker , “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2 <sup>nd</sup> Edition, Springer, 2015.							
2	John O Milewski , “Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelery”, Springer, 2017.							
<b>Reference(s):</b>								
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: <a href="https://nptel.ac.in/">Rapid Manufacturing – Course (nptel.ac.in)</a>							
6.	V Lab: <a href="https://vlabs.ac.in/">Welcome to Virtual Labs – A MHRD Govt of india Initiative (vlabs.ac.in)</a>							

\*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 to Rapid Prototyping (RP)	1
1.1	Definition and terminology of Rapid Prototyping	1
1.2	RP process chain,	1
1.3	History of RPT systems	1
1.4	Difference between RP and subtractive processes	1
1.5	Classifications of RP systems	1
1.6	Information workflow in RP	1
1.7	Impact of RP on product development	1
1.8	Reverse engineering	1
2.0	RP Processes for Polymers.	1
2.1	Vat photopolymerization processes.	1
2.2	Vector scan, mask projection, two-photon approach.	1
2.3	Materials and scan patterns.	1
2.4	Sheet lamination processes.	1
2.5	Bond-Then-Form processes, Form-Then-Bond processes, materials.	1
2.6	Fused deposition modeling.	1
2.7	Process parameters, influence of process parameters.	1
2.8	Mechanical properties of the prototype.	1
3.0	Metal Additive Manufacturing	1
3.1	Ultrasonic additive manufacturing: Working principle.	1
3.2	Process parameters, microstructures and mechanical properties.	1
3.3	Powder bed fusion processes, Electron beam melting.	1
3.4	Selective laser melting, selective laser sintering.	1
3.5	Binder jetting process for metals	1
3.6	Directed energy deposition processes (DED).	1
3.7	Laser-based and electron beam-based DED processes.	1
3.8	Process parameters, materials and microstructures.	1
4.0	RP Process Selection	2
4.1	Selection methods for a part	1
4.2	Decision theory, approaches to determining feasibility	1
4.3	Challenges in selection	1

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4.4	Applications: Automotive industries, aerospace industries	1
4.5	Applications: Foundry and casting technologies	1
4.6	Applications: Mold and die making applications	1
4.7	Medical applications	1
<b>5.0</b>	Post-Processing in RP	2
5.1	Support material removal, surface texture improvements	1
5.2	Aesthetic improvements	1
5.3	Property enhancement using thermal and non-thermal techniques	1
5.4	Design for additive manufacturing	1
5.5	Software for RP	1
5.6	Case studies using RP software	2

### Course Designer(s)

1. Mr. S. Karthikeyan – [karthikeyan.s@ksrct.ac.in](mailto:karthikeyan.s@ksrct.ac.in)

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

Nil

### Course Outcomes

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

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

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	30	30	40	40
Understand	20	30	40	40
Apply	10	0	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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 Tiruchengode - 637 215.

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E12 – Product Design for Manufacturing								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
<b>Introduction</b> 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]
<b>Factors Influencing Form Design</b> Working principle, Material, Manufacture, Design- Possible solutions – Materials choice – Influence of materials on form design – form design of welded members, forgings and castings.								[9]
<b>Component Design – Machining Consideration*</b> 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]
<b>Component Design – Casting Consideration*</b> 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]
<b>Design for Additive Manufacturing**</b> Introduction to AM, DFMA 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]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Boothroyd, G, Heartz and Nike, “Product Design for Manufacture”, 3 <sup>rd</sup> Edition, Marcel Dekker, New York, 2020.							
2	Kevien Otto, Kristin Wood, “Product Design”, 2 <sup>nd</sup> Edition, Indian Reprint, Pearson Education, 2021.							
<b>Reference(s):</b>								
1.	Boothroyd, G, “Design for Assembly, Automation and Product Design”, 2 <sup>nd</sup> Edition, Marcel Dekker, New York, 2020.							
2.	Fixel, J. “Design for the Environment”, 2 <sup>nd</sup> Edition, McGraw-Hill International Edition, New York, 2019.							
3.	Bralla, J G, “Design for Manufacture Handbook”, 2 <sup>nd</sup> Edition, McGraw-Hill International Edition, New York, 2018.							
4.	Chitale, A.K, and Gupta, R.C., “Product Design and Manufacturing”, 3 <sup>rd</sup> Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2021.							
5.	NPTEL video by IIT Kanpur: <a href="https://onlinecourses.nptel.ac.in/noc21_me66/preview">https://onlinecourses.nptel.ac.in/noc21_me66/preview</a>							

\*SDG 9 – Industry Innovation and Infrastructure

\*\*SDG 12 – Responsible Consumption and Production

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Introduction</b>	
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
<b>2.0</b>	<b>Factors Influencing Form Design</b>	
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
<b>3.0</b>	<b>Component Design – Machining Consideration</b>	
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
<b>4.0</b>	<b>Component Design – Casting Consideration</b>	
4.1	Redesign of castings based on Parting line considerations	2
4.2	Minimizing core requirements	1
4.3	machined holes	1

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4.4	redesign of cast members to obviate cores	2
4.5	Identification of uneconomical design	1
4.6	Modifying the design	1
4.7	Computer Applications for DFMA.	1
<b>5.0</b>	<b>Design for Additive Manufacturing</b>	
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 composite material strength
- 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.	Remember, Understand & Apply
CO2	Derive Flat plate Laminate equations for different orientation of fiber.	Remember, Understand & Apply
CO3	Perform design calculations for the development of fiber reinforced matrices and FEM	Remember, Understand & Apply
CO4	Portray the various methods manufacturing processes involved in the fabrication of composite material.	Remember, Understand & Apply
CO5	Analyze the characteristics of laminated flat plates.	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E13 – Composite Materials and Mechanics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
<b>Introduction</b> 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]
<b>Mechanics</b> 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]
<b>Design and Analysis*</b> 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]
<b>Manufacturing**</b> 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]
<b>Analysis of Laminated Flat Plates*</b> Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies.								[9]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Mallick P.K., "Fiber Reinforced Composites: Materials, Manufacturing and Design", 3 <sup>rd</sup> Edition, Taylor and Francis, 2008.							
2	Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", DEStech Publications, Inc, 2009.							
<b>Reference(s):</b>								
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", 3 <sup>rd</sup> Edition, Mc Graw Hill Company, New York, 2006.							
3.	Chawla K.K., "Composite Materials", 3 <sup>rd</sup> Edition, Springer Verlag, Boston, 2012.							
4.	Ever J. Barbero, "Introduction to Composite Materials Design", 2 <sup>nd</sup> edition, CRC Press, 2011.							
5.	NPTEL video by IIT Kanpur: <a href="https://archive.nptel.ac.in/courses/112/104/112104229/">https://archive.nptel.ac.in/courses/112/104/112104229/</a>							

\*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	<b>Introduction</b>	
1.1	Basics of fibers, matrices and composites	1
1.2	General Characteristics and Applications of Fibers	2

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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
<b>2.0</b>	<b>Mechanics</b>	
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
<b>3.0</b>	<b>Design</b>	
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
<b>4.0</b>	<b>Manufacturing</b>	
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
<b>5.0</b>	<b>Analysis of Laminated Flat Plates</b>	
5.1	Equilibrium Equations of Motion	1
5.2	Energy Formulations	1
5.3	Static Bending Analysis	1
5.4	Buckling Analysis	1
5.5	Free Vibrations	1
5.6	Natural Frequencies	2

#### Course Designer(s)

1. Mr.U.Vivek– viveku@ksrct.ac.in

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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 Technologies

### Course Outcomes

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

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

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	20	20	40	40
Understand	40	40	60	60
Apply	0	0	0	0
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E14- Manufacturing Information System								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
<b>Introduction</b> The Evolution of order policies, from MRP I to MRP II to ERP – Agile Manufacturing Information Systems, Manufacturing Database Integration.								[9]
<b>Database</b> 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]
<b>Designing Database*</b> Hierarchical model – Network approach- Relational Database concepts, principles, keys,– functional dependency – Normalization types – relational operations- Query Languages-Case studies.								[9]
<b>Manufacturing Consideration**</b> 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]
<b>Information System for Manufacturing*</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Introduction</b>	
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
<b>2.0</b>	<b>Database</b>	

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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
<b>3.0</b>	<b>Designing Database</b>	
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
<b>4.0</b>	<b>Manufacturing Consideration</b>	
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
<b>5.0</b>	<b>Information System for Manufacturing</b>	
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)

1. Mr.P.Tamilarasu – [tamilarasup@ksrct.ac.in](mailto:tamilarasup@ksrct.ac.in)

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

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3				3	3	3					3	3	
CO2	3	3				3	3	3					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)		Model Examination(Marks)	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	50	50	60	60
Apply	0	0	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E15- Power Plant Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
<b>Energy scenario and steam power plant*</b> 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]
<b>Nuclear and Hydro-Electric Power Plants*</b> 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]
<b>Gas Turbine and Diesel Power Plant*</b> 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]
<b>Non-Conventional Power Plants**</b> 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]
<b>Power Plant Economics***</b> 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]
<b>Total Hours: 45</b>								
<b>Text Book(s):</b>								
1.	Arora, S. C., and Domkundwar, S., “A course in Power Plant Engineering”, 8 <sup>th</sup> Edition, Dhanpatrai Publications Ltd., New Delhi, 2016							
2	Rajput R.K, "Power Plant Engineering", 4th Edition, Laxmi Publications, New Delhi, 2012.							
<b>Reference(s):</b>								
1.	Rai,G.D. “Introduction to Power Plant Technology”, 11 <sup>th</sup> reprint, Khanna Publishers, 2013							
2.	Hegde, R K., “Power Plant Engineering”, 1 <sup>st</sup> edition, Pearson education India, New Delhi, 2015.							
3.	Rajput R.K., “Power Plant Engineering”, 4 <sup>th</sup> edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016.							
4.	Nag, P K., “Power Plant Engineering”, 4 <sup>th</sup> edition, Tata McGraw-Hill, New Delhi, 2014.							
5.	<a href="https://onlinecourses.nptel.ac.in/noc20_me10/preview">https://onlinecourses.nptel.ac.in/noc20_me10/preview</a>							

\*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
<b>1.0</b>	<b>Energy scenario and steam power plant</b>	
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	2
1.7	Dust collectors and cooling towers	1
<b>2.0</b>	<b>Nuclear and Hydel Power Plants</b>	
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
<b>3.0</b>	<b>Gas Turbine and Diesel Power Plant</b>	
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
<b>4.0</b>	<b>Non-Conventional Power Plants</b>	
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)	2
4.7	Bio-solar cells	1
4.8	Solar energy harvesting trees.	1

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<b>5.0</b>	<b>Power Plant Economics</b>	
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
<b>Total</b>		<b>45</b>

### Course Designer(s)

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

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

### Objectives

- To make the Engineering student to know about the basic of economics & how to organize a business
- To know the financial aspects related to business
- To know about functions of banks.
- To understand the different methods of appraisal of projects.
- To know about the pricing & capital techniques.

### Pre-requisites

- -NIL-

### Course Outcomes

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

CO1	Know the suitable demand forecasting techniques and prevailing market structure.	Remember
CO2	Recognize the importance of forms of business and differentiate between proprietorship and partnership	Remember
CO3	Apprehend the kinds of banks and illustrate the Balance sheet with suitable example	Understand
CO4	Interpret fixed cost and variable cost and realize the process of technical feasibility and economic feasibility	Understand
CO5	Know about break even analysis and Taxes with GST	Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2			3	2	2	3		2	2			3	
CO2	3	2			2	2	2	3		3	3			2	
CO3		3			3			3		2	3			3	
CO4	2				3	3	3	2			3			2	
CO5	2	3			2	3	3	2		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)
	1	2		
Remember	20	20	40	40
Understand	20	20	40	40
Apply	20	20	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 HS 002 - Engineering Economics and Financial Accounting								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
<b>Introduction to Basic Economics*</b> Definition of economics – nature and scope of economics – basic concepts of economics – factors of production – demand analysis – definition of demand – Law of demand – Exception to law of demand – Factors affecting demand – elasticity of demand – demand forecasting – definition of supply – factors affecting supply – elasticity of supply – market structure – perfect competition – imperfect competition - monopoly – duopoly – oligopoly and bilateral monopoly.								[9]
<b>Organization and Business Financing**</b> Forms of business – proprietorship – partnership - joint stock company - cooperative organization - state Enterprise - mixed economy - Money and banking – kinds of banking - commercial banks - central banking functions - control of credit - monetary policy - credit instrument – Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations.								[9]
<b>Financial Accounting and Capital Budgeting</b> The balance Sheet and related concepts – The profit and loss statement and related concepts – Financial ratio analysis – Cash flow analysis – fund flow analysis – Capital budgeting – Average rate of return – Payback period – Net present value and internal rate of return.								[9]
<b>Cost Analysis</b> Types of costing – traditional costing approach - activity based costing - Fixed Cost – variable cost – marginal cost – cost output relationship in the short run and in long run – pricing practice – full cost pricing – marginal cost pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project profitability –cost benefit analysis – feasibility reports – appraisal process – technical feasibility - economic feasibility – financial feasibility.								[9]
<b>Concepts of Macroeconomics, GST and Breakeven Analysis*</b> National Income and its Components — GNP, NNP, GDP, NDP Government Sector — Taxes, GST- CGST, SGST and Subsidies, External Sector — Exports and Imports. Break even basic assumptions –break even chart – managerial uses of breakeven analysis - applications of breakeven analysis in engineering projects.								[9]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Khan, M Y, Jain, ‘Basic Financial Management ‘, 3rd Edition, McGraw Hill Education, 2017.							
2	Maheshwari K. L., Varshney R.L., ‘Managerial economics’,2nd Edition, S Chand and Co., New Delhi, ,2014.							
<b>Reference(s):</b>								
1.	Barthwal R.R., “Industrial Economics - An Introductory” Text Book, New Age Publications, New Delhi, 2010.							
2.	Samuelson P.A., “Economics - An Introductory Analysis”, McGraw - Hill & Co., New York, 2009.							
3.	S.K.Bhattacharyya, John Deardon and Y.M.Koppikar, “Accounting for Management Text and Cases”,							
4.	Dornbusch, Fischer and Startz, Macroeconomics, Tenth Edition, Tata Mcgraw Hill, 2012							

\*SDG 8. Decent Work and Economic Growth

\*\*SDG 9. Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
<b>1</b>	<b>Introduction to Basic Economics</b>	
1.1	Introduction and Definition of economics	1
1.2	Nature and scope of economics	1
1.3	Basic concepts of economics and factors of production	1
1.4	Law and definition of demand	1
1.5	Demand analysis and Factors affecting demand	1
1.6	Elasticity of demand and demand forecasting	1
1.7	Definition of supply, factors affecting supply and elasticity of supply	1
1.8	Market structure with perfect competition and imperfect competition	1
1.9	Monopoly, Duopoly, Oligopoly and bilateral monopoly.	1
<b>2</b>	<b>Organization and Business Financing</b>	
2.1	Forms of business, Proprietorship, partnership and joint stock company	1
2.2	Cooperative organization and state Enterprise mixed economy and Money and banking	1
2.3	Types of banking and commercial banks	1
2.4	Central banking functions and monetary policy	1
2.5	Control of credit and credit instrument	1
2.6	Types of financing, Short term borrowing and Long term borrowing	1
2.7	Internal generation of funds and External commercial borrowings	1
2.8	Assistance from of government budgeting support	1
2.9	International finance corporations	1
<b>3</b>	<b>Financial Accounting and Capital Budgeting</b>	
3.1	Balance Sheet and related concepts	1
3.2	The profit and loss statement and related concepts	1
3.3	Financial ratio analysis	1
3.4	Cash flow analysis	1
3.5	fund flow analysis	1
3.6	Capital budgeting	1
3.7	Average rate of return method	1
3.8	Payback period method	1
3.9	Net present value and internal rate of return	1
<b>4</b>	<b>Cost Analysis</b>	
4.1	Types of costing, traditional costing approach and activity based costing	1
4.2	Fixed Cost, variable cost and marginal cost	1
4.3	Cost output relationship in the short run and in long run	1
4.4	Pricing practice, full cost pricing and marginal cost pricing	1
4.5	Going rate pricing and bid pricing with pricing for a rate of return	1
4.6	Cost benefit analysis and feasibility reports	1
4.7	Appraisal process and technical feasibility	1
4.8	Economic feasibility and financial feasibility.	1

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4.9	Appraising project profitability	1
5	<b>Concepts of Macroeconomics, GST and Breakeven Analysis</b>	
5.1	National Income and its Components	1
5.2	Recognize the GNP, NNP	1
5.3	GDP, NDP Government Sector	1
5.4	Taxes, GST-CGST, SGST and Subsidies	1
5.5	Development of Exports and Imports	1
5.6	Understand the Break Even Analysis	1
5.7	Represent Applications of break-even chart	1
5.8	Develop the basic break-even analysis in engineering projects	1
5.9	Describe Managerial application of breakeven point	1
	<b>Total</b>	<b>45</b>

### Course Designer(s)

1. Dr.G.Mylsami - [mylsamig@ksrct.ac.in](mailto:mylsamig@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	Remember, Understand & Apply
CO2	Apply principle of P&ID, PFD to measure flow and estimate losses in pipelines for both laminar and turbulent conditions	Remember, Understand & Apply
CO3	Formulate the relationship among the variables in a pipe fittings	Remember, Understand & Apply
CO4	Select and estimate the characteristics of piping design and its application	Remember, Understand & Apply
CO5	Evaluate the performance characteristics of piping insulation	Remember, Understand & Apply

### Mapping with Programme Outcomes

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

3- Strong;2-Medium;1-Some

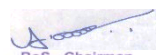
### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Examination Marks	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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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.

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E21- Piping Design								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
<b>Introduction of Piping and Process Flow Diagram</b> 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).								[12]
<b>Piping and Instrumentation Diagrams (P&amp;ID)</b> P&ID, Stages of development - Typical stages - P&ID for rotating and static pressure vessels. Absorber, Evaporator and its working.								[12]
<b>Pipe fittings*</b> 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.								[12]
<b>Piping Design and its Application**</b> 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.								[12]
<b>Piping insulation*</b> 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.								[12]
<b>Total Hours =(Lecture Hours: 30 Hrs; Hands on Training: 30 Hrs)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Dr.S.D.Dawande, “Process Design of Equipment’s”, 7th Edition Central Techno Publications, 2015.							
2	D. J.Deutsch, “Process piping systems”, Chemical Engineering Magazine.1 <sup>st</sup> edition McGraw Hill, 2011.							
<b>Reference(s)</b>								
1.	G.K. Sahu, “Handbook of Piping Design”, ,2nd edition New Age International Publisher, 2008							
2.	R. Weaver, “Process Piping Design”, Vol. 1 and 2, , Gulf Publishing,1992							
3.	H. F. Rase, “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
<b>1.0</b>	<b>Introduction of Piping and Process Flow Diagram</b>	
1.1	Importance of piping in chemical industry	1
1.2	Pipes & Tubing, Classification of pipes	1
1.3	Pipe codes and specification(piping symbols, line symbols, valve symbols, piping isometrics)	2
1.4	Pipe sizing, Schedule numbers	1
1.5	Desirable properties of piping materials	1

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1.6	Calculation of pipe diameter, thickness, equivalent lengths, etc., single liquid lines, single gas & vapour lines	2
1.7	NPSH	1
<b>2.0</b>	<b>Piping and Instrumentation Diagrams (P&amp;ID)</b>	
2.1	P&ID objectives	1
2.2	Stages of development of P&ID	1
2.3	Typical stages of P&ID	2
2.4	P&ID for rotating and static pressure vessels	2
2.5	Process vessels Absorber	1
2.6	Absorber, Evaporator and its working	2
<b>3.0</b>	<b>Pipe fittings</b>	
3.1	Pipe fittings their advantages & disadvantages	2
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	2
3.5	Calculation of frictional losses	1
3.6	Pressure drop for Newtonian & Non-Newtonian fluids.	2
<b>4.0</b>	<b>Piping Design and its Application</b>	
4.1	Design of pipeline for transportation of crude oil & for natural gas	2
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	1
4.7	Reboiler piping, piping for compressor	1
4.8	Pumps, utility piping	1
<b>5.0</b>	<b>Piping insulation</b>	
5.1	Insulation for piping systems	2
5.2	Purpose of insulation. Insulation materials	2
5.3	Principles of heat transfer to the extent of application to heat loss/gain through bare pipe surfaces.	2
5.4	Critical thickness of insulation, estimating thickness of insulation	2
5.5	Optimum thickness of insulation	1

#### Course Designer(s)

1. Dr.A.Murugesan – [hodmech@ksrct.ac.in](mailto:hodmech@ksrct.ac.in)
2. Dr.D.Vasudevan – [vasudevand@ksrct.ac.in](mailto:vasudevand@ksrct.ac.in)
3. Mr.R.Prakash – [prakashr@ksrct.ac.in](mailto:prakashr@ksrct.ac.in)

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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.	Remember, Understand
CO2	Design and develop the jigs for given component in lathe, milling, grinding, planning and welding process	Remember, Understand
CO3	Compute and select the capacities and tonnage of press for various processes and standard die sets for strip layout	Remember, Understand
CO4	Design and develop the dies for blanking, piercing, bending, drawing, forging and extrusion operations	Remember, Understand
CO5	Describe the sheet metal forming techniques and analyze using computer aids.	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	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 Exam	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	15	15	20	20
Apply	20	20	40	40
Analyze	15	15	20	20
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E22- Design of Jigs, Fixtures and Press Tools								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P			CA	ES	Total
VI	2	0	2	60	3	50	50	100
<b>Locating and Clamping Principles of Jigs and Fixtures</b> Tool Design Objectives - Production Devices - Inspection Devices - Materials used in Jigs and Fixtures - Basic Principle of Six Point Location - Locating Methods and Devices - Principle of Clamping and Its Types - Analysis of Clamping Force.								[12]
<b>Design of Jigs and Fixtures*</b> Drill Bushes - Classification of Jigs - Automatic Drill Jigs - Rack and Pinion operated Jigs - Air operated Jigs. Design and Development of Jigs for given Component. General Principles of Boring, Lathe, Milling and Broaching Fixtures - Grinding, Planning and Shaping Fixtures, Assembly, Inspection and Welding Fixtures - Modular Fixtures. Design and Development of Fixtures for given Component and Maintenance.								[12]
<b>Press Working Terminologies, Elements of Dies and Strip Layout*</b> Press Working Terminology - Presses and Press Accessories - Computation of Capacities and Tonnage Requirements. Elements of Progressive Combination and Compound Dies: Die Block - Die Shoe. Bolster Plate - Punch Plate – Punch Holder - Guide Pins and Bushes - Strippers - Knockouts - Stops - Pilots - Selection of Standard Die Sets. Strip Layout - Calculations-Critical spares management.								[12]
<b>Design and Development of Dies*</b> Design and Development of Progressive and Compound Dies for Blanking and Piercing Operations. Development of Bending Dies - Development of Forming and Drawing Dies. Design Considerations in Forging, Extrusion, Casting and Plastic Dies.								[12]
<b>Other Forming Techniques**</b> Bulging, Swaging, Embossing, Coining, Curling, Hole Flanging, Shaving, Sizing, Fine Blanking. 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.								[12]
<b>Total Hours =(Lecture Hours: 30 Hrs; Hands on Training: 30 Hrs)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Edward G Hoffman, “Jigs and Fixture Design”, 5 <sup>th</sup> Edition, Thomson – Delmar Learning, Singapore, 2010.							
2	Donaldson. C, George H.L., Goold V C and Ghose J., “Tool Design”, 5 <sup>th</sup> Edition, Tata McGraw-Hill, 2017.							
<b>Reference(s):</b>								
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) <a href="https://www.youtube.com/watch?v=7yzvno4AvKw">https://www.youtube.com/watch?v=7yzvno4AvKw</a>							
7	NPTEL Videos (2) <a href="https://www.youtube.com/watch?v=vOo2MCYPsm4">https://www.youtube.com/watch?v=vOo2MCYPsm4</a>							

\*SDG 9 – Industry Innovation and Infrastructure

\*\*SDG 12 – Responsible Consumption and Production

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Passed in BoS Meeting held on 24/11/2023

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## Course Contents and Lecture Schedule

S.No.	Topics	No.of hours
1.0	<b>Locating and Clamping Principles of Jigs and Fixtures</b>	
1.1	Introduction.	1
1.2	Tool Design Objectives.	1
1.3	Production Devices - Inspection Devices.	1
1.4	Materials used in Jigs and Fixtures.	1
1.5	Basic Principle of Six Point Location.	2
1.6	Locating Methods and Devices.	2
1.7	Principle of Clamping and Its Types.	2
1.8	Analysis of Clamping Force.	2
2.0	<b>Design of Jigs and Fixtures</b>	
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	Design and Development of Jigs for given Component.	1
2.4	General Principles of Boring, Lathe, Milling and Broaching Fixtures.	1
2.5	Grinding, Planning and Shaping Fixtures	2
2.6	Assembly, Inspection, Welding Fixtures and Modular Fixtures	2
2.7	Design and Development of Fixtures for given Component and Maintenance.	2
2.8	Case study for the specific component.	2
3.0	<b>Press Working Terminologies, Elements of Dies and Strip Layout</b>	
3.1	Press Working Terminology, Presses and Press Accessories	1
3.2	Computation of Capacities and Tonnage Requirements	1
3.3	Elements of Progressive Combination and Compound Dies	1
3.4	Die Block, Die Shoe.	1
3.5	Bolster Plate, Punch Plate, Guide Pins, Bushes and Strippers	2
3.6	Knockouts, Stops, Pilots, Selection of Standard Die Sets	2
3.7	Strip Layout, Calculations and Critical spares management	2
3.8	Case Study	2
4.0	<b>Design and Development of Dies</b>	
4.1	Design and Development of Progressive Dies for Blanking Operations	1
4.2	Design and Development of Progressive Dies for Piercing Operations	1
4.3	Design and Development of Compound Dies for Blanking Operations	1
4.4	Design and Development of Compound Dies for Piercing Operations	1
4.5	Development of Bending Dies	2
4.6	Development of Forming and Drawing Dies	2
4.7	Design Considerations in Forging and Extrusion Dies	2
4.8	Design Considerations in Casting and Plastic Dies	2
5.0	<b>Other Forming Techniques</b>	
5.1	Bulging, Swaging, Embossing	1
5.2	Coining, Curling, Hole Flanging	1

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5.3	Shaving, Sizing, Fine Blanking	1
5.4	. Recent Trends in Tool Design	1
5.5	Computer Aids for Sheet Metal Forming Analysis - Basic Introduction	2
5.6	Tooling for Numerically Controlled Machines	2
5.7	Setup Reduction for Work Holding	2
5.8	Single Minute Exchange of Dies - Poka Yoke	2
<b>Total</b>		<b>60</b>

#### Course Designer(s)

1. Dr.P.S.Sampath – [sampathps@ksrct.ac.in](mailto:sampathps@ksrct.ac.in)

60 ME E23	Design for Manufacturing and Assembly	Category	L	T	P	Credit
		PE	2	0	2	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

-Nil-

### 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	Remember & Apply
CO2	Evaluate the Properties of engineering materials and selection of materials	Remember & Analysis
CO3	Apply the concept of DFM for casting, welding, forming and Powder Metallurgy.	Remember, & Apply
CO4	Understand the quality aspects of design for manufacture and assembly	Remember & Apply
CO5	Apply the DFM method for designing process and manual assembly	Remember & Apply

### Mapping with Programme Outcomes

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

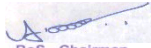
### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Exam	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	30	30	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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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.

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E23 - Design for Manufacturing and Assembly								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
<b>Introduction</b> 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.								[12]
<b>Material Consideration*</b> 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.								[12]
<b>Design for Manufacture**</b> 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.								[12]
<b>Design for Assembly*</b> 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								[12]
<b>Design of Manual Assembly*</b> 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.								[12]
<b>Total Hours =(Lecture Hours: 30 Hrs; Hands on Training: 30 Hrs)</b>								<b>60</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s) :</b>								
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.							
5.	NPTEL video by IIT Guwahati: <a href="https://archive.nptel.ac.in/courses/107/103/107103012/">https://archive.nptel.ac.in/courses/107/103/107103012/</a>							

\*\*SDG 8 – Decent work and Economic Growth

\*SDG 9 – Industry Innovation and Infrastructure

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Passed in BoS Meeting held on 24/11/2023

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## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Introduction</b>	
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
<b>2.0</b>	<b>Material Consideration</b>	
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
<b>3.0</b>	<b>Design for Manufacture</b>	
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	2
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	
<b>4.0</b>	<b>Design for Assembly</b>	
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

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<b>5.0</b>	<b>Design of Manual Assembly</b>	
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](mailto:venkatachalam@ksrct.ac.in)

60 ME E24	Computational Fluid Dynamics	Category	L	T	P	Credit
		PE	2	0	2	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.	Remember, Understand, Apply &Analyse
CO2	Perform the calculations for finite volume method to fluid flow problems.	Remember, Understand, Apply & Analyse
CO3	Evaluate the steady state heat transfer problems numerically and convection diffusion problem in 1D and 2D steady state condition.	Remember, Understand, Apply&Analyse
CO4	Identify the pressure viscous flow in incompressible flow analysis by use the finite difference method.	Remember, Understand, Apply& Analyse
CO5	Identify the turbulence model to engineering fluid flow problems with standard codes to develop the CFD models.	Remember, Understand, Apply&Analyse

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	3						2	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)		Model Examination Marks	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	20	20	30	30
Analyse	10	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E24 - Computational Fluid Dynamics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
<b>Governing Equations and Boundary Conditions*</b> 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.								[12]
<b>Discretization Methods*</b> Nature of numerical methods - Method of deriving discretization equations - Taylor series formulation – Variational formulation - Method of weighted residuals - Control volume - Formulation.								[12]
<b>Heat Conduction, Convection and Diffusion*</b> Steady one-dimensional conduction - Two and Three dimensional conduction- Steady one - dimensional convection and diffusion - Discretization equations for two dimensional convection and diffusion – applications								[12]
<b>Incompressible Fluid Flow *</b> Governing Equations - Stream Function – Vorticity method, Determination of pressure for viscous flow - Computation of boundary layer flow - Finite difference approach – applications.								[12]
<b>Turbulence Models*</b> Algebraic Models – One equation model, K-ε models, High and Low Reynolds number models, Unsteady turbulent model – applications. Prediction of fluid flow and heat transfer using standard codes.								[12]
<b>Total Hours =(Lecture Hours: 30 Hrs; Hands on Training: 30 Hrs)</b>								<b>60</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
1	T.J. Chung, 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: <a href="https://www.youtube.com/watch?v=aShONtHloUk&amp;list=PLbRMhDVUMngcFmWiK1YBhAbsYo8mYvPKJ">https://www.youtube.com/watch?v=aShONtHloUk&amp;list=PLbRMhDVUMngcFmWiK1YBhAbsYo8mYvPKJ</a>							
6.	NPTEL videos: <a href="https://www.youtube.com/watch?v=3QFT7pGx03I">https://www.youtube.com/watch?v=3QFT7pGx03I</a>							

\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	<b>Governing Equations and Boundary Conditions</b>	
1.1	Basics of computational fluid dynamics	1

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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
<b>2.0</b>	<b>Discretization Methods</b>	
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
<b>3.0</b>	<b>Heat Conduction, Convection and Diffusion</b>	
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
<b>4.0</b>	<b>Incompressible Fluid Flow</b>	
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
<b>5.0</b>	<b>Turbulence Models</b>	
5.1	Algebraic Models	1
5.2	One equation model,	1
5.3	K- $\epsilon$ 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 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 normal and abnormal combustion.
- To study the various stages of combustion in CI engines and effect of normal abnormal combustion.
- To identify the source of emission formation, control methods and measurement techniques.
- To study the alternative fuel resources and its utilization techniques in IC engines.
- To study the alternate combustion modes and data acquisition system for combustion analysis.

### Pre-requisites

- Thermal Engineering
- Automobile Engineering

### Course Outcomes

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

CO1	Calculate the air/fuel ratio for complete combustion and explain the various stages of combustion in SI engines.	Remember, Understand & Apply
CO2	Summarize the various stages of combustion in CI engines and role of combustion chamber for normal combustion	Remember & Understand
CO3	Identify the exhaust emission formation, control and measurement techniques.	Remember & Understand
CO4	Categorize the alternative fuel resources for SI and CI engines	Remember & Understand
CO5	Explain the alternate combustion modes and data acquisition system for combustion analysis. .	Remember & Understand

### Mapping with Programme Outcomes

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

3- Strong;2-Medium;1-Some

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Examination Marks	End Sem Examination(Marks)
	1	2		
Remember	12	12	20	20
Understand	38	48	70	70
Apply	10	0	10	10
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

### Syllabus

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K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E25 & Internal Combustion Engines								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
<b>Spark Ignition Engines*</b> Air-fuel ratio requirement-calculation. Stages of combustion-normal and abnormal combustion (Knock and Pre-ignition), factors affecting knock - fuel supply systems – Ignition systems - air motion - combustion chambers.								[11]
<b>Compression Ignition Engines*</b> Stages of combustion-normal and abnormal combustion – Factors affecting knock, direct and indirect injection systems, fuel Spray behavior – spray structure and spray penetration – air motion-combustion chambers.								[12]
<b>Emission Formation, Control, Measurement and Driving cycles**</b> Sources and Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter. Methods of controlling emissions - In-cylinder treatment - Injection strategies, exhaust gas recirculation and spark advancement, After cylinder treatment-catalytic converter, SCR, LNT, DOC and DPF. Exhaust gas analyzer and smoke meter. India emission norms and driving cycles.								[13]
<b>Alternative Fuels***</b> Alcohol Fuels, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - properties, suitability, merits and demerits – utilization methods - engine modifications.								[12]
<b>Alternate Combustion and Data Acquisition System*</b> Stratified charge engine - Homogeneous charge compression ignition (HCCI) – premixed charge compression ignition (PCCI) - Reactivity Controlled Compression Ignition (RCCI) - Gasoline compression ignition (GCI). Data acquisition system – engine combustion analysis – sensors & software.								[12]
<b>Total Hours =(Lecture Hours: 30 Hrs; Hands on Training: 30 Hrs)</b>								<b>60</b>
<b>Text Book(s):</b>								
1.	Ganesan, V., “Internal Combustion Engines”, 4 <sup>th</sup> edition, Tata McGraw Hill Company, New Delhi, 2017.							
2.	John B. Heywood, “Internal Combustion Engine Fundamentals”, McGraw Hill Company, 2nd edition, New Delhi, 2018.							
<b>Reference(s):</b>								
1.	Gupta H.N., “Fundamentals of Internal Combustion Engines”, 2 <sup>nd</sup> edition, Prentice Hall India Learning Private Limited, 2012.							
2.	Ramalingam K.K., “Internal Combustion Engines Theory and Practice”, 3 <sup>rd</sup> edition, Scitech Publications (India) Pvt.Ltd., Chennai, 2016							
3.	James D.Halderman, "Hybrid and Alternative Fuel Vehicles", Pearson publications, 4th Edition, 2015.							
4.	NPTEL: Engine Combustion, <a href="https://archive.nptel.ac.in/courses/112/104/112104033/">https://archive.nptel.ac.in/courses/112/104/112104033/</a> Prof. B.P. Pundir , IIT Kanpur.							

\*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
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<b>1.0</b>	<b>Spark Ignition Engines</b>	
1.1	Air-fuel ratio requirement & calculation	2
1.2	Stages of combustion – normal combustion	1
1.3	Abnormal combustion : Cause and effect (Knock and Pre-ignition)	2
1.4	Factors affecting knock - fuel supply systems – Ignition systems	1
1.5	Combustion chambers : types, construction and air motion	2
<b>2.0</b>	<b>Compression Ignition Engines</b>	
2.1	Stages of combustion- normal combustion	1
2.2	Abnormal combustion : cause and effect	2
2.3	Factors affecting abnormal combustion	1
2.4	Direct and indirect injection systems	2
2.5	Fuel Spray behavior – spray structure and spray penetration	1
2.6	Combustion chambers : types, construction and air motion	2
<b>3.0</b>	<b>Emission Formation and Control</b>	
3.1	Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter: Sources and Formation.	2
3.2	Methods of controlling emissions - In-cylinder treatment - Injection strategies, exhaust gas recirculation and spark advancement	2
3.3	After cylinder treatment-catalytic converter, SCR, LNT, DOC and DPF.	3
3.4	Exhaust gas analyzer and smoke meter.	2
3.5	India emission norms and driving cycles.	1
<b>4.0</b>	<b>Alternative Fuels</b>	
4.1	Alcohol Fuels: properties, suitability, merits and demerits	2
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	Liquefied Petroleum Gas: properties, suitability, merits and demerits	1
4.6	Liquefied Petroleum Gas: utilization methods - engine modifications	1
4.7	Bio Diesel: properties, suitability, merits and demerits	1
4.8	Bio Diesel: utilization methods - engine modifications	1
<b>5.0</b>	<b>Alternate Combustion and Data Acquisition System</b>	
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
5.5	Gasoline compression ignition (GCI): construction, working principles, merits and demerits	1
5.6	Data acquisition system: sensors & software for engine combustion analysis	2

#### Course Designer(s)


1. Dr.K.Raja –rajak@ksrct.ac.in

<b>60 ME E26</b>	<b>Production Planning and Control</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>PE</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

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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.

## 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-requisite

-NIL-

## Course Outcomes

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

CO1	Understand the PPC function in both manufacturing and service organizations.	Understand &Remember
CO2	Demonstrate the knowledge of Method study and work study	Understand &Remember
CO3	Understand the role of production Planning and process planning activities in manufacturing and services.	Understand &Remember
CO4	Demonstrate various Scheduling procedures	Understand &Remember
CO5	Employ various inventory management techniques and apply in real manufacturing scenario	Understand &Remember

## Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3							3	3		3	3	3
CO2	3	3	3							3	3		3	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)		Model Examination	End Sem Examination (Marks)
	1	2		
Remember	20	20	20	20
Understand	40	40	80	80
Apply	0	0	0	0
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus

<b>K.S. Rangasamy College of Technology – Autonomous R 2022</b>
<b>60 ME E26 - Production Planning and Control</b>

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Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
<b>Introduction**</b> 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.								[12]
<b>Work study**</b> 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)								[12]
<b>Production planning and process planning**</b> 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.								[12]
<b>Production scheduling*</b> 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.								[12]
<b>Inventory control and recent trends in PPC</b> 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)								[12]
<b>Total Hours =(Lecture Hours: 30 Hrs; Hands on Training: 30 Hrs)</b>								<b>60</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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.	N.G.Nair, “Production and Operations Management”, Tata McGraw-Hill, 2019.							
4.	S.K.Hajra Choudhury, Nirjhar Roy and A.K. Hajra Choudhury, “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 : <a href="https://nptel.ac.in/courses/112107143">https://nptel.ac.in/courses/112107143</a>							

\*SDG 9 Industry, Innovation and Infrastructure

\*\*SDG 12 Responsible consumption and production

### Course Contents and Lecture Schedule

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S. No	Topic	No. of Hours
<b>1</b>	<b>Introduction</b>	
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
<b>2</b>	<b>Work study</b>	
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
<b>3</b>	<b>Production planning and process planning</b>	
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
<b>4</b>	<b>Production Scheduling</b>	
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

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4.9	Manufacturing lead time-Techniques for aligning completion times and due dates.	1
<b>5</b>	<b>Inventory control and recent trends in PPC</b>	
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
	<b>Total</b>	<b>60</b>

### Course Designer(s)


1. Mr. S. VENKATESAN -venkatesans@ksrct.ac.in

60 ME E31	Advanced Mechanics of Materials	Category	L	T	P	Credit
		PE	3	0	0	3

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

## 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. 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	Apply the concepts of theory of elasticity in three-dimensional stress system.	Remember, Understand & Apply
CO2	Determine the shear centre of various cross-sections and deflections in beams subjected to unsymmetrical bending	Remember, Understand & Apply
CO3	Evaluate the stresses in flat plates and curved members.	Remember, Understand & Apply
CO4	Calculate torsional stress of non-circular sections.	Remember, Understand & Apply
CO5	Determine the stresses in rotating members, contact stresses in point and line contact applications.	Remember, Understand & Apply

## Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3		2		3					3	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)		Model Exam Marks (100)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	10	10	15	15
Apply	30	30	50	50
Analyse	10	10	15	15
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

## Syllabus


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

**60 ME E31 - Advanced Mechanics of Materials**

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

Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Elasticity</b> 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]
<b>Shear Centre and Unsymmetrical Bending*</b> Location of shear centre for various thin sections - shear flows. Stresses and Deflections in beams subjected to unsymmetrical loading-kern of a section.								[9]
<b>Stresses in Flat Plates and Curved Members*</b> 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]
<b>Torsion of Non-Circular Sections*</b> Torsion of rectangular cross section - St.Venants theory - elastic membrane analogy - Prandtl's stress function - torsional stress in hollow thin walled tubes.								[9]
<b>Stresses in Rotating Members and Contact Stresses*</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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: <a href="https://archive.nptel.ac.in/courses/112/101/112101095/#">https://archive.nptel.ac.in/courses/112/101/112101095/#</a>							

\*SDG 4 – Quality Education

### Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Elasticity</b>	
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

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1.9	St. Venant's principle	1
<b>2.0</b>	<b>Shear Centre and Unsymmetrical Bending</b>	
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
<b>3.0</b>	<b>Stresses in Flat Plates and Curved Members</b>	
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
<b>4.0</b>	<b>Torsion of Non-Circular Sections</b>	
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
<b>5.0</b>	<b>Stresses in Rotating Members and Contact Stresses</b>	
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
<b>Total</b>		<b>45</b>

#### Course Designer(s)

1. Dr. M.Kathirselvam - [mkathirselvam@ksrct.ac.in](mailto:mkathirselvam@ksrct.ac.in)

60 ME E32	Bio-Mechanics	Category	L	T	P	Credit
		PE	3	0	0	3

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## 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.	Remember, Understand & Apply
CO2	Analyse the mechanical properties of human tissues based on their design, purpose, and structure of the basic constituents.	Remember, Understand & Apply
CO3	Recognize the active muscle and its sliding filament theory	Remember, Understand & Apply
CO4	Analyse and quantify linear and angular characteristics of motion.	Remember, Understand & Apply
CO5	Analyse and assess different mobility problems in a joint	Remember, Understand & Apply

## Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination Marks (100)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	20	20	30	30
Apply	20	20	30	30
Analyse	10	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100


## Syllabus

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

Rev. No.1/w.e.f. 02.01.2024

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 E32 - Bio Mechanics								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Introduction to Biomechanics</b> 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
<b>Biomechanics of Tissues and Structures of the Musculoskeletal System*</b> Biomechanics of Bone, Biomechanics of Articular Cartilage, Tendons and Ligaments, Peripheral Nerves and Spinal Nerve Roots, Skeletal Muscle.								9
<b>Biomechanics of Active Muscle*</b> Muscle force production and transmission, Functional relations, History effects in muscle mechanics, Hill's model, sliding filament theory.								9
<b>Biomechanics of Human Motion*</b> 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
<b>Biomechanics of Joints and Blood flow*</b> Knee, Hip, Foot and Ankle, Lumbar Spine, Cervical Spine, Shoulder, Elbow, Wrist and Hand. implant material. Introduction to mechanics of blood flow.								9
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Susan J Hall, "Basic Biomechanics", 6 <sup>th</sup> 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 <sup>nd</sup> Edition, London, Springer- Verlag, 2015.							
<b>Reference(s):</b>								
1.	Margareta Nordin, Victor H Frankel, "Basic Biomechanics of the Musculoskeletal System", 4 <sup>th</sup> Edition, Lippincott Williams and Wilkins, Philadelphia, 2012.							
2.	Ozkaya, Nihat, Nordin Margareta, "Fundamentals of Biomechanics: Equilibrium, Motion and Deformation" 4 <sup>th</sup> Edition, Springer, NewYork, 2016.							
3.	David A. Winter, "Biomechanics and Motor Control of Human Movement", 4 <sup>th</sup> Edition, John Wiley, New Jersey, 2020							
4.	Luigi Ambrosio,"Biomedical Composites", Woodhead publishing Ltd., New Delhi, 2017							
5.	NPTEL: <a href="https://onlinecourses.nptel.ac.in/noc23_bt04/preview">https://onlinecourses.nptel.ac.in/noc23_bt04/preview</a>							

\*SDG 9 – Industry Innovation and Infrastructure

### Course Contents and Lecture Schedule

S.No.	Topics	No.of
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		hours
1.0	<b>Introduction to Biomechanics</b>	
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	<b>Biomechanics of Tissues and Structures of the Musculoskeletal System</b>	
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	<b>Biomechanics of Active Muscle</b>	
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	<b>Biomechanics of Human Motion</b>	
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	<b>Biomechanics of Joints and Blood Flow</b>	
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
<b>Total</b>		<b>45</b>

### Course Designer(s)


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

<b>60 ME E33</b>	<b>Welding Technology</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
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		PE	3	0	0	3
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### 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.	Remember, Understand
CO2	Relate the different types of resistance welding process and its applications	Remember, Understand
CO3	Demonstrate the different types of solid state welding process	Remember, Understand
CO4	Categorize and explain the advanced welding process	Remember, Understand
CO5	Design and analyze the characteristics of Weldments.	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination marks (100)	End Sem Examination(Marks)
	1	2		
Remember	30	30	50	50
Understand	30	30	50	50
Apply	0	0	0	0
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E33- Welding Technology								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Gas and Arc Welding Processes*</b> 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]
<b>Resistance Welding Processes*</b> 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]
<b>Solid State Welding Processes*</b> Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.								[9]
<b>Advanced Welding Processes*</b> 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]
<b>Design of Weld Joints, Weldability and Testing of Weldments**</b> 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]
<b>Total Hours</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Parmer R.S., “Welding Engineering and Technology”, 3 <sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2022.							
2	Parmer R.S., “Welding Processes and Technology”, 3 <sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2012.							
<b>Reference(s):</b>								
1.	Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34 <sup>th</sup> reprint, 2008.							
2.	“Welding Hand Book”, 9 <sup>th</sup> Edition, Vol - 2, American welding Society, Miami, Florida.							
3.	Nadkarni S.V. “Modern Arc Welding Technology”, 2 <sup>nd</sup> Edition, Oxford& IBH Publishers, New Delhi, 2005.							
4.	Paulo Davim J, “Welding Technology”, Springer International Publishing, 2022							
5.	NPTEL Video by Guwahati: <a href="https://archive.nptel.ac.in/courses/112/103/112103263/">https://archive.nptel.ac.in/courses/112/103/112103263/</a>							

\*SDG 9 – Industry Innovation and Infrastructure

\*\*SDG 12 – Responsible Consumption and Production

### Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
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<b>1.0</b>	<b>Gas and Arc Welding Processes</b>	<b>2</b>
1.1	Fundamental principles - Air Acetylene welding	1
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	1
1.5	Electro Gas welding limitations and applications.	1
<b>2.0</b>	<b>Resistance Welding Processes</b>	<b>2</b>
2.1	Spot welding, Seam welding	2
2.2	Projection welding, Resistance Butt welding	2
2.3	Flash Butt welding, Percussionwelding	1
2.4	High frequency resistance welding processes	1
2.5	advantages, limitations and applications.	1
<b>3.0</b>	<b>Solid State Welding Processes</b>	<b>2</b>
3.1	Cold welding, Diffusion bonding	2
3.2	Explosive welding, Ultrasonic welding	2
3.3	Friction welding, Forge welding	1
3.4	Rollwelding and Hot pressure welding processes	1
3.5	advantages, limitations and applications.	1
<b>4.0</b>	<b>Other Welding Processes</b>	<b>2</b>
4.1	Thermit welding, Atomic hydrogen welding	1
4.2	Electron beam welding	1
4.3	Laser Beam welding, Under Water welding	1
4.4	Friction stir welding	2
4.5	Welding automation in aerospace, nuclear and surface transport vehicles	2
<b>5.0</b>	<b>Design of Weld Joints</b>	<b>2</b>
5.1	Basic principles – Weld symbols inspection symbols	2
5.2	Residual stress – Defects in welding – Various welded joint designs.	2
5.3	Weldability of Aluminium, Copper and Stainless Steel	2
5.4	Destructive and Non-Destructive testing of weldments	1

#### Course Designer(s)


1. Dr. K. Mohan – [mohank@ksrct.ac.in](mailto:mohank@ksrct.ac.in)

60 ME E34	Renewable Sources of Energy	Category	L	T	P	Credit
		PE	3	0	0	3

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## 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	Remember, Understand
CO2	Describe the various solar energy technology and its applications	Remember, Understand
CO3	Explain the various wind turbine technology	Remember, Understand
CO4	Explore the various bio-energy technology	Remember, Understand
CO5	Update their knowledge in the field of hydrogen and fuel cells technology	Remember, Understand

## Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3				3	3					3	3	
CO2	3	3	3				3	3					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)		Model Examination Marks	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	40	50	70	70
Apply	10	0	10	10
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E34 - Renewable Sources of Energy								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Energy Scenario</b> 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]
<b>Solar Energy*</b> 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]
<b>Wind and Geo Thermal Energy*</b> 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]
<b>Biomass Energy*</b> 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]
<b>Hydrogen and Fuel Cells**</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	G.D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2020							
2	S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2016							
<b>Reference(s):</b>								
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	G.N. Tiwari, “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: <a href="https://onlinecourses.nptel.ac.in/noc24_ch26/preview">https://onlinecourses.nptel.ac.in/noc24_ch26/preview</a>							

\*SDG 7 – Affordable and Clean Energy

\*\*SDG 12 – Responsible Consumption and Production

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Energy Scenario</b>	
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
<b>2.0</b>	<b>Solar Energy</b>	
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
<b>3.0</b>	<b>Wind Energy</b>	
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	2
3.5	Vertical axis wind turbine	2
3.6	Wind turbine generators and its performance	2
3.7	Hybrid systems	1
3.8	Environmental issues - Applications.	1
<b>4.0</b>	<b>Biomass Energy</b>	
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

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4.8	Ethanol production - Applications	1
<b>5.0</b>	<b>Hydrogen and Fuel cells</b>	
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 principles	1
5.4	Alkaline Fuel cells (AFC), Phosphoric Acid Fuel cells (PAFC)	1
5.5	Polymer Electrolyte Membrane Fuel cells (PEMFC)	1
5.6	Specific characteristics, advantages and applications.	2

### Course Designer(s)

1. Dr.M.Gnanasekaran – gnanasekaran@ksrct.ac.in
2. Dr.D.Vasudevan – vasudevand@ksrct.ac.in
3. Mr.R.Prakash – prakashr@ksrct.ac.in

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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.	Remember, Understand
CO2	Characterize the warehousing and material handling of Logistics and Sourcing decision in supply chain management.	Remember, Understand
CO3	Measure the performance of the Logistics and Supply chain management system.	Remember, Understand & Apply
CO4	Demonstrate the role of Transportation in Logistics and Supply chain management system.	Remember, Understand & Apply
CO5	Describe the future trends in the Logistics and Supply chain management system.	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	30	20	30	30
Understand	30	20	40	40
Apply	0	20	30	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E35 - Logistics and Supply Chain Management								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Introduction to Logistics and Supply Chain Management</b> 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, issues - aligning supply chain with business strategy – reverse logistics.								[9]
<b>Sourcing Decision and Network design*</b> 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.								[9]
<b>Performance Measurement of Logistics and Supply Chain Management System*</b> 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.								[9]
<b>Transportation**</b> 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.								[9]
<b>Recent Trends in Logistics and Supply Chain Management System</b> 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.								[9]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Robert B Handfield, “Introduction To Supply Chain Management”, Pearson Publication, 2019. 5 <sup>th</sup> Edition.							
2	Bowersox & Closs, “Logistics Management”, McGraw-Hill Companies, 2017.							
<b>Reference(s):</b>								
1.	Sunil Chopra and Peter Meindl, “Supply Chain Management”, Strategy, Planning and Operation, Pearson publication, Edition 2018.							
2.	Mohanty, “Essentials of Supply Chain Management”, Jaico 2018, Publish house.							
3.	Raghuram G and Rangaraj N, “Logistics and Supply chain Management”, Macmillan India Limited, New Delhi, 2015.							
4.	Sople Vinod, “Logistics Management”, Pearson Education, 2014.							
5.	NPTEL videos : <a href="https://www.youtube.com/watch?v=A_0ParlzMjE">https://www.youtube.com/watch?v=A_0ParlzMjE</a>							
6.	NPTEL videos: <a href="https://www.youtube.com/watch?v=y9NukpnN-ZQ">https://www.youtube.com/watch?v=y9NukpnN-ZQ</a>							

\*SDG 8 – Decent work and Economic Growth

\*\*SDG 11 – Sustainable Cities and Communities

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

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Introduction to Logistics and Supply Chain Management</b>	
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
<b>2.0</b>	<b>Sourcing Decision and Network design</b>	
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
<b>3.0</b>	<b>Performance Measurement of Logistics and Supply Chain Management System</b>	
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	2
3.5	Supplier Partnerships – Issues in Retailer	1
3.6	Supplier Partnerships – Demand forecasting	1
3.7	collaborative forecasting models-bullwhip effect-information sharing	2
3.8	aggregate planning in supply chain	
3.9	strategies-multi echelon inventory planning-models- discounting- risk pooling	
<b>4.0</b>	<b>Transportation</b>	
4.1	Transportation System Evolution	1
4.2	Infrastructure and Networks	1
4.3	Freight Management, Route Planning	1

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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
<b>5.0</b>	<b>Recent Trends in Logistics and Supply Chain Management System</b>	
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	2
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](mailto: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	Remember, Understand & Apply
CO2	Acquaint of various parameters to operate injection molding machine.	Remember, Understand & Apply
CO3	Realize the application of different types of injection molds.	Remember, Understand & Apply
CO4	Gain knowledge of principle and process of extrusion, calendaring and blow molding operations	Remember, Understand & Apply
CO5	Aware of thermoforming, rotational molding and finishing, machining and welding of plastics	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3			3			2					2	3	2	2
CO2	3			3			2					2	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)		Model Examination	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	30	30	50	50
Apply	20	20	30	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME E36 - Plastic Manufacturing Processes								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
<b>Rheology and Melt Processing of Plastics*</b> Flow behavior – Flow analysis for Power law fluid - Viscosity and polymer processing, Melt flow index, capillary rheometer -thermal behaviour, crystallization, orientation.								[9]
<b>Extrusion Process and Blow Moulding*</b> 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								[12]
<b>Injection Moulding of Plastics*</b> 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								[12]
<b>Moulding of Thermosets*</b> 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								[6]
<b>Thermoforming, Calendaring and Rotational Moulding*</b> 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.								[6]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Harold Belofsky, “Plastics product design and process engineering” Hanser publishers,1995							
2	Tim A. Osswald, “Polymer Processing Fundamentals “, Hanser publishers, 1998							
<b>Reference(s):</b>								
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,” 3 rd Edition, Elsevier publications, 2005							
4..	NPTEL videos : : <a href="https://www.youtube.com/watch?v=iUH_EdNNtDU">https://www.youtube.com/watch?v=iUH_EdNNtDU</a>							
5.	NPTEL videos: <a href="https://www.youtube.com/watch?v=PYTiD0S-ixU">https://www.youtube.com/watch?v=PYTiD0S-ixU</a>							

\*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

S.No.	Topics	No.of hours
1.0	<b>Rheology and Melt Processing of Plastics</b>	
1.1	Introduction. Flow behavior	1

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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	<b>Extrusion Process and Blow Moulding</b>	
2.1	Extruder components and their functions	1
2.2	Geometry & various types of extruder screws	2
2.3	Barrier screws, flow analysis with extruder, two stage, vented extruders	2
2.4	Plastics compounding and its machinery	1
2.5	Extrusion of pipes, profiles, films and sheets, Co extrusion	2
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 -troubleshooting	1
3.0	<b>Injection Moulding of Plastics</b>	
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	2
3.4	Trouble shooting in injection moulding of Thermoplastics	2
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	2
4.0	<b>Moulding of Thermosets</b>	
4.1	Thermosetting compounds-properties and uses	1
4.2	Compression molding-preform and preheating-	1
4.3	Curing-process control; transfer molding	1
4.4	Integral and auxiliary mould	1
4.5	Process control-mould;	1
4.6	Thermoset injection moulding	1
5.0	<b>Thermoforming, Calendaring and Rotational Moulding</b>	
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	1
5.5	Welding of plastics -Adhesive bonding of plastics - Machining of plastics	1
5.6	Laser marking - pad printing-painting- Sintering	1

### Course Designer(s)

1. Dr.P.S.Sampath – [sampathps@ksrct.ac.in](mailto:sampathps@ksrct.ac.in)

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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.	Remember, Understand
CO2	Apply the concepts of rapid prototyping in product design and development	Remember, Understand & Apply
CO3	Select the suitable liquid based rapid prototyping system for a specific application	Remember, Understand
CO4	Select the suitable solid based rapid prototyping system for a specific application	Remember, Understand
CO5	Select the suitable powder based rapid prototyping system for a specific application	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	40	40	60	60
Apply	10	10	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L01 - Direct Digital Manufacturing								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Introduction</b> 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]
<b>Design for Additive Manufacturing (DFAM)*</b> 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]
<b>Liquid based RP systems*</b> 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]
<b>Solid based RP systems*</b> 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]
<b>Powder based RP systems*</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							
<b>Reference(s):</b>								
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: <a href="https://archive.nptel.ac.in/courses/112/103/112103306/">https://archive.nptel.ac.in/courses/112/103/112103306/</a>							

\*SDG 9 – Industry Innovation and Infrastructure

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## Course Contents and Lecture Schedule

S.No.	Topics	No.of hours
1.0	<b>Introduction</b>	
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	<b>Design for Additive Manufacturing (DFAM)</b>	
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	<b>Liquid based RP systems</b>	
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	<b>Solid based RP systems</b>	
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

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5.0	<b>Powder based RP systems</b>	
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](mailto: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.	Remember, Understand
CO2	Develop new product ideation, identification of customer requirements and selection of ideas.	Remember, Understand
CO3	Apply the principle of concept generation, testing and validation of new concepts.	Remember, Understand & Apply
CO4	Apply the technical standards with quality for branding new product.	Remember, Understand & Apply
CO5	Apply the principle of packaging and promote new strategy in launching new product in the market.	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination (Marks)	End Sem Examination (Marks)
	1	2		
Remember	10	10	20	20
Understand	30	30	50	50
Apply	20	20	30	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L02 - Product Design and Development								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Product Development Fundamentals and Process</b> Product Marketing Importance: Relevance of Customer 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]
<b>Product ideation and Opportunity seeking*</b> 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]
<b>Concept Creation, Testing and Validation*</b> 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]
<b>Branding, Quality with Technical Specifications**</b> 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]
<b>Packaging and Launching Strategies**</b> 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 to accelerate introduction.								[9]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
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.							

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<b>Reference(s):</b>	
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.	NPTTEL videos: <a href="https://onlinecourses.nptel.ac.in/noc21_me83/preview">https://onlinecourses.nptel.ac.in/noc21_me83/preview</a>

\*SDG 9 – Industry Innovation and Infrastructure

\*\*SDG 8 – Decent work and Economic Growth

### Course Contents and Lecture Schedule

<b>S.No.</b>	<b>Topics</b>	<b>No.of hours</b>
1.0	<b>Product Development Fundamentals and Process</b>	
1.1	Product Marketing Importance: Relevance of Customer 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	<b>Product ideation and Opportunity seeking</b>	
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	<b>Concept Creation, Testing and Validation</b>	
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

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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	<b>Branding, Quality with Technical Specifications</b>	
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	<b>Packaging and Launching Strategies</b>	
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.Jeyaprakam- sjeyparakasam@ksrct.ac.in

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60 ME L03	Composite Materials and Processing	Category	L	T	P	Credit
		OE	3	0	0	3

### Objectives

- Impart knowledge of various types of composites and its advantages and needs.
- Understand the various types of fiber materials and its applications for making Composites.
- Understand the knowledge of various resins materials used in processing of composites
- Understand various process for manufacturing composites
- 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	Remember, Understand & Apply
CO2	Analyze various types of fiber materials and its applications for making Composites	Remember, Understand & Apply
CO3	Analyze various resins materials used in processing of composites	Remember, Understand & Apply
CO4	Analyze various process for manufacturing composites	Remember, Understand & Apply
CO5	Apply basic destructive and non-destructive testing of composites	Remember, Understand & Apply

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	30	30	50	50
Apply	20	20	30	30
Analyse	0	0	0	20
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L03 - Composite Materials and Processing								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Introduction and Additives</b> Introduction – Advantages, Characteristics, of composites – Classification – particulate, fibrous, laminated, and hybrid composites, Additives for Composites - Catalysts - Accelerators – Coupling Agents - Fillers - Toughening Agents								[9]
<b>Matrix Materials*</b> Classification -Matrix Resins - Unsaturated Polyester - Vinyl Ester - Epoxy- Phenol Formaldehyde - Urea Formaldehyde - Melamine Formaldehyde Resin - Properties and Applications								[9]
<b>Reinforcement Materials*</b> Fibre Reinforcements - Glass – Types - CSM – Surface Mats - Performs - Woven and Non-Woven Fabrics - Carbon - Aramid Fibre - Boron Fibres - Natural Fibres – Cellulose.								[9]
<b>Processing Techniques**</b> DMC, SMC and Prepregs - Hand and Spray Layup - RTM - Bag - Autoclave - Centrifugal and Compression Molding Processes - Filament Winding - Pultrusion Sandwich Construction								[9]
<b>Testing</b> Testing of Composites – Standards -Tensile, Impact, Compression and Flexural Strength- Non Destructive testing for Composites - Application of FRP Products.								[9]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
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							
<b>Reference(s):</b>								
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: <a href="https://archive.nptel.ac.in/courses/112/104/112104229/">https://archive.nptel.ac.in/courses/112/104/112104229/</a>							

\*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	<b>Introduction and Additives</b>	
1.1	Introduction – Advantages, Characteristics, of composites	1

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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	<b>Matrix Materials</b>	
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	<b>Reinforcement Materials</b>	
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	<b>Processing Techniques</b>	
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	<b>Testing</b>	
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

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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.	Remember, Understand & Analyse
CO2	Identify the consumer's and producer's risk in sampling	Remember, Understand
CO3	Determine and analyze the reliability process.	Remember, Understand & Analyse
CO4	Apply reliability concepts and solve reliability problems.	Remember, Understand & Apply
CO5	Analyze and estimate the reliability of a product or system.	Remember, Understand & Analyse

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	30	30	40	40
Apply	10	10	20	20
Analyse	10	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L04 - Reliability Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Statistical Process Control</b> Introduction:-Definition of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance, Total quality management concepts, chance causes, assignable causes, Customer-Oriented: 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]
<b>Acceptance Sampling*</b> 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]
<b>Design For Reliability**</b> 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]
<b>Reliability Concepts</b> 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]
<b>Reliability Improvement</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Patrick D Connor, Practical Reliability Engineering, Wiley, 2012.							
2	Srinath. L.S., “Reliability Engineering”, 4 <sup>th</sup> Edition Affiliated East West Press, 2011.							
<b>Reference(s):</b>								
1.	Connor, P.D.T.O., “Practical Reliability Engineering”, 5 <sup>th</sup> 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: <a href="https://youtu.be/uutg8jKrL9w">https://youtu.be/uutg8jKrL9w</a>							

\*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	<b>Statistical Process Control</b>	

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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-Oriented	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	<b>Acceptance Sampling</b>	
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	<b>Design For Reliability</b>	
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	<b>Reliability Concepts</b>	
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	<b>Reliability Improvement</b>	
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](mailto:prasathm@ksrct.ac.in)

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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	Remember, Understand
CO2	Apply the concept of warehousing and material handling equipment systems in logistics management	Remember, Understand & Apply
CO3	Describe the Internal and External Performance Measurement in logistics management.	Remember, Understand
CO4	Outline the time and cost in freight management.	Remember, Understand
CO5	Describe Logistics Resource Management and, Automatic Identification Technologies.	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	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)		Model Examination	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	30	30	50	50
Apply	20	20	30	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L05 - Logistics Management								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Introduction to Logistics and Network Design</b> 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]
<b>Warehousing and Materials Handling, Material Handling Equipment and Systems*</b> 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]
<b>Strategic Alliances and Performance Measurement</b> 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]
<b>Transportation and Packaging*</b> Transportation System Evolution – Infrastructure and Networks, Freight Management , Route Planning, Containerization – Design considerations, Material and Cost, Packaging as Unitization – Consumer and Industrial Packaging.								[9]
<b>Current Trends</b> E-Logistics Structure and Operation – Logistics Resource Management, Automatic Identification Technologies – Warehouse Simulation, Reverse Logistics - Global Logistics , Strategic logistics Planning.								[9]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
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							
<b>Reference(s):</b>								
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: <a href="https://archive.nptel.ac.in/courses/110/106/110106045/">https://archive.nptel.ac.in/courses/110/106/110106045/</a>							

\*SDG 8 – Decent work and Economic Growth

## Course Contents and Lecture Schedule

S.No.	Topics	No.of hours
1.0	<b>Introduction to Logistics and Network Design</b>	
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

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1.4	models for facility location and capacity allocation	2
1.5	Impact of uncertainty on network design	2
2.0	<b>Warehousing and Materials Handling, Material Handling Equipment and Systems</b>	
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	<b>Strategic Alliances and Performance Measurement</b>	
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	<b>Transportation and Packaging</b>	
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
5.0	<b>Current Trends</b>	
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	Remember, Understand
CO2	Recognise the basic knowledge on nuclear processes and working of nuclear power plants with their layouts	Remember, Understand
CO3	Recognise the basic knowledge on hydro power generation processes and working of various types of hydro turbines	Remember, Understand
CO4	Apply the working principle of gas and diesel power plants	Remember, Understand
CO5	Illustrate the layout, construction and working of the components inside renewable energy power plants.	Remember, Understand

### Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3				3	3							3	
CO2	3	3				3	3							3	
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)		Model Examination	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	10
Understand	50	50	60	50
Apply	0	0	20	0
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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 Tiruchengode - 637 215.

## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L06 - Power Generation Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Energy scenario and Thermal power plant*</b> 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]
<b>Nuclear Power Plant*</b> 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]
<b>Hydroelectric power plant**</b> 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]
<b>Gas Turbine and Diesel Power Plant*</b> 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]
<b>Non-Conventional Power Plants**</b> 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]
<b>Total Hours:</b>								<b>45</b>
<b>Text Book(s):</b>								
1.	Arora, S. C., and Domkundwar, S., “A course in Power Plant Engineering”, 8 <sup>th</sup> Edition, Dhanpatrai Publications Ltd., New Delhi, 2016							
2	Rajput R.K, "Power Plant Engineering", 5 <sup>th</sup> Edition, Laxmi Publications, New Delhi, 2016.							
<b>Reference(s):</b>								
1.	Rai,G.D. “Introduction to Power Plant Technology”, 11 <sup>th</sup> reprint, Khanna Publishers, 2013							
2.	Hegde, R K., “Power Plant Engineering”, 1 <sup>st</sup> edition, Pearson education India, New Delhi, 2015.							
3.	Rajput R.K., “Power Plant Engineering”, 4 <sup>th</sup> edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016.							
4..	Nag, P K., “Power Plant Engineering”, 4 <sup>th</sup> edition, Tata McGraw-Hill, New Delhi, 2014.							
5.	NPTEL Video link: <a href="https://archive.nptel.ac.in/courses/112/107/112107291/">https://archive.nptel.ac.in/courses/112/107/112107291/</a>							

\*SDG 9 – Industry Innovation and Infrastructure

\*\*SDG 7 Affordable and clean energy

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## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Energy scenario and steam power plant</b>	
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
<b>2.0</b>	<b>Nuclear Power Plants</b>	
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
<b>4.0</b>	<b>Gas Turbine and Diesel Power Plant</b>	
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

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4.7	Application and advantages.	1
<b>5.0</b>	<b>Non-Conventional Power Plants</b>	
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.Gnanasekaran – 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 turbine 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	Remember, Understand
CO2	Describe the various solar energy technology and its applications	Remember, Understand & Apply
CO3	Explain the various wind turbine technology	Remember, Understand
CO4	Explore the various bio-energy technology	Remember, Understand
CO5	Discuss the ocean and geothermal technologies.	Remember, Understand

### Mapping with Programme Outcomes

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


### Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		Model Examination Marks	End Sem Examination(Marks)
	1	2		
Remember	10	10	20	20
Understand	40	40	70	70
Apply	10	10	10	10
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0
Total	60	60	100	100

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## Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
60 ME L07 – Green Energy Sources								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV/V/VI/VII	3	0	0	45	3	40	60	100
<b>Energy Scenario</b> 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]
<b>Solar Energy*</b> 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]
<b>Wind Energy*</b> 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]
<b>Biomass Energy*</b> 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]
<b>Ocean and Geothermal Energy*</b> 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]
<b>Text Book(s):</b>								
1.	G.D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2020							
2	S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2016							
<b>Reference(s):</b>								
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.	G.N. Tiwari, “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: <a href="https://onlinecourses.nptel.ac.in/noc22_ch27/preview">https://onlinecourses.nptel.ac.in/noc22_ch27/preview</a>							

\*SDG 7 Affordable and clean energy

## Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
<b>1.0</b>	<b>Energy scenario</b>	
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
<b>2.0</b>	<b>Solar Energy</b>	
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 Photovoltaic 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
<b>3.0</b>	<b>Wind Energy</b>	
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
<b>4.0</b>	<b>Biomass Energy</b>	
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

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<b>5.0</b>	<b>Ocean and Geothermal Energy</b>	
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)

1. Dr.M.Gnanasekaran – gnanasekaran@ksrct.ac.in
2. Dr.D.Vasudevan – vasudevand@ksrct.ac.in
3. Mr.R.Prakash – prakashr@ksrct.ac.in

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