K. S. Rangasamy College of Technology

(Autonomous)

Curriculum & Syllabus

of

B.E. Mechanical Engineering

(For the batch admitted in 2021 – 2022)

R 2018

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.

Rev. No.4/w.e.f. 02.01.24
Passed in BoS Meeting held on 24/11/23
Approved in Academic Council Meeting held on 23/12/2023

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

DEPARTMENT OF MECHANICAL ENGINEEIRNG

VISION OF THE DEPARTMENT

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

MISSION OF THE DEPARTMENT

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

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

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

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

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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

MAPPING: MECHANICAL ENGINEEIRNG (UG)

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	Communication Skills I					2			2	2.8	3	2	3	1.8	1.6	1.6
		Calculus and Differential Equations	3	3	2.8	2.4	2.4							2		3	
		Applied Physics	3	3	2.2	2.2	2			2		2.6		2.6	2.6	2	3
		Programming for Problem Solving	3	2	3		3				3	3	2	2	1.8	1.8	
		Engineering Drawing	3	2.8	3		3			3					3	2.8	
		Constitution of India								2	2	1		2			
		Engineering Physics Laboratory	3	3	2.4	2				2	3	3	2	3	2	2	
		Programming for Problem Solving Laboratory	3	2	3		3				3	3	2	2	1.8	1.8	
	II	Communication Skills II					2			2	3	3	2.4	3	1.8	2	1.8
		Laplace Transform and Complex Variables	3	3	2.4	2.2	2.8							2		3	
		Applied Chemistry	2.2	1.75	2	2.6	2.4	2.25	2	1		1		1	1.7	1.3	
		Basic Electrical Engineering	2.2	1.8	1.6	2	2	2.5	2	1.6		2		2	1.8	1.6	1
		Engineering Mechanics	3	3	2.8	3	3			3					3	2.8	
		Environmental Science	3	2	3	3	3	3	3	3	3	3	2	2	2.5	2.2	2.5
		Chemistry Laboratory	2.8	2.8	2.8	2.4		1	1.5			1		1.5	1.3	1.3	
		Engineering Practices Laboratory	3	2.4	2.4	3		2.4	2.4	3	3	3			3	2.4	3

3	III	Partial Differential Equations and Statistics	3	3	3	2.6	2.6							2	3	2.6	2.2
		Basic Electronics Engineering	3	3	3	3	2								3	2	
		Strength of Materials	3	2.8	2.6	3	3			3					3	3	
		Thermodynamics	3	2.8	2.6	3	2.5							2.5	2.5	3	2.5
		Manufacturing Processes	3	2.6	2.6			3	3					2.6	3	2.6	
		Universal Human Values (UHV)*	3	3	2	2	2	3	3	3	3	3	2	1			
		Manufacturing Processes Laboratory	3	2.6	2.6	3		3	3	3		2.4		2.6	3	2.6	3
		Computer Aided Machine Drawing Laboratory	3	3	3	3	2.6				2.5		2.5	2.5	2.4	2.4	3
		Career Competency Development- I						2		2	3	3	2	3		2	
	IV	Engineering Materials and Metallurgy	3	2.6	2.5	2.5									2.7	2.5	
		Fluid Mechanics and Fluid Machines	3	3	2.8	3	3			3					3	3	3
		Machining Processes	2.6	2.8	2.6			2.5	2.5					3	3	2.6	
		Kinematics of Machines	3	2.8	2.75		3								3	3	
		Thermal Engineering	3	2.8	2.5	3	2.5		3	3				2.6	2.6	3	
		Startups and Entrepreneurship	3	2	3	3	3	1	1	1			3	2	2.6	1	2
		National Cadet Corps (NCC)**	3	2	1	1	3	3	3	3	3	3	3	3			
		Strength of Materials, Fluid Mechanics and Fluid Machines Laboratory	3	3		3				3	3	3			3	3	3
		Machining Processes Laboratory	2.6	2.8	2.6	3		2.5	2.5	2.6		2.8	2.6	3	3	3	3
		Career Competency Development- II	3	2	2	2			1		2.8	3	2.3	3	1.4	1.5	1
3	V	Automobile Engineering	2.5	2.5			3	2.6	2.6			2.5		3	2.5	2.5	2
		Dynamics of Machines	3	2.8	3	3	3								3	3	
		Design of Machine Elements	3	3	3	3	2.67			2.67				3	3	3	3
		Applied Hydraulics and Pneumatics	3	2.4	3	3		2.5	2.6						2.4	2.8	
		Professional Elective -I															
		Open Elective – I															
		Thermal Engineering Laboratory	3	3		3				3	3	3		2.6			3
		Dynamics Laboratory	3		3	3				3	3	3			3	3	3
		Career Competency Development III	3	2	2	2	3	2	1	2	3	2.8	2.5	3	2.5	2	
	VI	Heat and Mass Transfer	3	3	2.6	3	3			2.5				2.6	2.6	3	3
		Finite Element Analysis	3	2.8	2.6	2.75	3			3	3	2.6			3	2.8	
		Design of Mechanical Transmission Systems	3	3	3	3	2.6			2.6				3	3	3	3
		Professional Elective – II															
		Professional Elective – III															
		Open Elective - II															

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		Heat Transfer Laboratory	3	2.6		2.4				2.6	2.6	3		3			3
		Analysis and Simulation Laboratory	3	3	3	3	2.8			2.8	3	3		3	2.8		1
		Career Competency Development IV	3	2.4	2	2.4	2.6	1.4	1	2	3	2.6	2.6	3	1.8	1.8	
IV	VII	Metrology and Measurements	2.6	2.8	2.6		3				2.5	2.8			3	3	3
		Automation in Manufacturing	2.6	2.8	2.6		3			3				3	3	2.8	
		Operations Research	2.8	2.6	2.8	2.6	2.6						2.6	2.6	2.5	2.5	2.7
		Total Quality Management	3	2.5			2.5	2.5	2.5	3	2.5	2.6		3	2.7	2.5	
		Professional Elective – IV															
		Open Elective – III															
		Research Skill Development - I	3	3					3	3	3	3	3	3		3	3
		Metrology and Measurements Laboratory	3	3	3	2.6					3	3			3	3	3
		Automation Laboratory	3	3	3	3	2.8			2.8	3	3		3	2.8	2.6	2.6
		Project Work - Phase I	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Career Competency Development V	3	2.3	2	2.3	2.5	1.5	1	2	3	2.6	2.6	3	2	2	
	VIII	Professional Elective – V															
		Research Skill Development - II							3	3	3	3	3	3		3	3
		Project Work – Phase II	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

**Universal Human Value (UHV) - extra credit is offered.*
***National cadet corps (NCC) is optional, Extra credit is offered.*

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		THEORY						
1.	50 EN 001	Communication Skills I	HS	2	1	1	0	2
2.	50 MA 001	Calculus and Differential Equations	BS	4	3	1	0	4
3.	50 PH 001	Applied Physics	BS	3	3	0	0	3
4.	50 CS 001	Programming for Problem Solving	ES	3	3	0	0	3
5.	50 ME 001	Engineering Drawing	ES	6	2	0	4	4
6.	50 MY 001	Constitution of India	MC	2	2	0	0	0
		PRACTICALS						
7.	50 PH 0P1	Engineering Physics Laboratory	BS	4	0	0	4	2
8.	50 CS 0P1	Programming for Problem Solving Laboratory	ES	4	0	0	4	2
			Total	**28**	**14**	**2**	**12**	**20**

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 EN 002	Communication Skills II	HS	2	1	1	0	2
2.	50 MA 002	Laplace Transform and Complex Variables	BS	4	3	1	0	4
3.	50 CH 001	Applied Chemistry	BS	3	3	0	0	3
4.	50 EE 001	Basic Electrical Engineering	ES	3	3	0	0	3
5.	50 ME 003	Engineering Mechanics	ES	4	3	1	0	4
6.	50 MY 002	Environmental Science	MC	2	2	0	0	0
PRACTICALS								
7.	50CH 0P1	Chemistry Laboratory	BS	4	0	0	4	2
8.	50 ME 0P1	Engineering Practices Laboratory	ES	4	0	0	4	2
			Total	**26**	**15**	**3**	**8**	**20**

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 MA 003	Partial Differential Equations and Statistics	BS	4	3	1	0	4
2.	50 EC 001	Basic Electronics Engineering	ES	3	3	0	0	3
3.	50 ME 004	Strength of Materials	PC	4	3	1	0	4
4.	50 ME 006	Thermodynamics	PC	4	3	1	0	4
5.	50 ME 301	Manufacturing Processes	PC	3	3	0	0	3
6.	50 MY 004	Universal Human Values (UHV)*	MC	3	2	1	0	3*
PRACTICALS								
7.	50 ME3P1	Manufacturing Processes Laboratory	PC	4	0	0	4	2
8.	50 ME3P2	Computer Aided Machine Drawing Laboratory	PC	4	0	0	4	2
9.	50 TP 0P1	Career Competency Development- I	EEC	2	0	0	2	0
			Total	**31**	**17**	**4**	**10**	**22**

**Universal Human Values (UHV) - extra credit is offered.*

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 ME 401	Engineering Materials and Metallurgy	PC	3	3	0	0	3
2.	50 ME 005	Fluid Mechanics and Fluid Machines	PC	4	3	1	0	4
3.	50 ME 402	Machining Processes	PC	3	3	0	0	3
4.	50 ME 403	Kinematics of Machines	PC	4	3	1	0	4
5.	50 ME 404	Thermal Engineering	PC	3	3	0	0	3
6.	50 MY 014	Startups and Entrepreneurship	MC	2	2	0	0	0
7.	50 GE 00*	National Cadet Corps (NCC)**	GE	5	3	0	2	4
PRACTICALS								
8.	50 ME 4P1	Strength of Materials, Fluid Mechanics and Fluid Machines Laboratory	PC	4	0	0	4	2
9.	50 ME 4P2	Machining Processes Laboratory	PC	4	0	0	4	2
10.	50 TP 0P2	Career Competency Development- II	EEC	2	0	0	2	0
			Total	**29**	**17**	**2**	**10**	**21**

***National Cadet Corps (NCC) is optional, Extra credit is offered*

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SEMESTER V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 ME 501	Automobile Engineering	PC	3	3	0	0	3
2.	50 ME 502	Dynamics of Machines	PC	4	3	1	0	4
3.	50 ME 503	Design of Machine Elements	PC	4	3	1	0	4
4.	50 ME 504	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
5.	50 ME E1*	Professional Elective -I	PE	3	3	0	0	3
6.	50 ME L1*	Open Elective – I	OE	3	3	0	0	3
PRACTICALS								
7.	50 ME 5P1	Thermal Engineering Laboratory	PC	4	0	0	4	2
8.	50 ME 5P2	Dynamics Laboratory	PC	4	0	0	4	2
9.	50 TP 0P3	Career Competency Development III	EEC	2	0	0	2	0
			Total	**30**	**18**	**2**	**10**	**24**

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 ME 601	Heat and Mass Transfer	PC	3	3	0	0	3
2.	50 ME 702	Finite Element Analysis	PC	4	3	1	0	4
3.	50 ME 603	Design of Mechanical Transmission Systems	PC	4	3	1	0	4
4.	50 ME E2*	Professional Elective – II	PE	3	3	0	0	3
5.	51 ME E3*	Professional Elective – III	PE	4	2	0	2	3
6.	50 ME L2*	Open Elective - II	OE	3	3	0	0	3
PRACTICALS								
7.	50 ME 6P1	Heat Transfer Laboratory	PC	4	0	0	4	2
8.	50 ME 7P2	Analysis and Simulation Laboratory	PC	4	0	0	4	2
9.	50 TP 0P4	Career Competency Development IV	EEC	2	0	0	2	0
			Total	**31**	**17**	**2**	**12**	**24**

SEMESTER VII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 ME 701	Metrology and Measurements	PC	3	3	0	0	3
2.	50 ME 602	Automation in Manufacturing	PC	3	3	0	0	3
3.	50 ME 703	Operations Research	PC	3	3	0	0	3
4.	50 HS 003	Total Quality Management	HS	3	3	0	0	3
5.	50 ME E4*	Professional Elective – IV	PE	3	3	0	0	3
6.	50 ME L3*	Open Elective – III	OE	3	3	0	0	3
7.	50 AC 001	Research Skill Development - I	AT	1	1	0	0	0
PRACTICALS								
8.	50 ME 7P1	Metrology and Measurements Laboratory	PC	4	0	0	4	2
9.	50 ME 6P2	Automation Laboratory	PC	4	0	0	4	2
10.	50 ME 7P3	Project Work - Phase I	EEC	4	0	0	4	2
11.	50 TP 0P5	Career Competency Development V	EEC	2	0	0	2	0
			Total	**33**	**19**	**0**	**14**	**24**

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SEMESTER VIII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 ME E5*	Professional Elective – V	PE	3	3	0	0	3
2.	50 AC 002	Research Skill Development - II	AT	1	1	0	0	0
PRACTICALS								
3.	50 ME 8P1	Project Work – Phase II	EEC	16	0	0	16	8
4.	50 TP 0P6	Internship	EEC	-	-	-	-	3*
			Total	**20**	**4**	**0**	**16**	**11**

**Internship Extra 3 Credits is offered*

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

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

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 EN 001	Communication Skills I	HS	2	1	1	0	2
2.	50 EN 002	Communication Skills II	HS	2	1	1	0	2
3.	50 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3
4.	50 HS 003	Total Quality Management	HS	3	3	0	0	3

BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 MA 001	Calculus and Differential Equations	BS	4	3	1	0	4
2.	50 PH 001	Applied Physics	BS	3	3	0	0	3
3.	50 PH 0P1	Engineering Physics Laboratory	BS	4	0	0	4	2
4.	50 MA 002	Laplace Transform and Complex Variables	BS	4	3	1	0	4
5.	50 CH 001	Applied Chemistry	BS	3	3	0	0	3
6.	50 CH 0P1	Chemistry Laboratory	BS	4	0	0	4	2
7.	50 MA 003	Partial Differential Equations and Statistics	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

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

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PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME 004	Strength of Materials	PC	4	3	1	0	4
2.	50 ME 006	Thermodynamics	PC	4	3	1	0	4
3.	50 ME 302	Manufacturing Processes	PC	3	3	0	0	3
4.	50 ME3P1	Manufacturing Processes Laboratory	PC	4	0	0	4	2
5.	50 ME 3P2	Computer Aided Machine Drawing Laboratory	PC	4	0	0	4	2
6.	50ME 401	Engineering Materials and Metallurgy	PC	3	3	0	0	3
7.	50 ME 005	Fluid Mechanics and Fluid Machines	PC	4	3	1	0	4
8.	50 ME 402	Machining Processes	PC	3	3	0	0	3
9.	50 ME 403	Kinematics of Machines	PC	4	3	1	0	4
10.	50 ME 404	Thermal Engineering	PC	3	3	0	0	3
11.	50 ME 4P1	Strength of Materials, Fluid Mechanics and Fluid Machines Laboratory	PC	4	0	0	4	2
12.	50 ME 4P2	Machining Processes Laboratory	PC	4	0	0	4	2
13.	50 ME 501	Automobile Engineering	PC	3	3	0	0	3
14.	50 ME 502	Dynamics of Machines	PC	4	3	1	0	4
15.	50 ME 503	Design of Machine Elements	PC	4	3	1	0	4
16.	50 ME 504	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
17.	50 ME 5P1	Thermal Engineering Laboratory	PC	4	0	0	4	2
18.	50 ME 5P2	Dynamics Laboratory	PC	4	0	0	4	2
19.	50 ME 601	Heat and Mass Transfer	PC	3	3	0	0	3
20.	50 ME 602	Automation in Manufacturing	PC	3	3	0	0	3
21.	50 ME 603	Design of Mechanical Transmission Systems	PC	4	3	1	0	4
22.	50 ME 6P1	Heat Transfer Laboratory	PC	4	0	0	4	2
23.	50 ME 6P2	Automation Laboratory	PC	4	0	0	4	2
24.	50 ME 701	Metrology and Measurements	PC	3	3	0	0	3
25.	50 ME 702	Finite Element Analysis	PC	4	3	1	0	4
26.	50 ME 703	Operations Research	PC	3	3	0	0	3
27.	50 ME 7P1	Metrology and Measurements Laboratory	PC	4	0	0	4	2
28.	50 ME 7P2	Analysis and Simulation Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

SEMESTER V, PROFESSIONAL ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 HS 004	Principles of Management	PE	3	3	0	0	3
2.	50 ME E12	Power Plant Engineering	PE	3	3	0	0	3
3.	50 ME E13	Rapid Prototyping	PE	3	3	0	0	3
4.	50 ME E14	Product Design for Manufacturing	PE	3	3	0	0	3
5.	50 ME E15	Instrumentation and Control	PE	3	3	0	0	3
6.	50 MA 014	Numerical Methods	PE	3	3	0	0	3
7.	50 CS 014	Object Oriented Programming	PE	3	3	0	0	3

GENERAL ELECTIVE (GE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 GE 001	National Cadet Corps (Air Wing)	GE	4	2	0	2	3
2.	50 GE 002	National Cadet Corps (Army Wing)	GE	4	2	0	2	3

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SEMESTER VI, PROFESSIONAL ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	51 ME E21	Gas Dynamics and Jet Propulsion	PE	3	3	0	0	3
2.	51 ME E23	Bio-Mechanics	PE	3	3	0	0	3
3.	50 ME E24	Internal Combustion Engines	PE	3	3	0	0	3
4.	50 ME E25	Quality Control and Reliability Engineering	PE	3	3	0	0	3
5.	50 CS E25	Python Programming	PE	3	3	0	0	3

SEMESTER VI, PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME E31	Process Planning and Cost Estimation	PE	4	2	0	2	3
2.	51 ME E32	Flexible Manufacturing System	PE	4	2	0	2	3
3.	51 ME E35	Design of Jigs, Fixtures and Press Tools	PE	4	2	0	2	3
4.	51 ME E36	Computational Fluid Dynamics	PE	4	2	0	2	3
5.	50 ME E37	Logistics and Supply Chain Management	PE	4	2	0	2	3
6.	50 ME E38	Refrigeration and Air Conditioning Engineering	PE	4	2	0	2	3
7.	50 PT T01	Creo for Design	PE	4	2	0	2	3

SEMESTER VII, PROFESSIONAL ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME E41	Thermal Turbomachines	PE	3	3	0	0	3
2.	50 ME E42	Energy Storing Devices and Fuel Cells	PE	3	3	0	0	3
3.	50 ME E43	Machine Learning	PE	3	3	0	0	3
4.	50 ME E45	Non-Destructive Evaluation of Materials	PE	3	3	0	0	3
5.	50 ME E46	MEMS Devices – Design and Fabrication	PE	3	3	0	0	3

SEMESTER VIII, PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME E51	Fundamentals of Nano Science	PE	3	3	0	0	3
2.	50 ME E52	Composite Materials	PE	3	3	0	0	3
3.	50 ME E53	Lean Manufacturing	PE	3	3	0	0	3
4.	50 ME E55	Cryogenics	PE	3	3	0	0	3
5.	50 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3
6.	50 PT T02	Creo for Production Engineering	PE	4	2	0	2	3

OPEN ELECTIVES (OE)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME L01	Rapid Prototyping	OE	3	3	0	0	3
2.	50 ME L02	Product Design for Manufacturing	OE	3	3	0	0	3
3.	50 ME L05	Logistics Management	OE	3	3	0	0	3
4.	50 ME L08	Reliability Engineering	OE	3	3	0	0	3
5.	50 ME L09	Green Energy Sources	OE	3	3	0	0	3
6.	50 ME L10	Power Generation Engineering	OE	3	3	0	0	3
7.	50 ME L11	Composite Materials and Processing	OE	3	3	0	0	3
8.	50 ME L12	Direct Digital Manufacturing	OE	3	3	0	0	3

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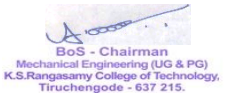

SEMESTER VII & SEMESTER VIII, AUDIT COURSES (AC)

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

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 TP 0P1	Career Competency Development I	EEC	2	2	0	0	-
2.	50 TP 0P2	Career Competency Development II	EEC	2	2	0	0	-
3.	50 TP 0P3	Career Competency Development III	EEC	2	2	0	0	-
4.	50 TP 0P4	Career Competency Development IV	EEC	2	2	0	0	-
5.	50 TP 0P5	Career Competency Development V	EEC	2	2	0	0	-
6.	50 TP 0P6	Internship	EEC	2/4/6 weeks	-	-	-	1/2/3*
7.	50 ME 7P3	Project Work - Phase I	EEC	4	0	0	4	2
8.	50 ME 8P1	Project Work – Phase II	EEC	16	0	0	16	8

SUMMARY

S.No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	2	2	-	-	-	-	3	-	**7**	**04.21**
2.	BS	9	9	4	-	-	-	-	-	**22**	**13.25**
3.	ES	9	9	3	-	-	-	-	-	**21**	**12.65**
4.	PC	-	-	15	21	18	15	13	-	**82**	**49.40**
5.	PE	-	-	-	-	3	6	3	3	**15**	**09.03**
6.	GE	-	-	-	-	3*	-	-	-	**3***	**--**
7.	OE	-	-	-	-	3	3	3	-	**9**	**05.42**
8.	EEC	-	-	-	-	-	-	2	8	**10**	**06.02**
9.	MC	MC I	MC II	MC III	MC IV	-	-	-	-	**-**	**-**
Total		**20**	**20**	**22**	**21**	**24**	**24**	**24**	**11**	**166**	**100**

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DEPARTMENT OF MECHANICAL ENGINEERING

HONOURS – DESIGN

CURRICULUM

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME H01	Reverse Engineering	PE	3	3	0	0	3
2.	50 ME H02	Optimization Techniques in Design	PE	3	3	0	0	3
3.	50 ME H03	Integrated Product Development	PE	3	3	0	0	3
4.	50 ME H04	Micro and Precision Engineering	PE	3	3	0	0	3
5.	50 ME H05	Quality Engineering	PE	3	3	0	0	3
6.	50 ME H06	Surface Engineering	PE	3	3	0	0	3

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50 EN 001 – Communication Skills I								
Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	1	0	30	2	40	60	100
Objective(s)	• To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts • To help learners develop strategies that could be adopted while reading texts • To help learners acquire the ability to speak effectively in English in real life and career related situations • To equip students with effective speaking and listening skills in English • To facilitate learners to enhance their writing skills with coherence and appropriate format effectively							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Utilize digital literacy tools to develop listening skills & make use of contextual clues to infer meanings of unfamiliar words CO2: Able to select, compile & synthesize information using communication strategies for an effective oral presentation CO3: Skim & Scan the textual content & infer meanings of unfamiliar words to develop reading & vocabulary skills CO4: Generate ideas from sources to develop coherent content and support with relevant Details in writing CO5: Recognize the basic phonetic patterns of language & execute it for competent loud reading							

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

Listening

Listening to Short Audios – Watching Short Videos - answering MCQs and Vocabulary Check- Listening to Short Comprehension Passages – Guided Listening – Listening to songs and cognizing the lyrics [4]

Speaking

Brainstorming – Group Discussion (unstructured) – Self Introduction - Just a Minute (JaM) - Short Narratives – Cue Cards – Picture Cards – Conversational Practices (Preliminary) [4]

Reading

Silent Reading – Scanning and Skimming - Reading short and Medium Passages – Cognition of Theme and Inferential Meaning - Academic and Functional Vocabulary List (350 words) – Word Power Check - Loud Reading – Modulation and Pronunciation Check [4]

Writing

Functional Vocabulary and Word Power – Data Interpretation - Paragraph Writing – Letter Writing –Email Writing – Conversational Fill Ups [3]

Total Hours: 15 + 15(Tutorial) = 30

Text Book(s):

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

Reference(s):

1. Paul Emmerson and Nick Hamilton, “Five Minute Activities for Business English”, Cambridge University Press, 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, New York, 2012.
4. https://learningenglish.britishcouncil.org/en/listening

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC

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OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 EN 001 & Communication Skills I	CO1					2			2	3	3	2	3	2	2	2
	CO2								2	3	3	2	3	2	2	2
	CO3					2			2	3	3	2	3	2	1	1
	CO4					2			2	3	3	2	3	2	2	2
	CO5								2	2	3	2	3	1	1	1

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 MA 001 - Calculus and Differential Equations

Common to All Branches

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

Objective(s)

- To familiarize the students with the basic concepts in Cayley - Hamilton theorem and Orthogonal transformation.
- To get exposed to the fundamentals in circle of curvature, evolute and envelope of thecurves.
- To acquire skills to understand the concepts involved in Jacobians and maxima and minima.
- To solve various linear differential equations and simultaneous differential equations.
- To learn various techniques and methods in solving definite and indefinite integrals.

Course Outcomes

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

CO1: Apply Cayley - Hamilton theorem and to reduce quadratic form into canonical form

CO2: Compute the equation of the circle of curvature, evolute and envelope of the curves.

CO3: Analyze Jacobian methods and constrained maxima and minima functions.

CO4: Apply various methods in differential equations to solve linear and simultaneous Differential equations.

CO5: Evaluate definite and indefinite integrals using different techniques.

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

Matrices

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (without proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation - Nature of quadratic form**.** [9+3]

Differential Calculus

Curvature – radius of curvature (Cartesian and polar co-ordinates) – Centre of curvature – Circle of curvature – Involute and evolute – envelope. [9+3]

Functions of Several Variables

Partial differentiation – Homogeneous functions and Euler's theorem – Jacobians– Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers. [9+3]

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Differential Equations

Linear differential equations of second and higher order with constant co-efficient - R.H.S is e^{ax}, $\sin ax, \cos ax, x^n\ n>0, e^{ax}\sin bx$, $e^{ax}\cos bx$, $e^{ax}x^n$, $x^n\sin ax$ **and** $x^n\cos ax$ – Differential equations with variable co-efficients : Cauchy's and Legendre's form of linear equation – Method of variation of parameters – Simultaneous first-order linear equations with constant co-efficients. [9+3]

Integral Calculus

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. [9+3]

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

1.	Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014. Web site: https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2.	Veerarajan.T., "Engineering Mathematics", for Semesters I and II, Tata McGraw Hill PubCo., New Delhi., 2010.

Reference(s)

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MA001 & Calculus and Differential Equations	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	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 PH 001 - Applied Physics

Common to Mech & MCT

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

Objective(s)

- To analyze the crystal structures, crystal growth techniques and crystal defects
- To enrich the understanding of various types of materials and their applications in engineering and technology.
- To enable the students to correlate the theoretical principles with application oriented studies in electrostatics.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, classifications of magnetic materials and its applications.
- To introduce advanced materials and nano technology for engineering applications

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognize the basics of crystals structures and different crystal growth techniques. CO2: Assess the engineering problems like plastic deformation, slip and twinning by material Testing methods. CO3: Analyze the concept of electrostatics and correlate with dielectric materials. CO4: Infer the magneto static boundary conditions and magnetic materials. CO5: Apply the properties of new engineering materials and nanomaterials for potential applications.

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

Crystal Physics

Introduction-Fundamental terms of crystallography–Bravais lattice–SC, FCC, BCC, HCP crystals-Miller indices-Relation between inter planer distance and inter atomic distance-Crystal defects–Crystal growth techniques-solution, melts (Bridgman and Czochralski) and vapour growth techniques. [9]

Properties of Matter and Materials Testing

Properties of matter: Hooke's Law - Stress -Strain Diagram - Elastic Moduli - Relation between elastic constants - Poisson's Ratio - Expression for bending moment and depression - Cantilever - Expression for Young's modulus by Non uniform bending and its experimental determination.

Materials testing: Mechanism of plastic deformation- slip and twinning – types of fracture – Vickers Hardness test - fatigue and creep test. [9]

Electrostatics

Maxwell's equation for electrostatics – E due to straight conductors, circular loop, infinite sheet of current-electric field intensity (D) - Electric potential - dielectrics - dielectric polarization -internal field – Clausius-Mossotti equation- dielectric strength – Dielectric loss- Breakdown mechanism- applications. [9]

Magnetostatics

Maxwell's equation for magnetostatics - B in straight conductors, circular loop, infinite sheet of current - Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law –Magnetic flux density (B) – magnetic materials – Classification – properties-Domain theory of ferromagnetism- Hysteresis- Hard and Soft magnetic materials-Ferrites: structure, preparation and applications-Applications. [9]

Advanced Materials and Nanotechnology

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

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

Total Hours: 45

Text Book(s):

1. Rajendran, V., "Engineering Physics", Tata McGraw Hill, New Delhi. 2011.
2. Brijlal and Subramanian, N. "Electricity and Magnetism", 6th edition, Ratan & Prakash, Agra, 2006.

Reference(s)

1. Hayt., W.H., and John Buck, A., "Engineering Electromagnetics", 6th ed., Tata McGraw Hill, New Delhi. 2014.
2. David J Griffith, "Introduction to Electrodynamics", 2nd Ed., Newdelhi,Prentice Hall of India Pvt.Ltd., 1997.
3. Gagadhar K A & Ramanathan and Khanna, P.M., "Electromagnetic Field Theory", 5thedition, Publishers, New Delhi. 2013.
4. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.

Pre-requisite: **Nil**

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 PH001 - Applied Physics	CO1	3	3	2	2	2			2		3		3	3	2	
	CO2	3	3	2	2	2			2		3		3	3		
	CO3	3	3	2	2	2			2		2		2	2		
	CO4	3	3	2	2	2			2		2		2	2		
	CO5	3	3	3	3	2			2		3		3	3	2	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 CS 001 - Programming For Problem Solving								
Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100
Objective(s)	• To learn the evolution of computers and examines the most fundamental element of the C language • To examine the execution of branching, looping statements, arrays and strings. • To understand the concept of functions , pointers and the techniques of putting them to use • To apply the knowledge of structures and unions to solve basic problems in C language • To enhance the knowledge in file handling functions for storage and retrieval of data							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Infer the evolution, generation, representation of problem and recognize the concepts of data types and expressions CO2: Annotate the concept of console Input and output features and examine the execution of branching, looping statements, arrays and strings CO3: Recognize the concepts of functions, recursion, storage class specifies and pointers with its features CO4: Comprehend basic concepts of structures ,unions ,user defined data types and preprocessor CO5: Interpret the file concepts using proper standard library functions							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Introduction to Computer and Programming Introduction to Computers - Evolution of computers - Generations of computers and Programming Languages– Introduction to components of a computer system -Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart–Pseudo code with examples. From algorithms to programs–variables (with data types)– Type Qualifiers - Constants – Operators –expressions and precedence [9] **Suggested Activities:** Knowing the history of computers Developing Pseudo codes and flowcharts for real life activities Developing algorithms for basic mathematical expressions using arithmetic operations. **Suggested Evaluation Methods:** Group Discussion on Introduction to Computers and its generation Assignments on pseudo codes and flowcharts								

I/O ,Branching ,Loops and Arrays

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

Suggested Activities:

Simple programs using I/O statements, arithmetic operations
Implementation of simple programs using **Branching, Loops and Arrays**
Performing String operations

Suggested Evaluation Methods:

Tutorial for the above activities
Group discussion on role of Branching, loop and Arrays in Programming Language

Functions and Pointers

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

Suggested Activities:

Develop simple applications like Calculator, Various Conversion Process using functions
Develop a simple programs by applying pointer concepts

Suggested Evaluation Methods:

Tutorial for the above activities
Group discussion on Function and Pointers

Structures, Unions, Enumerations, Typedef and Preprocessors

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

Suggested Activities:

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

Suggested Evaluation Methods:

Tutorial for the above activities

File

File: Streams –Reading and Writing Characters - Reading and Writing Strings -,File System functions - Random Access Files [9]

Suggested Activities:

Develop simple applications to apply files operations

Suggested Evaluation Methods:

Tutorial for the above activities
Group discussion on Files Concepts

Total Hours: 45

Text Book(s):

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

References:

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

Pre-requisite: **Nil**

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 CS 001 & Programming For Problem Solving	CO1	3	2	3		3				3	3	2	2			
	CO2	3	2	3		3				3	3	2	2	2	2	
	CO3	3	2	3		3				3	3	2	2	2	2	
	CO4	3	2	3		3				3	3	2	2	2	2	
	CO5	3	2	3		3				3	3	2	2	1	1	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 001 - Engineering Drawing

Common to Civil , Mech, MCT & Text

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	2	0	4	90	4	50	50	100

Objective(s)

- To acquire various concepts like dimensioning, conventions and standards.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views.
- To learn the concept of projection of solids.
- To draw the section of solids and development of surfaces.
- To learn the concept of isometric projection.

Course Outcomes

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

CO1: Use the drafting instruments and construct the conic sections
CO2: Convert the pictorial views of solids in to orthographic views
CO3: Draw the projections of regular solids and floor plans
CO4: Draw the true shape of sections and develop the lateral surfaces of right solids
CO5: Sketch the three dimensional view of solids for given orthographic views

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

Introduction to Engineering Drawing and Plane Curves

Use of drawing instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning – Drawing sheet layouts - Title block – Line types – Scales: plain, diagonal and vernier scales. Construction of ellipse, parabola and hyperbola (Eccentricity method) - Construction of rectangular hyperbola - Construction of cycloids, epicycloids and hypocycloids. [7+12]

Orthographic Projection

Introduction to orthographic projections – Planes of projection – Projection of points and lines inclined to both planes – Projection of planes (Inclined to one plane and parallel to other – Inclined to both planes) - Conversions of pictorial views to orthographic views. [6+12]

Projection of Solids and Floor plan

Projections of simple solids: prism, pyramid, cylinder and cone (Axis of solid inclined to both HP and VP) - Floor plans: windows, doors and fixtures such as water closet (WC), bath sink, shower etc. [5+12]

Sections of solids and Development of surfaces

Sections of solids :Prism, Cylinder, Pyramid, Cone – Auxiliary Views - Draw the sectional orthographic views of geometrical solids, objects from industry - Development of surfaces of Right solids – Prism, Pyramid, Cylinder and Cone. [6+12]

Isometric Projection

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. [6+12]

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

Text Book(s):

1.	Bhatt N.D., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2014.
2.	Basant Agarwal and C.M.Agarwal., "Engineering Drawing", McGraw Hill Education, 2013.

Reference(s)

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 001 & Engineering Drawing	CO1	3	2	3										3	3	
	CO2	3	3	3										3	3	
	CO3	3	3	3		3			3					3	3	
	CO4	3	3	3		3			3					3	3	
	CO5	3	3	3										3	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

50 MY 001 - Constitution of India

Common to all Branches

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

Objectives

- To know the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
- To gain knowledge on bill passing
- To acquire knowledge on function of election commission

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

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

History of Making of the Indian Constitution
History - Drafting Committee, (Composition & Working) [5]

Philosophy of the Indian Constitution
Preamble - Salient Features [5]

Contours of Constitutional Rights & Duties
Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties. [5]

Organs of Governance
Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions. [5]

Local Administration
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy. [5]

Election Commission
Election Commission: Role and Functioning- Chief Election Commissioner and Election Commissioners- State Election Commission: Role and Functioning- Institute and Bodies for the welfare of SC/ST/OBC and women.[5]

Total Hours: 30

Text book(s):

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

Reference(s):

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MY 001 & Constitution of India	CO1								2	2	1		2			
	CO2								2	2	1		2			
	CO3								2	2	1		2			
	CO4								2	2	1		2			
	CO5								2	2	1		2			

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 PH 0P1 - Engineering Physics Laboratory								
Common to Mech, MCT, TEXT, FT, BT, NST & Civil								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	0	0	4	60	2	60	40	100

Objective(s)	• To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory. • To demonstrate an ability to make physical measurements and understand the limits of precision in measurements • To introduce different experiments to test basic understanding of physics concepts applied in optics and electronics. • To enable the students to correlate the theoretical principles with application oriented studies. • To analyze the behavior and characteristics of various materials for its optimum utilization
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the concept of stress, strain and elastic limit for a given sample to find their properties.(1-3) CO2: Recognize the viscosity and surface tension properties of liquids for its various applications.(4-6) CO3: Recall the knowledge of properties of light through spectrometer grating and fiber optic cable (7-8) CO4: Assess the dielectric behavior of a given material.(9) CO5: Interpret the photovoltaic effect to demonstrate the working of solar cell.(10)

1. Determination of Young's modulus of a steel bar by uniform bending method.
2. Determination of Young's modulus of a cantilever (Pin & Microscope method).
3. Determination of rigidity modulus of a wire by torsional pendulum.
4. Comparison of co-efficient of viscosity of two different liquids by Poiseuille's method.
5. Co-efficient of viscosity of highly viscous liquids.
6. Comparison of surface tension of two different liquids by capillary rise method.
7. Determination of NA, acceptance angle, and wave length of a given laser by using optical fiber.
8. Determination of wavelength of mercury spectral lines – spectrometer grating.
9. Determination of dielectric constant.
10. V-I characteristics of solar cell.

Text Book(s):

1. Lab Manual: "Physics Lab Manual", Department of Physics, KSRCT.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 PH 0P1 & Engineering Physics Laboratory	CO1	3	3	2	2				2	3	3	2	3	2	2	
	CO2	3	3	2	2				2	3	3	2	3	2		
	CO3	3	3	3	2				2	3	3	2	3	2		
	CO4	3	3	2	2				2	3	3	2	3		2	
	CO5	3	3	3	2				2	3	3	2	3	2		

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 CS 0P1 - Programming for Problem Solving Laboratory								
Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	0	0	4	60	2	60	40	100

Objective(s)	• To enable the students to apply the concepts of C to solve simple problems • To use selection and iterative statements in C programs • To apply the knowledge of library functions in C programming • To implement the concepts of arrays, functions, structures and pointers in C • To implement the file handling operations through C
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply how to read, display basic information and use selection and iterative statements CO2: Demonstrate C program to manage collection of related data CO3: Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts CO4: Develop a C program to manage collection of different data using structures, Union, user-defined data types and preprocessor directives CO5: Demonstrate C program to store and retrieve data using file concepts

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.

Text Book(s):

Lab Manual: “Programming for Problem Solving Laboratory Manual”, Department of CSE, KSRCT.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 CS 0P1 & Programming for Problem Solving Laboratory	CO1	3	2	3		3				3	3	2	2			
	CO2	3	2	3		3				3	3	2	2	2	2	
	CO3	3	2	3		3				3	3	2	2	2	2	
	CO4	3	2	3		3				3	3	2	2	2	2	
	CO5	3	2	3		3				3	3	2	2	1	1	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 EN 002 – Communication Skills II								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	1	0	30	2	40	60	100

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

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

Advanced English Listening Module

Extended Listening to Podcasts – Listen and Watch Video Clips - answering Inferential Multiple Choice Questions and Vocabulary Check- Listening to Lengthy Discourses – Structured Listening – Listening to Songs and Cognizing the Lyrics-Listening to popular speeches, news briefs and stories. [4]

Oral Communication

Debates – Group Discussion (Structured) and rotate roles – Elevator Speech – Prepared Talk – Extempore – Brief Technical presentations- Spin-a-Yarn – Short Film reviews – talk on silent videos – Dialogues and Role plays (Intermediate & Higher Level) – Interviews. [4]

Critical Reading Process

Silent Reading – Scanning and Skimming - Reading comprehension with logical reasoning questions – Cognition of Theme and Inferential Meaning – advanced Academic and Functional Vocabulary List (1000 words) – word webs and semantic threads - Loud Reading – Modulation and Pronunciation Check – Mind maps – Note making – Deep Reading Skills [4]

Academic Writing Practices

Sentence Equivalence and Text completion tasks – Data Interpretation - Essay Writing – Letter Writing – Business Emails – Conversational Fill Ups-Rewordify (select a text and simplify/enhance the language)-Reports on events. [3]

Total Hours: 15 + 15(Tutorial) = 30

Text Book(s)

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

Reference(s)

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

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Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 EN 002 & Communication Skills II	CO1					2			2	3	3	2	3		2	1
	CO2								2	3	3	2	3	2	2	2
	CO3					2			2	3	3	2	3	2	2	2
	CO4					2			2	3	3	3	3	2	2	2
	CO5					2			2	3	3	3	3	1	2	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 MA 002 - Laplace Transform and Complex Variables

Common to All Branches

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

Objective(s)

- To provide exposure and ability in handling situations involving multiple integrals, Beta and Gamma functions.
- To familiarize the students with the basic concepts in Vector calculus.
- To get exposed to the fundamentals in analytic functions, conformal mappings and Bilinear transformation.
- To acquire skills to understand the concepts involved in Cauchy's integral formula, Cauchy's residue theorem and Contour integration.
- To understand the concepts in Laplace transform techniques and its properties.

Course Outcomes

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

CO1: Evaluate double and tripleintegrals and analyze Beta and Gamma functions.
CO2: Analyze the basic concepts of vector calculus to verify Green's, Stoke's and Gauss Divergence theorems.
CO3: Construct the analytic functions and Bilinear transformation.
CO4: Apply Cauchy's integral formula and Cauchy's residue theorem to evaluate the complex integrals.
CO5: Apply Laplace transform techniques for solving differential equations.

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

Multiple Integrals

Double integration – Cartesian and polar coordinates – Change of order of integration – Area between two curves – Area as double integral – Triple integration in Cartesian coordinates.
Beta and Gamma functions**:** Relationship between Beta and Gamma functions – Properties – Problems**.** [9+3]

Vector Calculus

Introduction - gradient of a scalar point function - directional derivative - angle of intersection of two surfaces – divergence and curl(excluding vector identities) - solenoidal and irrotational vectors - Green's theorem in the plane - Gauss divergence theorem -Stokes' theorem(without proof)- verification of the above theorems and evaluation of integrals using them. [9+3]

Analytic Functions

Analytic functions – Necessary conditions (Cauchy–Riemann equations)- Polar form of Cauchy–Riemann equations – Sufficient conditions (without proof) – Properties of analytic functions – Harmonic function – Harmonic conjugate – Construction of analytic functions– Conformal mapping: w = z + a, az, 1/z -Bilinear transformation. [9+3]

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Complex Integration

Cauchy's Integral theorem (without proof) – Cauchy's integral formula – Taylor's and Laurent's series (without proof) – Classification of singularities – Cauchy's residue theorem – Contour integration – Circular and semi-circular contours (excluding poles on real axis). [9+3]

Laplace Transforms

Conditions for existence – Transform of elementary functions – Basic properties – Shifting theorems- Derivatives and integrals of transforms –– Transform of unit step function – Dirac's delta function- Initial and final value theorem– Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Solution of second order ordinary differential equation with constant co-efficients – simultaneous equations of first order with constant co-efficients. [9+3]

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

1. Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014. Website:https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2. Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.

Reference(s)

1. Bali.N.P and Dr.ManishGoyal,"A text book of Engineering Mathematics",8thedition,Laxmi Publications (P) LTD,2011
2. Veerarajan.T., "Engineering Mathematics", for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi, 2010.
3. Kandasamy P, Thilagavathy K & Gunavathy K, "Engineering Mathematics -II", S.Chand & Company Ltd, New Delhi.
4. SWAYAM online video courses.(www.swayamprabha.gov.in)

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MA 002 & Laplace Transform and Complex Variables	CO1	3	3	3	2	3							2		3	
	CO2	3	3	2	2	3							2		3	
	CO3	3	3	3	2	2							2		3	
	CO4	3	3	2	2	3							2		3	
	CO5	3	3	2	3	3							2		3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018

50 CH 001 - Applied Chemistry

Common to All Branches

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

Objective(s)

- To endow with the periodic properties of elements and molecular orbitals variation of orbitals
- To assist the learners to apply the thermodynamic functions to electro chemical reactions and its application
- To help the learners to analyze the hardness of water and its removal techniques
- To endow with various spectroscopy techniques and its applications
- To facilitate the students with the basics of stereochemistry and types of chemical reactions with their mechanism

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

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

Periodic properties

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

Chemical equilibria and corrosion

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

Water chemistry

Sources - Water quality parameters - impurities in water and their effects. Hardness - Estimation of hardness - effect of hard water in various industries-Softening of water- zeolite process- ion-exchange process - reverse osmosis - electrodialysis. Boiler troubles - methods of prevention. [9]

Analytical techniques and applications

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

Concepts in Organic chemistry

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

Total Hours: 45

Text Book(s):

1.	Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 14th edition, 2015.
2.	Dr. S.Vairamand Dr. Suba Ramesh, “Engineering Chemistry”, Wiley India Private Limited , 2nd edition, 2013

Reference(s)

1.	Puri B. R., Sharma L.R., and Pathania M.S., “Principles of Physical Chemistry”, Vishal Publishing Company, Delhi, 2017.
2.	Dara. S.S, “A Text Book of Engineering Chemistry”, S Chand & co. Ltd., 2014.
3.	Bahl B.S. and Arun Bahl, “Advanced Organic Chemistry”, S.Chand, New Delhi, 2014.
4.	Sharma, B K., “Instrumental Methods of Chemical Analysis”, Goel Publishing House Meerut, 23rdedition, 2014.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 CH 001 & Applied Chemistry	CO1	2			2	2									1	
	CO2	3	2	2	2	2	2	2	1		1		1	2	2	
	CO3	3	3	3	3	2	3	2	1				1	2	1	
	CO4	1	1	2	3	3	2						1	1	1	
	CO5	2	1	1	3	3	2									

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 EE 001 - Basic Electrical Engineering

Common to All Branches

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

Objective(s)

- To familiarize the basic DC and AC networks used in electrical circuits.
- To explain the concepts of electrical machines and their characteristics.
- To explore the sources of electric power generation and various types of power plant.
- To identify the various components of low voltage electrical installation
- To describe various energy conservation methods useful in industry and commercial purpose.

Course Outcomes

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

CO1: Apply the basic laws of electric circuits to calculate the unknown quantities.
CO2: Acquire knowledge about the constructional details and principle of operation of DC machines and AC machines
CO3: Impart the knowledge of generation of electricity based on conventional and non-conventional energy sources
CO4: Recognize the significance of various components of low voltage electrical installations.
CO5: Create awareness of energy conservation and electrical safety

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

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

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

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

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

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

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

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Electrical Energy Conservation & Safety - Elementary calculations for energy consumption - BEE Standards - Electrical energy conservation - Methods. Electric shock, Precautions against shock, Objectives of earthing, Types of earthing - Basic electrical safety measures at home and industry. [6]	
Total Hours: 45	
Text Book(s):	
1.	Kothari D.P., and Nagrath, I.J., "Basic Electrical Engineering", Tata McGraw Hill, 2017.
2.	Kulshreshtha,D.C., "Basic Electrical Engineering", McGraw Hill, 2017.
Reference(s)	
1.	L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2.	E. Hughes, "Electrical and Electronics Technology", Pearson, 2016.
3.	V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2015.
4.	Rajendra Prasad "Fundamentals of Electrical Engineering", PHI Learning, 2014

Pre-requisite: **Applied physics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 EE 001 & Basic Electrical Engineering	CO1	3	2			2								2	2	1
	CO2	3	2			2		2						2	1	1
	CO3	2	2	1	2	2	3	2	2					2	2	1
	CO4	1	1	2		2		2	1					1	2	1
	CO5	2	2	2		2		2	2		2		2	2	1	1

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 003 – Engineering Mechanics								
Common to all branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100
Objective(s)	• To learn a process for analysis of static objects, concepts of force, moment, and mechanical equilibrium in two and three dimensions. • To learn the equilibrium of rigid bodies such as frames, trusses, beams. • To identify the properties of surfaces and solids by using different theorem. • To impart basic concept of dynamics of particles. • To acquire the concept of friction and elements of rigid body dynamics.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Use scalar and vector analytical techniques for analysing forces in statically determinate structures. CO2: Apply basic knowledge of scientific concepts to solve real-world problems. CO3: Calculate the properties of surfaces and solids using various theorems. CO4: Analyse and solve problems on kinematics and kinetics. CO5: Draw a shear force and bending moment diagrams, analysis of rigid body dynamics and calculation of frictional forces on contact surfaces.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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Basics and Statics of Particles

Introduction -Units and Dimensions-Laws of Mechanics–Principle of transmissibility-Lame's theorem, Parallelogram and triangular Law of forces–Vectors–Vectorial representation of forces and moments.

Vector operations

Addition, subtraction, dot product, cross product-Coplanar Forces–Resolution and Composition of forces–Equilibrium of a particle–Forces in space-Equilibrium of a particle in space-Equivalent systems of forces-Single equivalent force. [12]

Equilibrium of Rigid Bodies

Free body diagram–Types of supports and their reactions–requirements of stable equilibrium–Static determinacy, Moments and Couples–Moment of a force about a point and about an axis–Vectorial representation of moments and couples–Varignon's theorem-Equilibrium of Rigid bodies in two dimensions.

Trusses: Introduction, axial members, calculation of forces on truss members using method of joints-Method of sections [12]

Properties of Surfaces and Solids

Determination of Areas and Volumes-Centroid, Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method; T section, I section, Angle section, Hollow section using standard formula) - Parallel axis theorem and perpendicular axis theorem- Polar moment of inertia -Mass moment of inertia of thin rectangular section -Relation between area moment of inertia and mass moment of inertia. [12]

Dynamics of Particles

Displacement, Velocity, acceleration and their relationship–Relative motion -Projectile motion in horizontal plane– Newton's law–Work Energy Equation – Impulse and Momentum. [12]

Elements of Rigid Body Dynamics, Friction and Beams

Translation and Rotation of Rigid Bodies: Velocity and acceleration–General Plane motion: Crank and Connecting rod mechanism.

Friction

Frictional force–Laws of Coloumb friction–Simple contact friction–Ladder friction-Rolling resistance–Ratio of tension in belt.

Transverse bending on beams

Types of beams: Supports and loads – Shear force and bending moment in beams – Cantilever, simply supported and overhanging beams. [12]

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

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

Reference(s)

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

Pre-requisite: **Nil**

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 003 & Engineering Mechanics	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									3	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 MY 002 - Environmental Science

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

Objective(s)

- To help the learners to analyze the importance of environment, ecosystem and biodiversity.
- To familiarize the learners with the impacts of pollution and control.
- To enlighten the learners about waste and disaster management.
- To endow with an overview of food resources and human health.
- To enlighten awareness and recognize the social responsibility in environmental issues.

Course Outcomes

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

CO1: Recognize the concepts and importance of environment, ecosystem and biodiversity.
CO2: Analyze the source, effects, and control measures of pollution.
CO3: Enlighten of solid waste and disaster management.
CO4: Alertness about food resources, population and health issues.
CO5: Analyze the social issues and civic responsibilities.

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

Environment, Ecosystem and Biodiversity

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

Environmental Pollution

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

Waste and Disaster Management

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

Food Resources, Human Population and Health

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

Social Issues and the Environment Unsustainable to sustainable development - Use of alternate energy sources - Wind - Geothermal - Solar - Tidal - energy calculation and energy audit - Rain water harvesting - Water shed management - Deforestation – Greenhouse effect - Global warming - Climate change - Acid rain - Ozone layer depletion - Waste land reclamation. Consumerism and waste products - Role of an individual in conservation of natural resources - Case studies. [7]	
Total Hours: 30	
Text Book(s):	
1.	Anubha Kaushik and Kaushik, C P, "Perspectives in Environmental Studies", New Age International Publishers, New Delhi, 6th edition, January 2018.
2.	Tyler miller. G, "Environmental Science", 16th Edition Cengage Publications, Delhi, 2018.
Reference(s)	
1.	Gilbert M.Masters and Wendell P. Ela, "Environmental Engineering And Science", PHI Learning Private Limited, New Delhi, 3rd Edition, 2013.
2.	Rajagopalan. R, "Environmental Studies" Oxford University Press, New Delhi, 2nd edition, 2012.
3.	Deeksha Dave and Katewa. S.S, "Environmental Studies", Cengage Publications, Delhi, 2nd edition, 2013.
4.	Cunningham, W.P. and Saigo, B.W. "Environment Science", Mcgraw-Hill, USA. 9th edition, 2007.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MY 002 & Environmental Science	CO1	3	2	3	3	3	3	3	3	3	3	2	2		1	
	CO2	3	2	3	3	3	3	3	3	3	3	2	2	3	3	3
	CO3	3	2	3	3	3	3	3	3	3	3	2	2	3	3	3
	CO4	3	2	3	3	3	3	3	3	3	3	2	2	1	1	1
	CO5	3	2	3	3	3	3	3	3	3	3	2	2	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 CH 0P1 - Chemistry Laboratory								
Common to all branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100
Objective(s)	• To test the knowledge of theoretical concepts. • To develop the experimental skills of the learners. • To facilitate data interpretation. • To enable the learners to get hands-on experience on the principles discussed in theory sessions • To expose the learners to various industrial and environmental applications.							
Course Outcomes	**At the end of the course, the students will be able to** CO1. Calculate the amount of hardness, alkalinity, chloride ion and dissolved oxygen in water sample CO2. Estimate the amount of barium chloride and mixture of acids by conductometry CO3. Infer the amount of acid by pH metry and ferrous ion by potentiometry CO4 Examine the amount of ferrous ion by spectrophotometry CO5. Determine the percentage of corrosion by weight loss method							

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

Text Book(s):

1. Dr. S.Vairam andDr. Suba Ramesh, "Engineering Chemistry", Wiley India Private Limited , Delhi, 2nd edition, January 2013.

Reference(s)

1. Mendham. J, Denney. R.C, Barnes. J.D, and Thomas. N.J.K, "Vogel's Text Book of Quantitative Chemical Analysis", Pearson Education, 6th edition, 2009.
2. S.S. Dara, "A Text Book on Experiments and Calculations Engineering", S.Chand &Co., Ltd., 2nd Ed, 2003
3. Sunita Rattan, "Experiments in Applied Chemistry" S K Kataria &Sons, New Delhi, 2011

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 CH 0P1 & Chemistry Laboratory	CO1	3	3	3	3		1	2			1		2	1	1	
	CO2	3	3	3	2						1		1	1	1	
	CO3	3	3	3	2						1		1	1	1	
	CO4	3	3	3	3			1			1					
	CO5	2	2	2	2						1		2	2	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME 0P1 – Engineering Practices Laboratory								
Common to all branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	4	60	2	60	40	100
Objective(s)	• To acquire skills in basic engineering practices. • To identify the hand tools and instruments. • To provide hands on experience in Fitting, Carpentry, Sheet metal, Welding and lathe shop. • To provide practical training on house hold wiring and electronic circuits. • To offer real time activity on plumbing connections in domestic applications.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Perform facing, plain turning, drilling. CO2: Make a model of fitting and carpentry: Square, Dovetail and Cross lap joints. CO3: Fabricate the models of sheet metal and welding joints. CO4: Construct and demonstrate electrical and electronic wiring circuit. CO5: Construct the water pipe line in plumbing shop.							

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

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

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

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

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

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

Lab Manual :

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 0P1 & Engineering Practices Laboratory	CO1	3	3	3	3		3	3	3	3	3			3	3	3
	CO2	3	2	2	3		2	2	3	3	3			3	2	3
	CO3	3	3	3	3		3	3	3	3	3			3	3	3
	CO4	3	2	2	3		2	2	3	3	3			3	2	3
	CO5	3	2	2	3		2	2	3	3	3			3	2	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MA 003 - Partial Differential Equations and Statistics								
Common to Mech, MCT								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100

Objective(s)	• To develop the mathematical skills for solving partial differential equations • To provide exposure and ability to use Fourier series • To acquire skills in handling situations involving one-dimensional boundary value problems • To learn basic concepts in descriptive statistics • To familiarize the students with various methods in hypothesis testing and to get exposed to various statistical methods designed to make scientific judgments
Course Outcomes	**At the end of the course, the students will be able to** CO1: Compute the solution of partial differential equations using different methods CO2: Obtain the Fourier series expansion for the periodic functions CO3: Compute the solution for one-dimensional wave equation and one-dimensional heat equation. CO4: Apply the concepts in descriptive statistics to calculate measures of central tendency, measures of dispersion, correlation and regression CO5: Test the statistical hypothesis using Student's t test, F test and Chi-square test and analyze the design of experiments using CRD, RBD and Latin square

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

Partial Differential Equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Non-linear partial differential equations of first order (Type I – IV) – Solution of partial differential equations of first order – Lagrange's linear equations – Linear partial differential equations with constant coefficients. [9+3]

Fourier Series

Dirichlet's conditions – Fourier series – Odd and even functions – Half range Fourier series – Root mean square value of a function – Parseval's identity – Harmonic analysis. [9+3]

Boundary value problems

Classification of second order quasi - linear partial differential equations – Solution of one-dimensional wave equation – Solution of one-dimensional heat equation – Problems. [9+3]

Basic Statistics

Measures of central tendency: Mean, Median and Mode- measures of dispersion: Range, Quartile deviation and Standard deviation –measures of skewness : Bowley's co-efficient of skewness - Pearson's co-efficient of skewness - moments - kurtosis – correlation – rank correlation – regression. [9+3]

Testing of hypothesis and Design of experiments

Small sample tests based on t, F and χ^2distributions – Contingency table (Test for Independency) – Goodness of fit – One way classification – Completely randomized design – RBD – Two way classification –Latin square design. [9+3]

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

1. Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014. Web site: https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2. Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, 9th edition, New Delhi, 1996.

Reference(s)

1. Veerarajan T., "Probability, Statistics and Random process", 3rd Edition, Tata Mc-Graw Hill Publications, New Delhi, 2008.
2. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Lakshmi Publications Pvt Ltd, New Delhi, 2014.
3. Agrawal, P.N., Gupta, S.K., "Mathematical Methods and its Applications", NPTEL online video courses.
4. Basic statistics – nptelnptel.ac.in/courses/105103140/2

Pre-requisite: **Nil**

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Passed in BoS Meeting held on 24/11/23
Approved in Academic Council Meeting held on 23/12/2023

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MA 003&Partial Differential Equations and Statistics	CO1	3	3	2	2	3	2	1				1		3	2	1
	CO2	3	3	2	1	3	2	1				2		3	2	1
	CO3	3	3	2	1	3	2	2				3	3	3	3	3
	CO4	3	3	2	3	3	3	3		2	3	3	3	3	3	3
	CO5	3	3	2	3	3	3	3		2	3	3	3	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 EC 001 – Basic Electronics Engineering

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

Objective(s)

- To get the basic idea about diodes in circuits and in rectifiers.
- To familiarize the working and characteristics of transistors
- To understand the working of operational amplifier
- To study the concept of digital electronics
- To get the basic idea about electronic communication system

Course Outcomes

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

CO1: Explain the construction, characteristics and applications of semiconductor diodes.
CO2: Describe the construction, working and characteristics of bipolar junction transistor.
CO3: Describe the operational fundamentals, characteristics and application of an Opamp.
CO4: Explain the functions of logic gates, combinational circuits and sequential logic circuits.
CO5: Describe the Concepts of Electronic communication systems

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

Semiconductor Diodes

Review of semiconductor physics: Insulators, Conductors and Semiconductors-Semiconductor types-; PN Junction Diode- Ideal and Practical diode- VI characteristics- -Equivalent circuits- Zener Diode and its characteristics Zener diode as voltage regulator -Half wave and full-wave rectifiers. [9]

Bipolar Junction Transistors

Transistor- construction, types, operation, configurations- Transistor as a switch-Applications-BJT as a single stage CE amplifier, frequency response and bandwidth. [9]

Operational Amplifier

Introduction, Ideal Vs. Practical- Performance Parameters- Applications- Inverting and Non-inverting Amplifiers, Voltage Follower-Summing and difference amplifier, Comparator, Integrator, Differentiator, Instrumentation amplifier [9]

Digital Electronics

Number Systems- Boolean algebra – Logic gates- OR, AND, NOT, NAND, NOR-Adder, Subtractor, Multiplexer, Demultiplexer, Encoder, Decoder-Flip-Flops. [9]

Electronic communication Systems

The elements of communication system, Transmission media: wired and wireless, need of modulation,AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system. [9]

Total Hours: 45

Text Book(s):

1. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2016
2. Anil K. Maini, ‘Digital Electronics Principles and Integrated Circuits’, Wiley India Pvt.Ltd, 2016.

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Reference(s):	
1.	Robert L. Boylestad, Louis Nashelsky, 'Electronic Devices and Circuit Theory', Pearson New Delhi, 11th Edition, 2016
2.	Mehta V K, 'Principles of Electronics', S.Chand& Company Ltd., 11th Edition, 2014.
3.	Frenzel, " Communication Electronics: Principles and Applications", Tata McGraw Hill, 3rdEdition,2015
4.	David. A. Bell, "Electric Circuits",Oxford University Press, Seventh impression 2015.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 EC 001 & Basic Electronics Engineering	CO1	3	3	3	3	2								3	2	
	CO2	3	3	3	3	2								3	2	
	CO3	3	3	3	3	2								3	2	
	CO4	3	3	3	3	2								3	2	
	CO5	3	3	3	3	2								3	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 004 - Strength of Materials								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100
Objective(s)	• To identify the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads. • To calculate the elastic deformation occurring in various simple geometries for different types of loading • To determine the deflection of various beams. • To acquire the concept of buckling and be able to solve the problems related to isolated bars. • To impart the knowledge of mechanical and structural elements under different loads for the design and safe evaluation of any kind of structure.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Estimate the stress intensity and deformation in solid bodies subjected to various types of loading and compute the principal stresses and strains by analytical and graphical methods. CO2: Apply the concepts of shear force and bending moment diagrams in design of machine elements. CO3: Estimate the slope and deflection in determinate beams CO4: Compute the deflection and stress developed in shaft and springs. CO5: Calculate the stresses, strains and deformation of the thin, thick cylindrical and spherical vessels.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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Stress, strain and deformation of solids

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- thermal stresses-elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle. [12]

Transverse bending on beams

Beams and types transverse loading on beams- shear force and bend moment diagrams-Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads. [12]

Deflection of Beams

Deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems. [12]

Torsion

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of leaf and helical springs. [12]

Thin, Thick Cylinders, Spheres and Columns

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure. Columns - Euler's theory, slenderness ratio, Rankine formula. [12]

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

1.	Egor P. Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2015.
2.	Rajput R K., "A Textbook of Strength of Materials (Mechanics of Solids)" 7th edition, S Chand and Company Ltd., New Delhi, 2018.

Reference(s)

1.	Subramanian, R., "Strength of Materials", Oxford University Press, 2007.
2.	Rattan, S.S., "Strength of Materials", 2nd Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi 2011.
3.	James M. Gere and Timoshenko, "Mechanics of Materials", CBS Publisher, New Delhi, 6th Edition, 2012.
4.	Beer, F., Johnston, E.R., and Dewolf, J.T., "Mechanics of Materials", Tata Mc Graw Hill Publishing Co. Ltd., New Delhi 2011.

Pre-requisite: **Basic Knowledge of Engineering mechanics – Statics and Dynamics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 004 & Strength of Materials	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	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 006 - Thermodynamics

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

Objective(s)

- To evaluate the properties of 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.

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the basic concepts of zeroth law and first law of thermodynamics and apply the concepts of first law of thermodynamics to open and closed system. CO2: Relate the concept of second laws of thermodynamics to heat engine, refrigeration & air-conditioning cycles and discuss the concept of increase in entropy. CO3: Recognize the behaviour of pure substances and the performance of Rankine cycle with reheat and regenerative cycle. CO4: Describe the concept of Joule Thomson effect, Clausius Clapeyron equation, Equation of state and Compressibility and apply the differential equations for energy, Maxwell's equations and specific heat relations. CO5: Recognize the presence of moisture in atmosphere, its properties and also understand the application of psychrometric processes.

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

Basic Concepts and First Law

Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases. First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady Flow. [12]

Second Law and Availability

Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy, perpetual-motion machines, Exergy– simple problems. [12]

Properties of Pure Substance and Steam Power Cycles

Properties of pure substances - Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes. Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second-law analysis of vapour power cycles. [12]

Thermodynamic Relations

Gas mixtures –Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, TdS relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient. [12]

Psychrometry

Psychrometry and psychrometric chart, property calculations of air vapour mixtures. Psychrometric process – Sensible heating / cooling - cooling and dehumidification - heating and humidification - adiabatic mixing, evaporative cooling. [12]

[Note: Use of standard steam tables, Mollier diagram & Psychometric chart are permitted for examination.

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

1.	Cengel, Y. A., "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill Pub., New Delhi, 2015.
2.	Nag. P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw-Hill Publications, New Delhi, 2017.

Reference(s)

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

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Pre-requisite: **Mathematics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 006 & Thermodynamics	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 301 – Manufacturing Processes								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100
Objective(s)	• To introduce the students to the concepts of basic manufacturing processes • 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 concepts of plastic components.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Outline the construction features and operations performed in centre lathe CO2: Explain the various casting methods and casting defects. CO3: Select the different types of welding processes used for industrial fabrication process. CO4: Illustrate the metal forming processes and its applications. CO5: Select appropriate types of plastics and plastics processing methods.							

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

Machine Tools

Lathe: Specifications of centre lathe - operations performed - accessories and Attachments - principle of capstan and turret lathes - layout of tools. [7]

Metal Casting Process

Introduction- Moulding tools- Patterns- Pattern materials, types of pattern, Pattern allowances-types of molding sand and its properties – Cores and its types - gating and risering System- Melting furnaces: construction and operations - Special casting processes: Investment casting process, Die casting process, shell molding process-centrifugal casting process – Solidification and cooling - Casting cleaning and casting defects-Inspection methods. [11]

Metal Joining Process

Introduction-Classification of welding process: Principle of Gas welding, filler and flux materials Arc welding – Electrodes, coating and Specifications Resistance welding, Solid State Welding, Thermo-chemical welding and radiant energy welding - Brazing and soldering – Welding defects. [9]

Metal Forming Process

Forging- Classification- forging processes - forging operation - forging defects. Rolling: Classification of rolling processes - Rolling mill - Rolling of bars and shapes- Rolling defects- principle of rod and wire drawing-Tube drawing -Extrusion: Classification of extrusion processes- defects. Sheet metal characteristics-Typical shearing operations, bending and drawing operations, blanking, piercing, punching and trimming- special forming methods: Explosive forming, electromagnetic forming, electro hydraulic forming. [9]

Plastic Processing Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming. [9]	
Total Hours: 45	
Text Book(s):	
1.	Kaushish, J.P., "Manufacturing Processes," PHI Learning Ltd, New Delhi, 2013.
2.	Mikell P. Groover, "Principles of Modern Manufacturing", SI Version, Wiley & sons Pvt. Ltd, 2013.
Reference(s)	
1.	Jain R.K., Production Technology, Khanna Publishers, 2001
2.	Rao P N, " Manufacturing Technology", Tata McGraw Hill Publishing Co. Ltd., Volume 1, New Delhi, 2010
3.	SeropeKalpakjian and Stephen Schmid, "Manufacturing, Engineering and Technology", SI 6th Edition -ll, Pearson Education, 2006
4.	Rajput,R.K., "A Textbook of Manufacturing Technology",Laxmi publications (P) ltd, 2015.
5.	Heine R W, Loper C R and Rosenthal P C, " Principles of Metal Casting", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2010.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 301 &Manufacturing Processes	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	3	2			3	3					3	3	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MY 004 – Universal Human Values								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	2	1	0	45	3	40	60	100
Objective(s)	• To identify the essential complementarily between 'values' and 'skills' • To ensure core aspirations of all human beings. • To achieve holistic perspective towards life and profession • To acquire ethical human conduct, trustful and mutually fulfilling human behaviour • To enrich interaction with Nature.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Become more aware of themselves, and their surroundings CO2: Responsible in life, and in handling problems with sustainable solutions CO3: Maintain human relationships and human nature CO4: Committed towards human values, human relationship and human society CO5: Improve critical ability and apply it day-to-day life							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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Introduction to value Education [9]

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

Harmony in the Human Being [9]

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

Harmony in the Family and Society [9]

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.

Harmony in the Nature/Existence [9]

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.

Implications of the Holistic Understanding [9]

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.

Total Hours: 45

Text Book(s):

1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference(s)

1.	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MY 004 & Universal Human Values	CO1	3	3	3	2	2	3	3	3	2	3	3	1			
	CO2	3	3	3	2		3	3	3	2	3	2	1			
	CO3	3	3	2			3	3	3	3	3	2	1			
	CO4	3	3	3			3	3	3	3	3	2	2			
	CO5	3	3	1			3	3	3	3	3	2	2			

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 3P1 - Manufacturing Processes Laboratory								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	4	60	2	60	40	100
Objective(s)	• To introduce the students to the concepts of basic manufacturing processes • To infer practical knowledge in metal casting process. • To combine and use machine tools to operate and control manufacturing processes to solve production problems. • To plan, design, analyse, implement and improve cost-effective manufacturing methods • To recognize the dimensional characteristics of interchangeable parts							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Perform mold cavity for flange pattern, gear pattern and split pattern. CO2: Prepare mold cavity with core CO3: Perform facing, plain turning, step turning. CO4: Perform knurling, grooving and taper turning. CO5: Perform single and multi-start threading, drilling and tapping.							

Preparation of Sand Mould:

1. Mould with Flange Pattern.
2. Mould with Gear Pattern.
3. Mould with Split Pattern.
4. Mould with Core

Measurement of the Machined Components and Machining time estimation of:

5. Facing and Plain Turning.
6. Chamfering, Step Turning and Knurling.
7. Grooving and Taper Turning using Compound rest.
8. Single and Multi-start Thread cutting and Boring.
9. Internal taper turning.
10. Drilling and Tapping.

Design Experiment:

1. Make a new part using mild steel rod on a lathe.

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	**CO**	**PO**												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
50 ME 3P1 & Manufacturing Processes Laboratory	CO1	3	3	3	3		3	3	3		2		3	3	3	3
	CO2	3	3	2	3		3	3	3		2		2	3	3	3
	CO3	3	2	3	3		3	3	3		2		3	3	3	3
	CO4	3	2	3	3		3	3	3		3		2	3	2	3
	CO5	3	3	2	3		3	3	3		3		3	3	2	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 3P2 - Computer Aided Machine Drawing Laboratory								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	4	60	2	60	40	100

Objective(s)	• 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	**At the end of the course, the students will be able to** CO1: Select conventional representation of threaded parts, springs and gears on drawing using Indian standard code of practice CO2: Select fit, allowance, tolerance, and symbols for mechanical components based on requirement. CO3: Prepare the assembly drawing to assist the manufacturing from the given joints and couplings part drawing with the application of CAD software. CO4: Prepare the assembly drawing to assist the manufacturing from the given bearings and connecting rod part drawing with the application of CAD software. 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.

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.

Preparation of part modelling 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

Lab Manual

1.	"Computer Aided Machine Drawing Laboratory Manual", Department of Mechanical Engineering, KSRCT.

Pre-requisite: **Engineering Drawing**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 3P2 &Computer Aided Machine Drawing Laboratory	CO1	3	3	3		3				3		2	3	3	3	3
	CO2	3	3		3	2							3	2	2	3
	CO3	3	3			3				3		3		3	3	3
	CO4	3		3		3				2		2	2	2	2	3
	CO5	3	3		3	2				2		3	2	2	2	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology - Autonomous Regulation							R 2018
Semester III							
Course Code	Course Name	Hours/Week			Credit	Maximum Marks	
		L	T	P	C	CA	ES	Total
50 TP 0P1	Career Competency Development I	0	0	2	0	100	00	100

Objective(s)

- To help learners to enrich their grammatical correctness and vocabulary efficacy in the academic and professional contexts.
- To help the learners to frame syntactical structures of sentences and comprehend the meaning of reading passages effectively
- To help learners to adeptly sequence the information, draft letters and correct usage of foreign words with correct spelling and punctuation.
- To help the learners to introduce themselves and involve in situation conversations professionally
- To help learners to make various modes of presentations and express their opinion in a conducive way.

Course Outcomes

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

CO1: Reinforce the essential grammatical correctness and vocabulary efficacy in the academic and professional contexts

CO2: Generate syntactical structures and infer the semantics in the reading passages effectively

CO3: Reorganize and compose the sequential information, letter drafts, and interpret the appropriate usage of foreign words with correct spelling and punctuation

CO4: Demonstrate their introduction and relate to situational conversations adeptly

CO5: Exhibit various modes of presentations and organize their opinions in an expressive way

Unit – 1	Written Communication – Part 1	Hrs
Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition - Change of Voice - Change of Speech - Synonyms & Antonyms - One Word Substitution - Using the Same Word as Different Parts of Speech - Odd Man Out **Materials:** Instructor Manual, Word Power Made Easy Book		8
Unit – 2	**Written Communication – Part 2**	6
Analogies - Sentence Formation - Sentence Completion - Sentence Correction - Idioms & Phrases - Jumbled Sentences, Letter Drafting (Formal Letters) - Reading Comprehension(Level 1) - Contextual Usage - **Materials:** Instructor Manual, Word Power Made Easy Book		
Unit – 3	**Written Communication – Part 3**	4
Jumbled Sentences, Letter Drafting (Formal Letters) - Foreign Language Words used in English - - Spelling & Punctuation (Editing) **Materials:** Instructor Manual, News Papers		
Unit – 3	**Oral Communication – Part 1**	6

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Self-Introduction - Situational Dialogues / Role Play (Telephonic Skills) - Oral Presentations- Prepared -'Just A Minute' Sessions (JAM) **Materials:** Instructor Manual, News Papers	
Unit – 5 **Oral Communication – Part 2**	6
Describing Objects / Situations / People, Information Transfer - Picture Talk - News Paper and Book Review **Materials:** Instructor Manual, News Papers	
Total	**30**

Evaluation Criteria

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

Reference Books

1. Aggarwal, R.S. "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.
2. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note :

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 TP 0P1 & Career Competency Development I	CO1						2		2	3	3	2	3		2	
	CO2						2		2	3	3	2	3		2	
	CO3						2		2	3	3	2	3		2	
	CO4						2		2	3	3	2	3		2	
	CO5						2		2	3	3	2	3		2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 401- Engineering Materials and Metallurgy

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

Objective(s)

- 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 basic principles in metallurgy and testing of engineering materials.

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyse the structures of materials and interpret the phase diagrams. CO2: Acquire knowledge on tailoring material properties of ferrous and non-ferrous metals CO3: Describe the concept of heat treatment of steels & hardening mechanisms CO4: Acquire knowledge on the process of manufacturing of nonmetallic materials and powder metallurgy CO5: Apply suitable testing methods to analyse mechanical properties of materials.

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

Constitution of Alloys and Phase Diagrams

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructure of ferrite, austenite and cementite. [9]

Ferrous and Non-ferrous Metals

Classification of steel and cast iron – microstructure - properties and applications - Effect of alloying additions onsteel (Mn, Si, Cr, Mo, V, Ti &W) - stainless and tool steels - HSLA - maraging steels - Cast iron: gray, white,malleable, spheroidal graphite - alloy cast irons - Copper and Copper alloys; Brass, Bronze and Nickel-copperalloys - Aluminium and its alloys - Bearing materials. [9]

Heat Treatment

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. [9]

Non Metallic Materials and other Engineering Materials

Engineering Ceramics - Properties and applications of Al_2O_3, SiC–Composites – Types –fabrication methods. Powder metallurgy - characteristics and production of metal powders - applications - advantages and limitations. [9]

Testing of Engineering Materials

Destructive Testing: Testing of materials under tension, compression and shear loads - Hardness tests: Brinell, Vickers and Rockwell - Impact test: Izod and Charpy - fatigue and creep test – Metallography - Preparation of specimen, Metallurgical microscope and Scanning Electron Microscope. [9]

Total Hours: 45

Text Book(s):

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

Reference(s)

1.	Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, 7thEdition, Prentice Hall of India Private Limited, 2010.
2.	Raghavan.V, “Materials Science and Engineering: A First Course”, 6th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2016.
3.	William D. Callister, “Material Science and Engineering: An Introduction”, 5thEdition Wiley India Pvt Ltd, New Delhi, 2016.
4.	Jindal U.C, “Material Science and Metallurgy”, 1st Edition, Dorling Kindersley Publication, 2012.

Pre-requisite: **Basic Knowledge of Solid state chemistry, laws of thermodynamics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 401 & Engineering Materials and Metallurgy	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 005 - 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

Objective(s)	• To learn about the properties of fluids, manometry and buoyancy • To learn 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 dimensional analysis. • To analyze the flow in water pumps and turbines.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Explain and evaluate the various properties of fluids, manometry and buoyancy. CO2: Estimate the mass and momentum conservation laws for fluid flows. CO3: Evaluate the velocity and pressure variation in flow through pipes. CO4: Analyze the similarity of motion between model and prototype CO5: Evaluate the performance of pumps and turbines.

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

Fluid Properties and Fluid Statics

Units and Dimensions – Fluid Properties – Density, Specific gravity, Viscosity, Surface tension, capillarity, compressibility and bulk modulus - Fluid Statics - Pascal's law – Pressure measurements – Atmospheric, vacuum pressure and gauge pressure – simple and differential manometers - Buoyancy – Centre of buoyancy – meta center and meta center height. [13]

Fluid Kinematics and Fluid Dynamics

Types of fluid Flow – types of flow line – control volume - velocity field and acceleration - Continuity equation and momentum equation - stream and potential function – Euler's and Bernoulli's Equation and its applications. [12]

Flow through circular conduits

Laminar flow through circular pipes - Hagen Poiseuille equation – Turbulent flow - Boundary layer concepts – Darcy Weisbach equation, friction factor, Moody's diagram -Loss of energy in pipes. [11]

Dimensional Analysis

Need for dimensional analysis **–** methods of dimensional analysis - Similitude – types of similitude – Dimensionless parameters – application of dimensionless parameters – Model analysis. [11]

Hydraulic Pumps and Turbines

Impact of jet – force exerted by a jet on moving plates. Classification – construction, working principles and design of Pelton wheel and Francis turbines – head, losses, work done and efficiency – specific speed – operation characteristics – Governing of turbines – Classification of pumps – centrifugal pump and reciprocating pump - working principle – discharge, work done and efficiencies- cavitation in pumps – Submersible pumps – Types and applications. [13]

Total Hours: 45+15(Tutorial)=60

Text Book(s):

1. Rajput, R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines", S.Chand & company Ltd., 6th Edition, 2015.
2. Modi P. N and Seth S.M "Hydraulics and mechanics, including Hydraulic machines" Standard Book House, Delhi, 2017.

Reference(s)

1. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2017.
2. Cengel Yunus A. and Cimbala, John M., "Fluid Mechanics", Tata McGraw – Hill, New Delhi, 3rd Edition, 2015.
3. Ramamrutham.S. "Hydraulics Fluid Mechanics and Fluid Machines", 8th Edition, DhanpatRai Publishing company (P) Ltd, New Delhi, 2014.
4. Ojha, C.S.P., Chandramouli, P.N. and Berndtsson, R., "Fluid Mechanics and Machinery", Oxford University Press, 2010

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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.

Pre-requisite: **Engineering Mechanics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 005 & Fluid Mechanics and Fluid Machines	CO1	3	3	2	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
	CO5	3	3	3	3	3			3					3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 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
Objective(s)	• To introduce the students to the concepts of basic manufacturing processes • To acquire the basics concept of metal cutting • To impart knowledge on working of standard machine tools and allied machines. • To study process parameters, grinding and abrasive machining technique • To acquire the basic concepts of modern machine process and theirtechniques.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Choose appropriate cutting tools and cutting fluids for machining processes. CO2: Perform various machining operations on Reciprocating machine. CO3: Compare various machine tools for industrial applications. CO4: Apply the appropriate abrasive machining processes for making components. CO5: Select the modern machining processes for industrial applications.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Fundamentals of Metal Cutting Mechanism of metal cutting - Types, cutting force- chip formation - Tool geometry - Mechanics of orthogonal and oblique cutting - Merchant's circle diagram-calculations -Thermal aspects - Machinability-Tool wear - Tool life - Cutting tool materials-Cutting fluids - Types. [9] **Machine Tools I** Reciprocating machine tools: shaper, planer, and slotter. Milling: types, milling cutters, indexing, Operations – Hole making: drilling – Introduction, Reaming, Boring, Tapping – Other Hole - Making Operations. [9]								

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Machine Tools II

Sawing machine: hack saw, band saw, circular saw - Broaching machines: Broach construction – push, pull, surface and continuous broaching machines. Work holding devices - Concept of Jigs and Fixtures and its applications. [9]

Abrasive Processes and Gear Cutting

Abrasive processes: Introduction - Grinding wheel: Designations and selection, types of grinding machines cylindrical grinding, surface grinding, centre less grinding – Grinding Process parameters - honing, lapping, super finishing, polishing and buffing - Gear cutting: forming, generation, shaping, and hobbing**.** [9]

Modern Machining

High speed machining - Ultra precision Machining and Hard turning - Ultrasonic machining - Abrasive jet machining - Abrasive flow machining - Water jet machining - Electro chemical machining - Electric discharge machining - Wire Electric discharge machining -. Electron beam machining - Laser beam machining. [9]

Total Hours: 45

Text Book(s):

1.	Kaushish, J.P., "Manufacturing Processes", PHI Learning Ltd, New Delhi, 2013.
2.	Mikell P. Groover, "Principles of Modern Manufacturing", SI Version, Wiley & sons Pvt. Ltd, 2013.

Reference(s)

1.	Jain R.K., "Production Technology", Khanna Publishers, 2001
2.	Rao P N, " Manufacturing Technology", Tata McGraw Hill Publishing Co. Ltd., Volume 1, New Delhi, 2010
3.	SeropeKalpakjian and Stephen Schmid, "Manufacturing, Engineering and Technology", SI 6th Edition -ll, Pearson Education, 2006
4.	Rajput,R.K., "A textbook of Manufacturing Technology", Laxmi publications (p) ltd, 2015.
5.	Heine R W, Loper C R and Rosenthal P C, "Principles of Metal Casting", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2010.

Pre-requisite: **Manufacturing Processes**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 402 &Machining Processes	CO1	3	3	3			3	3					3	3	3	
	CO2	2	3	3			3	3					3	3	3	
	CO3	3	3	2			2	2					3	3	3	
	CO4	3	2	3			2	2					3	3	2	
	CO5	2	3	2			3	3					3	3	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 403 - Kinematics of 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

Objective(s)

- To learn the kinematics and rigid- body dynamics of kinematically driven machine components.
- To impart the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To design few linkage mechanisms and cam mechanisms for specified output motions.
- To acquire the basic concepts of toothed gearing and kinematics of gear trains.
- To impart the effects of friction in motion transmission and in machine components.

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Identify the different mechanisms. CO2: Calculate the velocity and acceleration of simple mechanism using graphical method. CO3: Construct the cam profile based on various follower motions. CO4: Calculate the contact ratio of gears and kinematics of epicyclic gear trains. CO5: Identify the type's friction and design the friction drives.

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

Basics of Mechanisms

Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint. [12]

Kinematics

Displacement, velocity and acceleration analysis of simple mechanisms using graphical method - kinematic analysis of simple mechanisms- slider crank, four bar mechanism dynamics, Coincident points- Coriolis component of acceleration. [12]

Cam and followers

Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers. [12]

Gears and gear trains

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- epicyclic and regular gear train kinematics. [12]

Friction drives

Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication friction clutches- belt and rope drives- friction in brakes. [12]

Total Hours: 45+15(Tutorial) = 60

Text Book(s):

1. Rattan, S S., "Theory of Machines", Tata McGraw–Hill Publishing Co.Ltd., New Delhi, 4th edition, 2014.
2. Uicker JJ, Pennock GR, Shigley JE. "Theory of Machines and Mechanisms", Oxford University Press, New York, 5th Edition, 2017.

Reference(s)

1. Rao JS, and Dukkipati. RY., "Mechanism and Machine Theory", Reprint, New Age International, New Delhi, 2nd Edition, 2014.
2. Khurmi RS, and Gupta JK., "Theory of machines", S.Chand & Company Ltd., New Delhi, 14th Edition, 2014.
3. Amitabh Ghosh and Malik, A K., "Theory of Mechanisms and Machines", Reprint, Affiliated East West Press Pvt. Ltd., 3rd Edition, 2011.
4. Bansal R.K and Brar.J S, "A Textbook of Theory of Machines", 5th Edition, Laxmi Publication (P) Ltd., New Delhi, 2015.

List of MATLAB Programmes applied for the following tutorials:

1. Determination of Spur Gear Contact Ratio.
2. Determination of number of teeth in gear train.
3. Solving problems in friction drives- bearings.
4. Solving problems in friction drives -belt.

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Pre-requisite: **Basic Knowledge of Engineering mechanics – Statics and Dynamics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 403 & Kinematics of Machines	CO1	3	2											3		
	CO2	3	3	2										3	3	
	CO3	3	3	3										3	3	
	CO4	3	3	3		3								3	3	
	CO5	3	3	3		3								3	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 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

Objective(s)

- To study the gas and vapor power cycles and their applications in IC Engines.
- To impart the principles of operation in IC engines and its components.
- To study the principles of steam boilers and analyze the performance of steam nozzles.
- To learn about reciprocating air compressors with and without inter cooling and its performance
- To study and analyze the performance of steam turbines.

Course Outcomes

At the end of the course, the 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.
CO2: Demonstrate the operation of steam boiler and it components.
CO3: Analyze the shapes and maximum discharge of the steam nozzle.
CO4: Recognise the functions of steam turbines.
CO5: Identify the various problems in single stage and multistage air compressors.

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

Gas Power Cycles

Introduction – Classification of Cycles - Air standard efficiency - Otto, Diesel, Dual and Brayton cycles. [9]

Internal Combustion Engines

I.C engines - Classification, components and functions. P-V diagram - Valve and port timing diagram, Two-stroke and four -stroke engines - Petrol and diesel engine – Ignition, Fuel injection system, Cooling systems – Governing. [9]

Steam Boilers

Classification of steam boilers - fire tube, water tube, low pressure and high pressure boiler - super-critical boiler - Boiler mountings and accessories. [9]

Steam Nozzles

Nozzles and its shapes, Friction in a nozzle, Maximum discharge through a nozzle. [6]

Steam Turbines

Introduction - Classification of steam turbines - compounding- velocity diagrams for turbines. [6]

Air Compressor

Classification of air compressor- Construction of reciprocating compressor – Intercooler - applications. [6]

Total Hours: 45

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Text Book(s):	
1.	Rajput, R.K.,"Thermal Engineering", 10th Edition, Laxmi Publications (P) Ltd., New Delhi, 2017.
2.	Mahesh M. Rathore, "Thermal Engineering", 1st Edition, Tata McGraw Hill Publications (P) Ltd., 2010.
Reference(s):	
1.	Khurmi, R.S and Guptha, J K, "A Textbook of Thermal Engineering", 15thEdition, S.Chand publisher, 2013.
2.	Kothandaraman C.P., Domkundwar S, Domkundwar. A.V., "A course in thermal Engineering", 5thEdition, Dhanpat Rai& sons, 2016.
3.	Cengel, Y.A., "Thermodynamics-An Engineering Approach", 8th Edition, Tata McGraw Hill Publication, New Delhi, 2015.
4.	Moran, M.J and Shapiro, H.N., "Fundamentals of Engineering Thermodynamics" 8th Edition, John Wiley and Sons, 2014.

Pre-requisite: **Thermodynamics**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 404 & Thermal Engineering	CO1	3	3		3	2		3	3				3	3	3	
	CO2	3			3	3			3				2	2	3	
	CO3	3	2	2	3				3				2	2	3	
	CO4	3	3	3	3				3				3	3	3	
	CO5	3	3		3				3				3	3	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 MY 014 - Startups and Entrepreneurship								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	2	0	0	30	0	100	-	100
Objective(s)	• To provides practical proven tools for transforming an idea into a product or service that creates value for others. • To build a winning strategy, how to shape a unique value proposition, prepare a business plan • To impart practical knowledge on business opportunities • To inculcate the habit of becoming entrepreneur • To know the financing, growth and new venture & its problems							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Transform ideas into real products, services and processes, by validating the idea, testing it and turning it into a growing, profitable and sustainable business. CO2: Identify the major steps and requirements in order to estimate the potential of an innovative idea as the basis of an innovative project. CO3: Reach creative solutions via an iteration of a virtually endless stream of world-changing ideas and strategies, integrating feedback, and learning from failures along the way. CO4: Apply the 10 entrepreneurial tools in creating a business plan for a new innovative venture. CO5: Apply methods and strategies learned from interviews with startup entrepreneurs and innovators.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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Introduction to Entrepreneurship & Entrepreneur

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

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

Business Opportunity Identification and Preparing a Business Plan

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

Innovations

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

Financing and Launching the New Venture

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

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

Managing Growth and Rewards in New Venture

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

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

Total Hours: 30

Text Book(s):

1	Stephen Key, "One Simple Idea for Startups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company" 1st Edition, Tata McGrawhill Company, New Delhi, 2013.
2	Charles Bamford and Garry Bruton, "ENTREPRENEURSHIP: The Art, Science, and Process for Success", 2nd Edition, Tata McGrawhill Company, New Delhi, 2016.

Reference(s):

1	Philip Auerswald, "The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy", Oxford University Press, 2012.
2	Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, "Entrepreneurial Finance: Strategy, Valuation, and Deal Structure, Stanford Economics and Finance", 2011
3	Edward D. Hess, "Growing an Entrepreneurial Business: Concepts and Cases", Stanford Business Books, 2011
4	Howard Love, "The Start-Up J Curve: The Six Steps to Entrepreneurial Success", Book Group Press, 2011

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MY 014 &Startups and Entrepreneurship	CO1	3	3	3	3	1	3	1	2	1		2	2	2	1	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		2
	CO4	3	3	3	3	3	2	2	1		1	3	3	3		2
	CO5	3	2	3	3	3			2			3	2	2		2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous					R 2018		
50 GE 001 – National Cadet Corps (Air Wing)							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
IV	2	0	2	60	3	50	50	100

Objective(s)	• Develop character , camaraderie, • Inculcate discipline, secular outlook • Enrich the spirit of adventure, sportsman spirit • Ideals of selfless service amongst cadets by working in teams • Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion. CO2:Demonstrate the sense of discipline with smartness and have basic knowledge of Weapons and their use and handling CO3: Illustrate various forces and moments acting on aircraft CO4:Outline the concepts of aircraft engine and rocket propulsion CO5: Design, build and fly chuck gliders/model airplanes and display static models

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

NCC Organization & National Integration **[9]**

NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF-Indo-Pak War-1971-Operation Safed Sagar. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

Drill & Weapon Training **[9]**

Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION). Main Parts of a Rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing (WITH PRACTICE SESSION)

Principles of Flight **[9]**

Laws of motion-Forces acting on aircraft–Bernoulli's theorem-Stalling-Primary control surfaces – secondary control surfaces-Aircraft recognition.

Aero Engines **[9]**

Introduction of Aero engine-Types of engine-piston engine-jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.

Aero Modeling **[9]**

History of aero modeling-Materials used in Aero-modeling-Types of Aero-models – Static Models-Gliders-Control line models-Radio Control Models-Building and Flying of Aero-models.

Total Hours: 45

Text Book(s):

1	"National Cadet Corps- A Concise handbook of NCC Cadets" by Ramesh Publishing House, New Delhi, 2014.
2	"NCC OTA Precise" by DGNCC, New Delhi, 2014

Reference(s):

1	"Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi,2019
2	"Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi,2017

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 GE 001 – National Cadet Corps (Air Wing)	CO1						3	3	3	3	3		3			
	CO2					3						3	2			
	CO3	3	2	1	1											
	CO4	3	2	1	1											
	CO5	3	2	1	1											

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous						**R 2018**		
50 GE 002 – National Cadet Corps (Army Wing)								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	2	0	2	60	3	50	50	100
Objective(s)	• Develop character , camaraderie, • Inculcate discipline, secular outlook • Enrich the spirit of adventure, sportsman spirit • Ideals of selfless service amongst cadets by working in teams • Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion. CO2:Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders. CO3: Basic knowledge of weapons and their use and handling. CO4: Aware about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils CO5: Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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NCC Organization & National Integration **[9]**

NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt.

National Integration - Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

Basic Physical Training & Drill **[9]**

Basic physical Training – various exercises for fitness(with Demonstration)-Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION)

Weapon Training **[9]**

Main Parts of a Rifle- Characteristics of .303 rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 5.56mm rifle- Characteristics of 7.62mm SLR- LMG- carbine machine gun – pistol.

Social Awareness and Community Development **[9]**

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes – MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility

Specialized Subject (ARMY) **[9]**

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews.

Total Hours: 45

Text Book(s):

1	National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014
2	Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi , 2014

Reference(s):

1	"Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi,2019
2	"Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi,2017

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 GE 002 – National Cadet Corps (Army Wing)	CO1						1		3							
	CO2								2							
	CO3						1		3							
	CO4								2							
	CO5								3							

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 4P1 - Strength of Materials, Fluid Mechanics and Fluid Machines 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

Objective(s)	• To emphasize the concepts of Bernoulli's principle using venturimeter. • To evaluate the frictional loss in pipes. • To acquire knowledge on hydraulics machines. • To analyze and design structural members subjected to various stresses using the fundamental concepts of stress, strain and elastic behavior of materials. • To utilize appropriate materials in design considering engineering properties and sustainability
Course Outcomes	**At the end of the course, the students will be able to** CO1: Perform Tension, Compression, Torsion, and Deformation test on Solid materials CO2: Assess the Hardness and Impact strength of mild steel CO3: Apply the Bernoulli's principle to find the rate of flow using venturimeter CO4: Determine the friction factor for set of pipes. CO5: Analyze the performance characteristics of turbine and pumps

Strength of Materials:

1. Determination of tensile, compression and shear strength of mild steel specimen.
   http://sm-nitk.vlabs.ac.in/exp13/index.html
   http://sm-nitk.vlabs.ac.in/exp16/index.html
   http://sm-nitk.vlabs.ac.in/exp7/index.html
2. Determination of modulus of rigidity of helical springs (tension and compression).
3. Beam deflection and torsion test on given specimen.
   http://sm-nitk.vlabs.ac.in/exp19/index.html
4. Hardness test on metallic specimen - Brinell and Rockwell hardness number.
   http://sm-nitk.vlabs.ac.in/exp10/index.html
   http://sm-nitk.vlabs.ac.in/exp20/index.html
5. Determination of Impact strength on mild steel specimen (Charpy and Izod).
   http://sm-nitk.vlabs.ac.in/exp6/index.html
   http://sm-nitk.vlabs.ac.in/exp5/index.html

Fluid Mechanics and Fluid Machines:

6. Determination of the Coefficient of discharge of venturimeter.
   http://fm-nitk.vlabs.ac.in/exp5/index.html
7. Determination of friction factor for a set of pipes.
   http://fm-nitk.vlabs.ac.in/exp4/index.html
8. Performance analysis of Pelton wheel.
   https://fmc-nitk.vlabs.ac.in/fluid-machinery/exp/pelton-turbine/
9. Performance analysis of reciprocating pump.
   https://fmc-nitk.vlabs.ac.in/fluid-machinery/exp/reciprocating-pump/
10. Performance analysis of centrifugal pump.
    https://fmc-nitk.vlabs.ac.in/fluid-machinery/exp/centrifugal-pump/

Design Experiment:

Evaluate and compare the stiffness of both Aluminium and Mild Steel simply supported beam. Discuss the following point, aluminium or mild steel specimen of same geometric dimensions which will deflect more?

Lab Manual

1.	"Strength of Materials, Fluid Mechanics and Fluid Machines Laboratory Manual", Department of Mechanical Engineering, KSRCT.

Rev. No.4/w.e.f. 02.01.24
Passed in BoS Meeting held on 24/11/23
Approved in Academic Council Meeting held on 23/12/2023

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Pre-requisite: **Strength of Materials**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 4P1 & Strength of Materials, Fluid Mechanics and Fluid Machines Laboratory	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME4P2– 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
Objective(s)	• 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 drilling • To study and practice the various operations that can be performed in shaping and milling machines. • To study and practice the various operations that can be performed in grinding machines. • To study and practice the various operations that can be performed in gear hobbing machines.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Measure the cutting forces using Lathe tool dynamometer. CO2: Perform drilling, reaming and tapping operations and estimate the power requirement and machining time in drilling machine and tap set, Machine the external splines in slotting machine CO3: Machine a dovetail, keyway and estimate the power requirement and machining time in shaper machine and horizontal milling machine, Machine the polygon surface in milling machine CO4: Practice cylindrical grinding operation and estimate the power requirement and machining time in cylindrical grinding machine and surface Grinding machine CO5: Produce spur gear and estimate the power requirement and machining time in gear hobbing machine.							

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1. Turning and Facing operations using capstan and Turret lathe and study of bar feeding mechanism.
2. Measurement of cutting forces in turning operations using lathe tool dynamometer.
3. Machining of external splines and estimation of machining time and power requirement in slotting machine.
4. a) Drilling and reaming operations and estimation of machining time and power requirement in drilling machines.
   b) Internal Threading operations using tap set.
5. Machining of dovetail, keyway and estimation of machining time and power requirement in shaper.
6. Machining of hexagonal surface and estimation of machining time and power requirement in milling machine.
7. Machining of spur gear and estimation of machining time and power requirement in milling machine.
8. Surface grinding using surface grinder and estimation of machining time and power requirement.
9. External cylindrical grinding of shaft using cylindrical grinding machine and estimation of machining time and Power requirement.
10. Spur Gear generation using Gear Hobbing Machine and estimation of machining time and power.

Design Experiment:

1. Create a Component using Drilling and Fitting Operation

Lab Manual	
1.	"Manufacturing Technology Lab Manual", Department of Mechanical Engineering, KSRCT.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME4P2 & Machining Processes Laboratory	CO1	3	3	3	3		3	3	3		3	2	3	3	3	3
	CO2	2	3	3	3		3	2	3		3	3	3	3	3	3
	CO3	3	3	2	3		2	3	2		3	2	3	3	3	3
	CO4	2	2	3	3		2	2	2		2	3	3	3	3	3
	CO5	3	3	2	3		3	3	3		3	3	3	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2018
Semester IV								
Course Code	**Course Name**	**Hours/Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**ES**	**Total**
50 TP 0P2	**Career Competency Development II**	**0**	**0**	**2**	**0**	**100**	**00**	**100**

Objective(s)	• To help the learners to paraphrase the reading passages, to draft continuous writing and review texts in the academic and professional contexts • To help the learners to acquire the phonetic skills of the language and express themselves precisely for effective professional presentations • To help the learners to enrich their verbal reasoning and ability to match the employability requirements of the corporates • To help the learners to comprehend the preliminary level of aptitude skills required to attend placement and competitive online exams • To help the learners to comprehend the Pre - Intermediate level of aptitude skills required to attend placement and competitive online exams
Course Outcomes	**At the end of the course, the students will be able to** CO1: Interpret and infer the meaning in the reading passages, organize continuous Writing and review texts both academically and professionally. CO2: Adapt to and demonstrate the phonetic skills accurately for effective presentations professionally. CO3: Interpret the various concepts of verbal reasoning and relate for the concepts to the requirements of the competitive exams and employability CO4: Infer the concepts of preliminary level of aptitude skills pertaining to competitive exams and company recruitments. CO5: Infer the concepts of pre-intermediate level of aptitude skills pertaining to competitive exams and company recruitments.

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

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Evaluation Criteria			
S.No.	**Particular**	**Test Portion**	**Marks**
1	Evaluation 1 Written Test	15 Questions Each from Unit 1, 3, 4 & 5 (External Evaluation)	60
2	Evaluation 2 Oral Communication	Extempore & Miming – Unit 2 (External Evaluation by English, MBA Dept.)	20
3	Evaluation 3 Technical Paper Presentation	Internal Evaluation by the Dept.	20
		Total	**100**

Reference Books

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

Note :

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 TP 0P2 & Career Competency Development II	CO1	3	2	2	2					2	3	3	3	1		1
	CO2	3	2	2	2					3	3	2	3	1	1	1
	CO3	3	2	2	2					3	3	2	3	1	1	1
	CO4	3	2	2	2			1		3	3	2	3	2	2	1
	CO5	3	2	2	2			1		3	3	2	3	2	2	1

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 501 – Automobile 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
Objective(s)	• To study the vehicle body and structure in automobiles. • To learn about various engine auxiliaries used in automobiles. • To study the construction and working principle of transmission systems. • To explain the construction and its principle of steering, brakes and suspension systems. • To study the concepts of electric, hybrid and connected vehicle systems.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognize the basic lay-out of an automobile and their functions. CO2: Analyze the engine auxiliary and electronic systems. CO3: Realize the principles of the transmission system. CO4: Acquire the knowledge in steering, brakes and suspension systems. CO5: Impart the basics of Electric and hybrid vehicles.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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Vehicle Structure and Engines

Automobiles - Types - vehicle construction - different layouts – chassis - frame and body. Vehicle aerodynamics (various resistances and moments involved). IC engines – components - functions and materials, variable valve timing (VVT) [9]

Engine Auxiliary Systems

Electronically controlled – SI and CI injection system, Electronic ignition system, Turbo chargers, Engine emission control by three-way catalytic converter system, BS VI norms. [9]

Transmission Systems

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive [9]

Brakes and Suspension Systems

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems- weveller, Pneumatic and Hydraulic. Braking Systems - Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control [9]

Electric Vehicles and Hybrid Vehicles

Introduction-Electric Vehicle development- system layout- basic system components-fuel cell Electric vehicle-hybrid vehicle- types - series – parallel - Connected and Automated Vehicles - Levels of Automation - Benefits - Challenges. [9]

Total Hours: 45

Text Book(s):

1.	Kirpal Singh, “Automobile Engineering”, Vol. 1 & 2, Standard Publishers, New Delhi, 13th Edition, 2017.
2.	Crouse W. H., Anglin D. L., “Automotive Mechanics”, McGraw Hill Education Private Limited, New Delhi, 10th Edition, 2017.

Reference(s)

1.	Ganesan V. “Internal Combustion Engines”, Tata McGraw-Hill, New Delhi, 4th Edition, 2017.
2.	Jain K.K. and Asthana R.B., “Automobile Engineering”, Tata McGraw Hill Publishers, New Delhi, 6th Edition, 2002.
3.	Heisler H., “Advanced Engine Technology”, SAE International Publications, USA, 1998.
4.	Srinivasan S., “Automotive Mechanics” McGraw Hill Education Private Limited, New Delhi, 2nd Edition, 2017.

Pre-requisite: **Thermal Engineering**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 501 & Automobile Engineering	CO1	3					3	3			3		3	2	2	2
	CO2	2	3			3	2				3		3	2	2	2
	CO3						3	2			2			3	3	2
	CO4	2					3	3			2		3	3	3	2
	CO5	3	2			3	2						3			2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 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

Objective(s)	• To apply the force-motion relationship in components subjected to external forces. • To analyse the undesirable effects of unbalances resulting from prescribed motions in mechanism. • To analyse the effect of dynamics of undesirable free vibrations. • To analyse the effect of dynamics of forced vibrations. • To apply the principles in mechanisms used for speed control and stability control
Course Outcomes	**At the end of the course, the students will be able to** CO1: Evaluate the problems related to dynamic force analysis and investigate the problems related with turning moment diagrams and flywheel. CO2: Apply the principle of static and dynamic balancing to solve the problems related to unbalancing of revolving and reciprocating masses. CO3: Apply the concepts of free vibrations. CO4: Estimate the parameters related to forced vibrations. CO5: Analyse the principle of governors and effect of gyroscopic couple.

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

Force analysis

Introduction to static force and dynamic force. D'Alembert's principle, dynamic force analysis in reciprocating engines- engine force analysis–equivalent masses–bearing loads. Turning moment diagrams–fluctuation of energy, flywheels–dimensions of flywheel rims–punching press. [12]

Balancing

Static and dynamic balancing–balancing of rotating masses–balancing of reciprocating masses–primary and secondary unbalanced forces–partial balancing of locomotives–balancing of multi cylinder inline engines, balancing of radial engines, balancing of V engines–balancing machines. [12]

Free vibrations

Basic features of vibratory systems– types of vibrations–degrees of freedom–free vibrations of single degree of freedom systems: longitudinal vibration with damping, transverse vibration–critical speed of shaft, torsional vibrations – natural frequency of two and three rotor systems. [12]

Forced vibrations

Step–input forcing–harmonic forcing–periodic forcing–magnification factor–vibration isolation and transmissibility. [12]

Governors and Gyroscopic Couple

Functions of Governors–gravity controlled and spring controlled governor characteristics. Stability–Hunting and Isochronism. Gyroscopic couple–Gyroscopic effects on aero planes, ships and automobiles. [12]

Total Hours: 45+15(Tutorial)= 60

Text Book(s):

1	Rattan S S., "Theory of Machines", Tata McGraw–Hill Publishing Co. Ltd., New Delhi, 4th Edition, 2014.
2	Uicker J J, Pennock G R, Shigley J E. "Theory of machines and mechanisms" Oxford University Press, New York, 5th edition, 2017.

Reference(s):

1	Rao J S, and Dukkipati. R Y., "Mechanism and Machine Theory", Reprint, New Age International, New Delhi, 2nd Edition, 2014.
2	Khurmi R S, and Gupta J K., "Theory of machines", S.Chand & Company Ltd., New Delhi, 14th Edition, 2014.
3	Amitabh Ghosh and Malik, A K., "Theory of Mechanisms and Machines", Reprint, Affiliated East West Press Pvt. Ltd., 3rd Edition, 2011.
4	Thomas Bevan, "The Theory of Machines", Pearson Education Ltd., 3rd Edition, 2010.

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List of MATLAB Programmes applied for the following tutorials:

1. Determination of torque in engine force analysis
2. Determination of critical speed of shaft in free vibrations.
3. Measure of natural frequency in torsional vibration.
4. Solving problems in gyroscopic couple.

Pre-requisite: **Statics and Dynamics, Kinematics of Machines**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 502 & Dynamics of Machines	CO1	3	2	3		3								3	3	
	CO2	3	3	3										3	3	
	CO3	3	3	3		3								3	3	
	CO4	3	3	3										3	3	
	CO5	3	3	3	3	3								3	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous					R2018		
50 ME 503 - Design of Machine Elements							
Semester	Hours / Week			Total Hours	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	40	60	100
Objective(s)	• To familiarize with various steps involved in the design process • To teach students how to apply the concepts of stress analysis, theories of failure and material selection • To analyze, design and/or select commonly used machine components • To familiarize principles involved in evaluating the shape and dimensions of a component • To satisfy functional and strength requirements, standard practices and standard data and use catalogues and standard machine components						
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply theories of failures (biaxial, steady load) and Soderberg, Goodman and Gerber relations (variable loading) in design of various machine elements. CO2: Design of a shafts, keys, keyways and couplings. CO3: Design and analyze the temporary and permanent joints. CO4: Design and optimize energy storing elements. CO5: Design the sliding and roller contact bearings.						

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

Steady and Variable Stresses in Machine Members

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Soderberg, Goodman and Gerber relations (variable loading) in design of various machine elements - stress concentration. [12]

Design of Shafts, keys and Couplings

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and keyways - Rigid and flexible couplings. Introduction to gear and shock absorbing couplings. [12]

Design of Temporary and Permanent Joints

Threaded fasteners: Design of bolted joints including eccentric loading. Welded joints, riveted joints for structures - theory of bonded joints - Power screws [12]

Design of Energy Storing Elements and Engine components

Types of springs – Design of helical and leaf springs**.** Rubber springs,theory of disc and torsional springs, Flywheels considering stresses in rims and arms for engines - Connecting Rods and crank shafts. [12]

Design of Bearings

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs**,** Mckee's equation- Selection of Rolling Contact bearings [12]

Note: Use of approved Design Data book is permitted for examination.

Total Hours: 45 + 15(Tutorial) = 60

Text Book(s):

1	Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill education Pvt. Ltd., 3rd Edition, 2010.
2	Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", Tata McGraw-Hill, 8th Edition, 2008.

Reference(s):

1	Khurmi R S.,Gupta J K., "A Text book of Machine Design", Eurasia Pub. House Pvt. Ltd., 14th Ed., 2005.
2	Norton R.L, "Design of Machinery", McGraw-Hill Book co, 3rd Edition, 2004.
3	Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
4	Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003.
5	Juvinall R. C., Marshek K.M., "Fundamentals of Machine Component Design", John Wiley & Sons, 5th Edition, 2011.

Data Book(s):

1	Design Data - Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam– Coimbatore, 2012.

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

Pre-requisite: **Engineering Mechanics, Strength of Materials**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 503 &Design of Machine Elements	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous								R 2018
50 ME 504 - Applied Hydraulics and Pneumatics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Objective(s)	• To study the different components in hydraulic and pneumatic system. • To apply the working principles of hydraulic actuators and control components. • To apply the function of pneumatic components. • To design and develop the hydraulic circuits and systems. • To solve problems and troubles in fluid power systems.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Identify fluid power components used in industry and also select suitable pump for hydraulic power pack CO2: Summarize the features and functions of hydraulic motors, actuators and flow control valves CO3: Apply the working of different pneumatic circuits and systems CO4: Design and construct a fluid power circuits real time applications CO5: Design, install, maintain and trouble shoot fluid power circuits for engineering applications

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

Fundamentals of Fluid power systems

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. [9]

Hydraulic Actuators and Control Components

Hydraulic pumps: Gear, Vane and Piston pumps, Pump Performance, Selection of pumps. 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. [9]

Elements of Pneumatic System

Introduction - Properties of air, Compressors – types - construction details, Filter - Regulator and Lubricator unit, Actuators – types and construction details, Valves - direction, flow and pressure – types and construction details**.** [9]

Fluid Power Circuit Design

Speed control circuits, Regenerative circuits, Feed circuits, Sequencing circuits, Synchronizing circuits, Automatic cylinder reciprocation circuit, Cascade method, Sealing devices-types and materials, Fail-safe circuits, Accumulators - types and circuits - Intensifier circuits and applications. [9]

Advanced Topics in Hydraulics and Pneumatics

Fluidics – Introduction to fluidic devices - simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control – low cost automation and its applications. Installation, maintenance, troubleshooting and remedies. [9]

Total Hours: 45

Text Book(s):

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education Asia Delhi, New Delhi, 7th Edition, 2015.
2. Majumdar S.R., "Oil Hydraulics Systems", Tata McGraw-Hill Education India, New Delhi, 2nd Edition, 2013.

Reference(s):

1. Srinivasan R, "Hydraulic and Pneumatic Controls", Tata McGraw – Hill Education India, New Delhi, 2nd Edition, 2016.
2. Majumdar S.R., "Pneumatic systems: Principles and Maintenance", Tata McGraw Hill Education, New Delhi, 2010.
3. Joji P., "Pneumatic Controls", Wiley India Pvt Ltd, New Delhi, 2011.
4. Ilango S, Soundararajan V, "Introduction to Hydraulics and Pneumatics", Prentice hall of India, New Delhi, 2nd Edition, 2015.
5. Andrew Parr, "Hydraulics and Pneumatics-Technicians and Engineers Guide", Jaico Pub., Chennai, 2005.

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Pre-requisite: **Fluid Mechanics and Fluid Machines**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 504 & Applied Hydraulics and Pneumatics	CO1	3	3	3			3	3						2	2	
	CO2	3	2	3			2	3						3	3	
	CO3	3	2	3	3			2						2	3	
	CO4	3	3	3	3									3	3	
	CO5	3	2	3										2	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 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
Objective(s)	• To demonstrate the port and valve timing diagram. • To study and analyze the properties of fuels & lubricants. • To investigate the performance of I.C engines, Air Compressor, refrigerator and air-conditioner. • To study the working of steam boilers and steam turbine. • To analyze the smoke level in diesel engine.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyze the petrol and diesel engine characteristics. CO2: Measure the physical, thermal properties of fuels, lubricants and assess the valve timings. CO3: Analyze the COP of refrigeration and air conditioning system. CO4: Demonstrate the working principles of steam turbine and steam generator. CO5: Evaluate the variations of volumetric efficiencies on two stage reciprocating air compressor.							

1. Valve Timing diagrams and Determination of flash point and fire point of fuels.
2. Performance Test on 4 - Stroke Diesel Engine.
3. Heat Balance Test on 4-Stroke Diesel Engine.
4. Morse Test on Multi-Cylinder Petrol Engine.
5. Determination of frictional power of a diesel engine by retardation test.
6. Determination of viscosity of lubricating oil by Redwood viscometer.
7. Performance test on vapour compression refrigeration system.
8. Performance and energy balance test on a steam generator.
9. Performance and energy balance test on steam turbine.
10. Performance test on two stage reciprocating air-compressor.
11. Performance test on air-conditioning system.
12. Measurement of smoke level using smoke meter.

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Virtual Lab Experiments:

1. PV Diagram of a SI Engine http://vlabs.iitkgp.ernet.in/rtvlas/exp1/index.html
2. Torque Crank Angle Curve of a SI Engine http://vlabs.iitkgp.ernet.in/rtvlas/exp2/index.html
3. Load Test on a SI Engine http://vlabs.iitkgp.ernet.in/rtvlas/exp3/index.html
4. Mechanical Efficiency of a SI Engine http://vlabs.iitkgp.ernet.in/rtvlas/exp4/index.html
5. Determination of Cylinder Mean Effective Pressure http://vlabs.iitkgp.ernet.in/rtvlas/exp5/index.html
6. Variation of Exhaust Noise with Engine Speed http://vlabs.iitkgp.ernet.in/rtvlas/exp7/index.html

Design Experiments :

1. Calculate the mechanical efficiency of four stroke diesel engine at 20 % load, 40 % load and 70 % load condition.
2. Find out the kinematic viscosity and absolute viscosity at different temperature like 20℃, 40℃ and 60℃ at various fuels.
3. Find out the flash point and fire point of the following mixtures.
   (i) 40 % of diesel and 60% of vegetable oil.
   (ii) 70 % of diesel and 30% of vegetable oil.
   (iii) 90 % of diesel and 10% of vegetable oil.

Lab Manual :

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

Pre-requisite: **Fluid Mechanics Laboratory**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 5P1 & Thermal Engineering Laboratory	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		2			3
	CO5	3	3		3				3	3	3		2			3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous					**R 2018**			
50 ME 5P2 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
Objective(s)	• To analyse the characteristics of governors. • To verify the laws of gyroscopic couple. • To demonstrate the concepts of free and forced vibrations. • To demonstrate the concepts of balancing of rotating masses. • To apply principle of cam and follower mechanism.							

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Course Outcomes	**At the end of the course students will be able to** CO1: Draw characteristics curves for governors, verify the laws of gyroscope. CO2: Calculate the moment of inertia of connecting rod. CO3: Evaluate the natural frequency of longitudinal, transverse and torsional vibrations. CO4: Estimate the transmissibility ratio using vibrating table and multi degree of freedom system. CO5: Analyse the balancing of rotating masses, draw the profile of given cam.

1. Determination of sensitivity and power of Porter governor.
2. Determination of sensitivity and power of Proell governor.
3. Determination of sensitivity and power of Hartnell governor.
4. Determination of gyroscopic couple using Motorized Gyroscope.
5. Calculate the moment of inertia of connecting rod by oscillation method.
6. Determination of natural frequency and critical speed of given shaft using MATLAB
7. Determination of natural frequency of given spring mass system.
8. Determination of natural frequency and deflection of free beam.
9. Determination of torsional frequency of a single rotor system.
10. Determination of transmissibility ratio using vibrating table.
11. Determination of influence co-efficient for multi-degree freedom suspension system.
12. Draw the cam profile for the given cam and follower setup.
13. Dynamic balancing of rotating masses.

Virtual lab Experiments:

1. Free vibration of cantilever beamhttp://mdmv-nitk.vlabs.ac.in/exp1/index.html
2. Free vibration of simply supported beamhttp://mdmv-nitk.vlabs.ac.in/exp2/index.html
3. Free vibration of fixed beamhttp://mdmv-nitk.vlabs.ac.in/exp3/index.html
4. Forced vibration of SDOF systemhttp://mdmv-nitk.vlabs.ac.in/exp4/index.html
5. Base Excitationhttp://mdmv-nitk.vlabs.ac.in/exp5/index.html
6. Rotating Unbalancehttp://mdmv-nitk.vlabs.ac.in/exp6/index.html
7. 2DOF Forced vibrationhttp://mdmv-nitk.vlabs.ac.in/exp7/index.html
8. Dynamic Vibration Absorberhttp://mdmv-nitk.vlabs.ac.in/exp8/index.html

Design Experiment:

1. Investigate the range of speed of gravity loaded governors and the spring-loaded governor

Lab Manual :

1. “Dynamics Laboratory Manual”, Department of Mechanical Engineering, KSRCT.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 5P2 & Dynamics Laboratory	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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Semester V								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
50 TP 0P3	**CAREER COMPETENCY DEVELOPMENT III**	0	0	2	0	100	00	100

Objective(s)	• To help the learners to enrich the written and oral communication skills in the academic and professional contexts • To help the learners to enrich their verbal and logical reasoning ability to meet out the employability requirements of the companies • To help the learners to comprehend the Intermediate level of aptitude skills required to attend placement and competitive online exams • To help the learners to enhance their knowledge in the quantitative aptitude skills in algebraic and linear equations. • To help the learners to augment the core technical and coding skills of their respective domains to compete in coding contests
Course Outcomes	**At the end of the course, the students will be able to** CO1: Examine the written and oral communication skills in the academic and professional contexts CO2: Interpret the concepts of verbal reasoning and relate for the concepts to the requirements of the competitive exams and employability CO3: Infer the concepts of intermediate level of aptitude skills pertaining to competitive exams and company recruitments. CO4: Assess their comprehension in the quantitative aptitude skills in algebraic and linear equations. CO5: Review the core technical and coding skills of their respective domains to compete in coding contests

Unit – 1	Written and Oral Communication – Part 1	Hrs
Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions **Practices:** Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations-Editing-GD-Debate.**Materials:**InstructorManual,WordpowerMadeEasyBook, News Papers		6
Unit – 2	Verbal & Logical Reasoning – Part 1	8
Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions - Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements. **Practices:** Analogies - Blood Relations - Statement & Conclusions. **Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit – 3	Quantitative Aptitude – Part 3	6
Probability - Calendar- Clocks - Logarithms - Permutations and Combinations **Materials:** Instructor Manual, Aptitude Book		
Unit – 4	Quantitative Aptitude – Part 4	6
Algebra - Linear Equations - Quadratic Equations – Polynomials. **Practices:** Problem on Numbers - Ages - Train - Time and Work - Sudoku – Puzzles. **Materials:** Instructor Manual, Aptitude Book		
Unit – 5	Technical & Programming Skills – Part 1	4
Core Subject – 1,2 3 **Practices:** Questions from Gate Material. **Materials:** Text Book, Gate Material		
	Total	30

Evaluation Criteria

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

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3	Evaluation 3 – Technical Paper Presentation	Internal Evaluation by the Dept.	20
		Total	**100**

Reference Books

1. Aggarwal,R.S."AModernApproachtoVerbalandNon-verbalReasoning",RevisedEdition2008,Reprint 2009, S.Chand & Co Ltd., NewDelhi.
2. Abhijit Guha, "Quantitative Aptitude", TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkarPublications.
4. Word Power Made Easy by Norman Lewis W.R. GOYALPublications

Note :

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 TP 0P3 & Career Competency Development III	CO1	3	2	2	2	3		1			3	2	3	3	2	
	CO2	3	2	2	2	3		1			3	3	3	3	2	
	CO3	3	2	2	2	3	2		2	3	3		3	2	2	
	CO4	3				3	2	1		3	3		3		2	
	CO5	3				3	2	1		3	2		3	2	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 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

Objective(s)	• To analyse the mechanisms of heat transfer under steady and transient conditions with extended surfaces. • To study the concepts of free and forced convection heat transfer. • To apply the concepts of radiation heat transfer. • To study the thermal analysis and design of heat exchangers. • To apply the basic concepts of mechanism of mass transfer.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the basic modes of heat transfer and compute temperature distribution in steady, unsteady state heat conduction in various applications. CO2: Interpret and analyze free and forced convection to solve the External and Internal Flow problems. CO3: Recognize the principles of radiation and analyze the reduction in heat transfer using radiation shield. CO4: Analyze the heat transfer during boiling and condensation problem and design the heat exchanger using LMTD and NTU method for industrial applications. CO5: Evaluate the co efficient for diffusive and convective mass transfer.

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

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Conduction

Basic Concepts – Fourier Law of Conduction - General Differential equation of Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Critical Thickness of Insulation – Fins – Unsteady Heat Conduction – Lumped Analysis –Semi-infinite and Infinite Solids – Use of Heislers. [9]

Convection

Free and Forced Convection – Hydrodynamic and thermal boundary layer- External Flow over Plates, Cylinders and Spheres and Internal Flow through tubes – Combined free and forced convection. [9]

Radiation

Laws of Radiation: Stefan Boltzmann Law, Kirchhoff's Law, Planck's law – Black Body Radiation –Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. [9]

Phase Change Heat Transfer and Heat Exchangers

Nusselt theory of condensation – Regimes of boiling - Pool boiling and Flow boiling - Correlations in boiling and condensation - Types of Heat Exchangers - Overall Heat Transfer Coefficient - Fouling Factors - LMTD Method - Effectiveness – NTU Method. [9]

Mass Transfer

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion - Equimolar Counter Diffusion - Convective Mass Transfer – Convective Mass Transfer Correlations [9]

NOTE : (Use of Heat and Mass Transfer Data Book and Steam Table are Permitted in the Examination)

Total Hours: 45

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

List of MATLAB programming applied for following assignment:

1. Problem solving in heat exchangers
2. Determination of mass flow rate using Ficks law

Pre-requisite: **Fluid Mechanics, Thermodynamics and Thermal Engineering**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 601 & Heat and Mass Transfer	CO1	3	3	3	3	3			3				3	3	3	3
	CO2	3	3	2	3								3	2	3	3
	CO3	3	3	3	3								2	2	3	3
	CO4	3	3	3	3	3			2				3	3	3	3
	CO5	3	3	2	3								2	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 702- 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

Objective(s)	• To develop mathematical models for Boundary Value Problems and their numerical solution • To apply concepts of Finite Element Analysis to solve 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
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the Rayleigh-Ritz, Weighted residual and Gaussian Elimination methods to solve engineering problems. CO2: Formulate 1D elements and apply them to solve structural and thermal problems. CO3: Implement the formulation techniques to solve 2D structural and thermal problems using triangular elements. CO4: Develop the stiffness matrices for axisymmetric element and solve structural problems. CO5: Formulate the iso-parametric elements to solve complex problem with irregular geometries.

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

Introduction

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]

One-Dimensional Problems

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from application to Bars, Beams and Plane Trusses. One dimensional Heat transfer problems. [12]

Two Dimensional Scalar Variable Problems

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – CST and LST elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems. [12]

Two Dimensional Vector Variable Problems

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body Constitutive matrices and Strain displacement matrices – Stress calculations - Plate and shell elements. [12]

Isoparametric Formulation

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software. [12]

Total Hours: 45+15(Tutorial) =60

Text Book(s):

1.	Rao, S.S., “The Finite Element Method in Engineering”, 6th Edition, Butterworth Heinemann, 2018.
2.	Chandrupatla, T.R. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, International Edition, Pearson Education Limited, 2014.

Reference(s)

1.	David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGrawHill, 2005
2.	Reddy. J.N., “An Introduction to the Finite Element Method”, 4th Edition, Tata McGraw-Hill, 2018.
3.	Seshu, P., “Text Book of Finite Element Analysis”, PHI Learning Pvt. Ltd., NewDelhi, 2012.
4.	Cook, R.D., David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2004.

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List of MATLAB exercises

1. Evaluate the integral by applying Gaussian elimination method to solve complex problems.
2. Calculate the stress, strain and displacement value for one dimensional structural problems
3. Calculate the thermal stress, strain and temperature value for one dimensional thermal problems
4. Evaluate the integral by applying Gaussian quadrature and compare with exact solution

Pre-requisite**: Strength of Materials**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 702 &Finite Element Analysis	CO1	3	3	3										3	2	
	CO2	3	3	3	2	3			3	3	2			3	3	
	CO3	3	3	3	3	3			3	3	3			3	3	
	CO4	3	3	2	3	3			3	3	3			3	3	
	CO5	3	2	2	3	3								3	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 603 – Design of Mechanical Transmission Systems								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	40	60	100
Objective(s)	• 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.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Select, design and analyze flexible drives. CO2: Design of spur and Helical gears based on Lewis and Buckingham equation and gear life. CO3: Design of bevel and Worm gears based on Lewis and Buckingham equation and gear life. CO4: Design and analyze the multi speed gear box. CO5: Design and analyze the frictional drives.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Selection of Flat ,V belts and chains Selection of flat belts and pulleys, selection of V belt and pulleys, wire ropes and pulleys, selection of Transmission chains and Sprockets. Design of pulleys and sprockets. [12] **Design of Spur and Helical Gears** Review of gear fundamentals, interference, force analysis in gears, 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. [12]								

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Design of Bevel and Worm Gears

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.

Worm Gear: Merits and demerits terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. [12]

Design of gearboxes

Geometric progression – Standard step ratio – Ray diagram, kinematics layout –Design of sliding mesh gear box – Design of multi speed gear box for machine tool applications – Constant mesh gear box – Speed reducer unit – Variable speed gear box. [12]

Design of Frictional Drives

Clutches – role of clutches, positive and gradually engaged clutches, toothed claw clutches, design of single plate and multiple plate clutches, variable speed drives, types and selection. Role of brakes-types of brakes-self energizing and de-energizing brakes. Design of internally expanding shoe brakes – calculation of heat generation and heat dissipation in brakes. [12]

Note: Use of Approved Design Data Book is permitted for examination.

Total Hours: 45 + 15 (Tutorial) = 60

Text book(s):	
1	Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill education private limited, 3rd Edition, 2010.
2	Richard G. Budynas, J.KeithNisbett, "Shigley's Mechanical Engineering Design", McGraw-Hill Education (India) P Ltd., 9th Edition, 2011
Reference(s) :	
1	Khurmi R S.,Gupta J K., " A Text book of Machine Design", Eurasia Publishing house Pvt. Ltd., 14th Edition, 2005
2	Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", 2nd Edition, Tata McGraw-Hill, 2010.
3	Juvinall R. C., Marshek K.M., "Fundamentals of Machine Component Design", John Wiley & Sons, 4th Edition, 2011.
4	Norton R.L, "Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines", McGraw-Hill Book co, 2008.
5	Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", McGraw-Hill Co., 2011.
Data book(s):	
1	Design Data – Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam – Coimbatore, 2012.

List of MATLAB Programmes applied for the following tutorial topics:

1. Determination of gear module inSpur 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

Pre-requisite: **Strength of Materials, Design of Machine Elements**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 603 &Design of Mechanical Transmission Systems	CO1	3	3	3	3									3	3	3
	CO2	3	3	3	3	2			2					3	3	3
	CO3	3	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 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

Objective(s)	• To analyze the conduction heat transfers in solids and insulation 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 types of surfaces. • To study the performance of double pipe and shell & tube heat exchangers.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Calculate the thermal conductivity and heat transfer co efficient for composite and insulation materials. CO2: Measure the convective heat transfer co efficient by natural and forced convection. CO3: Evaluate the heat dissipation of elliptical fin using PC based data acquisition system. CO4: Analyze the Stefan-Boltzmann constant and evaluate the emissivity of a test plate surface. CO5: Analyze the performance of steam condenser and evaluate the effectiveness of heat exchangers.

1. Determination of thermal conductivity of pipe insulation using lagged pipe apparatus.
2. Determination of heat transfer coefficient using composite walls.
   https://vlab.amrita.edu/?sub=1&brch=194&sim=801&cnt=1
3. Determination of temperature distribution and fin efficiency using pin-fin apparatus.
4. Determination of elliptical fin heat dissipation using data acquisition system.
5. Determination of convective heat transfer coefficient by natural convection apparatus.
   https://vlab.amrita.edu/?sub=1&brch=194&sim=791&cnt=1
6. Determination of Stefan-Boltzmann constant by Stefan-Boltzmann apparatus.
   https://vlab.amrita.edu/?sub=1&brch=194&sim=548&cnt=1
7. Determination of emissivity of a grey surface using emissivity measurement.
   https://vlab.amrita.edu/?sub=1&brch=194&sim=802&cnt=1
8. Determination of efficiency of steam condenser using shell and tube heat exchanger.
9. Determination of effectiveness of Parallel flow heat exchanger (water –water).
10. Determination of effectiveness of Counter flow heat exchanger (water –water).

Design Experiments:

1. Determine the thermal conductivity of pipe with various insulation materials using lagged pipe apparatus.
2. Effectiveness of parallel flow heat exchanger (water –Nanofluid).
3. Effectiveness of counter flow heat exchanger (water – Nanofluid).

Lab Manual :

1. "Heat Transfer Lab Manual", Department of Mechanical Engineering, KSRCT.

Pre-requisite: **Thermodynamics, Thermal Engineering, Fluid Mechanics and Heat and Mass Transfer**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 6P1 & Heat Transfer Laboratory	CO1	3	3		2				3	3	3		3			3
	CO2	3	3		2				2	2	3		3			3
	CO3	3	2		2				2	2	3		3			3
	CO4	3	2		3				3	3	3		3			3
	CO5	3	3		3				3	3	3		3			3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 7P2- 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

Objective(s)

- 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

Course Outcomes

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

CO1: Analyze the force, stress, deflection in mechanical components.

CO2: Analyze thermal stress and heat transfer in mechanical components.

CO3: Analyze the vibration of mechanical components.

CO4; Solve one dimensional problems using MATLAB Programming.

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. Modal analysis of Beams.
9. MATLAB programming for solving stepped bar problem using 1D bar element
10. MATLAB programming for solving beam problem using 1D beam element.

Lab Manual

1. "Analysis and Simulation Laboratory Manual", Department of Mechanical Engineering, KSRCT.

Pre-requisite: **Strength of Materials**

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 7P2 &Analysis and Simulation Laboratory	CO1	3	3	2		1							3	2		1
	CO2	3	2	3		1							3	3		1
	CO3	3	3	2		1							3	3		1
	CO4	3	2	3		1							3	3		1

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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Semester VI							
Course Code	Course Name	Hours/Week			Credit	Maximum Marks	
		L	T	P	C	CA	ES	Total
50 TP 0P4	**CAREER COMPETENCY DEVELOPMENT IV**	0	0	2	0	100	00	100
Objective(s)	• To help the learners to enrich the advanced written and oral communication skills in the academic and professional contexts • To help the learners to augment their advanced verbal and logical reasoning ability to meet out the employability requirements of the companies • To help the learners to comprehend the advanced level of aptitude skills in the concepts of Geometry • To help the learners to enhance the data interpretation and analytical skills in varied methods. • To help the learners to enrich the technical and programming skills to be focused on better employability, codeathons and hackathons						
Course Outcomes	**At the end of the course, the students will be able to** CO1: Examine and correlate the written and oral communication skills in the academic and professional contexts CO2: Predict and discriminate advanced verbal and logical reasoning ability to meet out the e mployability requirements of the companies CO3: Infer the concepts of advanced level of aptitude skills on Geometry pertaining to competitive exams and company recruitments. CO4: Illustrate the data interpretation and analytical skills in varied methods. CO5: Formulate the technical and programming skills to be focused on better employability, codeathons and hackathons						

Unit – 1	Written and Oral Communication – Part 2	Hrs
Self-Introduction – GD – Personal Interview Skills **Practices** on Reading Comprehension Level 2 – Paragraph Writing – Newspaper and Book Review Writing – Skimming and Scanning – Interpretation of Pictorial Representations – Sentence Completion- Sentence Correction – Jumbled Sentences – Synonyms & Antonyms – Using the Same Word as Different Parts of Speech – Editing. **Materials:** Instructor Manual, Word power Made Easy Book, News Papers		4
Unit – 2	Verbal & Logical Reasoning – Part 2	8
Analogies – Blood Relations – Seating Arrangements – Syllogism – Statements and Conclusions, CauseandEffect–DerivingConclusionsfromPassages –SeriesCompletion(Numbers,Alphabets& Figures) – Analytical Reasoning – Classification – Critical Reasoning **Practices**: Analogies – Blood Relations – Statement &Conclusions. **Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit – 3	Quantitative Aptitude – Part – 5	6
Geometry–StraightLine–Triangles–Quadrilaterals–Circles–Co-ordinateGeometry–Cube–Cone – Sphere. **Materials:** Instructor Manual, Aptitude book		

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Unit – 4	Data Interpretation and Analysis	6
Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs can be ColumnGraphs,BarGraphs,LineCharts,PieChart,GraphsrepresentingArea,VennDiagram&Flow Charts. **Materials:** Instructor Manual, AptitudeBook		
Unit – 5	Technical & Programming Skills – Part 2	6
Core Subject – 4, 5, 6 **Practices:** Questions from Gate Material. **Materials:** Text Book, Gate Material		
	Total	30

Evaluation Criteria

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

Reference Books

1. Aggarwal,R.S."AModernApproachtoVerbalandNon-verbalReasoning",RevisedEdition2008,Reprint 2009, S.Chand & Co Ltd., NewDelhi.
2. Abhijit Guha, "Quantitative Aptitude", TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkarPublications.
4. Word Power Made Easy by Norman Lewis W.R. GOYALPublications

Note:

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 TP 0P4 & Career Competency Development IV	CO1	3	3		3	3	2	1	2	3	3	2	3	1	1	
	CO2	3	2	2	2	3	1	1	2	3	3	2	3	2	1	
	CO3	3	2	2	2	2	1	1	2	3	3	3	3	2	2	
	CO4	3		2	2					3	2	3	3	1	2	
	CO5	3		2	3					3	2	3	3	3	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 701- Metrology and Measurements

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

Objective(s)

- To impart the basics of metrology, measurement concepts and perform measurement tasks accurately.
- To identify the right measurement practices for linear and angular measurements.
- 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 identify measurement parameters and select the appropriate sensor for it.

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the concepts of measurements to apply in various metrological instruments. CO2: Outline the principles of linear and angular measurement tools used for industrial applications**.** CO3: Demonstrate the techniques of form measurement used for industrial components. CO4: Explain the procedure for conducting computer aided technique. CO5: Discuss various measuring techniques of mechanical properties in industrial applications.

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

Basics of Metrology

Introduction to Metrology –Measurements -Need - Methods-Elements –Factors influencing measurements-Instruments –Precision and Accuracy – Errors – Errors in Measurements-calibration of measuring instruments, ISO Standards. [9]

Linear and Angular Measurements

Linear Measuring Instruments – Types – Classification – Tolerance - Limit gauges – Gauge design – Terminology – procedure – concepts of interchangeability and selective assembly – Angular measuring instruments – Types – Bevel protractor-optical protractors - Sine bar- Clinometers - Angle gauges – Angle Dekkor – Autocollimator – Applications. [9]

Form Measurement

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, Radius Measurements, surface finish measurement, Roundness measurement– Applications of Form Measurements - Introduction to 3D surface Metrology. [9]

Advances in Metrology

Basic concept of lasers Advantages of lasers – Laser Scan Micrometer – laser Interferometers– DC and AC Lasers interferometer – Applications – Straightness – Alignment – Ball bar tests. Basic concept of CMM – Types of CMM – Constructional features – Probes and Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications. [9]

Measurement of Power, Flow and Temperature

Force, torque, power - mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer. [9]

Total Hours: 45

Text Book(s):

1. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2018.
2. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2018.

Reference(s)

1. Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.
2. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2014.
3. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA, 1990.
4. Raghavendra, Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 701 &Metrology and Measurements	CO1	2	3	2		3					3				3	
	CO2	2	3	3							3					
	CO3	3	3	3		3					3			3	3	3
	CO4	3	3	2		3				3	3			3		
	CO5	3	2	3						2	2					

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME 602 - Automation in Manufacturing								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Objective(s)	• To perform a sequence of automated or mechanized assembly operations • To recognize logic control and associated technologies • To impart knowledge on data monitoring using Arduino • To apply the concept of automation and types of automations in the industries. • To enhance the knowledge on CAE in manufacturing.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the process of automation and types. CO2: Analyse the well-defined task accomplished by an automated machine. CO3: Apply knowledge on Automated Material handling equipment's and types. CO4: Enhance the practical knowledge on ARDUINO. CO5: Acquire knowledge of various simulation studies on CAE

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

Introduction

Principles and Components of industrial automation systems and their functionalities, Levels of automations, Fundamentals of manufacturing: Production System Facilities, Manufacturing support systems, Different types of manufacturing systems, Automation in Production Systems, Manufacturing Operations. [9]

Controllers for Industrial Automation

Industrial logic Control Systems, Mechanical, Electrical, Pneumatic, Electronic and Hybrid systems, Programmable Logic Controllers - Architecture - different types of I/O modules - Interfacing real world devices with PLC, different methodologies and strategies adopted for logic development, Basics of HMI and SCADA systems. [9]

Manufacturing Automation

Automated flow lines, buffers, part feeding systems, quantitative analysis of transfer lines and assembly systems. Material handling - AGV, AS/RS. FMS layout configurations and benefits of FMS, Automated inspection, Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Shop-Floor Control: Automated data collection - bar codes, optical character recognition, vision or image processing, radio frequency identification, magnetic identification, voice technology, comparison. [9]

Data Monitoring using Arduino

Basic structure - Input / Output processing - Programming -Mnemonics Timers, Internal relays and counters - Analog-to-Digital (A/D) and Digital-to-Analog (D/A) Conversion - Analog input / output, Programming and interfacing with Sensors in manufacturing applications, Design, develop and integrate the sensors to interface with Arduino. [9]

Application of CAE in Manufacturing

Simulation of molten metal flow using CAE Techniques, solidification process in casting, Analysis of forging process using CAE, Problem solving using CAE packages and softwares used in foundries - interpretation of results. [9]

Total Hors: 45

Text book(s):

1	Groover, M.P, "Automation, Production systems and Computer Integrated Manufacturing Systems", PHI Publishers, 2015.
2	Frank Lamb, "Industrial Automation", Mc Graw Hill, 2013.

Reference(s) :

1	Boothroyd, G., Poli, C. and Murch, L.E., "Automatic Assembly", Marcel Dekker Inc. 2014.
2	Nussey, J., "Arduino for Dummies", 1st edition, Wiley Publication, 2013.
3	Kesheng Wang, Yi Wang, Jan Ola Strandhagen and Tao Yu, "Advanced Manufacturing and Automation VII" 1st Edition, 2018.
4	Yusuf Altintas, "Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design", 2nd Kindle Edition, Cambridge University Press, 2012.

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Pre-requisite: **Manufacturing Processes**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 602 & Automation in Manufacturing	CO1	2		2											3	
	CO2	3	3	3		3			3					3	3	
	CO3	2	2	2											2	
	CO4	3	3	3		3			3				3	3	3	
	CO5	3	3	3		3			3					3	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous							**R 2018**
50 ME 703 – Operations Research							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100
Objective(s)	• To impart knowledge about Operations Research techniques and enable students to take effective engineering and managerial decisions. • To train students to apply Operations Research techniques for the effective utilization of available resources in engineering and business. • To equip students to find the optimum solution for transportation problems and assignment problems. • To impart knowledge a-bout network models and train students to apply these concepts to solve the real world problems. • To train students to apply simulation techniques to solve Inventory and queuing problems.						
Course Outcomes	**At the end of the course, the students will be able to** CO1: Form Linear Programming models and solve them. CO2: Apply transportation models and Assignment models to solve real world problems. CO3: Construct Networks and find optimum solution. CO4: Apply Inventory models to solve inventory problems. CO5: Apply Queuing models to solve problems and analyze them using simulation techniques.						

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

Linear Programming Problems

OR-definition – Phases of OR - Models, Concept of linear programming model-Development of LP models – Graphical solution - Simplex method - Big M method - Two phase method, Introduction to duality theory. [9]

Transportation Problems

Transportation problems- Balanced and Unbalanced TP- Basic feasible solution, Optimal solution by MODI method - Degeneracy, Production problems. Assignment problems - Hungarian method – Balanced and Unbalanced assignment problems - Problem with assignment restrictions-, Travelling salesman problem. [9]

Network Models and Project Management

Shortest route model- Minimal spanning tree model - Maximum flow model – Project network construction – Network logic - Fulkerson's rule - Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) – Probability of completing a project in a scheduled date - Crashing of project networks. [9]

Inventory Models

Types of inventory models - Inventory cost - Deterministic Inventory models - Economic Order Quantity (EOQ) - Purchase and Production models with and without shortages - Determination of buffer stock and re-order levels - EOQ with price breaks - Multi product EOQ models – ABC, VED&SDE analysis in inventory - Introduction to Stochastic inventory problems –discrete case and continuous case. [9]

Queuing Theory and Simulation

Queuing system - terminologies of queuing problem - applications of queuing model - Poisson distribution and exponential distribution –Single server queuing models – Simulation - Need for simulation - Advantages ,disadvantages and applications of simulation - Random number generation – Monte Carlo technique- Inventory and Queuing problems in simulation. [9]

Total Hours: 45

Text Book(s):

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

Reference(s):

1	Wayne L. Winston, "Operations Research – Applications and Algorithms", 4th Edition, Cengage Learning India Private Limited, New Delhi, 2011.
2	Frederick S. Hillier And Gerald J. Lieberman, "Introduction To Operations Research", 9th Edition, McGraw Hill Publishing Co., New Delhi, 2011.
3	Perm Kumar Gupta and Hira, D.S., "Operations Research", S.Chand and Company Ltd., 2014.
4	Srinivasan G, "Operations Research Principles and Applications", 3rd Edition EEE PHI, 2017.
5	Sharma J K, "Operations Research Theory and Applications", 5th Edition, Macmillan India, 2013.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 703 & Operations Research	CO1	3	2	3	3	3						3	2		3	3
	CO2	2	3	3	3	3						3	3	2	2	
	CO3	3	3	2	3	3						2	3			
	CO4	3	3	3	2	2						2	3	3		2
	CO5	3	2	3	2	2						3	2			3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 HS 003- Total Quality Management								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Objective(s)	• To facilitate the understanding of total quality management principles, tools and techniques. • To equip the students to apply the TQM principles, tools and techniques in manufacturing sectors. • To equip the students to apply the TQM principles, tools and techniques in service sectors. • To impart knowledge on quality management principles, tools, techniques and quality standards for real life applications • To make the students understand the importance of standards in the quality assurance process and their impact on the final product.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognise the need for quality concepts and its application in organizations. CO2 :Apply the TQM principles for survival and growth in world class competition CO3: Apply the traditional tools and new tools for quality improvement. CO4: Apply the tools and techniques like quality circle, QFD, TPM and FMEA for quality improvement. CO5: Apply QMS and EMS in organizations.

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

Introduction

Introduction, definitions of quality, need for quality, evolution of quality, dimensions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer satisfaction, customer complaints, customer retention; costs to quality. [9]

TQM Principles

TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; continuous process improvement; PDSA cycle, Kaizen, 5S & 7S ; Supplier partnership, Partnering, Supplier rating and selection. [9]

TQM Management Tools and Techniques

The seven traditional tools of quality; New management tools - applications to manufacturing, service sector, Statistical Fundamentals, Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, control charts, process capability, concepts of six sigma, Bench marking - Reasons to benchmark, Benchmarking process. [9]

TQM Process based Tools and Techniques

Quality circles, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performance, measures.FMEA- stages, types-Design FMEA and Process FMEA. [9]

Quality Management System

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001, ISO 9001:2008 Requirements-Implementation-Documentation-Internal Audits-Registration-Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS. [9]

Total Hours: 45

Text Book(s):

1. Dale H. Besterfield.,et. al, “Total Quality Management”, 3rd Edition., Pearson Education South Asia, 2013.
2. Janakiraman, B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

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Reference(s)	
1.	Joel.E. Ross, “Total Quality Management – Text and Cases”, 3rd Edition, Routledge, 2017.
2.	James R. Evans, James Robert Evans, William M. Lindsay , “The Management and Control of Quality”, 8th Edition, South-Western, 2010.
3.	Kiran.D.R, “Total Quality Management”, Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
4.	Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 HS 003 &Total Quality Management	CO1	3	2			2	3	3	3	3	3		3	3	2	
	CO2	3	2			2	3	3	3	3	3		3		2	
	CO3		3				2	2			3			3		
	CO4		3			3	2	2	3	2			3		3	
	CO5	3				3	3		3	2	2			2	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous							R 2018
50 AC 001 – Research Skill Development - I							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VII	1	0	0	10	0	100	--	100
Objective(s)	• To learn about the effective usage of power point presentation • To prepare presentation with various effects • To visualize the data in the presentation • To acquire knowledge about data sources • To investigate the research articles based on various applications						
Course Outcomes	**At the end of the course, the students will be able to** CO1: Develop presentation with visual effects CO2: Prepare a presentation with supporting data CO3: Attain the importance of research and data collection CO4: Analyze the various sources of research articles CO5: Interpret the tools and methods in preparing manuscript						
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.							

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Preparing a Presentation [3]

Presenting data using Power Point- Power Point preparation and presentation, Design principles for creating effective Power Point slides with visuals displaying data. - Profile, - Problem, and a set of basic Excel charts, use to create a presentation.

Creating effective slides using PowerPoint [2]

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

Research Designs and Data Sources [3]

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

Measurements and Analysis Plan [2]

Importance of well-specified research question and analysis plan: various data collection strategies - Variety of available modes for data collection – review of literature - Tools at hand for simple analysis and interpretation.

Total Hours: 10

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 AC 001 & Research Skill Development - I	CO1	3	3					3	3	3	3	3	3		3	3
	CO2	3	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 7P1- Metrology and Measurements Laboratory								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	60	40	100
Objective(s)	• To 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 train the students with advanced metrological devices. • To describe the various measurement techniques using measuring instrument.							

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the basic concepts of Metrology and classify different measuring tools related to experiments CO2: Select the precision measuring instrument for measurement of various components. CO3: Measure the gear tooth dimensions, angle using sine bar, straightness and flatness, thread parameters, temperature using thermocouple, force, displacement, torque and vibration. CO4: Discriminate the capabilities of machining process by measuring surface flatness of the component produced CO5: Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection

1. Calibration and use of measuring instruments – Vernier caliper, micrometer, dial gauge and vernier height gauge – using gauge blocks.
2. Calibration and use of measuring instruments – depth micrometer and telescopic gauge.
3. Measurement of angles using bevel protractor and sine bar.
4. Measurement of screw thread parameters – Screw thread micrometers and Three wire method (floating carriage micrometer).
5. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM).
6. Non-contact (Optical) measurement using Toolmaker's microscope and Profile projector.
7. Machine tool metrology – Level tests using precision level; Testing of straightness of a machine tool guide way using Autocollimator.
8. Measurement of force and pressure using strain gauges.
9. Measurement of torque using digital torque transducer.
10. Measurement of temperature using transducer (Thermocouple, RTD and Thermistor).
11. Measurement of vibration parameter using vibration setup.
12. Study of Coordinate Measuring Machines programming for repeated measurements of identical components.

Additional Experiment:

1. Calibration of LVDT

Lab Manual

1.	"Metrology and Measurements Laboratory Manual", Department of Mechanical Engineering, KSRCT.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 7P1 &Metrology and Measurements Laboratory	CO1	3	3	3						3	3			3		3
	CO2	3	3	3						3	3			3	3	
	CO3	3	3	3	3					3	3			3	3	3
	CO4	3		3	2					3	3			3		
	CO5	3		3	3					3	3			3		3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous								R 2018
50 ME 6P2 – Automation Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	60	40	100

Objective(s)	• To equip the students with understanding of the fundamental principles and techniques of automation in manufacturing. • To demonstrate the principle of logic control and associated technologies • To impart knowledge on CNC machining process • To apply the concepts of ARDUINO. • To apply the concepts of CAE Simulations.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Acquire knowledge about the hydraulics, pneumatics and electro–pneumatic systems. CO2: Recognize the concepts discussed in Computer Integrated Manufacturing course. CO3: Write CNC part programs using CADEM simulation package for simulation of machining operations such as Turning, Drilling & Milling. CO4: Apply these learnings to automate & improve efficiency of manufacturing process. CO5: Recognize the usage of computers in process planning and quality control.

1. Water level controller using programmable logic controller.
2. Logic implementation for Bottle Filling Application.
   http://ied-nitk.vlabs.ac.in/Container%20Filling%20Process%20Using%20PLC/index.html#
3. PLC Exercise: Traffic Light Control and Filling/Draining Control Operation.
4. PLC Exercise: Reversal of DC Motor Direction.
   http://ied-nitk.vlabs.ac.in/Motor%20forward%20and%20reverse%20direction%20control%20using%20PLC/index.html
5. Design of an automated part feeder.
6. Performance and simulation with CNC lathe software.
7. Performance on CNC lathe
8. Performance on CNC milling.
9. Simulation of component machining using software.
10. Simulation of molten metal flow using Software.
11. Simulation of solidification process in casting.
12. Analog input / output, Programming and interfacing with Sensors in manufacturing applications using Arduino.
13. Pneumatic automation by cascade method.
14. Case study on automated system of any Industry.

Lab Manual :

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 6P2 & Automation Laboratory	CO1	3	3	3	3	3			3	3	3			3	2	2
	CO2	3	3	3	3	2			2	3	3			2	2	2
	CO3	3	3	3	3	3			3	3	3			3	3	3
	CO4	3	3	3	3	3			3	3	3		3	3	3	3
	CO5	3	3	3	3	3			3	3	3			3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 7P3- Project Work - Phase I								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	100	--	100
Objective(s)	• To apply the knowledge/concepts acquired in the lower semesters to create/design/implement project relevant to the field of Mechanical Engineering • To acquire collaborative skills through working in a team to achieve common goals. • To search for related area in which the members are going to do their project. • To identify right project work, acquiring knowledge on that area, making preliminary works towards phase II of the project work. • To acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Survey the literature and market for availability of resources CO2: Select the title and collect relevant information related with selected title. CO3: Collect the literature based on survey and do the partially design of the system. CO4: Carryout partial design of the system CO5: Prepare and present the project report							
Methodology	• Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide. • Problem should be selected. • Students have to collect about 20 papers related to their work. • Report has to be prepared by the students as per the format. • Preliminary implementation can be done if possible. • Internal evaluation has to be done for 100 marks.							

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 7P3 &Project Work - Phase I	CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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Semester VII								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
50 TP 0P5	**CAREER COMPETENCY DEVELOPMENT V**	0	0	2	0	100	00	100

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

Unit – 1	**Written and Oral Communication**	Hrs
Self-Introduction – GD – HR Interview Skills – Corporate Profile Review - Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		6
Unit – 2	**Verbal & Logical Reasoning**	6
Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		
Unit – 3	**Quantitative Aptitude**	6
Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		
Unit – 4	**Data Interpretation and Analysis**	6
Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		
Unit – 5	**Programming & Technical Skills – Part 3**	6
Data Structure - Arrays – Linked List – Stack – Queues – Tree – Graph. Practices on Algorithms and Objective Type Questions. **Materials:** Instructor Manual		
	Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions each from Unit 1, 2,3, 4 & 5 (External Evaluation)	60
2	Evaluation 2 - Oral Communication	GD and HR Interview (External Evaluation by English, MBA Dept.)	20
3	Evaluation 3 – Technical Interview	Internal Evaluation by the Dept. – 3 Core Subjects	20
		Total	**100**

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Reference Books

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

Note:

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 TP 0P5 & Career Competency Development V	CO1	3	3		3			1	2	3	3	3	3	2	2	
	CO2	3	2		2			1	2	3	3	3	3	2	2	
	CO3	3	2	2	2			1			3	3	3	2	2	
	CO4			2		2	1	1			2	2	3	2	2	
	CO5			2		3	2	1			2	2	3	2	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous							R 2018
50 AC 002 – Research Skill Development - II							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VIII	1	0	0	15	0	100	--	100
Objective(s)	• To identify the ethics in preparing research paper • To organize manuscript for submission • To attain knowledge for filing Patent • To apply for copy right • To develop and deploy Mobile App. in play store							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Prepare a manuscript for journal publication. CO2: Apply the manuscript for publication CO3: Interpret the process of obtaining copyright and patent CO4: Analyze the various provisions to share the application CO5: Create and publish the mobile application in the digital store							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.							

Preparation of Manuscript [3]

Data necessary before writing a paper: the context in which the scientist is publishing. Learning and identification of research community - advantages of scientific journal publication and manuscript preparation - ethical values in publishing.

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Writing the paper [2]

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

Copyright [2]

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

Patents [3]

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

Deploying Mobile App. in play store [5]

Introduction to Application Stores – Play Store, App Store, Microsoft Store, Creating App – Android, iOS, UWP, Defining Manifest, Certifying App, Create Store Listing, Sharing Screenshots, Sharing App Credentials for Testing.

Total Hours: 15

Text Book(s):

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

Reference(s):

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

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 AC 002 & Research Skill Development - II	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME 8P1- Project Work - Phase II								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	0	0	16	240	8	40	60	100
Objective(s)	• To enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. • To have guidance for an every project team, by the faculty member of the concerned department. • To receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide. • To present in periodical seminars on the progress made in the project • To produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Make links across different areas of knowledge and to generate, develop and Evaluate ideas and information CO2: Apply these skills to the project CO3: Design the project work. CO4: Model and fabricate the project work CO5: Prepare and present the project work along with report.							
Methodology	• Three reviews have to be conducted by the committee of minimum of three members one of which should be their project guide. • Progress of project has to be monitored by the project guide and committee regularly. • Each review has to be evaluated for 100 marks. • Attendance is compulsory for all reviews. If a student fails to attend review for some valid reasons, one more chance may be given. • Final review will be carried out by the committee that consists of minimum of three members one of which should be their project guide (if possible include one external expert examiner within the college). • The project report should be submitted by the students around at the first week of April.							

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME 8P1&Project Work - Phase II	CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous								R 2018
50 HS 004 – Principles of Management								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Objective(s)	• To enable the students to understand evolution of Management. • To provide them knowledge on planning process • To make them differentiate between formal and informal organization • To provide them knowledge on leadership ,motivation and communication • To enable them to learn different controlling techniques
Course Outcomes	**At the end of the course the students will be able to** CO1: Identify the organizational factors and roles of Management CO2: Describe the nature and purpose of planning, forecasting and decision making CO3: Expose the knowledge on concepts of organizing CO4: Analyze the concepts of delegation of authority and Organization culture. CO5: Introduce the HRD concepts and planning operations

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

Introduction to Management and Organizations

Definition of Management – Science or Art – Manager Vs Entrepreneur – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company- public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management. [9]

Planning

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – Management of objective – policies – Planning premises – Strategic Management, Types of strategies – Planning Tools and Techniques – Decision making steps and process- Types of managerial decision – forecasting and its techniques. [9]

Organizing

Definition –Nature and purpose –Formal-Informal organizations-organization charts-Organization structures-Span of control-factors determining effective span-line and staff authority. Departmentation –Centralization and Decentralization-Job Design – Human Resource Management – HR Planning, Recruitment, Training and Development, Performance Management , Career planning and management. [9]

Directing

Directing: nature and purpose-Motivation and Satisfaction-Motivation theories-job enrichment-definition of leadership-elements of leadership-Leadership styles-leadership theories-Communication-process and barriers to effective communication –role of IT in communication. Organization culture-Elements and types of culture-Managing cultural diversity. [9]

Controlling

Process of controlling-Types of control-Budgetary and non-budgetary control techniques- use of computers and IT in Management control- Maintenance control-quality control-planning operations performance standards-Measurement of performance-Productivity problems and management – direct and preventive control – Remedial actions. [9]

Total hours: 45

Text Book(s):

1	Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall (India)Pvt. Ltd., 12th Edition, 2016
2	JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 8th Edition, 2015.

Reference(s):

1	Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management" Pearson Education, 9th Edition, 2016.
2	Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2012
3	Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill, 2015.
4	Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 2016.

Pre-requisite**: Nil**

Rev. No.4/w.e.f. 02.01.24
Passed in BoS Meeting held on 24/11/23
Approved in Academic Council Meeting held on 23/12/2023

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 HS 004 & Principles of Management	CO1			2		1	3	3	2	3	2	3	2	3	1	1
	CO2			1		2	2	2	1	3	2	3	2	1	3	2
	CO3			2		1	3	3	2	3	3	3	3	1	2	3
	CO4			1		1	2	2	1	3	1	3	2	2	1	2
	CO5			1		1	3	3	1	3	3	3	3	1	2	1

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

50 ME E12 – 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

Objective(s)

- To describe the current energy scenario and basics of steam power plant.
- To infer knowledge on working of nuclear power plant and hydel power plant.
- To apply the concept of diesel power plant and gas turbine power plant.
- To utilize renewable energy sources in power plants.
- To apply the principles in power plant economics.

Course Outcomes

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

CO1: Demonstrate the layout, construction and working of the components inside a thermal power plant.

CO2: Recognise the basic knowledge on nuclear processes and working of nuclear and hydel power plants with their layouts.

CO3: Apply the working principle of gas and diesel power plants.

CO4: Illustrate the layout, construction and working of the components inside renewable energy power plants.

CO5: Realise the various terminologies behind power plant economics and electricity cost estimation.

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

Energy scenario and steam power plant

Indian and Global energy scenario, environmental issues of present day power generation. Steam power plant- Layout of steam power plant – Selection Criteria – Fuel and Ash Handling systems. Pulverisers – Stokers – Types – Dust collectors and cooling towers. [9]

Nuclear and Hydel Power Plants

Nuclear Energy- Fuels and Nuclear reactions – Components and Layout of nuclear power plant – 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 hydel plants. [9]

Gas Turbine and Diesel Power Plant

Layout of Gas Turbine Power Plant- Selection criteria – Reheating – Regeneration and Intercooling – Combined – gas and steam – Integrated gasifier based combined cycle system (IGCC). Diesel Power Plant: Selection Criteria – Layout of Diesel power plant – application and advantages. [9]

Non-Conventional Power Plants

Layout and components: Magneto Hydro Dynamic (MHD) power plant – Geothermal power generation, Dry steam, flash steam, and binary cycle–Ocean thermal energy conversion (OTEC)–Tidal power generation–Wind energy power generation–Solar photo voltaic (SPV)–Bio-solar cells–Solar energy harvesting trees. [9]

Power Plant Economics

Cost of electric energy – Load duration curves – Fixed and operating Cost – Energy Rates – Types of tariffs – Economics of load sharing, comparison, Selection and economics of various power plants, Energy Auditing – Types, Energy auditing for Thermal Power Plant-Waste heat recovery techniques – Types. [9]

Total Hours: 45

Rev. No.4/w.e.f. 02.01.24
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Text Book(s):	
1	Arora, S. C., and Domkundwar, S., "A course in Power Plant Engineering", 8th Edition, Dhanpatrai Publications Ltd., New Delhi, 2016.
2	EI- Wakil, M, M. "Power Plant Technology", 1st edition, Tata McGraw-Hill, New Delhi, 2017.
Reference(s):	
1	Rai,G.D. "Introduction to Power Plant Technology", 11th reprint, Khanna Publishers, 2013.
2	Hegde, R K., "Power Plant Engineering", 1st edition, Pearson education India, New Delhi, 2015.
3	Rajput R.K., "Power Plant Engineering", 4th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016.
4	Nag, P K., "Power Plant Engineering", 4th edition, Tata McGraw-Hill, New Delhi, 2014.

Pre-requisite**: Thermal Engineering**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E12 &Power Plant Engineering	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	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018							
50 ME E13 – Rapid Prototyping							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
Objective(s)	• To study the fundamental theory behind RP process. • To acquire the basic concept of different software used in rapid prototyping systems. • To impart knowledge on CAD modelling technique • To be familiar with the characteristics of the different materials those are used in Additive Manufacturing. • To expose the emerging trends and applications of Additive Manufacturing technology						
Course Outcomes	**At the end of the course, the students will be able to** CO1: Demonstrate various material processes and additive manufacturing systems CO2: Deliver the concepts, fabrication and analysis of manufacturing components through Rapid prototyping technique. CO3: Elucidate the working principles and parameters involved in Rapid prototyping methods. CO4: Reveal the methods of rapid tooling. CO5: Expose the skills on programming and software knowledge of RPT.						
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.							
Introduction to Rapid Prototyping Need for the time compression in product development, History of RPT systems, Survey of applications, Growth of RPT industry and classification of RPT systems. [9]							

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Rapid Prototyping Methods

Fused deposition Modeling (FDM): Principle, Process Parameters, Path generation, Applications. Solid Ground Curing: Principle of operation, Machine details, Applications. Stereo Lithographic Resin (SLR) systems: Process parameters, Process details, Data Preparation, Data files, and Machine details, Applications. Selective Laser Sintering (SLS): Types of machines, Principle of operation, Process parameters, Data preparation for SLS, applications. Laminated Object Manufacturing (LOM): Principle of Operation, LOM materials, Process details, Applications. [9]

Concept Modelers

Concept modelers – Principle, Thermo jet printer, Sander's model market, 3-D Printer, Genisys Xs Printer, JP system 5, Object Quadra System. Laser Engineered Net Shaping (LENS) – Principle-applications. [9]

Rapid Tooling

Indirect Rapid Tooling- Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, etc., Direct rapid tooling- Direct Accurate clear epoxy solid injection molding (AIM), Quick cast Process, Copper polyamide, Rapid Tools, Direct metal laser sintering (DMLS), ProMetal, Sand Casting Tooling, Laminate tooling, Soft tooling v/s Hard tooling. [9]

Software for Rapid Tooling

STL Files, Over view of Solid view, Magics, mimics, magics communicator, etc, Internet based softwares, Collaboration tools. Rapid Manufacturing- Process optimization – Factors influencing accuracy, Data preparation Errors, Part building Errors, Errors in finishing, Influence of part orientation. Allied process – Vacuum Casting, SurfaceDigitizing, Surface Generation from point cloud, Surface modification, data transfer to solid models. [9]

Total Hours: 45

Text Book(s):

1	Chua C.K., Leong K.F. and Lim C.S., "Rapid Prototyping: Principles and Applications", 3rd Edition, World Scientific, New Jersey, 2010.
2	Pham D.T. and Dimov S.S., "Rapid Manufacturing", 1st Edition, Springer-Verlag, London, 2011.

Reference(s):

1	Frank W. Liou, "Rapid Prototyping and Engineering Applications", CRC Press, 2008.
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	Frank W. Liou, "Rapid Prototyping and Engineering Applications", CRC Press, 2008

Pre-requisite: **Basic knowledge of Manufacturing Technology and CAD/CAM**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E13 &Rapid Prototyping	CO1	3	3							2						2
	CO2	3	3			1				2			3			2
	CO3	3	3			1							2			2
	CO4	3	2			1							2			3
	CO5	2	2			1				2			2			2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME E14 – 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

Objective(s)	• 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 objectives of product design and the requirements of a good product design. • To know the concept of design for manufacturing, assembly and environment. • To learn the concepts of design for environment.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognise the knowledge on design principles for manufacturing. CO2: Express knowledge on form design and forgings. CO3: Interpret component design by considering machining. CO4: Develop knowledge on component design by considering casting. CO5: Observe and respond Environmental and safety issues for design.

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

Introduction

General design principles for manufacturability – strength and mechanical factors, mechanisms selection, evaluation method, Process capability – Feature tolerances, Geometric tolerances –Assembly limits –Datum features – Tolerance stacks. [9]

Factors Influencing Form Design

Working principle, Material, Manufacture, Design- Possible solutions – Materials choice – Influence of materials on form design – form design of welded members, forgings and castings. [9]

Component Design – Machining Consideration

Design features to facilitate machining–drills–milling cutters–keyways–Doweling procedures, counter sunk screws–Reduction of machined area-simplification by separation–simplification by amalgamation–Design for machinability–Design for economy–Design for clampability–Design for accessibility–Design for assembly. [9]

Component Design – Casting Consideration

Redesign of castings based on Parting line considerations – Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design – Modifying the design-Computer Applications for DFMA. [9]

Design for the Environment

Introduction – Environmental objectives – Global, Regional and local issues – Basic Design for Environment (DFE) methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment – Weighted sum, Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly, recyclability, remanufacture and energy efficiency – Design to regulations and standards. [9]

Total Hours: 45

Text Book(s):

1. Boothroyd, G, Heartz and Nike, "Product Design for Manufacture", 3rd Edition, Marcel Dekker, New York, 2002.
2. Kevien Otto, Kristin Wood, "Product Design", 2nd Edition, Indian Reprint, Pearson Education, 2004.

Reference(s)

1. Boothroyd, G, "Design for Assembly, Automation and Product Design", 2nd Edition, Marcel Dekker, New York, 2002.
2. Fixel, J. "Design for the Environment", 2nd Edition, McGraw-Hill International Edition, New York, 2012.
3. Bralla, J G, "Design for Manufacture Handbook", 2nd Edition, McGraw-Hill International Edition, New York, 2013.
4. Chitale, A.K, and Gupta, R.C., "Product Design and Manufacturing",3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

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Pre-requisite: **Manufacturing Processes, Machining Processes**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E14 & Product Design for Manufacturing	CO1	3	3	2	3	3			3					3	2	3
	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME E15 – Instrumentation and Control								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100
Objective(s)	• To analyse the performance of transducers • To realize the different methods of system representation. • To describe necessary knowledge in the time domain response • To apply the knowledge in obtaining the open loop and closed loop frequency responses • To apply the concept of stability and methods of stability analysis							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyze the static and dynamic characteristics of transducers. CO2: Identify the basic elements, derive the transfer function of a system and overall gain of the system. CO3: Analyze the system in time domain with different test inputs. CO4: Analyze the performance of the system in frequency domain CO5: Construct the root locus and Routh-Hurwitz array to analyses the stability and design the suitable compensator for the given performance criteria.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Basics of Transducers Classification of Transducers– Static characteristics– Dynamic characteristics: Generalized performance of systems, Zero-order systems, Responses of First-order systems and Second-order systems for Impulse, Step, Ramp and Sinusoidal test inputs [9]								
Systems and their Representation Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical system– Block diagram reduction – Mason's Gain formula –Signal flow graphs. [9]								
Time Response Analysis Review of Time response of zero, first and second order systems – Performance criteria – Error constants – Generalized error series – P, PI and PID controller. [9]								
Frequency Response Analysis Frequency domain specifications: peak resonance, resonant frequency, bandwidth and cut-off rate – Correlation between time and frequency responses for second order systems – Polar plot – Bode plot – Gain Margin and Phase Margin. [9]								
Stability of Control System Characteristic equation – Routh Hurwitz criterion – Root locus construction – Nyquist stability criterion – Lag, lead and lag-lead networks – Lag/Lead compensator design using Bode plots. [9]								
Total Hours: 45								
Text Book(s):								

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1.	Sawhney, A K., “Electrical & Electronic Measurements and Instrumentation”, Dhanpath Rai& Co (P) Ltd, 2015.
2.	Nagrath, I J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers, 2018.
Reference(s)	
1.	Kalsi, H S., “Electronic Instrumentation”, Tata McGraw Hill, 2017.
2.	Gopal, M., “Control Systems, Principles & Design”, 3rd edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2014.
3.	Patranabis D., “Instrumentation and Control”, Prentice Hall India Learning Private Limited, 2011.
4.	Padma Raju, D. and Reddy, Y.J., “Instrumentation and Control Systems”, McGraw Hill India, New Delhi, 2016.

Pre-requisite: **Electrical and Electronics Engineering**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E15 & Instrumentation and Control	CO1	3	1	2	1						1	1	2	2	3	2
	CO2	3	2	1	2						1	1	2	2	3	2
	CO3	3	2	1	2						1	1	2	2	3	2
	CO4	3	2	2	2						1	1	2	2	3	2
	CO5	3	3	3	3						1	2	2	2	3	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 MA 014 – Numerical Methods

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

Objective(s)

- To get exposed to various iteration techniques involved in solving the system of equations
- To understand and apply the concepts of interpolation
- To handle large datasets using interpolation
- To solve initial value problems of ordinary differential equations numerically
- To solve numerically partial differential equations of parabolic, elliptic and hyperbolic types with appropriate boundary and initial conditions encountered in engineering design

Course Outcomes

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

CO1: Analyze various iteration techniques to solve the algebraic, transcendental and linear equations

CO2: Apply various interpolation methods and finite difference concepts

CO3: Compute the numerical differentiation and integration whenever and wherever routine methods are not applicable.

CO4: Compute the solution for initial value problem using single and multi-step methods.

CO5: Apply different methods to evaluate the partial differential equations through the theory of Finite differences.

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

Solution of Equations and Eigen Value Problems

Linear interpolation methods (method of false position) - Newton’s method - Statement of Fixed Point Theorem - Fixed pointer iteration x=g(x) method - Solution of linear system of Gaussian elimination and Gauss- Jordan methods - Iterative methods: Gauss Jacobi and Gauss – Seidel methods- Inverse of a matrix by Gauss- Jordan method. Eigen value of a matrix by power methods. [9]

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Interpolation and Approximation
Lagrangian Polynomials - Divided difference - Interpolation with a cubic spline - Newton forward and backward difference formulae. [9]

Numerical Differentiation and Integration
Derivatives from difference table - Divided difference and finite difference - Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules - Romberg's method - Two and three point Gaussian quadrature formulas - Double integrals using trapezoidal and Simpson's rules. [9]

Initial Value Problems for Ordinary Differential Equations
Single step Methods: Taylor Series and methods - Euler and Modified Euler methods - Fourth order Runge- Kutta method for solving first and second order equations - Multistep methods –Milne's and Adam's predictor and corrector methods. [9]

Application of Boundary Value Problems
Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation by implicit and explicit methods - one dimensional wave equation and two dimensional Laplace and Poisson equations. [9]

Total Hours: 45

Text Book(s):

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi.2002.
2. Kandasamy, P.Thilakavthy, K and Gunavathy, K., "Numerical Methods", S.Chand and Co. New Delhi, 1999.

Reference(s)

1. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1999.
2. Venkatraman M.K, "Numerical Methods" National Pub. Company, Chennai, 1991.
3. Sankara Rao K., "Numerical Methods for Scientists and Engineers", 2nd Ed. Prentice Hall India, 2004.
4. Subramaniam N., "Numerical Methods", SCM Publications, Erode -1.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 MA 014 & Numerical Methods	CO1	3	3	3	3	3							2	3		
	CO2	3	3	3	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		

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 CS 014 - Object Oriented Programming

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

Objective(s)

- To enable the students to learn how C++ supports object Oriented properties
- To create and use classes, objects, constructors and destructors for specific applications
- To learn how inheritance and virtual functions implement dynamic binding with polymorphism.
- To learn how to design and implement generic classes with C++ templates.
- To learn how to use exception handling in C++ programs.

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognize the principles of object-oriented problem solving and programming CO2: Implement the concept of classes and objects CO3: Analyze the concept of reusability and compile time polymorphism CO4: Recognize the concept of dynamic memory allocation and runtime polymorphism CO5: Identify the uses of generic programming and exception handling

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

Introduction to C++ and Functions

Evolution of C++ - Concepts of OOP – Advantages of OOP, Basics of C++: Structure of a C**++** Program**–** Streams in C++ and Stream Classes – Unformatted Console I/O Operations, C++ Declarations, Functions: Return by Reference –Default Arguments – Const arguments – Inline Functions – Function Overloading. [9]

Suggested Activities:

Knowing the concepts of OOPS, structure of OOPS.
Developing simple programs in C++ basics, functions and its types

Suggested Evaluation Methods:

Checking output of programs implemented
Group Discussion on OOPS features and difference between C and C++
Quiz for the above topics.

Classes and Objects, Constructors and Destructors

Classes in C++ - Declaring Objects- Access Specifiers and their Scope – Defining Member Functions – Static Members – Array of Objects – Object as Function Arguments – Friend Function and Friend Classes, Constructors and Destructors: Characteristics – Parameterized Constructor – Overloading Constructor – Copy Constructor – Dynamic Initialization Constructor – Destructors. [9]

Suggested Activities:

Simple programs using classes and objects, static members
Implementation of simple programs using constructor and destructor
Implementation of simple programs using friend functions and classes, array of objects

Suggested Evaluation Methods:

Quiz for the above activities.
Checking output of programs implemented
Group Discussion for the above activities

Inheritance, Compile Time Polymorphism and Type Conversion

Inheritance: Reusability – Types of Inheritance – Abstract Classes – Object as Class Member, Operator Overloading: Rules for Operator Overloading – The Keyword Operator –Unary and Binary Operators Overloading-Overloading using Friend Function – Type Conversion. [10]

Suggested Activities:

Implement inheritance and its types in C++ program
Implement compile time polymorphism and unary,binary operator overloading concept in C++ program.

Suggested Evaluation Methods:

Quiz for the above activities.
Checking output of programs implemented
Group discussion on overloading using friend Function and type conversion

Pointers, Memory Models, Binding and Polymorphism

Pointers: Pointer to Class – Pointer to Object – void, wild and this Pointers – Pointer to Constant and Constant Pointers, Memory Models: Dynamic Memory Allocation – Heap Consumption – Dynamic Objects, Polymorphism: Binding in C++ - Pointer to Base and Derived class objects – Working with Virtual Functions – Pure Virtual Functions – Object Slicing – Virtual Destructor. [9]

Suggested Activities:

Develop simple programs using pointers and its types
Develop simple programs using virtual functions

Suggested Evaluation Methods:

Quiz for the above activities.
Checking output of programs implemented
Group discussion on pure virtual function and virtual destructor.

Generic Programming with Templates, Exception Handling

Class Templates – Function Templates – Exception Handling: Principles of Exception Handling – try, throw and catch keywords – Re-throwing Exception – Specifying Exception. [8]

Suggested Activities:

Develop simple programs on class template and function template.
Develop simple programs using exceptional handling and its types.

Suggested Evaluation Methods:

Quiz for the above activities.
Checking output of programs implemented
Group discussion on Exceptional handling Concepts

Total Hours: 45

Text Book(s):

1. Ashok N. Kamthane, “Programming in C++”, Pearson, Second Edition, 2016.
2. Herbert Schildt, “The Complete Reference C++”, Fourth Edition, McGraw-Hill Education, 2013.

Reference(s)

1. Bjarne Stroustrup, “The C++ programming language”, Addison Wesley, 2013.
2. Venugopal K.R., Rajkumar Buyya, “Mastering C++”, Second Edition,McGraw-Hill Education, 2013.
3. Rajesh K. Shukla, ”Object-Oriented Programming in C++”, Wiley-India Edition, 2008
4. Balagurusamy, E, ”Object Oriented Programming with C++”, Sixth Edition, McGraw-Hill Education, 2013.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 CS 014 & Object Oriented Programming	CO1	3		3	3	1				2		2		3		
	CO2	3		3	3	1				2		2		3		
	CO3	2		3	2					2		2		3		
	CO4	2		3	2									3		
	CO5	3		3	2					2		2		3		

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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51 ME E21 - Gas Dynamics and Jet Propulsion

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

Objective(s)

- To apply the fundamentals of compressible flow.
- To analyse the phenomenon of flow through constant and variable area ducts.
- To study the flow phenomenon through ducts with shock waves.
- To enhance the basic knowledge of jet and rocket propulsion technology.
- To study the performance analysis of jet and rocket propulsion.

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyse the Mach number, velocity of sound and calculate the flow properties. CO2: Analyse compressible flow properties across constant area with friction (without heat transfer) and with heat transfer (without friction). CO3: Synthesis the shock analysis across variable and constant area geometry. CO4: Apply the concept of jet propulsion and performance of jet engines. CO5: Apply the concept of rocket propulsion and performance of rocket engines.

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

Basic Concepts and Isentropic Flow

Fundamentals of compressible flow - Energy and momentum equations for compressible fluid flow- various regions of flow - reference velocities - stagnation states – propagation of sound waves and derivation for velocity of sound - critical states, Mach number, critical Mach number - types of waves - Mach cone - Mach angle - effect of Mach number on compressibility . [9]

Flow Through Ducts

Isentropic flow through variable area ducts - nozzle and diffuser flow - Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties. [9]

Flow With Normal and Oblique Shock

Governing equations - variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock - Prandtl - Meyer equation, flow in convergent and divergent nozzle with shock - normal shock in Fanno and Rayleigh flow - Impossibility of Shock in Subsonic Flows, flow with oblique shock (elementary treatment only) [9]

Air Craft Propulsion Systems

Aircraft propulsion – types - ram jet, turbojet, turbofan and turbo prop engines - performance of turbo jet engine – thrust, thrust power, propulsive and overall efficiencies. [9]

Rocket Propulsion Systems

Rocket propulsion – Classification of rocket engines – Propellants: solid and liquid propellants, rocket engine performance - Flow through rocket nozzles – mass ratio and propellant mass fraction. [9]

Total Hours: 45

Text Book(s):

1.	Yahya S.M., “Fundamental of Compressible Flow”, New Age International Ltd., New Delhi, 6th Ed., 2018.
2.	John D. Anderson, “Modern Compressible Flow”, McGraw Hill Education, 3rd edition, 2017.

Reference(s)

1.	Rathakrishnan E., “Gas Dynamics”, Prentice Hall of India, New Delhi, 6th edition, 2017.
2.	Ganesan V., “Gas Turbines”, McGraw Hill Education, New Delhi, 3rd edition, 2017.
3.	Saravanamuttoo, H.I.H., Rogers, G.F.C., Cohen H. and Andrew Nix, “Gas Turbine Theory”, 7th Edition, Pearson Education, 2017.
4.	Ahmed F.El-Sayed, “Aircraft Propulsion and Gas Turbines Engines”, 2nd Edition, CRC Press, 2017.

Data Book(s):

1.	Yahya S.M. “Gas Tables for Compressible Flow Calculations”, New Age International Publishers, New Delhi, 8th edition, 2018.

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
51 ME E21& Gas Dynamics and Jet Propulsion	CO1	3	3	1	3	2							1	1	1	3
	CO2	3	3	1	3	2							1	1	1	3
	CO3	3	3	2	3	2							1	1	1	3
	CO4	3	3	3	3	2	3	2					1	2	2	3
	CO5	3	3	3	3	2	3	2					1	2	2	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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51 ME E23 – 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

Objective(s)	• 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.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Demonstrate an understanding of basics of biomechanics, human tissues and their mechanical properties. CO2: Explain the mechanical properties of human tissues based on their design, purpose, and structure of the basic constituents. CO3: Recognize the active muscle and its sliding filament theory. CO4: Analyse and quantify linear and angular characteristics of motion. CO5: Analyse and assess different mobility problems in a joint.

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

Introduction to Biomechanics

Basic Terminology – Nine Fundamentals of Biomechanics, Nine Principles for application of Biomechanics-anatomical description – Bio composites for spinal implants, bone repair – Bio compatibility of Bio composites - Mechanical properties of soft tissues, bones and muscles. [9]

Biomechanics of Tissues and Structures of the Musculoskeletal System

Biomechanics of Bone, Biomechanics of Articular Cartilage, Tendons and Ligaments, Peripheral Nerves and Spinal Nerve Roots, Skeletal Muscle. [9]

Biomechanics of Active Muscle

Muscle force production and transmission, Functional relations, History effects in muscle mechanics, Hill's model, sliding filament theory. Muscle coordination – Problem of motor redundancy – Approach to studying muscle force production using optimization (forward and inverse) [9]

Biomechanics of Human Motion

Linear kinematic and kinetic aspects of human movement, angular kinematic and kinetic aspects of human movement, equilibrium and human moment, biomechanics of Gait. [9]

Bio-mechanics of Joints

Knee, Hip, Foot and Ankle, Lumbar Spine, Cervical Spine, Shoulder, Elbow, Wrist and Hand.implant material. [9]

Total Hours: 45

Text Book(s):

1. Susan J Hall, "Basic Biomechanics", 6th 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", 2nd Edition, London, Springer- Verlag, 2015.

Reference(s)

1. Margareta Nordin, Victor H Frankel, "Basic Biomechanics of the Musculoskeletal System", 4th Edition, Lippincott Williams and Wilkins, Philadelphia, 2001.
2. Ozkaya, Nihat, Nordin Margareta, "Fundamentals of Biomechanics: Equilibrium, Motion and Deformation" 2nd Edition, Springer,NewYork, 2009.
3. Duane Knudson, "Fundamentals of Biomechanics" 2nd Edition, Springer Science & Business Media, NewYork, 2007.
4. Luigi Ambrosio,"Biomedical Composites", Woodhead publishing Ltd., New Delhi, 2010.

Pre-Requisite: **Engineering Mechanics and Mechanical Energy**

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
51 ME E23 & Bio-Mechanics	CO1	3	2	2	1								2	2		3
	CO2	3	2	2	1								2	2		3
	CO3	3	2	3	1								2	2		3
	CO4	3	2	3	1								2	2		3
	CO5	3	2	3	1								2	2		3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME E24 – Internal Combustion Engines

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

Objective(s)

- To acquire the principles of operation in IC engines and its components.
- To study the various stages of combustion in SI and CI engines.
- To demonstrate the pollutant formations and its control techniques.
- To identify the alternative fuels in the existing IC engines.
- To study the advanced electronic management system in IC engines.

Course Outcomes

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

CO1: Analyze optimum air-fuel mixture for complete combustion and understand combustion phenomena in SI engines

CO2: Analyze the stages of combustion and knocking phenomenon in CI engine.

CO3: Measure the emission of SI and CI engine and analyses the different methods of emission control mechanism with driving cycles.

CO4: Recognize the electronic engine management system.

CO5: Incorporate the emerging technologies in IC engines.

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

Spark Ignition Engines

Air-fuel ratio requirements, Gasoline Direct Injection Engine – fuel jet size, Stages of combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Thermodynamic analysis of SI Engine combustion process. [9]

Compression Ignition Engines

Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Thermodynamic Analysis of CI Engine Combustion process. [9]

Engine Exhaust Emission Control

Formation of NO_X, HC/CO mechanism, Smoke and Particulate emissions, Greenhouse effect, Methods of controlling emissions, Selective catalytic converter and Particulate Trap, Emission measuring equipment's, Indian Driving Cycles. [9]

Engine Electronics and Sensors

Working of MPFI & CRDI – Sensors – Types - manifold absolute pressure (MAP) sensor, knock sensor, mass air flow (MAF) sensor, Temperature sensors, coolant and exhaust gas sensor, exhaust oxygen level sensor – position sensors: throttle position sensor, accelerator pedal position sensor and crank shaft position sensor – Air mass flow sensor. [9]

Recent Technology in IC Engines

Stratified Charge Engine, Lean Burn Engine, Low Heat Rejection Engine, Surface Ignition Engine, Homogeneous Charge Compression Ignition Engine, Premixed Charge Compression Ignition Engine, Reactive Charge Compression Ignition Engine, Data Acquisition System and combustion analysis in Engines. [9]

Total Hours:45

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Text Book(s):	
1.	John B. Heywood, “Internal Combustion Engine Fundamentals", McGraw Hill Company, 2nd edition, New Delhi, 2018.
2.	Ganesan, V., “Internal Combustion Engines”, Tata McGraw Hill Company, 4thedition, New Delhi, 2017.
Reference(s)	
1.	Gupta H.N., “Fundamentals of Internal Combustion Engines”, Prentice Hall India Learning Private Limited, 2nd edition, 2012.
2.	James D.Halderman, "Hybrid and Alternative Fuel Vehicles", Pearson publications, 4th Edition, 2015.
3.	Ramalingam K.K., “Internal Combustion Engines Theory and Practice”, Scitech Publications (India) Pvt. Ltd., Chennai, 3rd edition, 2016.
4.	Rajput, R.K., “Thermal Engineering”, Laxmi Publications (P) Ltd., 10th Edition, 2017.

Pre-requisite: **Thermodynamics, Thermal Engineering**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E24 & Internal Combustion Engines	CO1	3	3		3		3	3		3	2			2	2	
	CO2		3		3		3	3		3	2			2	2	
	CO3	3					2	2						3	3	
	CO4		2		3		2	2		2	3			3	3	
	CO5	2	2		3		3	3		2	3			2	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME E25 –Quality Control and Reliability Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
Objective(s)	• To impart knowledge about statistical quality control and reliability concepts to students. • To equip the students to apply the statistical process control and reliability concepts to improve the quality of products in manufacturing sectors. • To train the students to apply the online and offline quality control and reliability concepts to improve the quality of products. • To equipthe students to analyze the reliability of a product or system. • To train the students to evaluate the reliability of a product or system.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyze quality costs and apply statistical process control techniques. CO2: Prepare control charts for quality control in manufacturing industries. CO3: Apply sampling techniques for quality control. CO4: Apply reliability concepts and solve reliability problems. CO5: Analyze and estimate the reliability of a product or system.							

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

Introduction and Statistical Process Control

Introduction:-Definition of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance, Total quality management concepts, chance causes, assignable causes, Customer-Orientation: Internal & External Customer Concept, Quality costs- Prevention; Appraisal and Failure costs. Analysis techniques for quality costs, Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart. [9]

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Online Quality Control

Statistical concepts in quality ,Normal curve, Control chart for attributes –control chart for non-conforming – p chart and np chart – control chart for nonconformities– C and U charts, Control chart for variables – X bar chart, R chart and σ chart -State of control and process out of control identification in charts, pattern study and process capability studies. [9]

Offline Quality Control

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producers Risk and consumers Risk. AQL, LTPD, AOQL concepts, standard sampling plans for AQL and LTPD- uses of standard sampling plans. [9]

Reliability Concepts

Reliability engineering - fundamentals – Failure rate, failure data analysis, Bathtub curve, Mortality curves concept of burn –in period, useful life and wear out phase of a system, Mean Time Between Failures (MTBF), Mean Time To Failure (MTTF), hazard rate – failure density and conditional reliability-Maintainability and availability – simple problems. [9]

Reliability Estimation

System reliability: Series, Parallel and Mixed configurations, Reliability improvement techniques, use of Pareto analysis – design for reliability – redundancy unit and standby redundancy- fault tree analysis – FMEA analysis, Optimization in reliability – Product design – Product analysis – Product development –Product life cycle. [9]

Total hours: 45

Text Book(s):

1. Douglas.C. Montgomery, "Introduction to Statistical Quality Control", 7th edition, John Wiley 2012.
2. Srinath. L.S., "Reliability Engineering", 4th Edition Affiliated East West Press, 2011.

Reference(s)

1. Besterfield D.H., "Quality Control", 8th edition, Prentice Hall, 2009.
2. Connor, P.D.T.O., "Practical Reliability Engineering", 5th edition, Wiley India, 2012.
3. Grant, Eugene .L "Statistical Quality Control", TMH, 2005.
4. John.S. Oakland. "Statistical Process control", Elsevier Butterworth-Heinemann, 2008.
5. Monohar Mahajan, "Statistical Quality Control", DhanpatRai & Sons 2016.

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E25 &Quality Control and Reliability Engineering	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	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 CS E25– Python Programming								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	40	60	100
Objective(s)	• To know basic programming in Python • To understand modules and handle exceptions • To learn object oriented programming concepts • To connect database and network through programming • To create layouts using graphical tools							

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the basics of Python programming for problem solving CO2: Develop programs using package and handling exceptions CO3: Implement object oriented programming concepts using Python CO4: Design layouts with GUI toolkits using Tkinter CO5: Deploy database management for implementing DB connectivity and expel network programming

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

Introduction to Python

Introduction to Python –Strings –List–Tuples –Dictionaries–Basic Operators–Decision Making statements – Looping statements -File Input and Output [09]

Modular Design and Exception Handling

Modules in Python –Creation of modules -Namespaces –Importing modules –Loading and Execution ; Program Routine –Functions –Parameter Passing -Types –Recursion ; Exceptions –Types –Handling Exceptions-User Defined Exceptions. [09]

Object Oriented Programming

ObjectOrientedProgramming–ClassandObjects–DataAbstraction-Encapsulation–Inheritance–Polymorphism –Implementation. [09]

Database Connectivity and Network Programming

Introduction to database –Relational Databases : Writing SQL statements; Defining tables; Setting up a Database – Python database APIs –Network Protocols –Socket Programming –Client Server Program –Chat Application. [09]

GUI Programming and Graphics

GUI Programming toolkits –Introduction to Tkinter –Creating GUI widgets –Resizing –Configuring widget options – Creating Layouts –Radio buttons –Check boxes –Dialog boxes –Drawing using Turtle. [09]

Total hours: 45

Text Book(s):

1. James Payne, —Beginning Python –using Python 2.6 and Python 3.1, Wiley India Pvt Ltd, 2010
2. Charles Dierbach, —Introduction to Computer Science using Python, Wiley India Pvt Ltd, 2015

Reference(s)

1. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education, 2013.
2. John Paul Mueller, “Beginning Programming with Python”, Wiley India Pvt Ltd, 2014.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, “Learning with Python”, Dream Tech Press, 2015.
4. Dr. R. Nageswara Rao “Core Python Programming”, Dream Tech Press, Second Edition,2018

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 CS E25 & Python Programming	CO1	3	3	3	2	2							2	3	3	3
	CO2	3	3	3	2	2							2	3	3	3
	CO3	3	3	3	2	2							2	3	3	3
	CO4	3	3	3	2	2							2	3	3	3
	CO5	3	3	3	2	2							2	3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME E31 - Process Planning and Cost Estimation								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Objective(s)	• To recognize the traditional process planning and methods of computer aided process planning • To impart knowledge on importance of estimation and costing • To study the various elements of costs and depreciation methods • To estimate the cost incurred for various manufacturing methods. • To analyse the concept of budgeting and decision making.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Create a process plan for a given product CO2: Describe the importance and objectives of cost estimation and costing CO3: Explain the various cost components involved in cost estimation and allocate the overhead cost to different jobs CO4: Estimating the costing for different machining and manufacturing process CO5: Describe the concept of budgetary control

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

Process Planning

Introduction - Types of production, importance of process planning - Steps involved in manual experienced process planning -Need for CAPP -Retrieval/ Variant and Generative approaches of CAPP- Production drawing- limits, fits, tolerance, Surface Roughness and Process Sheet- Case Study in process planning. [12]

Estimation and Costing

Estimating - Importance, aims, function of estimating - Constituents of estimation - Estimating procedure - Sources of errors - costing - Aims of costing - Costing procedure - Methods of costing - Advantages of efficient costing - Difference between estimating and costing. [12]

Elements of Costs

Price determination - Elements of costs - Ladder of cost - Material cost - Determination of direct material cost - Labour cost - Determination of direct labour cost- over heads - Classification of overhead expenses - Depreciation- Methods of depreciation - Allocation of overhead expenses. [12]

Cost Estimation

Estimation of machining time and cost -- Lathe operations, Milling, Grinding, Planning & shaping operations. Estimation in welding shop: Arc welding, Gas Welding, Flame cutting- Estimation of forging operations: Forging losses- Estimation in Foundry shop: pattern making, moulding. [12]

Cost Economics

Budget - Essentials of budgeting - Types of Budgets - Budgetary control - Objectives - Benefits - Measures of cost economics - Make or buy decision and Analysis. [12]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):

1. Narang G B S. and Kumar, V., “Production and Costing”, 4th Edition, Khanna Publishers, New Delhi 2013.
2. Banga T R., and Sharma, S C., “Mechanical Estimating and Costing Including Costing”, 16th Edition, Khanna Publishers, New Delhi.2006

Reference(s)

1. Adithan M and Pabla, B S., “Production Engineering Estimating and Costing”, Konark Publishers Pvt. Ltd., New Delhi, 2007
2. Chitale, A K., and Gupta, R C., “Product Design and Manufacturing”, 6th Edition, Prentice Hall Pvt. Ltd., New Delhi, 2015.
3. Nanua Singh, “System approach to Computer Integrated Design and Manufacturing”, Wiley publications, New Delhi, 2013.
4. Joseph G.Monks, “Operations Management, Theory & Problems”, 2nd Edition, McGraw Hill Book Company, 2006.
5. Hariprasad, “Mechanical Estimating and costing”, Khartna Publishers, 2005.

Pre-requisite: Nil

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OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E31 & Process Planning and Cost Estimation	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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51 ME E32 – Flexible Manufacturing System								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Objective(s)

- To acquire the role of flexible manufacturing systems (FMS) in manufacturing
- To impart knowledge on processing stations and data base
- To learn the concept computer-controlled simulation software
- To demonstrate the concept of Group Technology
- To realize automatic manufacturing systems and factory of the future.

Course Outcomes

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

CO1: Explain the various products in the production system and interpret the scheduling system.
CO2: Select appropriate type of computer control and software for the production system.
CO3: Apply the various simulation techniques to FMS and use data base techniques.
CO4: Describe the tool management technology and processing stations of Production system.
CO5: Design the FMS installation philosophy and Characteristics for factory future.

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

Planning, Scheduling and Control of Flexible Manufacturing Systems

Limitations with conventional manufacturing - Introduction to FMS – Development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility - Single product, N-product, Single batch, N-Batch scheduling problem – Modelling of N operations in M machines – Knowledge based scheduling system - computerized production scheduling system. [12]

Computer Control and Software for Flexible Manufacturing Systems

Introduction – Composition of FMS – Hierarchy of computer control – Computer control of work center and assembly lines – FMS supervising computer control. Types of software – specification and selection – trends. [12]

FMS Simulation and Data Base

Application of simulation – Model of an FMS – Simulation software –Manufacturing data systems – Data flow – CAD/CAM considerations in planning the FMS data base – FMS database systems – Planning for FMS database. Distributed data processing in FMS –DBMS and their applications in CAD/CAM and FMS – distributed systems in FMS -Integration of CAD and CAM - Part programming in FMS, tool data base - Clamping devices and fixtures data base. [12]

Management technology and Processing stations

Tool Management - tool magazine - Tool preset – identification - Tool monitoring and fault detection – routing - Production Planning and Control - Salient features Machining Centres -Turning centre - Coordinate measuring machine (CMM) - Introduction - Wash Station and Operation Description - Deburring Station and Operation Description - Importance of Cleaning and Deburring in Automated Manufacturing

Group Technology and FMS

Introduction – matrix formulation – Mathematical Programming formulation – Graph Formulation – Knowledge based system for Group Technology. Application of possibility distributions in FMS systems justification [12]

FMS Installation and Factory of the Future

FMS Installation - FMS implementation - FMS application in aerospace industries, sheet metal fabrication and prismatic component production. FMS development towards factories of the future – Artificial intelligence and Expert systems in FMS – Design Philosophy and Characteristics for Future. [12]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):	
1	Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 4th edition, Pearson Education India Pvt. Ltd., Noida, India, 2015.
2	Jha N.K., "Handbook of Flexible Manufacturing Systems" Acadamic Press Inc.1991.
Reference(s):	
1	Jain K C., and Sanjay Jain, "Principles of Automation and Advanced Manufacturing Systems" 1st Edition, Khanna Publishers, New Delhi, 2004.
2	Raouf, A. and Ben-Daya, M, "Flexible Manufacturing Systems: Recent Development", Elsevier Science,1995.
3	Kalpakjian S and Steven R Schmid, "Manufacturing engineering and technology", 7th Edition, Pearson Education India Pvt. Ltd., Noida, India, 2014.
4	Radhakrishnan P. and Subramanyan S., "CAD/CAM/CIM", 4th edition, New Age International (P) Ltd., New Delhi, 2016.

Pre-requisite: **Manufacturing Processes, Machining processes**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
51 ME E32 & Flexible Manufacturing System	CO1	3	2	3	3			3		3		2		3		2
	CO2	3	3			3				3				3	3	3
	CO3	3	3			3		3						3		3
	CO4	3	3			2				3		3		3	3	3
	CO5	3	3			2				3				1	2	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous							**R 2018**
51 ME E35 - Design of Jigs, Fixtures and Press Tools							
Semester	Hours / Week			Total hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
Objective(s)	• To apply the principles of locating and clamping elements for machining operations. • To apply the principles, functions and design practices of Jigs and fixtures. • 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.						

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Select the locating methods, clamping devices and design jigs for automatic drill and rack and pinion. CO2: Design and develop the jigs for given component for lathe, milling, grinding, planning and welding process. CO3: Compute and select the capacities and tonnage of press for various processes and standard die sets for strip layout. CO4: Design and develop the dies for blanking, piercing and bending operations, drawing, forging and extrusion operations. CO5: Describe the sheet metal forming techniques and analyze using computer aids.

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

Locating and Clamping Principles of Jigs and Fixtures

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]

Design of Jigs

Drill Bushes - Classification of Jigs - Automatic Drill Jigs - Rack and Pinion Operated - Air Operated Jigs. Design and Development of Jigs for given Component.

Design of Fixtures

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**.** [12]

Press Working Terminologies and Elements of Dies and Strip Layout

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 - Strip Layout Calculations. [12]

Design and Development of Dies

Design and Development of Progressive and Compound Dies for Blanking and Piercing Operations. Bending Dies - Development of Bending Dies - Forming and Drawing Dies - Development of Drawing Dies. Design Considerations in Forging, Extrusion, Casting and Plastic Dies. [12]

Other Forming Techniques

Bulging, Swaging, Embossing, Coining, Curling, Hole Flanging, Shaving and Sizing, Fine Blanking Dies - 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]

Total Hours: 30 (Lecture:30 + Hands on Training:30)

Text Book(s):

1	Edward G Hoffman, “Jigs and Fixture Design”, 5th Edition, Thomson – Delmar Learning, Singapore, 2010.
2	Donaldson. C, George H.L., Goold V C and Ghose J., “Tool Design”, 5th Edition, Tata McGraw-Hill, 2017.

Reference(s):

1	Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2	Joshi, P.H., “Jigs & Fixtures”, Third Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2010.
3	Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
4	“Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
5	Design Data - Data Book of Engineers, PSG College of Technology, Kalaikathir Achchagam–Coimbatore, 2012.

Pre-requisite: **Machining Processes**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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Tiruchengode - 637 215.

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
51 ME E35 & Design of Jigs, Fixtures and Press Tools	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

51 ME E36 – 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

Objective(s)

- To provide a thorough background into basic computational fluid dynamics analysis.
- To acquire mathematical characteristics of partial differential equations
- To comprehend the concepts like accuracy, stability, consistency of numerical methods for the governing equations.
- To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.
- To evaluate the numerical experiments and carry out data analysis.

Course Outcomes

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

CO1: Perceive and solve the governing equations numerically of boundary conditions for engineering problems

CO2: Perform the calculations for finite volume method to fluid flow problems

CO3: Evaluate the steady state heat transfer problems numerically and convection diffusion problem in 1D and 2D steady state condition.

CO4: Identify the pressure viscous flow in incompressible flow analysis by use the finite difference method.

CO5: Identify the turbulence model to engineering fluid flow problems with standard codes to develop the CFD models.

Governing Equations and Boundary Conditions

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations - Physical boundary conditions - Classification, Initial and boundary conditions, Initial and boundary value problems - Numerical errors, Grid independence test. [12]

Discretization Methods

Nature of numerical methods - Method of deriving discretization equations - Taylor series formulation – Variational formulation - Method of weighted residuals - Control volume - Formulation. [12]

Heat Conduction, Convection and Diffusion

Steady one-dimensional conduction - Two and Three dimensional conduction- Steady one - dimensional convection and diffusion - Discretization equations for two dimensional convection and diffusion – applications [12]

Incompressible Fluid Flow

Governing Equations - Stream Function – Vorticity method, Determination of pressure for viscous flow - Computation of boundary layer flow - Finite difference approach – applications [12]

Turbulence Models

Algebraic Models – One equation model, K-Є models, High and Low Reynolds number models, Unsteady turbulent model – applications, Prediction of fluid flow and heat transfer using standard codes. [12]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):

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1	Muralidhar K. and Sundararajan T, "Computational Fluid Flow and Heat Transfer ", 2nd Ed., Narosa Publishing House, New Delhi, 2014.
2	Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics", Pearson India 2nd edition, 2009.
Reference(s):	
1	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	John D Anderson, "Computational Fluid Dynamics", McGraw hill Education, 1st Indian edition, 2012.

Pre-requisite: **Fluid Mechanics, Heat Transfer and Numerical Methods**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
51 ME E36 & Computational Fluid Dynamics	CO1	3	3	2	2	1	1	1	1	1	1	2	3	3	1	3
	CO2	3	3	2	2	1	1	1	1	1	1	2	3	3	1	3
	CO3	3	3	2	2	1	1	1	1	1	1	1	3	3	1	3
	CO4	3	3	2	2	1	1	1	1	1	1	1	3	2	1	3
	CO5	3	3	2	2	1	1	1	1	1	1	1	3	2	1	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous							**R 2018**
50 ME E37– Logistics and Supply Chain Management							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100
Objective(s)	• 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 L & SCM. • To exhibit role of Transportation in Logistics and Supply Chain Management system. • To recognize recent trends in Logistics and Supply chain Management system.						
Course Outcomes	**At the end of the course, the students will be able to** CO1: Outline of Logistics and supply chain Management in competitive strategy. CO2: Characterize the warehousing and material handling of Logistics and Sourcing decision in SCM. CO3: Performance measurement of the Logistics and Supply chain management System. CO4: Demonstrate the role of Transportation in Logistics and Supply chain management System. CO5: Describe the future trends in theLogistics and Supply chain management System.						
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.							

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Introduction to Logistics and Supply Chain Management

Definition and Scope of Logistics – Functions & Objectives - factors influencing the network design, framework for network design, models for facility location and capacity allocation, Impact of uncertainty on network design - Evolution of supply chain-essentials of SCM-structure of supply chain, examples-process views-decision phases, issues - aligning supply chain with business strategy –- reverse logistics. [12]

Sourcing Decision and Network design

Warehousing Functions – Types and Site Selection, Layout Design and Costing – Virtual Warehouse, Role of Material Handling in Logistics – Material Storage Systems - Supply chain configuration design - factors involved - sourcing, models for strategic alliances – supplier selection, outsourcing and procurement process - evaluation using simulation models. [12]

Performance Measurement of Logistics and Supply Chain Management System

Framework for strategic alliances – Third Party Logistics(3PL) – 3PL issues and requirements – Retailer – Supplier Partnerships – Issues in Retailer – Supplier Partnerships – Demand forecasting-collaborative forecasting models-bullwhip effect-information sharing - aggregate planning in supply chain - strategies-multi echelon inventory planning-models- discounting- risk pooling. [12]

Transportation

Transportation System Evolution – Infrastructure and Networks, Freight Management, Route Planning, Containerization – Design considerations, Material and Cost, Packaging as Unitization – Consumer and Industrial Packaging and pricing. [12]

Recent Trends inLogistics and Supply Chain Management System

E-Logistics Structure and Operation – Logistics Resource Management, Automatic Identification Technologies – Warehouse Simulation - Role of IT in supply chain -IT infrastructure-CRM-SRM-e-business-RFID-supply chain collaboration. [12]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):

1	Bowersox & Closs, “Logistical Management”, McGraw-Hill Companies, 2017.
2	Sunil Chopra and Peter Meindl, Supply Chain management - Strategy, Planning and Operation, Pearson Education 2018.

Reference(s):

1	David Simchi-Levi, Philip Kaminsky, and Edith Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies", 3rd Edition, McGraw-Hill, 2019.
2	Mohanty, Essentials of Supply Chain Management, Jaico 2018.Publishing House, 2018.
3	Raghuram, G. and Rangaraj, N., Logistic And Supply Chain Management: Cases And Concept, Macmillan India Limited, New Delhi, 2015.
4	Sople Vinod V, “Logistics Management – The Supply Chain Imperative”, Pearson Education, 2014.

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E37 &Logistics and Supply Chain Management	CO1	2	2		1	3	2		3	2		2		1		
	CO2	2	1		1	2	2		3	2		1			1	
	CO3	2	2		2	3	2		3	2		2				2
	CO4	1	1		2	2	1		2	3		1		1		2
	CO5	1	1		2	1	1		2	3		3		1		

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous								R 2018
50 ME E38– Refrigeration and Air conditioning Engineering								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	2	0	2	60	3	50	50	100

Objective(s)	• To describe the concepts of simple vapor compression and absorption refrigeration cycles. • To demonstrate the working principle of various refrigeration systems and properties of refrigerants. • To evaluate the properties of psychometric process by psychometric chart. • To design and estimate the cooling load calculations for various HVAC systems. • To recognize the working principle, understand the energy efficiency and conservation measures in the HVAC systems.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Evaluate the performance of vapour compression and absorption refrigeration system. CO2: Identify the desirable properties of refrigerants and describe the components of refrigeration system (compressors, condensers, evaporators, expansion valve and cooling towers CO3: Perform the calculations for various properties of air for various psychometric processes and to evaluate the effective and grand sensible heat factor for Air conditioning systems. CO4: Identify the elements of a typical heating ventilation and air-conditioning systems and to evaluate the cooling load calculations with various standards. CO5: Elucidate the various components, working, energy performance assessment and applications of air conditioning systems

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

Refrigeration Cycle and Systems

Introduction about Aircraft Air-Conditioning -Basic cycles - Reverse Carnot cycle - Simple Vapor compression cycle (sub-cooling, superheating) - Actual vapour compression cycle - Bell Coleman. Multistage and Multiple evaporator systems - Cascade system -Vapor absorption refrigeration system (Ammonia water and Lithium Bromide water) - Steam jet refrigeration system - COP comparison. [12]

Refrigerants, System Components and Balancing

Compressors: Reciprocating and Rotary (elementary treatment) - Scroll compressors - Condensers - Evaporators - Cooling towers. Refrigerants - Properties - Selection of refrigerants - Alternate Refrigerants - Global warming and Ozone depleting aspects - Refrigeration plant controls - Testing and Charging of refrigeration units. Balancing of system components. Applications to refrigeration systems - ice plant - food storage plants - milk chilling plants – refrigerated cargo ships. [12]

Psychrometry

Psychrometric processes - use of psychrometric charts - Grand and Room Sensible Heat Factors - bypass factor - requirements of comfort air conditioning - comfort charts - factors governing optimum effective temperature - recommended design conditions [12]

Cooling Load Calculations

Types of load - design of space cooling load - heat transmission through building - Solar radiation – infiltration - internal heat sources (sensible and latent) - outside air and fresh air load - estimation of total load - Domestic – commercial - industrial systems - central air conditioning systems. Computerized cooling load calculations- Packages –simulation of psychrometric process-simulation of air flow in AC systems-Computerized calculation Domestic and Industrial cooling. Standards for HVAC system – ASHRAE 55, ASHRAE 62.1, Energy Efficiency standards - ASHRAE 90.1, Energy Conservation Building Code (ECBC) [12]

Air-Conditioning Components and Energy Performance assessment

Air conditioning equipments: air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser – Temperature sensor - Pressure sensors - Humidity sensors - Actuators - Safety controls- cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems. Applications: car – industry – stores - public buildings.- Energy Performance assessment [12]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):

1	Billy C and Langley, "Refrigeration and Air conditioning", 3rd Edition, Engle wood cliffs (NJ), Prentice Hall, 1986.
2	Arora, C P, "Refrigeration and Air Conditioning", 3rd Edition, Tata McGraw-Hill, New Delhi, 2014.
Reference(s):	
1	Roy.J Dossat, “Principles of Refrigeration”, Pearson Education, New Delhi, 2011.
2	Jordon and Prister, “Refrigeration and Air Conditioning”, Prentice Hall of India Pvt Ltd., New Delhi, 1985.
3	Stoecker N F and Jones, "Refrigeration and Air Conditioning", Tata McGraw hill company, New Delhi, 1983.
4	Manohar Prasad, "Refrigeration and Air Conditioning", 3rd Edition, Wiley Eastern Ltd., 2014.
5	BEE Energy Auditor Exam Guide Book-4 Energy Performance Assessment for Equipment and Utility System
6	ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings
7	ASHRAE 55 Thermal Comfort Standard
8	ASHARE 62.1.2016 – Ventilation for Acceptable Indoor Air Quality
9	Energy Conservation Building Code 2017

Pre-requisite**: Thermodynamics, Thermal Engineering, Fluid Mechanics and Heat and Mass Transfer**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E38 & Refrigeration and Air-conditioning Engineering	CO1	3	3	3	2		3	3					3	3	3	
	CO2	3	3	3	3		3	3					3	2	2	
	CO3	3	3	2	3		3	3					3	3	3	
	CO4	3	3	2	3		2	3					3	3	3	3
	CO5	3	3	3	3		2	3					3	3	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PT T01- Creo for 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
Objective(s)	• To provide the fundamental concepts of drawing and elaborating on how to concretize the idea of new structure such as a machine element. • To study the conventions and rules to be followed by engineers for making accurate drawings. • To acquire the basic dimensioning practices that have to be followed in the preparation of drawings. • To provide hands on exposure of mechanism design and simulation using Creo. • To acquire design knowledge on the sheet metal design and advanced surfacing modeling.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Create knowledge about the various practices with regard to the dimensioning, sectioning and development of views. CO2: Realise the importance of the linking functional and visualization aspects in the Preparation of the part drawings CO3: Interpret the machine drawings that in turn help them in the preparation of the production drawings CO4: Crafting knowledge about the various practices with regard to the dimensioning, sectioning and development of views in sheet metal. CO5: Developing knowledge about the various practices with regard to the dimensioning, sectioning and development of views in surface model.							

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

Advance Part Modeling

Advanced Selection Techniques - Advanced Datum Features - Advanced Sketching Techniques - Create advanced holes - Create advanced drafts and ribs - Create advanced shells - Create advanced rounds and chamfers - Use relations and parameters - Create advanced blends - Create sweeps with variable sections - Create helical sweeps - Create swept blends - Advanced Layer Techniques - Advanced reference management techniques - Create family tables - Reuse features - Advanced copy techniques - Create advanced patterns. [15]

Advance Assembly Design

Use advanced component selection - Use advanced assembly constraints - Create and use component interfaces - Utilize intelligent fasteners Extension (IFX) - Create and use flexible components - Restructure and mirror assemblies - Use assembly features and shrink wrap – Replace components in an assembly - Understand the basics of simplified reps - Create cross-sections, display styles, and combined views - Substitute components by reps, envelopes, and simplified reps - Understand advanced simplified rep functionality - Create and use assembly structure and skeletons - Utilize design exploration, extension (DEX). [15]

Sheet Metal Design

Sheet metal Model Fundamentals - Creating Primary Sheet metal Wall Features - Creating Secondary Sheet metal Wall Features - Bending and Unbending Sheet metal Models - Sheet metal Form Features - Modifying Sheet metal Models - Sheet metal Setup and Tools - Detail sheet metal designs. [15]

Advanced Surfacing

Describe surface modeling and its terminology - Create various boundary surfaces - Utilize surface analysis tools - Additional Surface Analysis Tools - Extend and trim surfaces - Manipulate surfaces - Create and edit solid models using surface quilts - Utilize the master model technique - Style Surfacing. [15]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):

1. Sham Tickoo, “PTC Creo Parametric 7.0 for Engineers and Designers”, Revised and updated edition (MISL-DT), Dreamtech Press, 2018.
2. Kelly D.S, Pro / Engineer 3.0 for Engineers and Designers, Mcgraw Hill, 2014.

Reference(s)

1. Creo Work Book,Dysmech Consultancy Servicers Private Limited, Pune, 2016.
2. David S. Kelley, Pro/Engineer wildfire 5.0 instructor, McGraw-Hill,2016
3. Sham Tickoo , Designing with Pro Engineer, Dreamtech Press ,2001
4. Creo Work Book,Dysmech Consultancy Servicers Private Limited, Pune, 2016.

Pre-requisite: Engineering Drawing

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 PT T01 & Creo for Design	CO1	2					1		2		2			2		
	CO2	2					2		2		2			2		
	CO3	2					2		2		1			3		
	CO4	3					3		3		1			3		
	CO5	3					3		3		1			3		

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME E41- Thermal Turbomachines								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100
Objective(s)	• To apply the working principles of different types of turbo machinery. • To recognize the concept of centrifugal and axial flow compressors used in turbo machines. • To explain the stages of combustion phenomenon in gas turbine engines. • To recognize the concept of centrifugal and axial flow turbines used in turbo machines. • To familiarize the working principles of various gas turbine engines and jet engines.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyze the fundamentals of energy transfer using velocity diagram. CO2: Comprehend the working principle of centrifugal and axial flow compressors. CO3: Identify with the combustion phenomena and flame stability. CO4: Design of spool and matching the gas turbine components. CO5: Analyze the various gas turbine engines used in real time applications.							

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

Basic concept of Turbo machines

Energy transfer between fluid and rotor velocity triangles for a generalized turbo machine - Methods of representing velocity diagrams - Euler turbine equation and its different forms - Degree of reaction in turbo-machines – Various efficiencies; Isentropic - Mechanical - Thermal - Polytrophic. [9]

Centrifugal and Axial Flow Compressors

Centrifugal compressor: Configuration and working - Slip factor - Work input factor - Ideal and actual work - Pressure coefficient - Pressure ratio. Axial flow compressor: Geometry and working - Velocity diagrams - Ideal and actual work - Stage pressure ratio - Free vortex theory – Performance curves. [9]

Combustion Chamber

Basics of combustion –Combustion chamber arrangements - Flame stability - Fuel injection nozzles - Swirl for stability - Cooling of combustion chamber – Combustion process simulation studies. [9]

Axial and Radial Flow Turbines

Elementary theory of axial flow turbines: Stage parameters - Multi-staging - Stage loading and flow coefficients - Degree of reaction - Stage temperature and pressure ratios - Single and twin spool arrangements - Performance. Matching of components - Blade cooling - Radial flow turbines. [9]

Gas Turbine and Jet Engine Cycles

Gas turbine cycle analysis: Simple and actual - Reheater, Regenerator and Intercooled cycles. Working principles of Turbojet, Ramjet, Scarmjet and Pulsejet engines - Cryogenics liquid engine cycles – Thrust - Specific impulse – SFC - Thermal and Propulsive efficiencies – Governing mechanism in Gas turbines. [9]

Total Hours: 45

Text Book(s):

1. Khajuria P.R and Dubey S.P., “Gas Turbines and Propulsive Systems”, DhanpatRai Publications, 2014.
2. Ganesan, V., “Gas Turbines”, 3rdedition, Tata Mc GrawHill company, New Delhi, 2012.

Reference(s)

1. Cohen H, Rogers G F C and Saravanamuttoo H I H, “Gas Turbine Theory, 6th Edition, John Wiley & Co, 2009.
2. Philip Hill and Carl Peterson C R, “Mechanics and Thermodynamics of Propulsion”, 2nd edition, Pearson Education India Pvt. Ltd., 1992.
3. Jack Mattingly, “Elements of Gas Turbine Propulsion”, 1st Edition, McGraw Hill Company, New Delhi, 2005.
4. Rolls Royce, “The Jet Engine”, 5th edition, Wiley Publications, 2015.
5. Erian A. Baskharone, “Principles of Turbo machinery in Air-Breathing Engines”, 1st edition, Cambridge University Press, USA, 2006.
6. Onkar Singh, “Thermal Turbomachines”, Wiley Precise Textbook Series, Second Edition, 2019.

Pre-requisite: **Thermal Engineering**

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E41 & Thermal Turbomachines	CO1	3	3	3	3		3	3					3	3	3	3
	CO2	3	3	3	3		3	3					3	3	3	3
	CO3	3	3	3	3		3	2					3	3	3	3
	CO4	3	3	2	3		2	2					3	2		3
	CO5	3	3	2	3		2	2					3	2	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

50 ME E42 – Energy Storing Devices and Fuel Cells

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

Objective(s)

- To describe the types of batteries and its applications.
- To analyse the various types of batteries used in electric vehicles.
- To demonstrate the working principles of fuel cells.
- To analyse the various methods of production of hydrogen.
- To demonstrate the different types of solar cells.

Course Outcomes

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

CO1: Recognise the fundamentals of various types of batteries and its disposal.
CO2: Identify the capacity and types of batteries used in electric vehicles.
CO3: Comprehend the importance of fuel cells and its applications.
CO4: Analyze the various method of production of hydrogen gas and its applications.
CO5: Identify the renewable energy technology for various applications.

Batteries

Characteristics: Voltage – Current – Capacity - Electricity storage density - Power - Discharge rate - Cycle life- Energy efficiency - Shelf life. Primary batteries: **I**ntroduction - Zinc – Carbon - Magnesium – Alkaline- Manganese dioxide - Mercuric oxide - Silver oxide batteries - Recycling/Safe disposal of used cells. [9]

Batteries for Electric Vehicles

Secondary batteries: Introduction - Cell reactions - Cell representations and applications - Lead acid - Nickel - Cadmium and lithium ion batteries - Rechargeable zinc alkaline battery - Reserve batteries: Zinc silver oxide- Lithium anode cell, - Photo galvanic cells. Battery specifications for cars and automobiles – Life cycle analysis of batteries. [9]

Fuel Cells

Importance and classification of fuel cells: Description - Working principle - Components. Applications and environmental aspects of the following types of fuel cells: Alkaline fuel cells - Phosphoric acid - Solid oxide- Molten carbonate and direct methanol fuel cells. [9]

Hydrogen as a Fuel

Sources of hydrogen - Production of hydrogen - Electrolysis - Photo catalytic water splitting - Biomass pyrolysis -Gas clean up - Methods of hydrogen storage; High pressurized gas - Liquid hydrogen type - Metal hydride. Hydrogen as engine fuel. Features application of hydrogen technologies in the future limitations. [9]

Energy and Environmental Applications

Future prospects of renewable energy and efficiency of renewable fuels. Solar Cells: Energy conversion devices - Photovoltaic and photo-electro-chemical cells – photo-bio-chemical conversion cell - Solar waste. Applications – Food preservation - Green house heating. [9]

Total Hours: 45

Text Book(s):

1. B. Viswanathan, M. AuliceScibioh, “Fuel Cells: Principles and Applications”, 1st edition, CRC Press, India, 2008.
2. Frano Barbir, “PEM fuel cells: Theory and practice”, 2nd edition, Elsevier Academic press, 2012.

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Reference(s):	
1.	J. S. Newman and K. E. Thomas-Alyea, “Electrochemical Systems”, 3rd edition, Wiley publications, Hoboken, NJ, 2004.
2.	G. Hoogers, “Fuel Cell Handbook”, CRC press, 2002.
3.	Lindon David, “Handbook of Batteries”, 3rd edition, McGraw Hill company, 2002.
4.	H. A. Kiehne , “Battery Technology Hand Book”, CRC Press, 2003.
5.	Ter Gazarian A, Energy Storage for Power Systems, Institute of Engineering and Technology, 2nd Edition, 2011.

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E42 & Energy Storing Devices and Fuel Cells	CO1	3	3	2	2	1	1	1	1	1	1	2	3	3	3	2
	CO2	3	2	3	2	1	2	2	1	1	1	2	3	3	3	2
	CO3	3	2	3	2	1	2	2	1	1	1	2	3	3	3	2
	CO4	3	2	2	2	1	2	1	1	1	1	1	3	2	3	2
	CO5	3	3	3	2	1	1	1	1	1	1	1	3	2	3	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME E43 - Machine Learning								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100
Objective(s)	• To impart knowledge on artificial intelligence and deep learning in engineering applications • To enlighten the students in the features of linear regression • To distinguish the classification and representation of logistics regression • To learn the different machine learning algorithm • To acquire the necessity and application of machine learning in design and manufacturing domain							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Realize the necessity of artificial intelligence and deep learning in engineering application CO2: Recognize the parameter learning and properties of linear regression CO3: Classify and represent the logistic regression CO4: Infer knowledge on different machine learning algorithm for system design CO5: Comprehend the machine learning concept in design and manufacturing application							

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

Introduction

Definition of Machine Learning – History of Artificial Intelligence – Supervised Learning – Unsupervised Learning – Model Representation - Cost Function - Data Science – Artificial Intelligence and deep learning in engineering applications. [9]

Linear Regression

Parameter Learning - Gradient Descent for Linear Regression - Linear Algebra – Matrices and Vectors, Properties - Multivariate Linear Regression - Gradient Descent for Multiple Variables - Features and Polynomial Regression - Gradient Descent in Practice - Feature Scaling, Learning Rate. [9]

Classification and Representation

Logistic Regression - Classification - Hypothesis Representation - Decision Boundary - Advanced Optimization - Multiclass Classification –Underfitting & Overfitting – Logistic Regression Practice. [9]

Machine Learning Algorithms

Random Forest Algorithm (RFA) – Decision Tree – Bayesian Network, Applications – Support Vector Machine Algorithm (SVR) – Artificial Neural Networks (ANN) – Training Data, Hidden Layers, and Predicted Output-Evaluating a Learning Algorithm - Machine Learning System Design. [9]

Applications of Machine Learning

Text Categorization (spam filtering) – Predictive Text Messaging – Optical Character Recognition – Machine Vision (Object Detection And Colour Identification) – Market Segmentation and Prediction – Locating the Position of End-Effector in Robotic Grasping – Predicting the price of a used car – dynamic pricing applications– Applications in Design and Manufacturing Domain. [9]

Total Hours: 45

Text Book(s):

1.	Tom M. Mitchell, “Machine Learning”, 1st Edition, McGraw Hill Education, New Delhi, 2017.
2.	Oliver Theobald, “Machine Learning For Absolute Beginners: A Plain English Introduction”, 2nd Edition, Scatterplot Press, 2017.

Reference(s)

1.	John D. Kelleher, “Fundamentals of Machine Learning for Predictive Data Anayltics (Algorithms, Worked Examples, and Case Studies)”, 1st Edition, The MIT Press, 2015.
2.	Shai Ben-David and Shai Shalev-Shwartz, “Understanding Machine Learning: From Theory to Algorithms”, 1st Edition, Cambridge University Press, 2014.
3.	Marc Peter Deisenroth, Aldo Faisal A., and Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge University Press, 2020.
4.	Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, 1st Edition, Cambridge University Press, 2012.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E43 &Machine Learning	CO1	3	3	2	3	2						2	2	2	1	2
	CO2	3	3	3	2	3						2	3	2	1	2
	CO3	2	3	3	3	3						3	2	2	1	2
	CO4	3	2	3	3	3						3	2	3	2	2
	CO5	3	2	3	3	3						3	2	3	2	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

50 ME E45 – Non-Destructive Evaluation of Materials

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

Objective(s)

- To make the students to understand the importance of NDT in quality assurance.
- To imbibe the students the basic principles of surface NDE methods, its applications, limitations.
- To equip the students with proper competencies to locate a flaw using thermography and eddy current testing.
- To make the students to be ready to use ultrasonic and acoustic emission techniques.
- To inculcate the knowledge of radiography.

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Course Outcomes	**At the end of the course the students will be able to** CO1: Compare the differences between the various visual inspection techniques and apply the same to the components to be inspected. CO2: Recognise the importance of Penetrant testing in NDT and the procedures involved CO3: Interpret the results obtained from the thermographic technique and Eddy current testing CO4: Evaluate and interpret the results obtained in the Ultrasonic inspection and Acoustic Emission technique CO5: Explain the techniques involved in the Radiography and advancements.

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

Overview of NDT

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT. Visual inspection – Unaided and aided. [9]

Surface NDE Methods

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing - Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism. [9]

Thermography and Eddy Current Testing

Thermography - Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy current testing, Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Interpretation/Evaluation, advantages, Limitations, Applications with few case studies. [9]

Ultrasonic Testing and Acoustic Emission

Ultrasonic Testing - Principle, Transducers, transmission and pulse - echo method, straight beam and angle beam, instrumentation, Data representation: A-scan, B-scan and C-scan. Phased Array Ultrasound - Time of Flight Diffraction. Acoustic Emission Technique - Principle, AE parameters, Applications - Case studies. [9]

Radiography

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy - Xero-Radiography, Computed Radiography, Computed Tomography, Applications with few case studies. [9]

Total Hours: 45

Text Book(s):

1	Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2015.
2	Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edn, New Age International Publishers, 2010.

Reference(s):

1	Paul E Mix, “Introduction to Non-destructive testing:a training guide”, Wiley, New Jersey, 2nd Edition, 2005
2	G. Gaussorgues, “Infrared Thermography”, Chapman & Hall, University Press, Cambridge, 1994.
3	Charles, J. Hellier,“ Handbook of Non-destructive evaluation”, McGraw Hill, New York 2001.
4	ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17

Pre-requisite: **Engineering Materials and Metallurgy**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E45 & Non-Destructive Evaluation of Materials	CO1	3	2	3	3	3						3		3	3	3
	CO2	3	2	3	3	2						3		3	3	
	CO3	3	3	3	3							3		3	3	3
	CO4	3	3	3	3							2		3	3	
	CO5	3	3	3	3	3								3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

50 ME E46 – MEMS Design and Fabrication

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

Objective(s)

- To familiar with the fundamentals, fabrication process and applications of MEMS
- To describe the basic principles of MEMS sensors and actuators
- To design the process flow of a basic MEMS device, such as an inertia sensor (accelerometer), given a fabrication process description.
- To demonstrate the fabrication process through the hands-on activities.
- To apply the microsystems in various industrial applications

Course Outcomes

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

CO1: Assess the scaling laws in microsystems
CO2: Select suitable micro sensors and actuators
CO3: Fabricate microsystems for specific applications
CO4: Design and develop microsystem manufacturing process and packaging
CO5: Develop a design procedure for microproducts

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

Microsystems

Overview-Microsystems-Working principle of Microsystems-Scaling laws- Scaling in geometry– Scaling in rigid body dynamics-Scaling in electrostatic forces-Scaling in electromagnetic forces-Scaling in electricity-Scaling in fluid mechanics-Scaling in heat transfer. [9]

Micro sensors and Actuators

Micro sensors-Micro actuation techniques-Micro pump–Micro motors–Micro valves–Micro grippers-Micro Accelerometers. [9]

Micro System Fabrication

Substrates-Single crystal silicon wafer formation-MEMS materials– Photolithography–Ion implantation-Diffusion-Oxidation-CVD-Physical Vapor Deposition-Deposition by epitaxy–Etching process. [9]

Micro System Manufacturing and Design

Bulk Micro manufacturing-Surface Micro machining–LIGA–SLIGA. Micro system packaging–Materials-Dielevel-Device level-System level-Packaging techniques-Surface bonding–Wire bonding–Sealing-Design considerations. [9]

Micro System Applications

Applications of micro system in – Automotive-Bio medical – Aerospace –Tele communications field. Basic exposure to software for MEMS design–Intellisuite. [9]

Total Hour: 45

Text Book(s):

1. MohamedGad-el-Hak,—TheMEMSHandBook‖,CRCPress,Florida,2005.
2. Tai-Ran Hsu, —MEMS and Microsystems: Design and Manufacture‖, 2nd Edition, John Wiley and Sons, New York, 2008.

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Reference(s):	
1.	FatikowS. and RemboldU.,—Microsystem Technology and Microrobotics‖,Springer-Verlag,BerlinHeidelberg,2014.
2.	Gardner JulianW., Varadan Vijay K. and Awadel Karim Osama O.,—Micro sensors MEMS and Smart Devices ‖,John Wiley &Sons, New York, 2001.
3.	MarcMadou, —FundamentalsofMicrofabrication‖,2nd Edition,CRCpress,NewYork,2011.
4.	TrimmerW.,—MicromechanicsandMEMS:ClassicandSeminarpapersto1990‖,IEEEPress,1997.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E46 & MEMS Design and Fabrication	CO1	3	2	2	1				2				2	3		
	CO2	2	3	3	2				2				2	3		
	CO3	3		2					1				2	2		
	CO4			3					2				2	3		
	CO5		2		2				2				2	3		

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME E51- Fundamentals of Nano Science								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100
Objective(s)	• To help learners to Impart the basic knowledge on nanoscience and technology • To explore the various process techniques available for the processing of nanostructured materials • To learn about basis of nanomaterial science, preparation methods and applications • To help them understand in broad outline of Nanoscience and Nanotechnology • To acquire knowledge of the Nanoscience and related fields							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Elucidate the basics of nanotechnology in physics, chemistry and biology CO2: Recognize the methods of preparation of nanomaterials CO3: Relate the characterization techniques for confirming nanomaterials CO4: Categorize the nanomaterials and its preparation CO5: Identify the area of application and its field							

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

Introduction

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only). [9]

General Methods of Preparation

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE. [9]

Nano materials

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications. [9]

Characterization Techniques

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation. [9]

Applications

Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nano crystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bio imaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery. [9]

Total Hours: 45

Text Book(s):

1.	John Dinardo N, "Nanoscale Characterisation of Surfaces & Interfaces", 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.
2.	Nils O. Petersen, "Foundations for Nanoscience and Nanotechnology", 1st Edition, CRC Press, 2017.

Reference(s)

1.	Akhlesh Lakhtakia (Editor), "The Hand book of Nanotechnology, Nanometer structure, Theory, Modeling and Simulations", Prentice Hall India (P) Ltd. New Delhi, 2007.
2.	Mick Wilson, Kamali Kannargare., Geoff Smith, "Nano technology: Basic Science and Emerging Technologies", Overseas Press, 2005.
3.	Pradeep T, "NANO: The Essentials: Understanding Nanoscience and Nanotechnology", Tata McGraw hill, 2007.
4.	Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003
5.	J. Dutta, H. Hoffmann, "Nanomaterials", Topnano-21, 2003.
6.	Mark A. Ratner, Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice Hall P7R:1st Edition, 2002.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E51 & Fundamentals of Nano Science	CO1	3	3	3	2	2							2	2	2	
	CO2	3	3	3	2	2							2	2	2	
	CO3	3	3	3	2	2							2	2	2	
	CO4	3	3	3	2	2							2	2	2	
	CO5	3	3	3	2	2							2	2	2	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME E52 - Composite Materials								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100

Objective(s)	• To impart knowledge on the behaviour of constituents in the composite materials. • To enlighten the students in different types of reinforcement • To describe the code for laminate stacking sequence • To classify the different manufacturing methods available for composite material. • To impart the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Demonstrate the fundamentals of fibers, matrices and composites. CO2: Realize and solve problems concerning the mechanics of composite materials. CO3: Perform design calculations for the development of fiber reinforced matrices. CO4: Portray the various manufacturing processes involved in the fabrication of composite material. CO5: Infer knowledge on the performance of composite materials

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

Introduction

Basics of fibers, matrices and composites: Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Fiber surface treatments, Fillers and Additives. [9]

Mechanics

Fiber content, density and void content. Rule of mixture -Volume and mass fractions – Density – Void content, Evaluation of four elastic moduli based on strength of materials approach and semi-empirical model Longitudinal Young‘s modulus-Transverse Young‘s modulus–Major Poisson‘s ratio-In-plane shear modulus, Ultimate strengths of a unidirectional lamina. Characteristics of Fiber-reinforced lamina–Laminates–Lamination theory. [9]

Design

Failure Predictions, Laminate Design Consideration-Design criteria-Design allowable -Design guidelines, Joint design-Bolted and Bonded Joints, Design Examples-Design of a tension member – Design of a compression member – Design of a beam-Design of a torsional member, Application of Finite element method (FEM) for design and analysis of laminated composites. [9]

Manufacturing

Bag molding – Compression molding – Pultrusion – Filament winding – Resin film infusion – Elastic reservoir molding - Tube rolling – Quality inspection methods. Processing of metal matrix composites (MMC) – Diffusion bonding – Stir casting – Squeeze casting. [9]

Performance

Static mechanical properties – Fatigue and impact properties – Environmental effects (thermal, degradation, creep) – Long term properties, Fracture behavior and Damage tolerance. [9]

Total Hours: 45

Text Book(s):

1. Mallick P.K.,”Fiber Reinforced Composites: Materials, Manufacturing and Design”, 3rd Edition, Taylor and Francis, 2008.
2. Autar K. Kaw, “Mechanics of Composite Materials”, 2nd Edition, CRC Press, London, 2006.

Reference(s)

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

Pre-requisite: **Manufacturing Processes**

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E52 & Composite Materials	CO1	2	3	3	3									2	3	3
	CO2	2	3	2	2									3	3	3
	CO3	3	2	3	3									3	3	3
	CO4	3	2	3	2									2	3	2
	CO5	3	3	3	3			3						3	3	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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

50 ME E53- Lean Manufacturing

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

Objective(s)

- To study the various tools for lean manufacturing.
- To apply the above tools to implement LM system in an organization.
- To attain optimum level in quality without any or low fluctuation in operating cost.
- To impart knowledge to increase productivity, reduce waste and optimum utilization of resources.
- To identify and remove or reduce "waste" in value streams,

Course Outcomes

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

CO1: Describe the brief history of manufacturing approaches employed and the philosophy of lean production
CO2: Apply the concept of various organizational and logistic element in lean manufacturing
CO3: Apply the tools in lean manufacturing to analyze a manufacturing system and plan for its Improvements
CO4: Implement the concepts and methodologies of lean manufacturing.
CO5: Recognize the future state map and factory simulation scenario

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

Introduction

Holistic view of lean principles - Five primary elements, Comparison of Mass Manufacturing and Lean Manufacturing, Types of Wastes, Types of activities – Value Added, Non Value Added. [9]

Organizational and Logistic Element

Organization element: Communication planning, product-focused responsibility, leadership development, workforce preparation. Logistics element**:** Planning/control function, A,B,C material handling, service cells, customer/supplier alignment, cell team work plan, level loading, mix-model manufacturing, workable work. [9]

Manufacturing and Process Control Element

Manufacturing Flow Element: Product/quantity analysis, process mapping, routing analysis, takt time, workload balancing and one-piece flow, cellular manufacturing, pull system and kanban sizing. Process Control Element: Single minute exchange of dies, poka-yoke, 7S, visual controls, graphic work instructions. [9]

Metrics Element and Implementing Lean

DuPont model, output-based measures, process-driven measures, goal alignment through policy deployment, measurement definition and understanding.
Lean implementation, Reconciling lean with other systems -Toyota production system, lean six sigma-lean and ERP- lean with ISO 9001: 2015. [9]

Value Stream Mapping

Introduction - Primary icons - Customer and supplier icons - Production control icon - Data box icon - Truck icon - Material direction arrow icon - Process icon - Push icon - Pull icon - Information and communication flow icons - Secondary icons - Developing the VSM - Current state mapping - Future state mapping. [9]

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	Total Hours: 45
Text Book(s):	
1.	William M Feld, “Lean Manufacturing, Tools, Techniques and How To Use Them”, The St. Lucie Press/APICS Series on Resource Management, 2001.
2.	Ronald G. Askin & Jeffrey B. Goldberg, “Design and Analysis of Lean Production Systems”, John Wiley & Sons, 2003.
Reference(s)	
1.	Joseph De Feo, William Barnard , “Juran Institute's Six Sigma Breakthrough and Beyond”, Tata McGrawHill, New Delhi, 2004.
2.	Micheal Wader, “Lean Tools: A Pocket guide to Implementing Lean Practices”, Productivity and Quality Publishing Pvt Ltd, 2002.
3.	Askin R.G, Goldberg J.B, “Design and Analysis of Lean Production Systems”, John Wiley & Sons, New York, 2003.
4.	Michael L George, David T Rowlands, Bill Kastle, “What is Lean Six Sigma”, McGraw Hill Inc., New York,2004

Pre-requisite: **Manufacturing Processes**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E53 & Lean Manufacturing	CO1	3	3	3			3	3	3		3		3	3	3	3
	CO2	3	2	3			3	2	2		2		3	2	3	3
	CO3	2	3	3			2						2	2	3	3
	CO4	2	2	3			2	3	3		3		2	3	3	3
	CO5	3		3			2	2	2		2			3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S. Rangasamy College of Technology – Autonomous							**R 2018**
50 ME E55 - Cryogenics							
Semester	Hours / Week			Total Hrs.	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100
Objective(s)	• To study the physical behavior of the materials at cryogenic temperature. • To impart the concepts of Liquefaction and gas separation systems. • To acquire the construction and working principle of Cryogenic Refrigeration systems. • To enhance knowledge of theoretical and modern technological aspects in Cryogenic Engineering. • To correlate the theoretical principles with application oriented studies.						
Course Outcomes	**At the end of the course the students will be able to** CO1: Define the mechanical properties of materials at low temperatures and to draw the schematic diagram and explain the gas liquefaction system. CO2: Identify the steps in the liquefaction systems for Neon, Hydrogen and Helium and also compare the liquefaction systems. CO3: Compare the gas separation, purification systems also Distinguish between the air and gas separation. CO4: Explain the cryogenic refrigeration systems, working media, solids, liquids and gases, outline the Cryogenic fluid storage and its transfer. CO5: List the applications of cryogenic fluids to gas, biological industries, LOX in space, medicine and electronic industries.						
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.							

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Introduction to Cryogenic Systems

Thermodynamics principle of cryogenic system-Mechanical Properties at low temperatures –Properties of cryogenic fluids. Gas Liquefaction: Minimum work for liquefaction –Methods to produce low temperature: Linde Hampson system –Claude system -Linde dual pressure system–Liquefaction systems for gases other than Neon, Hydrogen and Helium. [9]

Liquefaction Systems

Liquefaction systems for Neon, Hydrogen and Helium Components of Liquefaction systems-Magnetic cooling, magnetic refrigeration systems–Heat Exchangers –Compressors and Expanders –expansion valve –Losses for real machines. [9]

Gas Separation and Purification Systems

Gas separation and purification systems –Properties of mixtures –Principles of mixtures –Principles of gas separation –Air separation systems and Safety in handling of cryogens-Cryogenic instrumentation and Measurement. [9]

Cryogenic Refrigeration Systems

Cryogenic Refrigeration Systems –Working media –Solids, Liquids and gases. Cryogenic fluid storage and transfer –Cryogenic storage systems and Optimization of tank design –Insulation –Fluid transfer mechanisms –Cryostat –Cryo Coolers. [9]

Applications of Cryogenic Refrigeration Systems

Applications –Space technology –In-flight air separation and collection of LOX –Gas Industry –Biology –Medicine –Electronics-nuclear propulsions, chemical propulsions. [9]

Total Hours: 45

Text Book(s):

1	Thipse, S.S., "Cryogenics -A Text book",1st Edition, Narosa publishing house, New Delhi, March 2013
2	Randall F. Barron, "Cryogenics Systems", 2nd Edition, Oxford University Press, New York, 1985.

Reference(s):

1	Mukhopadhyay, M., "Fundamentals of Cryogenic Engineering", 2nd Edition, PHI learning Pub., Delhi, 2014.
2	White. G K., "Experimental Techniques in Low Temperature Physics", 4th Edition, Oxford Press, 2002.
3	Robort Ackermann. "Cryogenic Regenerative Heat Exchangers", 1st Edition Plenum Press, 2013.
4	Timmerhaus, Flynn, "Cryogenics Process Engineering", 1st Edition, Plenum Press,New York,1989
5	Fredrick J. Edeskutty and Watter F. Stewart "Safety in Handling of Cryogenic Fluids", 1st Edition, Plenum Press, 2012.

Pre-requisite: **Thermodynamics, Thermal Engineering, Fluid Mechanics and Heat and Mass Transfer**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME E55 & Cryogenics	CO1	3	3	2	2	1	2	2	3	2	1	1	3	2	3	1
	CO2	3	2	3	2	3	1	2	1	1	2	3	3	2	2	2
	CO3	3	1	1	2	1	2	2	1	1	2	1	3	3	3	1
	CO4	3	2	2	2	2	2	2	1	1	1	1	3	3	2	2
	CO5	3	1	2	2	2	2	2	1	1	1	1	3	1	1	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 HS 001 - Engineering Economics and Financial Accounting								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	40	60	100
Objective(s)	• To recognize the basic of economics, how to organize a business • To enhance the knowledge in financial aspects related to business • To enhance the knowledge about central banking with commercial banks and generation of funds • To learn different methods of appraisal of projects and pricing techniques. • To describe the applications of break-even analysis in engineering projects							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Outline the suitable demand forecasting techniques with prevailing market structure. CO2: Describe forms of business and Distinguish between proprietorship and partnership. CO3: Explain the various kinds of banking and Interpret technical feasibility CO4: Describe pricing practice and appraisal process CO5: Apply break even analysis in engineering projects and the managerial uses of break-Even analysis.							

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

Basic Economics

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

Organization and Business Financing

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

Financial Accounting and Capital Budgeting

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

Cost Analysis

Types of costing – traditional costing approach - activity based costing - Fixed Cost Variable cost – marginal cost- Cost output relationship in the short run and in long run – pricing practice – full cost pricing – marginal cost pricing– going rate pricing Bid pricing – pricing for a rate of return Appraising project profitability - cost benefit analysis – feasibility reports – appraisal process – technical feasibility - economic feasibility Financial feasibility. [9]

Break Even Analysis

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

Total Hours: 45

Text Book(s):

1. Khan M Y and Jain P K., “Financial Management” McGraw - Hill Publishing Co., Ltd., New York, 2000.
2. Varshney R L and Maheshwary, K L., “Managerial Economics”, S Chand and Co., New Delhi, 2001.

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Reference(s)	
1.	Barthwal R.R., “Industrial Economics - An Introductory Text Book”, New Age Pub., New Delhi, 2001.
2.	Samuelson P.A., “Economics - An Introductory Analysis”, McGraw - Hill & Co., New York, 2000.
3.	Bhattacharyya, S K, John Deardon and Koppikar Y M, “Accounting for Management: Text and Cases”, South Asia Books, 1986.
4.	Mote, V L, Samuel and Gupta, G S., “Managerial Economics – 110002, 1984.– Concepts and Cases”, Tata Mcgraw Hill, New Delhi, 2007.

Pre-requisite: **Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 HS 001 & Engineering Economics and Financial Accounting	CO1	3				1	2	2		3	2	2			3	
	CO2		2			2	2	2			3	3			2	
	CO3	2				3				3	2	3			3	
	CO4	3				3	3	3		2		3			2	
	CO5		3			2	3	3			3	3			3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PT T02 - Creo for Production Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100
Objective(s)	• To enable the students with various concepts in mold design using Creo software. • To demonstrate the basic operations of CAM and automation of manufacturing industries. • To ensure that the error rate is decreased, uniformity of the product is high and the precession in the process can achieved. • To impart the mathematical formatting and documentation related to manufacturing process in order to become professionally efficient. • To create an ability to make a design and production model using rapid prototyping methods respectively.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Create, modify and analyze mold components and assemblies. CO2: Create geometries, tool paths and generate NC codes for turning using Creo software. CO3: Create geometries, tool paths and generate NC codes for milling using Creo software CO4: Retrieve the mathematical functions during design process. CO5: Relate the concepts of rapid prototyping to create real time products.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Mold design Basic Mold Process - Prepare design models for the mold process - Design Model Analysis - Mold Models – Shrinkage – Work pieces - Mold Volume Creation - Parting Lines - Skirt Surfaces – Parting Surface Creation - Splitting Mold Volumes - Mold Component Extraction - Mold Features Creation - Filling and Opening the Mold. [20]								

Manufacturing Process

Manufacturing Process Overview - Creating Manufacturing Models – Configuring Operations - Using Reference Models - Using Work piece Models - Creating and Using NC Model Assemblies - Creating and Configuring a Work Center - Creating and Configuring Tools - Using Manufacturing Parameters - Creating Face Milling Sequences - Creating Volume Milling Sequences - Creating Profile Milling Sequences - Creating Straight Cut Surface Milling Sequences - Creating From Surface Isolines Surface Milling Sequences - Creating Cut Line Surface Milling Sequences - Advanced Surface Milling Options - Creating Roughing and Re-roughing Sequences - Creating Finishing Sequences -Creating Trajectory Milling Sequences – Creating Hole making Sequences - Creating Engraving Sequences - Using the Process Manager - Creating and Post- Processing CL Data Files. [25]

Rapid Prototyping: Introduction to RPT - Data Preparation - RPT Data Processing - Data Post Processing - RPT assignment. [15]

Total Hours: 60 (Lecture:30 + Hands on Training:30)

Text Book(s):

1.	Sham Tickoo, “Pro / Engineer PTC Creo Parametric 3.0 for Engineers and Designers”, Revised and updated edition (MISL-DT), Dreamtech Press, 2015.
2.	Chua C.K., Leong K.F. and Lim C.S., “Rapid Prototyping: Principles and Applications”, 3rd Edition, World Scientific, New Jersey, 2010.

Reference(s)

1.	Chee Kai Chua, “Rapid Prototyping: Principles and Applications”, World Scientific publications, 3rd edition, Singapore, 2010.
2.	Philip. J. Pritchard, “Mathcad: a Tool for Engineers and Scientists”, Wiley publications, Indiana, 2013.
3.	Jacobs P.F., “Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography”, McGraw-Hill, New York, 2010
4.	David S. Kelley, Pro/Engineer wildfire 5.0 instructor, McGraw-Hill,2016

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 PT T02 & Creo for Production Engineering	CO1	3		3		3								3	3	3
	CO2	3		3		3								3	3	3
	CO3	3		3		3								3	3	3
	CO4	3		3		3								3	3	3
	CO5	3		3		3								3	3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous							R 2018
50 ME L01 – Rapid Prototyping							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100
Objective(s)	• To study the fundamental theory behind RP process. • To acquire the basic concept of different software used in rapid prototyping systems. • To impart knowledge on CAD modelling technique • To be familiar with the characteristics of the different materials those are used in Additive Manufacturing. • To expose the emerging trends and applications of Additive Manufacturing technology						

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Course Outcomes	**At the end of the course, the students will be able to** CO1: Demonstrate various material processes and additive manufacturing systems CO2: Deliver the concepts, fabrication and analysis of manufacturing components through rapid prototyping technique. CO3: Elucidate the working principles and parameters involved in Rapid prototyping methods. CO4: Reveal the methods of rapid tooling. CO5: Expose the skills on programming and software knowledge of RPT.

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

Introduction to Rapid Prototyping

Need for the time compression in product development, History of RPT systems, Survey of applications, Growth of RPT industry and classification of RPT systems. [9]

Rapid Prototyping Methods

Fused deposition Modeling (FDM): Principle, Process Parameters, Path generation, Applications. Solid Ground Curing: Principle of operation, Machine details, Applications. Stereo Lithographic Resin (SLR) systems: Process parameters, Process details, Data Preparation, Data files, and Machine details, Applications. Selective Laser Sintering (SLS): Types of machines, Principle of operation, Process parameters, Data preparation for SLS, applications. Laminated Object Manufacturing (LOM): Principle of Operation, LOM materials, Process details, Applications. [9]

Concept Modelers

Concept modelers – Principle, Thermo jet printer, Sander‘s model market, 3-D Printer, Genisys Xs Printer, JP system 5, Object Quadra System. Laser Engineered Net Shaping (LENS) – Principle-applications. [9]

Rapid Tooling

Indirect Rapid Tooling- Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, etc., Direct rapid tooling- Direct Accurate clear epoxy solid injection molding (AIM), Quick cast Process, Copper polyamide, Rapid Tools, Direct metal laser sintering (DMLS), ProMetal, Sand Casting Tooling, Laminate tooling, Soft tooling v/s Hard tooling. [9]

Software for Rapid Tooling

STL Files, Over view of Solid view, Magics, mimics, magics communicator, etc, Internet based softwares, Collaboration tools. Rapid Manufacturing- Process optimization – Factors influencing accuracy, Data preparation Errors, Part building Errors, Errors in finishing, Influence of part orientation. Allied process – Vacuum Casting, SurfaceDigitizing, Surface Generation from point cloud, Surface modification, data transfer to solid models. [9]

Total Hours: 45

Text Book(s):

1	Chua C.K., Leong K.F. and Lim C.S., “Rapid Prototyping: Principles and Applications”, 3rd Edition, World Scientific, New Jersey, 2010.
2	Pham D.T. and Dimov S.S., “Rapid Manufacturing”, 1st Edition, Springer-Verlag, London, 2011.

Reference(s):

1	Frank W. Liou, “Rapid Prototyping and Engineering Applications”, CRC Press, 2008.
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	Frank W. Liou, “Rapid Prototyping and Engineering Applications”, CRC Press, 2008

Pre-requisite: **Manufacturing Technology and CAD/CAM**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L01&Rapid Prototyping	CO1	3	3							2						2
	CO2	3	3			1				2			3			2
	CO3	3	3			1							2			2
	CO4	3	2			1							2			3
	CO5	2	2			1				2			2			2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME L02 – Product Design for Manufacturing								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• 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 objectives of product design and the requirements of a good product design. • To recognize the concept of design for manufacturing, assembly and environment. • To learn the concepts of design for environment.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Recognise the knowledge on design principles for manufacturing. CO2: Express knowledge on form design and forgings. CO3: Interpret component design by considering machining. CO4: Develop knowledge on component design by considering casting. CO5: Observe and respond Environmental and safety issues for design.

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

Introduction

General design principles for manufacturability – strength and mechanical factors, mechanisms selection, evaluation method, Process capability – Feature tolerances, Geometric tolerances –Assembly limits –Datum features – Tolerance stacks. [9]

Factors Influencing Form Design

Working principle, Material, Manufacture, Design- Possible solutions – Materials choice – Influence of materials on form design – form design of welded members, forgings and castings. [9]

Component Design – Machining Consideration

Design features to facilitate machining – drills – milling cutters – keyways – Doweling procedures, counter sunk screws – Reduction of machined area- simplification by separation – simplification by amalgamation – Design for machinability – Design for economy – Design for clampability – Design for accessibility – Design for assembly. [9]

Component Design – Casting Consideration

Redesign of castings based on Parting line considerations – Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design – Modifying the design- Computer Applications for DFMA. [9]

Design for the Environment

Introduction – Environmental objectives – Global, Regional and local issues – Basic Design for Environment (DFE) methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment – Weighted sum, Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly, recyclability, remanufacture and energy efficiency – Design to regulations and standards. [9]

Total Hours: 45

Text Book(s):

1.	Boothroyd, G, Heartz and Nike, "Product Design for Manufacture", 3rd Edition, Marcel Dekker, New York, 2002.
2.	Kevien Otto, Kristin Wood, "Product Design", 2nd Edition, Indian Reprint, Pearson Education, 2004.

Reference(s)

1.	Boothroyd, G, "Design for Assembly, Automation and Product Design", 2nd Edition, Marcel Dekker, New York, 2002.
2.	Fixel, J. "Design for the Environment", 2nd Edition, McGraw-Hill International Edition, New York, 2012.
3.	Bralla, J G, "Design for Manufacture Handbook", 2nd Edition, McGraw-Hill International Edn, NY, 2013.
4.	Chitale, A.K, and Gupta, R.C., "Product Design and Manufacturing",3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

Pre-requisite: **Manufacturing Processes**

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MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L02 & Product Design for Manufacturing	CO1	3	3	2	3	3			3					3	2	3
	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S. Rangasamy College of Technology – Autonomous							**R 2018**
50 ME L05 – Logistics Management							
Semester	Hours / Week			Total Hrs.	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• 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
Course Outcomes	**At the end of the course the students will be able to** CO1: Outline the logistics in competitive strategy. CO2: Apply the concept of warehousing and material handling equipment systems in logistics management. CO3: Describe the Internal and External Performance Measurement in logistics management. CO4: Outline the time and cost in freight management. CO5: Describe Logistics Resource Management and, Automatic Identification Technologies.

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

Introduction to Logistics and Network Design

Definition and Scope of Logistics – Functions & Objectives, Customer Value Chain – factors influencing the network design, framework for network design, models for facility location and capacity allocation, Impact of uncertainty on network design. [9]

Warehousing and Materials Handling, Material Handling Equipment and Systems

Warehousing Functions – Types and Site Selection, Layout Design and Costing – Virtual Warehouse, Role of Material Handling in Logistics – Material Storage Systems – Principles, Benefits, Methods – Automated Material Handling. [9]

Strategic Alliances and Performance Measurement

Framework for strategic alliances – Third Party Logistics(3PL) – 3PL issues and requirements – Retailer – Supplier Partnerships – Issues in Retailer – Supplier Partnerships – Distributor Integration – Types and issues of Distributor Integration – Internal and External Performance Measurement – Logistics Audit. [9]

Transportation and Packaging

Transportation System Evolution – Infrastructure and Networks, Freight Management , Route Planning, Containerization – Design considerations, Material and Cost, Packaging as Unitization – Consumer and Industrial Packaging. [9]

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Current Trends E-Logistics Structure and Operation – Logistics Resource Management, Automatic Identification Technologies – Warehouse Simulation, Reverse Logistics - Global Logistics , Strategic logistics Planning. [9]	
Total Hours: 45	
Text Book(s):	
1	Sople Vinod V, "Logistics Management – The Supply Chain Imperative", Pearson Education, 2014
2	Ailawadi C Sathish and Rakesh Singh, "Logistics Management", Prentice Hall India, 2012
Reference(s):	
1	Coyle, "The Management of Business Logistics", Thomson Learning, 2014
2	Bloomberg David J, "Logistics", Prentice Hall India, 2014
3	Simchi – Levi Davi, Kaminsky Philip and Simchi-Levi Edith, "Designing and Managing the Supply Chain", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.
4	Musgrave Adam, "Transportation and Logistics Management", Global Vision Publishing, 2013.

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L05 & Logistics Management	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R 2018								
50 ME L08– Reliability Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/ VI / VII	3	0	0	45	3	40	60	100
Objective(s)	• 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 equipthe students to analyze the reliability of a product or system. • To train the students to evaluate the reliability of a product or system.							
Course Outcomes	**At the end of the course, the students will be able to** CO1: Analyze quality costs and apply statistical process control techniques. CO2: Identify the consumer's and producer's risk in sampling CO3: Determine and analyze the reliability process. CO4: Apply reliability concepts and solve reliability problems. CO5: Analyze and estimate the reliability of a product or system.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								

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Statistical Process Control

Introduction:-Definition of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance, Total quality management concepts, chance causes, assignable causes, Customer-Orientation: Internal & External Customer Concept, Quality costs- Prevention; Appraisal and Failure costs. Analysis techniques for quality costs, Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart. [9]

Acceptance Sampling

Lot-by-Lot Sampling – Types – Probability of Acceptance in Single - Double - Multiple Sampling Techniques – O.C. Curves – Producer's Risk and Consumer's Risk. (Acceptable Quality Limit) AQL - Lot Tolerance Percent Defective (LTPD) - Average Outgoing Quality Limit (AOQL) Concepts-Standard Sampling Plans for AQL and LTPD - Uses of Standard Sampling Plans. [9]

Design For Reliability

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, System safety-analysis of down-time-Repair time distribution. [9]

Reliability Concepts

Reliability engineering - fundamentals – Failure rate, failure data analysis, Bathtub curve, Mortality curves concept of burn –in period, useful life and wear out phase of a system, Mean Time Between Failures (MTBF), Mean Time To Failure (MTTF), hazard rate – failure density and conditional reliability-Maintainability and availability – simple problems. [9]

Reliability Improvement

System reliability: Series, Parallel and Mixed configurations, Reliability improvement techniques, use of Pareto analysis – design for reliability – redundancy unit and standby redundancy- fault tree analysis – FMEA analysis, Optimization in reliability – Product design – Product analysis – Product development –Product life cycle. [9]

Total hours: 45

Text Book(s):

1. Patrick D Connor, Practical Reliability Engineering,Wiley,2012.
2. Srinath. L.S., "Reliability Engineering", 4th Edition Affiliated East West Press, 2011.

Reference(s)

1. Connor, P.D.T.O., "Practical Reliability Engineering", 5th edition, Wiley India, 2012.
2. Charles E Ebling, An Introduction to Reliability and Maintainability Engineering, Overseas Press,2011
3. David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth-Heinemann, 2011
4. NPTEL video:https://youtu.be/uutg8jKrL9w

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L08&Reliability Engineering	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	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S. Rangasamy College of Technology – Autonomous R 2018								
50 ME L09– Green Energy Sources								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/ VI / VII	3	0	0	45	3	40	60	100

Objective(s)	• To know the energy scenario and potential of renewable energy • To learn the various solar energy technology and its applications • To educate the various wind energy technology • To explore the various bio-energy technology • To provide knowledge about the ocean and geothermal technologies.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Discuss the energy scenario and potential of renewable energy. CO2: Describe the various solar energy technology and its applications CO3: Explain the various wind turbine technology. CO4: Explore the various bio-energy technologies. CO5: Discuss the ocean and geothermal technologies

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

Energy Scenario

Energy scenario in india — domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present green energy status- Potential of various green energy sources-Global energy status-Per capita energy consumption-Future energy plans. [9]

Solar Energy

Solar Energy: Solar Radiation-Measurements of Solar Radiation and Sunshine - Solar Thermal Collectors –Flat Plate and Concentrating collectors-Fundamentals of Solar Photo Voltaic Conversion–Solar PV Systems-Types-Design of a Standalone Solar PV System - Solar PV and Thermal Applications - Building Integrated Solar- Leadership in Energy Environment Design(LEED) Certification- Challenges - Economics. [9]

Wind Energy

Wind data and energy estimation – Betz limit - Site selection for wind farms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine –Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications. [9]

Biomass Energy

Bio resources–Bio mass direct combustion–thermo chemical conversion-bio chemical conversion- mechanical conversion - Biomass gasifier - Types - Cogeneration —- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol and methanol production – Applications. [9]

Ocean and Geo thermal Energy

Smallhydro-Tidalenergy—Waveenergy—OpenandclosedOTECCycles—Limitations— Geo thermal energy– Geo thermal energy sources-Types of geo thermal power plants–Applications-Environmental impact. [9]

Total hours: 45

Text Book(s):

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

Reference(s)

1.	Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 2012
2.	Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 3rd Edition, 2015.
3.	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

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Rev. No.4/w.e.f. 02.01.24
Passed in BoS Meeting held on 24/11/23
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COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L09 &Green Energy Sources	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	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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50 ME L10– Power Generation Engineering

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

Objective(s)

- 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.

Course Outcomes

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

CO1: Demonstrate the layout, construction and working of the components inside a thermal power plant

CO2: Recognise the basic knowledge on nuclear processes and working of nuclear power plants with their layouts

CO3: Recognise the basic knowledge on hydro power generation processes and working of various types of hydro turbines

CO4: Apply the working principle of gas and diesel power plants.

CO5: Illustrate the layout, construction and working of the components inside renewable energy power plants..

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

Energy scenario and Thermal power plant

Indian and Global energy scenario, -environmental issues of present day power generation.- Thermal power plant-Layout of thermal power plant – Selection Criteria – Coal and Ash Handling systems. Pulverisers –Stokers – Types– Electrostatic precipitator(ESP) and cooling towers [9]

Nuclear Power Plant

Nuclear Energy- Fuels and Nuclear reactions – Types of Reactors - Radioactivity – Fission Process – Reaction Rates – Diffusion Theory- Components and Layout of nuclear power plant – Pressurized Water Reactor – Boiling Water Reactor – Fast Breeder Reactor – Radioactive waste disposal. [9]

Hydroelectric power plant

Hydro-electric power plant- Site selection – Components and Layout – Classification of turbines – Working principle of Pelton turbine – Francis turbine – Kaplan turbine Advantages – Mini and micro hydel plants. [9]

Gas Turbine and Diesel Power Plant

Gas Turbine Power Plant: Gas Turbine Cycles - Thermodynamic Analysis of Cycles - Reheating - Regeneration and Intercooling - Layout of Gas Turbine Power Plant- Selection Criteria - Binary and Combined Cycle - IGCC. Diesel Power Plant: Layout –Types - Selection Criteria– Applications and advantages. [9]

Non-Conventional Power Plants

Layout and components: Magneto Hydro Dynamic (MHD) power plant – Geothermal power generation, Dry steam, flash steam, and binary cycle – Ocean thermal energy conversion (OTEC) – Tidal power generation – Wind energy power generation – Solar photo voltaic (SPV) –Bio-solar cells – Solar energy harvesting trees.. [9]

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	Total hours: 45
Text Book(s):	
1.	Arora, S. C., and Domkundwar, S., "A course in Power Plant Engineering", 8th Edition, Dhanpatrai Publications Ltd., New Delhi, 2016
2.	Rajput R.K, "Power Plant Engineering", 5th Edition, Laxmi Publications, New Delhi, 2016.
Reference(s)	
1.	Rai,G.D. "Introduction to Power Plant Technology", 11th reprint, Khanna Publishers, 2013
2.	Hegde, R K., "Power Plant Engineering", 1st edition, Pearson education India, New Delhi, 2015.
3.	Rajput R.K., "Power Plant Engineering", 4th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016.
4.	Nag, P K., "Power Plant Engineering", 4th edition, Tata McGraw-Hill, New Delhi, 2014.

Pre-requisite: Nil

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L10 &Power Generation Engineering	CO1	3	3				3	3							3	
	CO2	3	3				3	3							3	
	CO3	3	2				3	3							3	
	CO4	3	3				3	3							3	
	CO5	3	3				3	3							3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S. Rangasamy College of Technology – Autonomous							**R 2018**
50 ME L11 & Composite Materials and Processing							
Semester	Hours / Week			Total Hrs.	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100
Objective(s)	• 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						
Course Outcomes	**At the end of the course the students will be able to** CO1: Analyze various types of composites and its advantages and needs CO2: Analyze various types of fiber materials and its applications for making Composites CO3: Analyze various resins materials used in processing of composites CO4: Analyze various process for manufacturing composites CO5: Apply basic destructive and non-destructive testing of composites						
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.							

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Introduction and Additives

Introduction – Advantages, Characteristics, of composites – Classification – particulate, fibrous, laminated, and hybrid composites, Additives for Composites - Catalysts - Accelerators – Coupling Agents - Fillers - Toughening Agents [9]

Matrix Materials

Classification -Matrix Resins - Unsaturated Polyester - Vinyl Ester - Epoxy- Phenol Formaldehyde - Urea Formaldehyde - Melamine Formaldehyde Resin - Properties and Applications [9]

Reinforcement Materials

Fibre Reinforcements - Glass – Types - CSM – Surface Mats - Performs - Woven and Non-Woven Fabrics - Carbon - Aramid Fibre - Boron Fibres - Natural Fibres – Cellulose. [9]

Processing Techniques

DMC, SMC and Prepregs - Hand and Spray Layup - RTM - Bag - Autoclave - Centrifugal and Compression Molding Processes - Filament Winding - Pultrusion Sandwich Construction [9]

Testing

Testing of Composites – Standards -Tensile, Impact, Compression and Flexural Strength- Non Destructive testing for Composites - Application of FRP Products. [9]

Total Hours: 45

Text Book(s):

1	Vinay Kumar Patel, Rishi Kant, Pankaj Singh Chauhan and Shantanu Bhattacharya, “Trends in Fabrication of Polymers and Polymer Composites”, AIP Publishing, 2022
2	Sabu Thomas, Joseph Kuruvilla, Sant Kumar Malhotra, Koichi Goda, Meyyarappallil Sadasivan Sreekala, Polymer Composites, Wiley-VCH Verlag GmbH & Co. KGaA, 2012

Reference(s):

1	Md Rezaur Rahman, Advances in Sustainable Polymer Composites, Woodhead Publishing Series in Composites Science and Engineering, 2020
2	Sanjay Mavinkere Rangappa, Suchart Siengchin, Jyotishkumar Parameswaranpillai, Klaus Friedrich, “Tribology of Polymer Composites: Characterization, Properties, and Applications”, Elsevier Series on Tribology and Surface Engineering, 2020
3	Donald F. Adams, Leif Carlsson A Carlsson, R. Byron Pipes Experimental Characterization of advanced composite materials, Third Edition, CRC Press, 2002.
4	M.C.Gupta and A.P.Gupta, Polymer Composites, New Age International Publishers, 2007.

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L11 &Composite Materials and Processing	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

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S. Rangasamy College of Technology – Autonomous								R 2018
50 ME L12 & Direct Digital Manufacturing								
Semester	Hours / Week			Total Hrs.	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• 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.
Course Outcomes	**At the end of the course the students will be able to** CO1: Recognize the development of AM technology in various businesses and developing opportunities. CO2: Apply the concepts of rapid prototyping in product design and development CO3: Select the suitable liquid based rapid prototyping system for a specific application CO4: Select the suitable solid based rapid prototyping system for a specific application CO5: Select the suitable powder based rapid prototyping system for a specific application

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

Introduction

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain- ASTM/ISO 52900 Classification - Benefits. Applications: Building Printing - Bio Printing - Food Printing- Electronics Printing. Business Opportunities and Future Directions – Case studies: Automobile, Aerospace, Healthcare. [9]

Design for Additive Manufacturing (DFAM)

Concepts and Objectives - AM Unique Capabilities - Part Consolidation – Topology Optimization- Generative design - Lattice Structures - Multi-Material Parts and Graded Materials - Data Processing: CAD Model Preparation - AM File formats: STL-Problems with STL- AMF Design for Part Quality Improvement: Part Orientation - Support Structure - Slicing - Tool Path Generation – Design rules for Extrusion based AM. [9]

Liquid based RP systems

Stereo Lithography Apparatus (SLA): Principle, Photo polymers, Post processes, Process parameters, Machine details, Advantages. Solid Ground Curing (SGC): Principle, Process parameters, Process details, Machine details, Limitations. Solid Creation System (SCS): Principle, Process parameters, Process details, Machine details, Applications. [9]

Solid based RP systems

Fusion Deposition Modeling (FDM): Principle, Raw materials, BASS, Water soluble support system, Process parameters, Machine details, Advantages and limitations. Laminated Object Manufacturing (LOM): Principle, Process parameters, Process details, Advantages and limitations. Solid Deposition Manufacturing (SDM): Principle, Process parameters, Process details, Machine details, Applications. [9]

Powder based RP systems

Selective Laser Sintering (SLS): Principle, Process parameters, Process details, Machine details, Advantages and applications. 3-Dimensional Printers (3DP): Principle, Process parameters, Process details, Machine details, Advantages and limitations. Laser Engineered Net Shaping (LENS): Principle, Process details, Advantages and applications. [9]

Total Hours: 45

Text Book(s):

1	Chua.C.K. Leong K.F. and Lim C.S., “Rapid prototyping: Principles and Applications”, World scientific, New jersey, 2017.
2	Pham D.T. and Dimov S.S, “Rapid Manufacturing”, Springer -Verlag, London, 2011.
Reference(s):	
1	Amitabha Ghosh, “Rapid Manufacturing a brief Introduction”, Affiliated East West Press, New Delhi, 2019.
2	Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2017.
3	Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
4	Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME L12 & Direct Digital Manufacturing	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													

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S. Rangasamy College of Technology

(Autonomous)

Curriculum & Syllabi
for
Honours Degree

B.E Mechanical Engineering
Honours - Design

R 2018

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.

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K.S. RANGASAMY COLLEGEOF TECHNOLOGY, TIRUCHENGODE – 637215

(Autonomous)

DEPARTMENT OF MECHANICAL ENGINEERING

DESIGN (HONOURS)

CURRICULUM & SYLLABI

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 ME H01	Reverse Engineering	PE	3	3	0	0	3
2.	50 ME H02	Optimization Techniques in Design	PE	3	3	0	0	3
3.	50 ME H03	Integrated Product Development	PE	3	3	0	0	3
4.	50 ME H04	Micro and Precision Engineering	PE	3	3	0	0	3
5.	50 ME H05	Quality Engineering	PE	3	3	0	0	3
6.	50 ME H06	Surface Engineering	PE	3	3	0	0	3
			Total	18	18	0	0	18

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME H01 - Reverse Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• Applying the fundamental concepts and principles of reverse engineering in product design and development. • Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development. • Applying the concept and principles of material identification and process verification in reverse engineering of product design and development. • Analysing the various legal aspect and applications of reverse engineering in product design and development. • Understand about 3D scanning hardware & software operations and procedure to generate 3D model
Course Outcomes	**At the end of the course, the students will be able to** CO1: Apply the fundamental concepts and principles of reverse engineering in product design and development. CO2: Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development. CO3: Apply the concept and principles of material identification and process verification in reverse engineering of product design and development. CO4: Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development. CO5: Analyse the various legal aspect Applications of reverse engineering in product design and development.

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

Introduction and Geometric Form

Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping. [9]

Material Characteristics and Process Identification

Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification. [9]

Data Processing

Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility. [9]

3D Scanning and Modelling

Introduction, working principle and operations of 3D scanners: Laser, White Light, Blue Light - Applications- Software for scanning and modelling: Types- Applications- Preparation techniques for Scanning objects- Scanning and Measuring strategies - Calibration of 3D Scanner- Step by step procedure: 3D scanning - Geometric modelling – 3D inspection- Case studies. [9]

Industrial Applications

Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry. Case studies and Solving Industrial projects in Reverse Engineering. Legality: Patent – Copyrights –Trade Secret – Third-Party Materials. [9]

Total Hours: 45

Text Book(s):

1.	Robert W. Messler, “Reverse Engineering: Mechanisms, Structures, Systems & Materials”, 1st Edition, McGraw-Hill Education, 2014
2.	Wego Wang, “Reverse Engineering Technology of Reinvention”, CRC Press, 2011

Reference(s):

Rev. No.4/w.e.f. 02.01.24
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1.	Scott J. Lawrence , “Principles of Reverse Engineering”, Kindle Edition, 2022
2.	Kevin Otto and Kristin Wood, “Product Design: Techniques in Reverse Engineering and New Product Development”, Prentice Hall, 2001
3.	Linda Wills, “Reverse Engineering”, Kluver Academic Publishers, 1996
4.	Vinesh Raj and Kiran Fernandes, “Reverse Engineering: An Industrial Perspective”, Springer- Verlag London Limited 2008.

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME H01 - Reverse Engineering	CO1	3	3	3				3							3	2
	CO2	3	3	3											3	3
	CO3	3	3	3		3			3	3	3			3	3	3
	CO4	3	3	3		3			3	3	3			3	3	3
	CO5	3	3	3											3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME H02 - Optimization Techniques in Design								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• To impart knowledge about optimization techniques and enable students to take effective engineering and managerial decisions. • To train and apply linear programming techniques suitable for engineering and business. • To find the optimum solution for non-linear programming problems. • To impart knowledge about geometric programming and optimum design for machine elements. • To apply genetic algorithm techniques to engineering optimization problems.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Formulate an optimization problem CO2: Form Linear Programming models and solve them CO3: Apply algorithms for unconstrained and constrained optimization CO4: Apply geometric programming technique and design for mechanical elements CO5: Find the optimum solution using non-traditional optimization techniques.

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

Introduction

Introduction to optimization, classification of optimization problems, classical optimization. [9]

Linear Programming

Simplex method and Duality in linear programming, sensitivity or post-optimality analysis, Karmarkar's methods. [9]

Non-Linear Programming

One dimensional minimization, unconstrained and constrained minimization, direct and indirect methods. [9]

Geometric Programming and Optimum Design

Geometric programming, Optimum design of mechanical elements like beams, columns, gears, shafts. [9]

Genetic Algorithms

Introduction to Genetic Algorithms, Operators, applications to engineering optimization problems. [9]

Total Hours: 45

Text Book(s):

1. Rao Singiresu, S., "Engineering Optimization: Theory and Practice", New Age International (P) Limited, Publishers New Delhi, 2010.
2. Deb Kalyanamoy., "Optimization for Engineering Design: Algorithms and Examples", Prentice Hall of India, Pvt. Ltd., New Delhi, 2009.

Reference(s):

1. Johnson Ray, C., "Optimum Design of Mechanical Elements", John Wiley & Sons, New York, 1990.
2. Goldberg, D.E., "Genetic Algorithms in Search, Optimization and Machine", Barnen, Addison-Wesley, New York, 2005.
3.. Duffin, R J., Peterson E L., and Zener, C., "Geometric Programming-Theory andApplications", Willey, New York, 2007.
4. J. S. Arora, "Introduction to Optimum Design", McGraw Hill, New York, 4thEdition,2012.

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Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME H02 - Optimization Techniques in Design	CO1	3	2	3	3	3				3	3	3	3	3	3	3
	CO2	2	3	3	3					3	3	3	2		3	3
	CO3	3	3	3	3					3	3	3	2		2	3
	CO4	3	3	2	3	3				2	2	2	3	3	3	2
	CO5	3	3	3	2					3	3	3	3		3	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME H03 – Integrated Product Development								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• To understand the global trends and development methodologies of various types of products and services • To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems • To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification • To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics • To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
Course Outcomes	**At the end of the course, the students will be able to** CO1: Define, formulate, and analyze a problem CO2: Solve specific problems independently or as part of a team CO3: Gain knowledge of the Innovation & Product Development process in the Business Context CO4: Work independently as well as in teams CO5: Manage a project from start to finish

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

Basics of Product Development

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management. [9]

Requirements and System Design

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design &Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design. [9]

Design and Testing

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation. [9]

Sustenance Engineering and End-of-Life (EoL) Support

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal [9]

Business Dynamics – Engineering Services Industry

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management. [9]

Total Hours: 45

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

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Text Book(s):	
1.	Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
2.	John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.
Reference(s):	
1.	Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2.	Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3..	Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4.	Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME H03 – Integrated Product Development	CO1	3	3	3											3	
	CO2	3	3	3											3	
	CO3	3	3	3											3	3
	CO4	3	2	3											3	3
	CO5	2	3	3											3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME H04 - Micro and Precision Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• Learn about the precision machine tools • Learn about the macro and micro components. • Understand handling and operating of the precision machine tools. • Learn to work with miniature models of existing machine tools/robots and other instruments. • Learn metrology for micro system
Course Outcomes	**At the end of the course, the students will be able to** CO1: Select suitable precision machine tools and operate CO2: Apply the macro and micro components for fabrication of micro systems. CO3: Apply suitable machining process CO4: Able to work with miniature models of existing machine tools/robots and other instruments. CO5: Apply metrology for micro system

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

Introduction to Microsystems

Design, and material selection, micro-actuators: hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications. Micro-sensors based on Thermal, mechanical, electrical properties; micro-sensors for measurement of pressure, flow, temperature, inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems. [9]

Fabrication Processes for Micro-Systems

Additive, subtractive, forming process, microsystems-Micro-pumps, micro- turbines, micro engines, micro-robot, and miniature biomedical devices [9]

Introduction to Precision Engineering

Machine tools, holding and handling devices, positioning fixtures for fabrication/ assembly of microsystems. Precision drives: inch worm motors, ultrasonic motors, stick- slip mechanism and other piezo-based devices. [9]

Precision Machining Processes

Precision machining processes for macro components - Diamond turning, fixed and free abrasive processes, finishing processes. [9]

Metrology for Micro Systems

Metrology for micro systems - Surface integrity and its characterization. [9]

Total Hours: 45

Text Book(s):

1.	Davim, J. Paulo, ed. Microfabrication and Precision Engineering: Research and Development. Woodhead Publishing, 2017.
2.	Gupta K, editor. Micro and Precision Manufacturing. Springer; 2017.

Reference(s):

1.	Dornfeld, D., and Lee, D. E., Precision Manufacturing, 2008, Springer.
2.	H. Nakazawa, Principles of Precision Engineering, 1994, Oxford University Press.
3..	Whitehouse, D. J., Handbook of Surface Metrology, Institute of Physics Publishing, Philadelphia PA, 1994.
4.	Murthy.R.L, —Precision Engineering in Manufacturing‖, New Age International, New Delhi, 200.5

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Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME H04 - Micro and Precision Engineering	CO1	3	3	3											3	3
	CO2	3	3	3											3	3
	CO3	3	3	3											3	3
	CO4	3	3	3											3	3
	CO5	3	3	3											3	3

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME H05 - Quality Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• Developing a clear knowledge in the basics of various quality concepts. • Facilitating the students in understanding the application of control charts and its techniques. • Developing thespecialcontrolproceduresforserviceandprocessorientedindustries. • Analyzing and understanding the process capability study. • Developing the acceptance sampling procedures for incoming raw material.
Course Outcomes	**At the end of the course, the students will be able to** CO1: Control the quality of processes using control charts for variables in manufacturing industries. CO2: Control the occurrence of defective product and the defects in manufacturing companies. CO3: Control the occurrence of defects in services. CO4: Analyse and understand the process capability study. CO5: Develop the acceptance sampling procedures for incoming raw material.

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

Introduction

Quality Dimensions–Quality definitions–Inspection-Quality control–Quality Assurance–Quality planning-Quality costs–Economics of quality– Quality loss function [9]

Control charts

Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- $\bar{X}$, R and S charts, attribute control charts - p, np, c and u- Construction and application. [9]

Special Control Procedures

Warning and modified control limits, control chart for individual measurements, multi-vari chart, $\bar{X}$ chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts. [9]

Statistical Process Control

Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits. [9]

Acceptance Sampling

The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables,MIL-STD-105DandMIL-STD-414E&IS2500 standards. [9]

Total Hours: 45

Text Book(s):

1.	Ugene.E, Grant.L, Richard S, Leavenworth, “Statistical Quality Control”, Tata McGraw Hill New, Delhi, 2017.
2.	Jeff Tian, “Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement", Wiley-IEEE Computer Society Press, 2005.

Reference(s):

1.	Douglas C Montgomery, “Introduction to Statistical Quality Control”, John Wiley Publication, 7th Edition, 2012.
2.	Phadko, “Quality Engineering Using Robust Design, Pearson, 2013.
3..	Kan S H, “Metrics and Models in Software Quality Engineering”, Pearson, 2013.
4.	K Krishnaiah, Applied Statistical Quality control and Improvement, PHI, 2014

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Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME H05 - Quality Engineering	CO1	2	3	3						2					3	
	CO2		3	3		3	3			3				3	3	
	CO3	3	3	3		3				3				3		
	CO4	3		2		3								3		
	CO5		2			3				3					3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

K.S.Rangasamy College of Technology – Autonomous R2018								
50 ME H06 – Surface Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Objective(s)	• To study the fundamentals of surface features and different types of friction associated with metals and non-metals • To study the different types of wear mechanism and its standard measurement. • To study the different types of corrosion and its preventive measures • To study the different types of surface properties and surface modification techniques • To study the various types of materials used in the friction and wear applications
Course Outcomes	**At the end of the course, the students will be able to** CO1: Describe the fundamentals of surface features and different types of friction associated with metals and non-metals CO2: Analyze the different types of wear mechanism and its standard measurement. CO3: Analyze the different types of corrosion and its preventive measures CO4: Analyze the different types of surface properties and surface modification techniques. CO5: Analyze the various types of materials used in the friction and wear applications.

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

Surfaces and Friction

Basics of surfaces features – Roughness parameters – surface measurement - Cause of friction- Laws of friction – Static friction – Rolling Friction – Stick-slip Phenomenon - Friction properties of metal and non-metals – Friction in extreme conditions – Thermal considerations in sliding contact. [9]

Wear

Laws of Wear - Types of Wear mechanism – wear debris analysis - Theoretical wear models - Wear of metals and nonmetals – International standards in friction and wear measurements. [9]

Corrosion

Introduction – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors. [9]

Surface Treatments

Surface properties – Hydrophobic – Super hydrophobic – Hydrophilic - surface metallurgy –Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying - New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings. [9]

Engineering Materials

Introduction – High and low friction materials - Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Bio Tribology - Nano Tribology. [9]

Total Hours: 45

Text Book(s):

1. G.W .Stachowiak and A.W.Batchelor, “Engineering Tribology”, Butterworth-Heinemann, 2005
2. S.K. Basu, S.N.Sengupta and B.B.Ahuja , “Fundamentals of Tribology”, Prentice Hall of India, 2005.

Reference(s):

1. Fontana G., “Corrosion Engineering”, McGraw Hill, 1985
2. Rabinowicz.E., “Friction and Wear of materials”, John Willey &Sons,1995
3.. Williams J.A., “Engineering Tribology”, Oxford University Press, 1994.
4. Joseph R. Davis, Corrosion: Understanding the Basics, ASM International, 2000

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Pre-requisite**: Nil**

MAPPING OF COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COURSE CODE & COURSE NAME	CO	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
50 ME H06 – Surface Engineering	CO1		3	3	3				2				2		3	
	CO2	3	3	3	2				3				3	3	3	
	CO3		3	3	3				3				3	3	3	
	CO4		3	3	3				3				3	3	3	
	CO5			3											3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution