SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

CURRICULUM & SYLLABI

B.E. MECHANICAL

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2023

(For the Students Admitted in the Academic Year 2023-2024 onwards)

Note: The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program under the same Regulation as may be decided by the Academic Council.

INDEX

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

B. E. MECHANICAL ENGINEERING

VISION

- To impart quality education in mechanical engineering by promoting innovative, research, and entrepreneurial skills to contribute to society with ethics.

MISSION

- To educate the students of mechanical engineering to excel as professionals.
- To promote research activities by undertaking multidisciplinary and collaborative industrial projects.
- To motivate the students to integrate mechanical engineering with business as entrepreneurs for global benefits.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

- ✓ Be a successful career in mechanical engineering and allied Industries.
- ✓ Exhibit professional competency in research and development through life-long learning.
- ✓ Have ethical attitudes and leadership qualities to work efficiently with diverse teams to solve real-life problems.

PROGRAM 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.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Acquire excellence in materials selection andmethods of manufacturing.
PSO2	Ability to design and analyze the mechanical engineering componentsby utilizing modern CAD/CAM and Analysis tools.
PSO3	Apply optimization techniques in inter-disciplinary engineering problemsfor innovative projects.

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	23HST101 - Professional English - I	-	-	-	-	-	1.4	2.2	1.25	1.8	3	-	3	-	-	-
		23MAT101 - Matrices and calculus	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
		23HST102 - தமிழர்மரபு / Heritage of Tamils															
		23PHE101 - Engineering Physics	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
		23CYE101 - Chemistry for Engineers	1.6	1.6	2.4	1.25	1.8	1	2	-	-	-	-	1.5	-	-	-
		23GEE101 - Programming in C	2.	2.33	2.33	1.16	2	1.66	1	0.83	2	0.16	2.83	2.33	1.83	2.16	-
		23EEC101 - Soft Skills															
		23MDC101 - Induction Program (2 Weeks)															
	II	23HST201 - Professional English - II	-	-	-	-	2	1.2	1.2	1	2	3	-	3	-	-	-
		23MAT201 - Statistics and Numerical Methods with MATLAB	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
		23PHT201 - Materials Science	2	3	2	1	1.8	1	1	-	-	-	-	-	-	-	-
		23CYT201 - Environmental Sciences and Sustainability	1.5	1.8	2.2	1.8	1.5	1.4	2.2	2	1	2	-	1	-	-	-
		23MET201 - Manufacturing technology- I	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
		23HST202 - தமிழரும் தொழில்நுட்பமும் / Tamils and Technology															
I	II	23GEE201 - Engineering Graphics	3	2	2	-	2	-	-	-	-	3	-	2	2	2	2
		23GEL201 - Engineering Practice Laboratory	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
		23EEC201 - Communication Skills/Foreign Language															
		23MDC201 - Life skills & Leadership Enhancement Programme															
II	III	23MAT301 - Transforms and complex functions	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
		23MET301 - Engineering Thermodynamics	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1
		23MET302 - Engineering Mechanics	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2
		23MEE301 - Manufacturing Technology - II	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2
		23MEE302 - Metrology and Measurement	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
II	III	23CEE402 - Fluid Mechanics and Machinery	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
		23EEC301 - Professional Development															
	IV	23MET401 - Fluid Power Systems	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
		23MET402 - Kinematics of Machinery	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2
		23MET403 - Engineering Materials and Metallurgy	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1
		23MEE401 - Thermal Engineering	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2
		23MEE402 - Strength of Materials	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
		23GEE301 - Problem solving using Python Programming	2.33	2.5	1.5	1.83	1.83	-	-	-	-	-	1.5	0.66	2.66	0.5	-
		23EEC101 - Value Added Course - I															

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

SCHEME FOR CURRICULUM

B.E. – MECH (MECHANICAL)

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST101	Professional English - I	HS	3	0	0	3	40	60	100
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23PHE101	Engineering Physics	BS	3	0	2	4	50	50	100
23CYE102	Chemistry for Engineers	BS	3	0	2	4	50	50	100
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills	EEC	1	0	0	1	100	-	100
MANDATORY COURSE									
23MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
	TOTAL CREDITS IN SEMESTER - I					21			

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST201	Professional English II	HS	3	0	0	3	40	60	100
23MAT201	Statistics and Numerical Methods	BS	3	1	0	4	40	60	100
23PHT201	Materials Science	BS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23MET201	Manufacturing Technology- I	PC	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23GEE201	Engineering Graphics	ES	3	0	2	4	50	50	100
PRACTICALS									
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Communication Skills/Foreign Language	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC201	Life Skill & Leadership Enhancement Programme	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - II			25						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MAT301	Transforms and Complex Functions	BS	3	1	0	4	40	60	100
23MET301	Engineering Thermodynamics	PC	3	1	0	4	40	60	100
23MET302	Engineering Mechanics	PC	3	1	0	4	40	60	100
EMBEDDED COURSE									
23MEE301	Manufacturing Technology - II	PC	3	0	2	4	50	50	100
23MEE302	Metrology and Measurement	PC	3	0	2	4	50	50	100
23CEE402	Fluid Mechanics and Machinery	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER - III			25						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MET401	Fluid Power Systems	PC	3	0	0	3	40	60	100
23MET402	Kinematics of Machinery	PC	3	1	0	4	40	60	100
23MET403	Engineering Materials and Metallurgy	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23MEE401	Thermal Engineering	PC	3	0	2	4	50	50	100
23MEE402	Strength of Materials	PC	3	0	2	4	50	50	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC401	Value Added Course - I	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - IV			24						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MET501	Design of Machine Elements	PC	3	1	0	4	40	60	100
	Professional Elective - I	PE	3	0	0	3	40	60	100
	Professional Elective - II	PE	3	0	0	3	40	60	100
	Professional Elective - III	PE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23MEE501	Dynamics of Machinery	PC	3	0	2	4	50	50	100
23MEE502	Heat and Mass Transfer	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC501	Value Added Course - II	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC501	Mandatory Course - I	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - V			23						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
	Professional Elective IV	PE	3	0	0	3	40	60	100
	Professional Elective V	PE	3	0	0	3	40	60	100
	Professional Elective VI	PE	3	0	0	3	40	60	100
	Open Elective-I/NCC L1/ L3	OE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23MEE601	Finite Element Analysis	PC	3	0	2	4	50	50	100
23MEE602	Mechatronics	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23MEJ601	Project Work	EEC	0	0	10	5	40	60	100
MANDATORY COURSE									
23MDC601	Mandatory Course - II	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - VI			25						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST701	Human Values and Ethics	HS	3	0	0	3	40	60	100
	Elective - Management	GE	3	0	0	3	40	60	100
	Open Elective – II/ NCC-II L2/ L4	OE	3	0	0	3	40	60	100
	Open Elective - III	OE	3	0	0	3	40	60	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC701	Research Paper writing and Publication	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VII			14						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - MECHANICAL ENGINEERING - EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
EMPLOYABILITY ENHANCEMENT COURSE									
23MEJ801	Innovative Product Development	EEC	0	0	14	7	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VIII			9						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

LIST OF HUMANITIES AND SOCIAL SCIENCES COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HST101	Professional English - I	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
23HST201	Professional English - II	HS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	40	60	100
23HST701	Human Values and Ethics	HS	3	0	0	3	40	60	100

LIST OF BASIC SCIENCES COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23PHE101	Engineering Physics	BS	3	0	2	4	50	50	100
23CYE102	Chemistry for Engineers	BS	3	0	2	4	50	50	100
23MAT201	Statistics and Numerical Methods	BS	3	1	0	4	40	60	100
23PHT201	Material Science	BS	3	0	0	3	40	60	100
23MAT301	Transforms and complex functions	BS	3	1	0	4	40	60	100

LIST OF ENGINEERING SCIENCES COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23GEE201	Engineering Graphics	ES	3	0	2	4	50	50	100
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23MEE302	Fluid Mechanics and Machinery	ES	3	0	2	4	50	50	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100

LIST OF PROFESSIONAL CORE COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MET201	Manufacturing technology- I	PC	3	0	0	3	40	60	100
23MET301	Engineering Thermodynamics	PC	3	1	0	4	40	60	100
23MET302	Engineering Mechanics	PC	3	1	0	4	40	60	100
23MEE301	Manufacturing Technology - II	PC	3	0	2	4	50	50	100
23MEE302	Metrology and Measurement	PC	3	0	2	4	50	50	100
23MET401	Fluid Power Systems	PC	3	0	0	3	40	60	100
23MET402	Kinematics of Machinery	PC	3	1	0	4	40	60	100
23MET403	Engineering Materials and Metallurgy	PC	3	0	0	3	40	60	100
23MEE401	Thermal Engineering	PC	3	0	2	4	50	50	100
23MEE402	Strength of Materials	PC	3	0	2	4	50	60	100
23MET501	Design of Machine Elements	PC	3	1	0	4	40	60	100
23MEE501	Dynamics of Machinery	PC	3	0	2	4	50	50	100
23MEE502	Heat and Mass Transfer	PC	3	0	2	4	50	50	100
23MEE601	Finite Element Analysis	PC	3	0	2	4	50	50	100
23MEE602	Mechatronics	PC	3	0	2	4	50	50	100

LIST OF PROFESSIONAL ELECTIVE COURSES

Professional Elective - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEP501	Welding Technology	PE	3	0	0	3	40	60	100
23MEP502	Non-Destructive Test and Evaluation of Materials	PE	3	0	0	3	40	60	100
23MEP503	Composite Materials	PE	3	0	0	3	40	60	100
23MEP504	Green Manufacturing	PE	3	0	0	3	40	60	100
23MEP505	Unconventional Machining Processes	PE	3	0	0	3	40	60	100
23MEP506	Metal Casting Technology	PE	3	0	0	3	40	60	100

Professional Elective - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEP507	Advanced IC Engines	PE	3	0	0	3	40	60	100
23MEP508	Automobile Engineering	PE	3	0	0	3	40	60	100
23MEP509	Design of Heat Exchangers	PE	3	0	0	3	40	60	100
23MEP510	Computational Fluid Dynamics	PE	3	0	0	3	40	60	100
23MEP511	Refrigeration and Air Conditioning	PE	3	0	0	3	40	60	100
23MEP512	Solar Thermal System	PE	3	0	0	3	40	60	100

Professional Elective - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEP513	Product Design and Development	PE	3	0	0	3	40	60	100
23MEP514	Computer Applications in Design	PE	3	0	0	3	40	60	100
23MEP515	Entrepreneurship Development	PE	3	0	0	3	40	60	100
23MEP516	Process Planning and Cost Estimation	PE	3	0	0	3	40	60	100
23MEP517	Power Plant Engineering	PE	3	0	0	3	40	60	100
23MEP518	Rapid Prototying	PE	3	0	0	3	40	60	100

Professional Elective - IV

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEP601	CAD/CAM	PE	3	0	0	3	40	60	100
23MEP602	Design for Manufacturing and Assembly	PE	3	0	0	3	40	60	100
23MEP603	Lean Manufacturing	PE	3	0	0	3	40	60	100
23MEP604	Production Planning and Control	PE	3	0	0	3	40	60	100
23MEP605	Computer Integrated Manufacturing Systems	PE	3	0	0	3	40	60	100
23MEP606	Flexible Manufacturing System	PE	3	0	0	3	40	60	100

Professional Elective - V

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEP607	Engineering Ethics	PE	3	0	0	3	40	60	100
23MEP608	Instrumentation and control Engineering	PE	3	0	0	3	40	60	100
23MEP609	Surface Engineering	PE	3	0	0	3	40	60	100
23MEP610	Maintenance Engineering	PE	3	0	0	3	40	60	100
23MEP611	Industrial Engineering	PE	3	0	0	3	40	60	100
23MEP612	Robotics	PE	3	0	0	3	40	60	100

Professional Elective - VI

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEP613	Machine Drawing	PE	3	0	0	3	40	60	100
23MEP614	Material Handling and Solid Processing Equipment	PE	3	0	0	3	40	60	100
23MEP615	Design of Jig and fixtures	PE	3	0	0	3	40	60	100
23MEP616	Gas Dynamics and Jet Propulsions	PE	3	0	0	3	40	60	100
23MEP617	Design of Transmission Systems	PE	3	0	0	3	40	60	100
23MEP618	Fuel Cells	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVE COURSES

OPEN ELECTIVES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEO601	Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
23ECO602	Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
23EEO603	Electric Vehicle Technology	OE	3	0	0	3	40	60	100
23EEO604	Renewable Energy System	OE	3	0	0	3	40	60	100
23MEO605	Resource Management Technique	OE	3	0	0	3	40	60	100
23MAO606	Graph Theory	OE	3	0	0	3	40	60	100
23CEO607	Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
23PMO608	Pharamaceutical Nanotechnology	OE	3	0	0	3	40	60	100
23RAO609	Foundation of Robotics	OE	3	0	0	3	40	60	100
23CSO610	Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
23MDO611	Biomolecules	OE	3	0	0	3	40	60	100
23CSO612	Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100

OPEN ELECTIVES – II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HSO701	English for Competitive Examinations	OE	3	0	0	3	40	60	100
23MGO702	Democracy and Good Governance	OE	3	0	0	3	40	60	100
23MEO703	Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
23CEO704	Remote Sensing Concepts	OE	3	0	0	3	40	60	100
23MEO704	Nano Technology	OE	3	0	0	3	40	60	100
23MDO705	Ultrasound Principles and its Medical Applications	OE	3	0	0	3	40	60	100
23PMO706	IPR For Pharma Industry	OE	3	0	0	3	40	60	100
23RAO707	Concepts in Mobile Robots	OE	3	0	0	3	40	60	100
23ECO708	Energy Technology	OE	3	0	0	3	40	60	100
23EEO709	Sensors and Actuators	OE	3	0	0	3	40	60	100
23MAO710	Probability and Queuing Theory	OE	3	0	0	3	40	60	100
23CSO711	Introduction to Cyber Security	OE	3	0	0	3	40	60	100
23MEO712	3D Printing and Design	OE	3	0	0	3	40	60	100

OPEN ELECTIVES - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HSO713	Project Report Writing	OE	3	0	0	3	40	60	100
23MAO714	Advanced Numerical Methods	OE	3	0	0	3	40	60	100
23CSO715	Fundamentals of Blockchain Technology	OE	3	0	0	3	40	60	100
23EEO716	Electrical,Electronic and Magnetic Materials	OE	3	0	0	3	40	60	100
23CEO717	Geographical Information System	OE	3	0	0	3	40	60	100
23ECO718	VLSI Design	OE	3	0	0	3	40	60	100
23MDO719	Wearable Technology	OE	3	0	0	3	40	60	100
23MEO720	Additive manufacturing	OE	3	0	0	3	40	60	100
23RAO721	Nanomaterials and Application	OE	3	0	0	3	40	60	100
23MGO722	Cost Management of Engineering Projects	OE	3	0	0	3	40	60	100
23HSO723	Food Safety and Quality Regulations	OE	3	0	0	3	40	60	100
23MDO724	Lifestyle Diseases	OE	3	0	0	3	40	60	100

GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23NCCL01	NCC AIRFORCE LEVEL - 1	GE	3	0	0	3	40	60	100
23NCCL02	NCC AIRFORCE LEVEL - 2	GE	3	0	0	3	40	60	100
23NCCL03	NCC ARMY LEVEL - 3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY LEVEL - 4	GE	3	0	0	3	40	60	100

ELECTIVE - MANAGEMENT

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MGT701	Principles of Management	GE	3	0	0	3	40	60	100
23MGT702	Total Quality Management	GE	3	0	0	3	40	60	100
23MGT703	Engineering Economics and Financial Accounting	GE	3	0	0	3	40	60	100
23MGT704	Human Resource Management	GE	3	0	0	3	40	60	100
23MGT705	Knowledge Management	GE	3	0	0	3	40	60	100
23MGT706	Industrial Management	GE	3	0	0	3	40	60	100
23MGT707	Hospital Management	GE	3	0	0	3	40	60	100
23MGT708	e-Waste Management	GE	3	0	0	3	40	60	100

LIST OF EMPLOYABILITY ENHANCEMENT COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEC101	Soft Skills	EEC	1	0	0	1	100	-	100
23EEC201	Communication Skills/Foreign Language	EEC	0	0	4	2	100	-	100
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
23EEC101	Value Added Course-I	EEC	0	0	4	2	100	-	100
23EEC501	Value Added Course-II	EEC	0	0	4	2	100	-	100
23EEC604	Project Work	EEC	0	0	10	5	40	60	100
23EEC701	Research Paper Writing / Publication	EEC	0	0	4	2	100	-	100
23EEJ801	Innovative Product Development	EEC	0	0	14	7	40	60	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100

LIST OF MANDATORY COURSES

MANDATORY COURSES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC501	Introduction to Women and Gender Studies	MC	3	0	0	0	-	-	-
23MDC502	Elements of Literature	MC	3	0	0	0	-	-	-
23MDC503	Film Appreciation	MC	3	0	0	0	-	-	-
23MDC504	Disaster Risk Reduction and Management	MC	3	0	0	0	-	-	-
23MDC505	Constitution of India	MC	3	0	0	0	-	-	-

MANDATORY COURSES - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC601	Well Being with Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	0	-	-	-
23MDC602	History of Science and Technology in India	MC	3	0	0	0	-	-	-
23MDC603	Political and Economical Thought for a Human Society	MC	3	0	0	0	-	-	-
23MDC604	State,Nation Building and Politics in India	MC	3	0	0	0	-	-	-
23MDC605	Industrial Safety	MC	3	0	0	0	-	-	-

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023 - 2024 onwards)

CREDIT SUMMARY

B.E. MECHANICAL ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	7	-	-	-	-	3	-	14
BS	12	7	4	-	-	-	-	-	23
ES	4	6	4	4	-	-	-	-	18
PC	-	3	16	18	12	8	-	-	57
PE	-	-	-	-	9	9	-	-	18
GE	-	-	-	-	-	-	3	-	03
OE	-	-	-	-	-	3	6	-	09
EEC	1	2	1	2	2	5	2	9	24
MC	-	-	-		-	-	-	-	-
Total	21	25	25	24	23	25	14	09	166

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

SCHEME FOR SYLLABI

B.E. – MECH (MECHANICAL)

SEMESTER I

23HST101	PROFESSIONAL ENGLISH - I	L T P C
	(Common to all B.E. & B.Tech. Branches)	3 0 0 3

OBJECTIVES

- To develop learning English language through grammar.
- To use grammar efficiently for demonstrating all the four language skills (LSRW).
- To write business letters, dialogue writing, paragraph and essay writing.
- To speak effectively about self introduction and real time situation.
- To build the reading skills through reading comprehension and note taking

UNIT I VOCABULARY 8

Synonyms and Antonyms - Word Formation - Sentence Types (declarative, imperative, interrogative & exclamatory) - Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones - Collocation - British and American Vocabulary.

UNIT II GRAMMAR 10

Parts of speech - Be, Have and Do verbs - Punctuation - Tenses - Numerical Adjectives - modal verbs - Single line Definition - Direct and Indirect Speech - Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

UNIT III WRITING 9

Letter Writing - Business communications - quotations, placing orders, complaints, replies to queries from business customers - Dialogue Writing – Paragraph Writing (descriptive, narrative, expository & persuasive) - Essay Writing - Writing Instructions.

UNIT IV SPEAKING 9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Tongue twisters

UNIT V READING SKILLS 9

Reading Comprehension – Reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions) - Short Comprehension Passages, practice skimming - Scanning and Predicting - Reading the passage and taking (Note making) Notes - Scan and understand main contents of the passage.

TOTAL: 45 PERIODS

Mandatory activity: Self Introduction

OUTCOMES

Upon completion of the course, the students will be able to:

- Use a wide range of vocabulary in oral and written communication
- Frame grammatically correct sentences.
- Write letters, frame paragraphs and Essays, develop conversation.
- Develop speaking skills for self-Introduction, delivering speeches and Technical Presentation
- Read and comprehend the passage, technical content and take notes.

TEXT BOOKS

1. Board of Editors. Using English A Course book for Under graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", 1st Edition, Orient Black Swan, Chennai, 2012.
2. MacMillan, Krishna Mohan, Meera Banerji, Developing Communication Skills, Paperback, 2019.

E-RESOURCES

1. http://www.usingenglish.com
2. https://www.khanacademy.org/humanities/grammar

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	1	3	1	2	3	-	3	-	-	-
2	-	-	-	-	-	1	2	-	1	3	-	3	-	-	-
3	-	-	-	-	-	3	3	2	3	3	-	3	-	-	-
4	-	-	-	-	-	1	2	1	2	3	-	3	-	-	-
5	-	-	-	-	-	1	1	1	1	3	-	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	-	-	-	-	-	1.40	2.20	1.25	1.80	3.00	-	3.00	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

23MAT101 **MATRICES AND CALCULUS** **L T P C**
(Common to all B.E./ B.Tech. Branches) **3 1 0 4**

OBJECTIVES

- To develop the use of matrix algebra techniques those are needed by engineers for practical applications.
- To familiarize the students with differential and integral calculus.
- To describe the student with functions of several variables.
- To acquire the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus that is needed for problems in engineering disciplines.

UNIT I MATRICES **9+3**

Eigen values and Eigen vectors – Properties of Eigen values – Cayley-Hamilton theorem – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic form.

UNIT II DIFFERENTIAL AND INTEGRAL CALCULUS **9+3**

Differentiation rules: Derivatives of polynomials and exponential functions – The product and quotient Rules – Derivatives of trigonometric functions – The Chain rule – Implicit differentiation – Applications of differentiation: Maximum and Minimum Values – Techniques of integration: Integration by parts – Trigonometric integrals – Integration of rational functions by partial fractions.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partial derivatives – Homogeneous functions – Euler's theorem – Total derivative – Jacobians – Taylor's theorem for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double integrals.

UNIT V VECTOR CALCULUS **9+3**

Scalar and vector point functions – Gradient – Divergence and curl – Line integral – Surface integral – Green's theorem in a plane – Volume integral – Divergence theorem – Irrotational and Solenoidal fields.

OUTCOMES

Upon completion of the course, Students will be able to:

- Classify the matrix algebra methods for solving practical problems.
- Discover differential calculus tools in solving various application problems and compare different methods of integration in solving practical problems.
- Develop differential calculus ideas on several variable functions.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.
- Solve engineering problems using the concept of vector calculus.

LIST OF TUTORIALS

1. Computation of Eigen values and Eigenvectors.
2. Calculate differentiation and integration of simple functions.
3. Determining Maxima and minima of functions for two variables.
4. Evaluating double and triple integrals.
5. Computing Gradient, divergence and curl of point functions.

TOTAL : 45 + 15 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Forty Third Edition, New Delhi, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, Seventh Edition, New Delhi, 2015.

REFERENCES

1. Bali N.P, Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, Seventh Edition, 2009.
2. Kanti B. Dutta., "Mathematical Methods of Science and Engineering – Aided with MATLAB", Cengage Learning, New Delhi, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/111105121 (Differential Calculus and Integral Calculus)
2. https://nptel.ac.in/courses/111107112 (matrix analysis)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
2	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
3	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
4	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
5	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23HST102 HERITAGE OF TAMILS L T P C
1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils..

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu,Oyillattam,Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

TEXT BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

5. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

REFERENCE BOOKS

1. Heritage of Tamils,Publishedby:Yes Dee Publishing Pvt Ltd,Chennai
2. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

23HST102	தமிழர் மரபு	L T P C 1 0 0 1

Unit - I மொழி மற்றும் இலக்கியம் **3**

இந்திய மொழி குடும்பங்கள்- திராவிட மொழிகள் -தமிழ் ஒரு செம்மொழி -தமிழ் செவ்விலக்கியங்கள்- சங்க இலக்கியத்தில் சமய சார்பற்ற தன்மை- சங்க இலக்கியத்தில் பகிர்தல் அறம்- திருக்குறளில் மேலாண்மை கருத்துக்கள் -தமிழ் காப்பியங்கள்- தமிழகத்தில் பௌத்த சமயங்களின் தாக்கம் -பக்தி இலக்கியம் ஆழ்வார்கள் மற்றும் நாயன்மார்கள்- சிற்றிலக்கியங்கள் -தமிழில் நவீன இலயக்யத்தின் வளர்ச்சி -தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

UNIT - II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை- சிற்பக்கலை **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை -ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினை பொருட்கள் ,பொம்மைகள் -தேர் செய்யும் கலை-சுடுமண் சிற்பங்கள் -நாட்டுப்புற தெய்வங்கள்- குமரி முனையில் திருவள்ளுவர் சிலை-இசை கருவிகள் - மிருதங்கம் ,பறை ,வீணை,யாழ், நாதஸ்வரம் ,தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

UNIT - III நாட்டுப்புற கலைகள் மற்றும் வீர விளையாட்டுகள் **3**

தெருக்கூத்து,கரகாட்டம் ,வில்லுப்பாட்டு, கணியான் கூத்து ,ஒயிலாட்டம், தோல்பாவை கூத்து,சிலம்பாட்டம், வளரி ,புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

UNIT - IV தமிழர்களின் திணைகோட்பாடுகள் **3**

தமிழகத்தின் தாவரங்களும் , விலங்குகளும் -தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறகோட்பாடுகள்-தமிழர்கள் போற்றிய அறக்கோட்பாடு -சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவு,கல்வியும்- சங்க கால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி -கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT-V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு- இந்தியாவின் பிறபகுதிகளில் தமிழ்பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் -

இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு- கல்வெட்டுகள், கையெழுத்துப்படிகள்-தமிழ் புத்தகங்களின்வரலாறு

TOTAL: 15 PERIODS

TEXT BOOKS

1. தமிழக வரலாறு -மக்களும் பண்பாடும் -கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினி தமிழ் -முனைவர் இல சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி -வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

REFERENCE BOOKS

1. தமிழர் மரபு -முனைவர் ஆ பூபாலன் (வி ஆர்பி பி பப்ளிஷர்ஸ்)

23PHE101 **ENGINEERING PHYSICS** **L T P C**

(Common to Civil, Mechanical, R & A and Pharm.Tech) **3 0 2 4**

OBJECTIVES

- To study the structure of crystalline materials using crystallographic knowledge.
- To learn elasticity, placticity, stress, strain behavior of materials for industrial applications.
- To generalize the fundamentals of ultrasonics and sound waves, as well as their applications.
- To explore the complex physical phenomenon using the fundamental principles of quantum mechanics and Schrödinger's wave equation.
- To exhibit different materials heat transmission modes and fundamentals of thermal conduction in solid and its applications.
- To understand the Engineering Physics that can be applied to optics, acoustics and ultrasonic's, matter characteristics and to determine thermal properties.

UNIT I CRYSTAL PHYSICS **9**

Lattice and Unit cell – Crystal Systems and Bravais lattice – Lattice planes – Miller Indices – d - Spacing in Cubic lattice – Calculation of Number of Atoms per Unit Cell – Atomic radius ,Coordination Number, Packing factor for SC, BCC, FCC and HCP structures – Crystal Growth Techniques – Melt Growth Techniques (Bridgman and Czochralski).- Silicon chip Production Process.

UNIT II MECHANICAL PROPERTIES OF SOLIDS & FLUIDS **9**

Elasticity – Stress-Strain Diagram and its Uses - Factors Affecting Elastic Modulus – Torsional Stress and Deformations – Twisting Couple - Torsion Pendulum: Theory and Experiment - Bending of beams - Bending Moment – Cantilever: Theory and Experiment – Non-Uniform Bending: Theory and Experiment - I-Shaped Girders.

UNIT III ACOUSTICS & ULTRASONICS **9**

ACOUSTICS : Classification of Sound – Decibel - Weber Fechner Law- Reverberation-Sabine's formula (Qualitative) - Factors affecting Acoustics of Buildings and their Remedies.

ULTRASONICS: Properties -Production of Ultrasonics - Magnetostriction and Piezoelectric methods - Non Destructive Testing – Pulse echo system, through Transmission and Reflection modes - Medical applications – Sonogram.

UNIT IV QUANTUM PHYSICS **9**

Black Body Radiation – Planck's Theory (derivation) – Electron Diffraction – Wave function and its Physical significance – Schrödinger's Wave Equation: Time independent and time dependent equations – Particle in a One-Dimensional box - Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunneling – Scanning Tunneling Electron Microscope.

UNIT V THERMAL PHYSICS **9**

Transfer of Heat Energy – Thermal expansion of Solids and Liquids – Expansion joints - Bimetallic strips - Thermal Conduction, Convection and Radiation – Heat conductions in Solids – Thermal Conductivity – Lee's disc method: Theory and Experiment - Conduction through Compound Media (series and parallel) – Geothermal Energy - Geothermal power - Thermal battery - Thermal Energy Storage.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course to:

- Familiarize the structure of crystalline solids by applying knowledge of crystallography.
- Analyze theories of failure and yield criteria as an elements of properties of matter.
- Understand different materials characterization techniques.
- Apply the basic principles of quantum mechanics and Schrödinger's wave equation to study the complex physical phenomenon.
- Build knowledge about thermal conductivity and its applications.
- Experimentally combine the concepts of thermal, optical, acoustic, and elasticity for use in engineering applications

TEXT BOOKS

1. P.Mani, "A Text book of Engineering Physics" Dhanam Publications, 2018.
2. Rajendran V. "Engineering Physics". TaTa McGraw Hill Publications, 2016
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill, 2017.

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2009
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019

4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015

E-RESOURSES

1. https://archive.nptel.ac.in/courses/122/107/122107035/
2. https://archive.nptel.ac.in/courses/115/101/115101107/

LIST OF EXPERIMENTS

(**Common to Civil, Mechanical, Robotics & Automation & Pharmaceutical Technology**)

(Eight experiments are to be conducted in Lab)

1. Determination of wavelength of laser.
2. Determination of particle Size lycopodium powder using laser.
3. Determination of wavelength of mercury spectrum- Spectrometer.
4. Determination of Young's modulus - Uniform bending.
5. Torsional Pendulum: Determination of moment of inertia and rigidity modulus.
6. Determination of velocity of ultrasonic in liquid.
7. Determination of Viscosity of a liquid –Poiseulle's Method.
8. Determination of thermal conductivity of bad conductor using Lee's Disc Apparatus.
9. Determination of Specific resistance of a given wire using Carey's Foster's Bridge (Virtual).
10. Radiation with Temperature Change Using Stefan's Law. (Virtual)

TOTAL: 15 PERIODS

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
2	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
4	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
5	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
6	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23CYE102 **CHEMISTRY FOR ENGINEERS** **L T P C**
(Common to CIVIL, MECH, R&A) **3 0 2 4**

OBJECTIVES

- To classify the impurities of water and know the treatment and the conditioning methods for domestic and industrial uses.
- To familiarize the types of fuels, calorific value calculations and characteristics of solid, liquid and gaseous fuels.
- To impart knowledge onprinciples and instrumentation of spectroscopy and chromatography.
- To provide students with an understanding of different types of energy sources, energy storage devices, and the principles of energy conversion.
- To be familiar with the types of corrosion and control measures and working of batteries.
- To inculcate practical skills in the determination of water quality parameters and instrumental analysis.

UNIT I WATER TECHNOLOGY 9

Introduction - Characteristics – Hardness – Estimation of hardness by EDTA method – Alkalinity and its estimation - Boiler feed water – Requirements –Boiler troubles (Scale and Sludge) – Internal conditioning (colloidal – Phosphate – Calgon and carbonate conditioning methods) – External conditioning – Zeolite process, Demineralization process – Desalination of brackish water by reverse osmosis-Nano filtration - Municipality water treatment - Break point chlorination.

UNIT II FUELS AND COMBUSTION 9

Fuels: Introduction - Classification of fuels - Coal - Analysis of coal (proximate and ultimate) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method) - Petroleum – Manufacture of synthetic petrol (Bergius process) - Knocking - Octane number - Diesel oil - Cetane number –Natural gas - Compressed Natural Gas (CNG) –Liquefied Petroleum Gases (LPG) - Power Alcohol and Biodiesel. Combustion of fuels: Introduction - Calorific value - Higher and lower calorific values- Theoretical Calculation of calorific value - Ignition temperature - Spontaneous ignition temperature – Explosive range - Flue gas analysis (ORSAT Method).

UNIT III ANALYTICAL CHEMISTRY 9

Spectroscopy: Electromagnetic spectrum-Absorption of radiation –Electronic, Vibrational and rotational transitions. UV-Visible and IR Spectroscopy-Principles, instrumentation (Block Diagram Only).-Chromatography- General principles - classification - Chromatographic behavior

of solutes-Quantitative determination - Gas chromatography - Liquid chromatography – High Pressure Liquid Chromatography –Applications.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear Fission – Controlled nuclear fission – Nuclear fusion – Differences between nuclear fission and fusion – Nuclear chain reactions – Nuclear energy – Light water nuclear power plant – Breeder reactor – Solar energy conversion – Solar cells - Wind energy. Batteries - Types of batteries – Primary battery (dry cell) Secondary battery (lead acid battery, lithium-ion-battery) Fuel Cells - H_2 -O_2 fuel cell – Supercapacitors.

UNIT V ELECTROCHEMISTRY, CORROSION AND ITS CONTROL 9

Introduction-Electrochemical cells applications of electrochemical series-Reference electrode-Standard calomel electrode, ion selective electrode-Glass electrode-Potentiometric titration, Redox titration, Conductometric titration-Strong acid vs Strong base. Corrosion – Types – Chemical Corrosion – Electrochemical Corrosion (galvanic and differential aeration) - Factors influencing corrosion – Material selection and design aspects-Control methods of corrosion – sacrificial anodic and impressed current cathodic protection.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Infer the quality of water and Identify the method of removal of impurities from water for domestic and industrial purpose.
- Illustrate the quality of fuels from its characteristics, to design and develop new combustion systems that are sustainable, efficient, and environmentally friendly.
- Analyze about the interactions of light with matter and the use of analytical techniques to analyze and characterize molecules.
- Recognize different forms of Energy resources and apply them for suitable application in Energy sectors.
- Analyze the causes of corrosion and discuss the control measures and discuss the functions of batteries.
- Determine the water quality parameters and perform quantitative chemical analysis by pH metery, flame photometry, conductometry and potentiometry.

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company (P) Ltd.,New Delhi, 2015.
2. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India Pvt Ltd, New Delhi, 2013.
3. R.Gopalan, "Analytical Chemistry" Sultan Chand & Sons,Third Edition,2017.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. ShobhaRamakrishnan, BananiMukhopadhyay,"Essentials of Analytical Chemistry" Pearson Education India,2018.

E-RESOURCES

1. https://nptel.ac.in/courses/104105084
2. http://library.iitbbs.ac.in/open-access-e-resources.php

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of sodium and potassium present in water using flame photometer.
7. Conductometric Precipitation Titration using $BaCl_2$ and Na_2SO_4.
8. Conductometric titration of strong acid vs strong base.
9. Estimation of Ferrous ions by Potentiometric Titration.
10. Estimation of copper content in the brass by Iodometry.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	3	-	1	-	3	-	-	-	-	2	-	-	-
2	1		2	-	1	-	-	-	-	-	-	-	-	-	-
3	2	2	3	1	1	1	-	-	-	-	-	1	-	-	-
4	1	1	2	1		-	-	-	-	-	-	-	-	-	-
5	2	1	2	1	3	-	1	-	-	-	-	-	-	-	-
6	2	3	-	-	3	-	-	-	-	-	-	-	-	-	-
AVG	1.6	1.6	2.4	1.25	1.8	1	2	-	-	-	-	1.5	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

23GEE101 **PROGRAMMING IN C** **L T P C**

(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To understand the constructs of C Language.
- To study arrays and strings for developing C programs
- To know the functions and pointers application in C programs
- To understand the concepts of structures and Union.
- To understand input/output and file handling in C.
- To develop programs and applications using C.

UNIT I BASICS OF C PROGRAMMING **9**

Introduction to programming paradigms – Structure of C program – C programming: Data Types– variables–Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions –Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process.

UNIT II ARRAYS AND STRINGS **9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program**:** Computing Mean, Median and Mode – Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) – String operations: length, compare, concatenate, copy –Sorting – Selection sort, Insertion sort, Merge sort, quick sort – Searching – linear and binary search.

UNIT III FUNCTIONS AND POINTERS **9**

Introduction to functions: Function prototype, function call, Built–in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions – Pointers – Pointer operators – Arrays and pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV STRUCTURES AND UNION **9**

Structure – Example Programs – Nested structures – Pointer in Structures – Array of structures - Example Program using structures and pointers – Self referential structures – Dynamic memory allocation. Union- Storage classes

UNIT V FILE PROCESSING **9**

Files – Operations of File – Types of file processing: Sequential access, Random access – Sequential access file – Random access file – Command line arguments.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Programs using I/O statements, expressions and decision–making constructs.
2. Write a program to find whether the given year is leap year or Not.
3. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
4. Check whether a given number is Armstrong number or not?
5. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
    a) 5 if it is a perfect cube.
    b) 4 if it is a multiple of 4 and divisible by 6.
    c) 3 if it is a prime number.
6. Populate an array with height of persons and find how many persons are above the average height.
7. From a given paragraph perform the following using built–in functions:(i)Find the total number of words.(ii)Capitalize the first word of each sentence.(iii)Replace a given word with another word.
8. Solve towers of Hanoi using recursion.
9. Locate and Display the Contents of an Array using Pointers.
10. Generate salary slip of employees using structures and pointers.
11. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Build C programs for simple applications using basic constructs
- Develop C programs using arrays and strings.
- Construct C programs using functions, recursion and pointers
- Implement applications in C using structures.
- Develop applications in C using file processing.
- Develop applications using C programming constructs

TEXT BOOKS

1. E.Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, Eighth Edition, 2019.
2. Kernighan, B.W and Ritchie,D.M,"The C Programming language", Second Edition, Pearson Education, 2016.

REFERENCES

1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt.Ltd., 2011.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105085/ (Introduction to C Programming)
2. https://nptel.ac.in/courses/106/106/106106210/ (Stack Operations)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	1	2	1	1	1	2	-	3	2	1	2	-
2	2	2	2	1	2	1	1	1	2	-	3	3	2	2	-
3	2	3	2	1	2	1	1	1	2	-	3	2	2	2	-
4	3	2	2	1	3	1	1	1	2	-	3	3	2	2	-
5	2	3	3	1	2	1	2	1	2	-	3	2	2	3	-
6	2	2	3	2	1	2	-	-	2	1	2	2	2	2	-
AVG	2.00	2.33	2.33	1.16	2.00	1.66	1.00	0.83	2.00	0.16	2.83	2.33	1.83	2.16	-

1 - low, 2 - medium, 3 - high, '-"- no correlation

SEMESTER II

23HST201	PROFESSIONAL ENGLISH - II	L T P C
	(Common to all B.E. & B.Tech. Branches)	3 0 0 3

OBJECTIVES

- To use grammatical components effectively in written communication.
- To read and understand on comprehend technical writing.
- To develop skills for writing email, business letters, Job Application Letter and Resume.
- To write checklist, recommendation, transcoding graphics and letter.
- To speak fluently in real contexts.

UNIT I GRAMMAR **9**

Articles - Prepositions - Compound words - Conditionals - Subject verb agreement - Active and Passive voice - Impersonal Passive Voice.

UNIT II LISTENING & READING **9**

Syllabification – Reading Vocabulary - Reading Newspapers - Listening to Youtube Documentaries - Listening to Podcast - Listening to Motivational Movies.

UNIT III BUSINESS WRITING **9**

E-mail writing - fixing an appointment, cancelling appointment, conference details, training programme details, paper submission for seminars and conferences - Job Application Letter and Résumé.

UNIT IV WRITING **9**

Checklist - Writing Recommendations - Transcoding Graphics - Bar Chart, Flow Chart, Pie Chart and Tables - Formal Letter Writing - inviting dignitaries and declining invitations.

UNIT V SPEAKING **9**

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting – Expressing - Finding out facts, attitudes and opinions - Situational Role-play.

TOTAL: 45 PERIODS

Mandatory activity: PowerPoint Presentation

OUTCOMES

Upon completion of the course, the students will be able to:

- Use grammar to frame sentences and write sentences in passive forms

- Read vocabulary, newspaper and improve listening skills
- Draft emails, write business letters, construct resume with job application letter.
- Frame checklist, write recommendation and Transcoding graphical representation.
- Develop speaking skill for taking part in Collaborative task and Situational Role-play.

TEXT BOOKS

1. S. Sumant Maven Learning. Technical English II.
2. KN Shoba, Lourdes Joavani Rayen. Communicative English. Published by Cambridge university, 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, First Edition, Foundation Books, New Delhi, 2013.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3. Norman Whitby, Business Benchmark- Pre-Intermediate to Intermediate, Students book, Cambridge University Press, 2006.

E-RESOURCES

1. https://www.fluentu.com/Blog/english/english-small-talk
2. https://www.britishcouncil.com

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	1	1	-	2	3	-	3	-	-	-
2	-	-	-	-	2	1	1	1	2	3	-	3	-	-	-
3	-	-	-	-	2	1	2	1	2	3	-	3	-	-	-
4	-	-	-	-	-	1	1	1	1	3	-	3	-	-	-
5	-	-	-	-	-	2	1	1	3	3	-	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	-	-	-	-	2.00	1.20	1.20	1.00	2.00	3.00	-	3.00	-	-	-

1.Low 2-Medium 3-High '-' – No Correlation

23MAT201 STATISTICS AND NUMERICAL METHODS WITH MATLAB LT P C
(Common to all B.E./ B.Tech. Branches) **3 1 0 4**

OBJECTIVES

- To provide the necessary basic concepts in testing of hypothesis for small and large samples which plays an important role in real life problems.
- To acquaint the knowledge of classifications of design of experiments.
- To extend the basic concepts of solving algebraic and transcendental equations.
- To apply the numerical techniques of interpolation and integration.
- To produce the knowledge of various techniques in solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3

Sampling distribution – Testing of significance for single proportion, single mean and difference of means – Test of significance for small samples by 't' test – Snedecor's F- test of significance – Chi-square test : Chi-square test of goodness of fit – Independent of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

Basic principles of experimental design – Completely randomised design – Analysis of vaiance for one way classification – Randomised block design – Analysis of variation for two factor experiments variations – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations by Newton Raphson method – Solution of simultaneous algebraic equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods – Matrix Inversion by Gauss Jordan method – Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9+3

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's interpolation formula – Newton's divided difference formula – Numerical integration by Trapezoidal and Simpson's 1/3 rule –Numerical double integration by Trapezoidal rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Euler's method – Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations – Taylor's series method – Predictor-corrector methods: Milne's method – Adams-Bash forth method.

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Summarize the numerical techniques of interpolation in various intervals and apply the numerical techniques of integration for engineering problems.
- Produce various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial conditions by using certain techniques with engineering applications.

LIST OF TUTORIALS

1. Solving one sample and paired sample't' test.
2. Determination of roots of a polynomial.
3. Solution of linear system of equations by Gauss Seidel methods.
4. Evaluation of line integrals by Trapezoidal rule.
5. Solution of ordinary differential equations by Euler's method.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Statistics and Numerical Methods", S. Chand and Company Ltd., NewDelhi, 2010.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, New Delhi, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/111/105/111105041/ (Statistics)
2. https://nptel.ac.in/courses/111/107/111107105/ (Numerical Methods)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
2	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
3	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
4	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
5	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23PHT201 **MATERIALS SCIENCE** **L T P C**

(Common to Civil, Mechanical, R & A and Pharm.Tech) **3 0 0 3**

OBJECTIVES

- To learn the principles of cryogenics and superconductivity and applications.
- To be familiar with the application of physics concepts to microscopic and NDT Testing.
- To explore different kind of nano materials and synthesis of nano materials, applications.
- To gain the knowledge of advanced and smart materials for various engineering applications.
- To study different composite materials and synthesize methods.

UNIT I CRYOGENICS **9**

Introduction to Cryogenics - Properties of Cryogenic Fluids- Gas-Liquefaction of Gases and Refrigeration Systems – Cryocoolers -Cryogenic Insulations - Superconductivity: Properties – Type I and Type II Superconductors – BCS theory of Superconductivity - High Tc superconductors – General applications of Superconductors –Cryotron and Magnetic levitation.

UNIT II MATERIALS CHARACTERIZATION **9**

Introduction to materials and Techniques-X-Ray Diffraction (XRD) – Atomic Force Microscopy (AFM)- Fourier Transform Infrared Spectroscopy (FTIR)- UV-Vis Spectroscopy- Non-Destructive Testing (NDT) : Liquid Penetrant Test, Magnetic Detection, Electromagnetic Testing, Ultrasonic Test, Thermal Infrared Testing and Spark Test.

UNIT III NANOMATERIALS & NANODEVICES **9**

Emergence of Nano science - Role of Particle Size - Quantum Structures: Quantum Well, Quantum Wire and Quantum Dot- Properties at Nano Scale (Optical, Electronic and Magnetic) - Synthesis of Nanomaterials: Physical Vapour Deposition (PVD) - Pulsed Laser Deposition (PLD) - Carbon Nanotubes - Micro Electro Mechanical Systems (MEMS) - Nano Electro Mechanical Systems (NEMS).

UNIT IV SMART MATERIALS **9**

Intelligent / Smart materials – Functional materials – Polyfunctional Materials – Structural Materials, Electrical Materials, Bio-Compatible Materials - Metallic Glasses: Types, Glass forming ability of Alloys, Melt spinning process, Applications - Shape Memory Alloys: Phases, Shape Memory Effect, Pseudo elastic effect, NiTi alloy, and applications.

UNIT V COMPOSITE MATERIALS **9**

Definitions, Composites, Reinforcements and Matrices, Types of Reinforcements, Types of Matrices, Types of Composites, Carbon Fibre Composites, Properties of Composites in Comparison with Standard Materials, Applications of Metal, Ceramic and Polymer matrix composites. Hand and spray lay - Up, Injection molding, Resin injection, Filament winding, Pultrusion, Centrifugal casting and Prepregs.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the students will be able to,

- Learn the potential applications of superconductors.
- Acquire knowledge on various materials characterization techniques.
- Understand the fundamentals of nano materials and various synthesize methods.
- Build knowledge about smart materials and their applications.
- Be familiar with the fundamentals of composite materials and synthesize methods.

TEXT BOOKS

1. P.Mani, " A Text book of Engineering Physics " Dhanam Publications, 2018
2. Rajendran V. "Engineering Physics". TaTa McGraw Hill Publications, 2012.
3. Sam Zhang, Lin Ki, Ashok Kumar, Materials Characterization Techniques,CRC Press, Taylor & Francis Group, Boca Raton, Florida, 2009

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2009.
3. P. SanthanaRagavan and P. Ramasamy, "Crystal Growth Processes and Methods", KRU Publications, Kumbakonam, 2017

E-RESOURCES

1. https://nptel.ac.in/courses/112108150/
2. https://swayam.gov.in/nd1_noc19_mm13/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	1	2	1	1	-	-	-	-	-	-	-	-
2	2	3	2	1	2	1	1	-	-	-	-	-	-	-	-
3	2	3	2	1	2	1	1	-	-	-	-	-	-	-	-
4	2	3	2	1	1	1	1	-	-	-	-	-	-	-	-
5	2	3	2	1	2	1	1	-	-	-	-	-	-	-	-
AVG	2	3	2	1	1.8	1	1	-	-	-	-	-	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23CYT201 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY L T P C
(Common to All B.E /B.Tech Branches) **3 0 0 3**

OBJECTIVES

- To understand the importance of the environment, ecosystem, biodiversity and its conservation.
- To impart knowledge on various kinds of pollutions, solid waste management and precautionary measures for disasters.
- To be familiar with the social issues and identify the possible way to improve the quality of the environment.
- To analyze the problems of overpopulation and understand the value education.
- To familiarize the concept of sustainability and implement sustainable practices in various fields.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment – Need for public awareness - Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, rivers, oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – Biogeographically classification of India – Value of biodiversity – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity – Endangered and endemic species of India – Conservation of biodiversity: In-Situ and Ex-Situ conservation of biodiversity.

Activity: Biodiversity in and around the campus and report submission.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solid wastes - E-waste – Role of an individual in prevention of pollution - Pollution case studies – Disaster management: floods, earthquake and cyclone.

Activity: Local pollution case study and report submission.

UNIT III SOCIAL ISSUES AND THE ENVIRONMENT 9

Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies - Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Green Chemistry and principles - Environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Public awareness.

Activity: Creating environmental awareness.

UNIT IV HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

Activity: Visit to local primary health center.

UNIT V SUSTAINABLE MANAGEMENT 9

Sustainability-Concept, needs and challenges-economic, social and aspects of sustainability-From unsustainability to sustainability-Millennium development goals, and protocols-Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-Case studies. Zero waste and R concept, Material Life cycle assessment, Environmental Impact Assessment, Sustainable habitat: Energy efficiency, Sustainable transports.

Activity: Field trips to local organizations or facilities with sustainable practices in place.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Acquire knowledge on public awareness & about the environment, ecosystem and biodiversity.
- Find solutions for pollutions and waste management to improve the quality of environment.
- Identify the causes of social issues and apply the concept of green chemistry to maintaining a clean environment.
- Analyze the effects of human population and issues related to the environment and human health.

- Understand the different goals of sustainable development and apply them for suitable technological advancement and societal development.

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Second Edition, Pearson Education, 2004.
3. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", First Edition, Prentice Hall, 2015.

REFERENCES

1. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt Ltd, Hydrabad, 2015.
2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt Ltd, New Delhi, 2007.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	1	3	2	-	1	3	-	1	-	-	1	-	-	-
2	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-
3	-	2	2	2	1	1	3	-	-	-	-	-	-	-	-
4	1	2	2	1	1	2	3	3	-	-	-	-	-	-	-
5	-	2	2	2	2	1	1	1	-	2	-	-	-	-	-
AVG	1.5	1.8	2.2	1.8	1.5	1.4	2.2	2	1	2	-	1	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23MET201 **MANUFACTURING TECHNOLOGY- I** **L T P C**
3 0 0 3

OBJECTIVES

- To study the sand casting for a two part mould is to remove the pattern without breaking the mould cavity and ready to be filled with the molten metal.
- To join two separate pieces of metal or plastic together to form one singular piece and not be able to break apart under (potential) applied load.
- To understand modern forging machine driven impact hammers or presses which deform the workpiece by controlled pressure.
- To obtain the sheet metal forming involves a wide range of processes that manufacture parts for a vast amount of purposes, both seen and unseen.
- To provide the students with overall knowledge on the manufacturing of plastic materials, their properties, applications, processing & quality control, and recycling through theory as well as practical training.

UNIT I METAL CASTING PROCESSES **9**

Sand casting - Sand moulds - Type of patterns - Pattern materials - Pattern allowances - Types of moulding sand - Properties - Core making - Methods of Sand testing - CO_2 process - Moulding machines - Working principle of special casting processes - Shell, investment casting - Pressure die casting - Centrifugal casting - Sand Casting defects.

UNIT II METAL JOINING PROCESSES **9**

Introduction to welding processes - Principle of Gas welding and arc welding. Principle of Resistance welding, Gas metal arc welding, submerged arc welding, Tungsten Inert Gas welding, Thermit welding and Electron beam welding- Welding defects.

UNIT III BULK DEFORMATION PROCESSES **9**

Hot working and cold working of metals - Forging processes - Open and closed die forging - Characteristics of the process - Rolling of metals - Types of Rolling mills - Flat strip rolling - Shape rolling operations - Defects in rolled parts - Principle of rod and wire drawing.

UNIT IV SHEET METAL FORMING PROCESSES **9**

Sheet metal characteristics - Typical shearing operations, bending and drawing operations - Stretch forming operations.Working principle and application of special forming processes - Hydro forming - Rubber pad forming - Metal spinning - Explosive forming - Magnetic pulse forming - Peen forming - Super plastic forming.

UNIT V PROCESSING OF PLASTIC COMPONENTS 9

Types of plastics - Characteristics of the forming and shaping processes - Moulding of Thermoplastics - Working principles and applications of Injection moulding - Plunger and screw machines - Compression moulding - Transfer moulding - Blow moulding - Rotational moulding - Film blowing - Extrusion - Thermoforming - Bonding of Thermoplastics.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the different metal casting processes, associated defects, merits and demerits.
- Identify the different metal joining processes.
- Summarize various hot working and cold working methods of metals.
- Analysis the various sheet metal making processes.
- Distinguish various methods of manufacturing plastic components.

TEXT BOOKS

1. Hajra Chouldhary S.K and Hajra Choudhury. A.K., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008.
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2013.
3. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.

REFERENCES

1. Rao,P.N. "Manufacturing Technology Foundry, Forming and Welding", Fourth Edition, TMH-2013.
2. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006.
3. Serope Kalpakjian, and Steven R. Schmid, "Manufacturing Engineering and Technology", Fifth Edition, Pearson Education, 2015

E-RESOURCES

1. http://nptel.ac.in/courses/1121 05126/ - Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools"
2. https://freevideolectures/A0dTvf_Q8BA / - Prof.A.B.Chattopadhyay, "Manufacturing Process"

Mapping of Cos-Pos & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
2	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
3	2	1	1	-		1	2	-	-	-	1	1	2	1	2
4	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
5	2	1	1	-		1	2	-	-	-	1	1	2	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AV G	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2

1-Low 2-Medium 3-High '-' – No Correlation

23HST202	TAMILS AND TECHNOLOGY	L T P C 1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY **3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY **3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- ThirumalaiNayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY **3**

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING **3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

TOTAL: 15 PERIODS

TEXT BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. 6.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

REFERENCE BOOKS

1. Heritage of Tamils, Published by:Yes Dee Publishing Pvt Ltd, Chennai
2. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

23GEE201	ENGINEERING GRAPHICS (Common to all Programmes)	L T P C 3 0 2 4

OBJECTIVES

- To acquire the knowledge of various curves.
- To learn projections of points, lines, planes viewed in different positions.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views and perspective projections.
- To learn the principles of projection of simple solids.
- To gain the knowledge about the section of solids and development of surfaces of the given solids.

UNIT I PLANE CURVES (Manual drafting) 9+3

Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per BIS conventions. **(Not for Examination)**

Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES (Manual drafting) 9+3

Projection of points – Projection of straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to one reference planes.

UNIT III ORTHOGRAPHIC AND PERSPECTIVE PROJECTIONS (Manual drafting) 9+3

Conversion of isometric projection into orthographic projection. Perspective projection of prisms, pyramids, cones and cylinders by visual ray method.

UNIT IV PROJECTION OF SOLIDS (CAD software) 9+3

Projections of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V SECTION OF SIMPLE SOLIDS AND DEVELOPMENT OF SURFACES (CAD software) 9+3

Sectioning of simple solids like prisms – pyramids, cylinder and cone - Inclined to one reference plane. Development of lateral surfaces of simple and truncated solids: Prisms, Pyramids, Cylinders and Cones.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Predict the construction of various curves.
- Analyze the principles of projection of various planes by different angle to project points, lines and plane surfaces.
- Draw the projection of three dimensional into two dimensional objects and perspective projections.
- Draw the principles of projection of simple solids by change of position method.
- Construct the sectional views of components and develop the component surface.

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., - "Engineering Graphics", Fifteenth Edition, New Age International (P) Limited, 2018.
2. Natarajan K.V., "Engineering Graphics", Thirty Second Edition, Dhanalakshmi Publishers, 2019.
3. Bhatt N.D., "Engineering Drawing", Fifty Third Edition Charotar Publishing House Pvt. Ltd., 2014.

REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", Fifty Fifth Edition, Subhas Publications, Bangalore, 2017.
2. T.Jeyapoovan., "Engineering Graphics using Auto CAD" Third Edition, vikas publishing house Pvt Ltd, New Delhi, 2017.
3. Dhananjay A. Jolhe, Engineering Drawing with an introduction to AutoCAD, Tata McGraw Hill Publishing Company Limited, 2008.

E- RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/ - (Geometric Constructions)
2. https://nptel.ac.in/courses/105/104/105104148/ - (Projections)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
2	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
3	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
4	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
5	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2

1-Low 2-Medium 3-High '-' – No Correlation

23GEL201 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch boardwiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type usingDiac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone..
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
4	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
5	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
6	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
AVG	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER III

23MAT301 **TRANSFORMS AND COMPLEX FUNCTIONS** **L T P C**
(Common to Civil, EEE, Mech, R&A and PT) **3 1 0 4**

OBJECTIVES

- To explain Fourier transforms techniques used in wide variety of situations.
- To utilize the effective mathematical tools to develop Z transform techniques for discrete time systems.
- To apply the Fourier series analysis to many applications in engineering to solve boundary value problems.
- To develop the fundamental concepts in analytic functions, conformal mapping and bilinear transformations.
- To extend the standard techniques of complex integration.

UNIT I FOURIER TRANSFORMS **9+3**

Statement of Fourier integral theorem – Fourier transform – Fourier sine and cosine transforms – Properties of Fourier transform – Convolution theorem for Fourier transform – Parseval's identity for Fourier transform

UNIT II Z-TRANSFORMS AND DIFFERENCE EQUATIONS **9+3**

Z-transforms: Some standard Z-transforms – Elementary properties – Some useful Z-transforms and inverse Z- transforms – Convolution theorem – Evaluation of Inverse Z-transforms by partial fraction method – Application to difference equations.

UNIT III FOURIER SERIES **9+3**

Euler's formulae – Conditions for a Fourier expansion – Functions having points of discontinuity – Odd and even function – Half range series – Parseval's formula – Practical Harmonic analysis.

UNIT IV ANALYTIC FUNCTIONS **9+3**

Cauchy-Riemann equations – Analytic functions – Properties of analytic functions – Harmonic functions – Orthogonal system – Construction of analytic functions – Bilinear transformation – Conformal transformation by $w = 1/z$.

UNIT V COMPLEX INTEGRATION **9+3**

Cauchy's theorem – Cauchy's integral formula –Taylor's and Laurent's series – Residues: Residue theorem – Calculation of residues – Evaluation of real definite integrals: Integration around the unit circle.

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze some of the physical problems of engineering by Fourier transforms.
- Apply Z transforms techniques in solving difference equation.
- Solve differential equations using Fourier series analysis.
- Develop the concept of analytic functions, conformal mapping and bilinear transformations.
- Evaluate integrals using Cauchy's integral formula and residue theorem.

LIST OF TUTORIALS

1. Calculate Fourier transform of simple functions.
2. Solve difference equations by Z transforms.
3. Computation of Fourier series coefficient.
4. Determination of Bilinear transformation for the given set of points.
5. Calculate complex line integration.

TOTAL:45+15 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, Forty Third Edition, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", Tenth Edition, John Wiley, India, 2016.

REFERENCES

1. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", Nineth Edition, Laxmi Publications Pvt. Ltd, 2014
2. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Engineering Mathematics - Volume III", S. Chand and Company Ltd., NewDelhi, 2010.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/111/102/111102129/# (Transforms)
2. https://archive.nptel.ac.in/courses/111/105/111105134/ (Complex functions)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
2	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
3	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
4	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
5	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23MET301 ENGINEERING THERMODYNAMICS L T P C

(Use of Standard Refrigerant Tables and Chart Data Book and Steam Table is Permitted) **3 1 0 4**

OBJECTIVES

- To understand the fundamentals of thermodynamics and basic conversion principles of mass and energy to closed and open systems
- To provide better understanding of laws of thermodynamics.
- To understand the thermodynamic properties and properties of pure substance.
- To develop an ability to identify the concept of thermodynamic relations.
- To enlighten the basic concept of psychrometry.

UNIT I BASIC CONCEPTS AND FIRST LAW 9+3

Basic concepts - Concept of continuum, comparison of microscopic and macroscopic approach - Thermodynamic systems - Closed, open and isolated - Thermodynamic equilibrium state, path and process - Quasi-static, reversible and irreversible processes - Heat and work transfer, Zeroth law of thermodynamics and First law of thermodynamics - Application to closed and open systems - Steady and unsteady flow processes.

UNIT II SECOND LAW OF THERMODYNAMICS AND CONCEPT OF ENTROPY 9+3

Heat Reservoir, source and sink - Heat Engine, Refrigerator, Heat pump - Second law of themodynamics - Kelvin - Planck and Clausius statements - Carnot cycle Reversed Carnot cycle, Performance - Clausius inequality - Concept of entropy, entropy change for - Pure substance, ideal gases, principle of increase in entropy. Basic concept of availability.

UNIT III PROPERTIES OF PURE SUBSTANCE 9+3

Properties of pure substance, thermodynamic properties of pure substance in solid, liquid and vapour phases, phase rule, Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Thermodynamic properties of steam. Calculations of work done and heat transfer in non flow and flow processes. Determination of steam quality.

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9+3

Properties of Ideal gas - Ideal and real gas comparison - Equations of state for ideal and real gases. Compressibility factor and Compressibility chart and its use. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation.

UNIT V PSYCHROMETRY **9+3**

Psychrometric - Properties, charts. property calculations of air vapour mixtures by using chart and expressions - Psychrometric process - Adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the fundamental concepts and definitions, thermodynamic principles to Engineering problems.
- Understand the second law of thermodynamics and availability analysis.
- Identify the properties of pure substance and explain the working of steam power cycle.
- Discuss the thermodynamic relation, ideal and real gas behavior.
- Understand the fundamental properties and types of psychrometric process.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010.
3. Rajput.R.K, "A Textbook of Engineering Thermodynamics", 5th ed., Laxmi Publications, 2016.

REFERENCES

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam publications, 2012.
3. Holman.J.P, "Thermodynamics", 10th ed., McGraw Hill Education, 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/112/105/112105266/ - (Concepts of Thermodynamics)
2. https://nptel.ac.in/courses/112/104/112104113/ - (Basics of Thermodynamics)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1
2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1
3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1
4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1
5	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	3	3	3	-	-	-	-	-	-	3	3	3	1

2- Low 2-Medium 3-High '-' – No Correlation

23MET302 **ENGINEERING MECHANICS** **L T P C**
(Common to Civil, Mech and R&A) **3 1 0 4**

OBJECTIVES

- To understand the definition of particle, body, force and their equilibrium conditions.
- To understand the concept of equilibrium of rigid bodies.
- To learn the basic concepts of friction.
- To learn about the center of gravity and moment of inertia of surfaces.
- To develop basic dynamics concepts – force, momentum, and impact of elastic bodies.

UNIT I FUNDAMENTAL CONCEPTS OF MECHANICS **9+3**

Introduction to mechanics – Scalars & vectors - Unit conversion – Laws of Mechanics (Parallelogram law, Lami's theorem and Triangular law of forces) – Types of forces acting on a body - Resolution and composition of force – Free body diagram – Equilibrium of a particle - Equivalent system of forces and computation of resultant forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES **9+3**

Introduction - Varignon's theorem - Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Resolution of a given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III FRICTION **9+3**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – Angle of Repose – Equilibrium of bodies on inclined plane - Belt friction – Ladder friction – Wedge friction – Rolling resistance.

UNIT IV CENTRIODS AND AREA MOMENT OF INERTIA **9+3**

Introduction – Centroids of simple Plane Areas and Curves (rectangle, triangle, circle, hollow circle, T-section & I-section) – Area moment of inertia for rectangle, circle, hollow circle, triangle, I-Section and T-Section - Parallel axis theorem and Perpendicular axis theorem. Principle moments of inertia of plane areas.

UNIT V DYNAMICS OF PARTICLES **9+3**

Kinematics - Rectilinear Motion and Curvilinear Motion of particles. Principle of Impulse and Momentum - Impact of elastic bodies.

TOTAL: 45+15=60 PERIODS

OUTCOMES

On successful completion of this course, The Students can able to:

- Illustrate the vector and scalar representation of forces and moments
- Analyze the rigid body in equilibrium.
- Determine the friction and the effects by the laws of friction.
- Solve the moment of inertia of the structural members.
- Apply the principles of dynamics to study the motion of a body.

TEXT BOOKS

1. Dr.N.Kottiswaran, "Engineering Mechanics", Eleventh Edition, Sri Balaji Publications,Coimbatore, 2017.
2. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell,Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education.,Twleveth Edition, 2019.
3. Vela Murali, "Engineering Mechanics", Oxford University Press, 2017.

REFERENCES

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", Eleventh Edition, Pearson Education, 2010.
2. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, Seventh Edition, Wiley student edition, 2013.
3. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, Fifth Edition, McGraw Hill Higher Education, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/122/104/122104015/ - ((Engineering Mechanics)
2. https://www.courses.com/indian-institute-of-technology-guwahati/engineering-mechanics - (Engineering Mechanics)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2
2	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2
3	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2
4	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2
5	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	1	2	-	-	-	-	-	-	2	3	1	2

1- Low 2-Medium 3-High '-' – No Correlation

23MEE301 MANUFACTURING TECHNOLOGY-II L T P C
3 0 2 4

OBJECTIVES

- To acquire knowledge on the mechanism of chip formation in machining, cutting tool materials, tool life and cutting fluids.
- To understand the working of lathe and milling machine.
- To provide working skill and knowledge on shaping, planing, slotting and different drilling operations.
- To learning the process parameters in grinding operations, finishing operations and gear generations.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming.
- To study and practice the moulding processes techniques, various operations that can be performed in lathe, Milling, shaping machines, CNC part programming and their techniques.

UNIT I THEORY OF METAL CUTTING 9

Mechanism of chip formation - Orthogonal and Oblique cutting - Machining forces - Merchant's Circle Diagram- Thermal aspects of metal machining - Cutting fluids - Machinability - Cutting tool materials - Tool wear - Tool life calculations.

UNIT II LATHE AND MILLING MACHINE 9

Lathe machine - Centre lathe, tool nomenclature, operations, machining time and power estimation - Milling - Specifications - Types - Cutter nomenclature - Operations - Milling processes - Indexing - Gear forming.

UNIT III MACHINE TOOLS AND HOLE MAKING 9

Types, Specification and Quick return Mechanisms: Shaper, Planer and Slotter - Hole making operations - drilling, reaming, boring, counter boring, counter sinking and tapping.

UNIT IV GRINDING AND GEAR GENERATION 9

Grinding - Types of grinding - Grinding wheel designation and selection - Honing, lapping, super finishing, polishing and buffing - Gear generation - Gear shaping and gear hobbing - Specifications - Cutting spur and helical gears.

UNIT V CNC MACHINING 9

Numerical Control (NC) machine tools - CNC types, constructional details, special features, machining centre, part programming fundamentals CNC - Manual part programming - Micromachining - Wafer machining**.**

LIST OF EXPERIMENTS

1. Mould with solid and split patterns.
2. Mould with loose-piece pattern.
3. Perform facing, plain turning and step turning operations in centre lathe.
4. Perform taper turning, thread cutting and knurling operations in centre lathe.
5. Fabrication of simple structural shapes using arc welding.
6. Spur gear/contour cutting in milling machine.
7. Prepare good surface finish on flat metal.
8. Round to square in shaper.
9. CNC part Programming using CNC lathe and CNC milling machine.
10. Cylindrical grinding

TOTAL: 45+15=60 PERIODS

OUTCOMES

On successful completion of this course, The Students can able to:

- Describe the fundamentals of metal cutting in machining operations
- Identify the components of lathe and milling machine.
- Execute various machining processes such as shaping, milling and gear cutting.
- Select the process parameters in grinding operations, finishing operations and gear generations for the given material.
- Summarize numerical control of machine tools operations and write a part program.
- Perform moulding processes techniques, welding and various operations that can be performed in lathe machines, milling and shaper.

TEXT BOOKS

1. Rajput R. K, "Manufacturing Technology", Laxmi Publications (P) Ltd., New Delhi, 2013.
2. Richard R Kibbe, John E Neely, Roland O Merges and Warren T White, "Machine Tool Practices",Prentice Hall of India, New Delhi, Tenth Revised edition, 2014.
3. Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; Fourth edition, 2018.

REFERENCES

1. Hajra Choudhury S. K, "Elements of Workshop Technology", Vol. II, Media \ Promoters & Publishers Pvt Ltd., Mumbai, 2010.

2. Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2011.
3. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, Second edition, 2017.

E-RESOURCES

1. http://nptel.ac.in/courses/1121 05126/ - Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools"
2. https://freevideolectures/A0dTvf_Q8BA/-Prof.A.B.Chattopadhyay, "Manufacturing Process"

Mapping of Cos-Pos & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2
2	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2
3	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2
4	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2
5	3	2	1	-		1	-		-		-	1	1	1	2
6	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2
AV G	3	2	1	-	-	1	-	-	-	-	-	1	1	1	2

1- Low 2-Medium 3-High '-' – No Correlation

23MEE302 **METROLOGY AND MEASUREMENTS** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To study the concepts of measurement and characteristics of instruments.
- To learn the method of linear and angular measurements techniques.
- To identify the use of laser and advances in metrology for linear geometric dimensions.
- To provide knowledge on measurement of thread and gear terminologies using suitable instruments.
- To categorize the methods of measurement of force, torque, power, flow and temperature.
- To attain knowledge on measurement of mechanical parameters using suitable instruments.

UNIT I BASICS OF METROLOGY **9**

Introduction - Need for measurements - Methods of measurement - Generalized measuring systems - Units and Standards - Types of measuring instruments - Errors in Measurement - Types of errors - Calibration and Interchangeability - Precision and Accuracy - Characteristics of measuring instruments. Limits, Fits and Tolerance.

UNIT II LINEAR AND ANGULAR MEASUREMENTS **9**

Linear Measuring Instruments: Vernier Caliper, Vernier Height and Vernier Depth Gauge - Inside, Outside and Depth Micrometer - Slip Gauge - Limit Gauge - Comparator: Mechanical, Pneumatic and Electrical - Angular Measurements: Bevel protractor, Sine bar, Angle Decker, Autocollimator.

UNIT III ADVANCES IN METROLOGY **9**

Interferometer: NPL Flatness, Laser and Michelson - Coordinate Measuring Machine - Basic concept, Types, Constructional features, Probes, Accessories - Basic concepts of Machine Vision System - Element - Applications.

UNIT IV FORM MEASUREMENT **9**

Principles and Methods of straightness - Flatness measurement - Thread measurement, gear measurement, surface finish measurement, Roundness measurement - Applications

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS **9**

Measurement of forces: Direct methods - Equal arm balance and unequal arm balance - Indirect methods - Accelerometers, Load cells, Bourdon tubes. Torque measurement: Strain gauges -

Torsion bars. Measurement of Power: Mechanical and DC dynamometers, Eddy current dynamometers. Measurement of flow: Hot wire anemometer, Ultrasonic flow meter. Temperature Measurement: Bimetallic strip, pyrometers, Pressure thermometers, Thermocouples, Thermopoile, Thermistors.

LIST OF EXPERIMENTS

1. Calibration of precision measuring instruments: Vernier caliper, Micrometer, Vernier height gauge and
2. Calibration of bore gauge and telescopic gauge.
3. Measurement of taper angle using sine bar/sine center and angular dimension measurement using Bevel protractor.
4. Measurement of thickness of gear tooth using gear tooth Vernier.
5. Comparison of gear/screw parameter using Profile projector/Tool Maker"s microscope.
6. Measurement of force
7. Measurement of torque
8. Measurement of temperature.
9. Inspection of specimen using Mechanical/Electrical comparator.
10. Measurement of screw thread parameter using Floating Carriage Micrometer.
11. Measurement of straightness and flatness using two axes Auto Collimator.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Describe the concepts of measurements to apply in various metrological instruments.
- Illustrate the methods for linear, angle and flatness measurements and select a suitable method and its relevant instrument for a given application.
- Understand the procedure for conducting computer aided inspection.
- Measure the threads, gear tooth profiles, surface roughness and flatness using appropriate instruments and analyze the data.
- Identify the construction, working principles and select appropriate measuring instruments for force, torque, power, flow and temperature for a given application.

- Examine various measuring techniques of mechanical properties in industrial applications.

TEXT BOOKS

1. R.K .Rajput, " A textbook of Measurements and Metrology", Katson Publishers, 2013.
2. Venkateshan, S. P., "Mechanical Measurements", Second Edition, John Wiley & Sons, 2015.
3. Jain R.K. "Engineering Metrology", Khanna Publishers, Twenty First Edition, 2010.

REFERENCES

1. Raghavendra , Krishnamurthy "Engineering Metrology & Measurements", Oxford Univ. Press, 1st Edition, 2013.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 4th Edition, 2018.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2014.

E-RESOURCES

1. https://nptel.ac.in/courses/112/104/112104250/ - (Introduction to Measurements and Metrology)
2. http://www.downloadmela.com/videolectures/engineering5/mechanicalengineering6/mechanical measurements-and-metrology/ - (Metrology and Measurements)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1
2	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1
3	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1
4	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1
5	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1
6	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1
AVG	3	2	2	2	-	-	-	-	1	-	-	1	3	2	`1

1- Low 2-Medium 3-High '-' – No Correlation

23CEE402 **FLUID MECHANICS AND MACHINERY** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To impart knowledge on the properties of fluid flow characteristics and its dynamics.
- To understand the difference between laminar and turbulent flow through circular conduits and losses in pipe flow.
- To gain the knowledge of dimensional and model analysis.
- To improve the knowledge of types of pumps, working principle, application and performance analysis of fluid pumps.
- To recognize the basic knowledge of types of turbines, working principle, velocity triangle and performance curves of hydraulic turbines.
- To verify the principles studied in fluid mechanics theory by performing experiments in lab.

UNIT I FLOW CHARACTERISTICS AND DYNAMICS OF FLUID FLOW 9

Introduction - Properties of fluids - Flow characteristics - Rate of flow, concept of control volume and continuity equation for one dimensional flow. Dynamics of fluid flow - Euler's equation of motion, Bernoulli's equation and its application.

UNIT II FLUID FLOW TYPES AND FLOW THROUGH PIPES 9

Flow of viscous fluid through circular pipe- Hagen Poiseuille equation - Types of fluid flow - Steady and unsteady, Uniform and non-uniform, Laminar and Turbulent, Compressible and incompressible, Rotational and irrotational (Qualitative treatment). Flow through pies (Loss of energy in pipes) - Major losses - Darcy-Weisbach equation and Chezy's formula - Minor losses - Moody diagram (Qualitative treatment) - Flow though pipes in series and in parallel.

UNIT III DIMENSIONAL AND MODEL ANALYSIS 9

Introduction - Derived quantities - Dimensional Homogeneity - Method of dimensional analysis - Rayleigh's method and Buckingham's π- theorem. Similitude - Types of similitude - Dimensionless numbers - Model laws - Application of dimensionless parameters - Model analysis.

UNIT IV HYDRAULIC PUMPS 9

Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies– Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and it's variations - Work saved by fitting air vessels - Rotary pumps.

UNIT V HYDRAULIC TURBINE 9

Impact of jets - Velocity triangles - Theory of rotodynamic machines - Classification of turbines - Working principles - Pelton wheel - Modern Francis turbine - Kaplan turbine - Work done - Efficiencies - Draft tube - Specific speed - Performance curves for turbines.

LIST OF EXPERIMENTS

1. Coefficient of discharge of Venturi meter.
2. Coefficient of discharge of Orifice meter.
3. Determination of friction factor for a given set of pipes.
4. Determination of co-efficient of discharge for an external mouth piece.
5. Performance test on centrifugal pump.
6. Performance test on reciprocating pump
7. Performance test on gear pump.
8. Performance analysis of Pelton wheel.
9. Performance analysis of Francis turbine.
10. Performance analysis of Kaplan turbine.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the dynamics of fluid flow and summarize the flow characteristics.
- Identify the flow characteristics and calculate major and minor losses associated with pipe flow in piping networks.
- Invent the principles of dimensional analysis and model analysis to fluid flow problems.
- Evaluate the performance of pumps.
- Conduct the performance study on different turbines.
- Apply the Bernoulli's principle to find the coefficient of discharge, determine the friction factor for set of pipes, and analyze the performance characteristics of turbine and pumps.

TEXT BOOKS

1. Bansal R.K, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2019.
2. Modi P.N and Seth S.M, "Hydraulics and Fluid Mechanics includingHydraulic Machines", Standard Book House, New Delhi. 2019.

3. Rajput R.K , "Fluid Mechanics and Hydraulic Machines", S.Chand Publishing Limited, New Delhi ,2016.

REFERENCES

1. K.L Kumar, "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, Seventh Edition, 2016.
2. Giles, R.V, Evett, J.B & Liu C, "Fluid Mechanics and Hydraulics", Tata McGraw Hill, New Delhi, 2015.
3. Khurmi R S, "Fluid mechanics& hydraulic Machines. (in S.I. units)", S Chand & Company Limited, New Delhi,2015.

E-RESOURCES

1. https://nptel.ac.in/courses/112/105/112105171/ - (Fluid Mechanics)
2. https://nptel.ac.in/courses/112/105/112105182/ - (Introduction to Fluid Mechanics and Compressible flow)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
2	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
3	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
4	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
5	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
6	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3
AVG	3	3	2	2	-	2	2	-	2	-	-	2	3	2	3

1- Low 2-Medium 3-High '-' – No Correlation

SEMESTER IV

23MET402 FLUID POWER SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To study the different components in hydraulic and pneumatic system.
- To describe the working principles, operation of hydraulic components.
- To describe the working principles, operation of pneumatic components.
- To explain the various techniques of circuit building in hydraulics and pneumatics.
- To solve problems and troubles in fluid power systems.

UNIT I FUNDAMENTALS OF FLUID POWER SYSTEMS 9

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow

UNIT II HYDRAULIC CONTROL COMPONENTS 9

Introduction - Hydraulic pumps, Actuators, Motors – types and construction details, Cushioning mechanism, Valves - direction, flow and pressure - types and construction details.

UNIT III PNEUMATIC CONTROL COMPONENTS 9

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.

UNIT IV INDUSTRIAL APPLICATION OF FLUID POWER SYSTEMS 9

Speed control circuits, Regenerative circuits, Feed circuits, Sequencing circuits, Synchronizing circuits, Fail-safe circuits, Cascade method, Accumulators and Intensifier circuits and its applications.

UNIT V RECENT TREND IN FLUID POWER SYSTEMS 9

Servo systems – Proportional valves. 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 – Hydraulic and Pneumatic power packs.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Identify fluid power components used in industry and also select suitable pump for hydraulic power pack.
- Explicit the types, working and performance of pumps and actuators in hydraulic system.
- Outline the types and its functions of control valves in pneumatic systems.
- Design and develop the hydraulic and pneumatic circuits for simple industrial applications.
- Design, install and maintain fluid power circuits for engineering applications

TEXT BOOKS

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education Asia Delhi, New Delhi, Seventh Edition, 2015.
2. Majumdar S.R., "Oil Hydraulics Systems", Tata McGraw-Hill Education India, New Delhi, Second Edition, 2013.
3. Shanmugasundaram K, Hydraulic and Pneumatic Controls, Chand & Co, Delhi, Third Edition, 2019.

REFERENCES

1. Ilango S, Soundararajan V, "Introduction to Hydraulics and Pneumatics", Prentice hall of India, New Delhi, Second Edition, 2015.
2. Jagadeesha. T., "Pneumatics Concepts, Design and Applications", Universities Press, 2015.
3. Srinivasan.R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints, Third Edition, 2019.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/112/106/112106300/(oil Hydraulics and Pneumatics)
2. https://www.digimat.in/nptel/courses/video/112106300/L81.html(Pump control Hydraulic Systems)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
2	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
3	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
4	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
5	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1

1-Low 2-Medium 3-High '-' – No Correlation

23MET402 **KINEMATICS OF MACHINERY** **L T P C**
3 1 0 4

OBJECTIVES

- To comprehend the fundamentals of kinematics and to understand the concept of machines, mechanisms and related terminologies.
- To study the displacement, velocity and acceleration analysis of simple mechanisms.
- To draw the displacement, velocity and acceleration diagrams for a given cam profile and analyse the special contour cams.
- To inferring about the basic concepts, terminologies of gears and gear trains.
- To illustrate the occurrence and its effects of friction in various machine elements.

UNIT I BASICS OF MECHANISMS **9 + 3**

Classification of mechanisms - Basic kinematic concepts and definitions - Degree of freedom, Mobility - Kutzbach criterion, Gruebler's criterion – Grashof's Law - Kinematic inversions of four -bar chain and slider crank chains - Limit positions - Mechanical advantage – Transmission Angle - Quick return mechanisms

UNIT II LINKAGE MECHANISMS **9 + 3**

Displacement, velocity and acceleration analysis of simple mechanisms - Graphical method - Velocity and acceleration polygons - Velocity analysis using instantaneous centres.

UNIT III CAM MECHANISMS **9 + 3**

Classification of cams and followers - Terminology and definitions - Displacement diagrams - Uniform velocity, parabolic, simple harmonic and cycloidal motions - Derivatives of follower motions - Layout of plate cam profiles.

UNIT IV GEARS AND GEAR TRAINS **9 + 3**

Law of toothed gearing - Involutes and cycloidal tooth profiles - Spur Gear terminology and definitions – Gear tooth action - Contact ratio - Interference and undercutting.Gear trains - Speed ratio, train value - Epicyclic Gear Trains

UNIT V FRICTION IN MACHINE ELEMENTS **9 + 3**

Surface contacts - Sliding and Rolling friction - Friction drives - Friction in screw threads - Friction clutches

TOTAL :45 +15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the various mechanical engineering problems related to kinematics of machines.
- Analyze the velocity and acceleration on various links which constitute a mechanism.
- Understand the working principle of cams.
- Solve problems on gears and gear trains.
- Examine friction in machine elements.

TEXT BOOKS

1. Rattan, S.S, "Theory of Machines", Fifth Edition, Tata McGraw-Hill, 2019.
2. R.S.Khurmi and J.K.Gupta, "Theory of Machines" S.Chand and Co Ltd., 2019.
3. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, Third Edition 2019.

REFERENCES

1. Cleghorn. W. L, "Mechanisms of Machines",Oxford University Press, Third Edition, 2019.
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, Third Edition, 2015.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/112/104/112104121/ - (Kinematics of Machines)
2. https://nptel.ac.in/courses/112/105/112105268/-(Kinematics of Mechanism and Machines)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2
2	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2
3	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2
4	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2
5	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	-	2	-	-	1	-	-	-	1	3	1	2

1-Low 2-Medium 3-High '-' – No Correlation

23MET403 ENGINEERING MATERIALS AND METALLURGY L T P C
3 0 0 3

OBJECTIVES

- To provide in depth knowledge on the constitution of alloys and phase diagrams.
- To learn about different phases and heat treatment methods to tailor the properties of Fe-C alloys.
- To predict the metallurgical properties of Non-ferrous metals, aluminium alloy and bearing materials.
- To impart knowledge on non-metallic materials.
- To Identify and select suitable materials properties and testing.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys - Solid solutions, substitutional and interstitial - Phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron-carbon equilibrium diagram - Classification of steel and cast Iron microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition - Full annealing, stress relief, recrystallisation and spheroidising - Normalising, Hardening and Tempering of steel - Isothermal transformation diagrams - cooling curves superimposed on I.T - Diagram CCR - Hardenability, Jominy end quench test - Austempering, martempering - Case hardening, carburizing, Nitriding, cyaniding, carbonitriding - Flame and Induction hardening.

UNIT III FERROUS AND NON-FERROUS METALS 9

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W stainless and tool steels - HSLA, Maraging steels - Cast Iron - Grey, white, malleable, spheroidal - Alloy cast irons, Copper and copper alloys - Brass, Bronze and Cupronickel - Aluminium and Al-Cu - Precipitation strengthening treatment - Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV NON-METALLIC MATERIAL 9

Polymers - Types of polymer, commodity and engineering polymers - Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers - Urea and Phenol formaldehydes) - Engineering Ceramics - Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and Sialon.

UNIT V MECHANICAL PROPERTIES AND TESTING 9

Mechanisms of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the structures of materials and interpret the phase diagrams.
- Describe the concept of heat treatment of steels and hardening mechanisms.
- Acquire knowledge on tailoring material properties of ferrous and non-ferrous metals.
- Summarize the properties and applications of non metallic materials.
- Apply suitable testing methods to analyze mechanical properties of materials.

TEXT BOOKS

1. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers, 2014.
2. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials properties and selection" Pearson India Education Services Pvt ltd, 9 edition, 2017.
3. William D.Callister,Jr and David G.Rethwisch " Materials science and Engineering, An introduction" Wiley, 10th Edition, 2020.

REFERENCES

1. Jindal U.C, "Material Science and Metallurgy", First Edition, Dorling Kindersley Publication, 2012.
2. Raghavan.V, "Materials Science and Engineering: A First Course", Sixth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2016.
3. T. DebRoy, H. K. D. H. Bhadeshia "Innovations in Everyday Engineering Materials" Springer International Publishing. 2021.

E-RESOURCES

1. https://nptel.ac.in/courses/113/102/113102080/ - (Introduction to Material science and Engineering)
2. https://nptel.ac.in/courses/113/104/113104068/ - (Phase diagram in Material science and Engineering)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1
2	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1
3	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1
4	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1
5	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1
6	-	-	-	-	-			-	-		-	-	-	-	-
AVG	2	2	-	2	-	2	2	-	-	2	-	-	2	3	1

1-Low 2-Medium 3-High '-' – No Correlation

23MEE401 **THERMAL ENGINEERING** **L T P C**

(Lab Embedded Theory Course) **3 0 2 4**

(Use of Standard Refrigerant Tables and Chart Data Book and Steam Table is Permitted)

OBJECTIVES

- To understand the working of various auxiliary systems of internal combustion engines.
- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes.
- To apply the thermodynamic concepts into various thermal application like steam nozzles and turbines.
- To acquire knowledge on the principles and working of air compressors.
- To analyze various refrigeration and air conditioning systems,
- To understand the value timing, port timing diagram of IC engine, performance test on diesel engine, compressor and characteristics of fuels/lubricates.

UNIT I INTERNAL COMBUSTION ENGINES **9**

IC engines - Classification, Components and their function - Valve timing diagram and port timing diagram - Actual and theoretical p-V diagram of four stroke and two stroke engines and their comparison - Fuel injection system and Ignition system - Battery and Magneto Ignition System - Knocking in SI and CI Engines - Supercharger and Turbocharger - Lubrication and Cooling systems - Performance calculation.

UNIT II GAS POWER CYCLES **9**

Air standard efficiency - Mean effective pressure - Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency - Comparison of cycles.

UNIT III STEAM NOZZLES AND TURBINES **9**

Steam nozzle - Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow - Impulse and Reaction principles, compounding, velocity diagram for simple turbines, speed regulations - Governors.

UNIT IV AIR COMPRESSOR **9**

Classification of air compressors and working principle of various types of compressors - Construction and working of single stage air compressor with and without clearance - Volumetric efficiency - Isothermal efficiency and Isentropic efficiency of reciprocating compressors - Multistage air compressor and inter cooling - Work of multistage air compressor.

UNIT V REFRIGERATION AND AIR CONDITIONING 9

Refrigerants - Vapour compression refrigeration cycle - Performance calculations - Super heat, sub cooling - Working principle of vapour absorption system, Ammonia - Water, Lithium bromide - Water systems (Description only) - Air conditioning system - Processes - Types and Working Principles - Simple Cooling Load calculations.

LIST OF EXPERIMENTS

1. Valve Timing diagrams.
2. Port Timing diagrams.
3. Performance Test on 4 - stroke Diesel Engine.
4. Heat Balance Test on 4 - stroke Diesel Engine
5. Morse Test on Multi-cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of Flash Point and Fire Point of various fuels / lubricants.
8. Performance Test on Reciprocating air compressor.
9. Determination of COP of refrigeration systems.
10. Experiments on Psychrometric processes

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Identify the various components of IC engine and their process.
- Analyze the different properties of gas power cycles and apply in different Thermal engineering applications.
- Explain the formation of steam, steam nozzles and turbines.
- Find out the various flow parameters of air compressors.
- Describe the concepts of Refrigeration cycles and Air Conditioning systems.
- Conclude the value timing, port timing diagram of IC engine, Perfomance test on Petrol Engine, Diesel Engine and compressor and characteristics of fuels/Lubricates.

TEXT BOOKS

1. Kothandaraman.C.P., Domkundwar. S,Domkundwar.A.V., "A course in thermal Engineering" Fifth Edition, "DhanpatRai & sons , 2016.
2. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2017.
3. Michael A. Boles, Yunus A. Cengel, "Thermodynamics: An Engineering Approach", Eigth Edition., Tata McGraw - Hill Education, 2017.

REFERENCES

1. Arora.C.P, "Refrigeration and Air Conditioning ", Tata McGraw-Hill Publishers, 2008.
2. Ganesan V.." Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill, 2012.
3. Manohar Prasad, "Refrigeration and Air Conditioning", Third Edition, New Age International publications, 2021.

E-RESOURCES

1. https://nptel.ac.in/courses/112/103/112103262/ - (Engine and Gas Turbines)
2. https://nptel.ac.in/courses/112/103/112103275/-(Applied Thermodynamics for Engineers)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	2	1	1	1	-	1	-	1	3	3	1	2
2	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2
3	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2
4	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2
5	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2
6	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2
AVG	3	3	2	2	1	1	1	-	1	-	1	3	3	1	2

1-Low 2-Medium 3-High '-' – No Correlation

23MEE402	STRENGTH OF MATERIALS	L T P C
	(Lab Embedded Theory Course)	3 0 2 4

(Common to Mechanical and Robotics and Automation)

OBJECTIVES

- To make the students to understand the concepts of stress and strains.
- To study the concept of two dimensional stress systems and stresses in thin and thick cylinders.
- To familiarize about shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To impart knowledge on finding slope and deflection of beams by various methods..
- To provide awareness on stresses on shafts and helical springs based on theory of torsion.
- To learning the mechanical properties of materials when subjected to different types of loading.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Stresses types -Tension, Compression and Shear Stresses - Hooke's law - Stresses and strains due to axial force in stepped and composite bars - Stresses due to thermal effect in composite bars - Factor of safety - Poisson ratio - Elastic constants and their relationship.

UNIT II STRESSES IN TWO DIMENSIONS 9

Stresses on inclined planes - Principal planes and Principal stresses - Mohr's circle for bi-axial stress with shear stress - Analytical and Graphical methods. Hoop and longitudinal stresses in thin and thick cylindrical vessels, Maximum Shear stress, Changes in dimensions and volume.

UNIT III TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAMS 9

Types of supports, Loads and beams - Shear force and bending Moment in cantilever, simply supported and overhanging beams. Theory of simple bending - Bending stress distribution – Load carrying capacity - Proportioning of sections - Shear stress distribution.

UNIT IV DEFLECTION OF BEAMS 9

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - Conjugate beam method for computation of slope and deflection of determinant beams.

UNIT V TORSION IN SHAFT AND HELICAL SPRING 9

Torsion of circular solid and hollow shafts - Shear strength - Angle of twist and torsional stiffness - Stresses in helical springs - Deflection of helical springs, carriage springs.

LIST OF EXPERIMENTS

1. Tension test on steel rod in U.T.M.
2. Torsion test on steel rod.
3. Impact test on metal specimen.
4. Hardness test on metals - Brinell and Rockwell Hardness.
5. Deflection test on beams.
6. Spring Test - Open coil and Closed coil.
7. Effect of Hardening – improvement of hardness and impact resistance of steels
8. Tempering- Improvement Mechanical properties Comparison
   (i) Unhardened specimen
   (ii) Quenched Specimen and
   (iii) Quenched and tempered specimen.
9. Double shear test on metal
10. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Calculate the stress and strains in regular and composite structures subjected to axial loads.
- Analyze the importance of two dimensional stress systems and stresses in thin and thick cylinders.
- Draw the shear force diagram, bending moment diagram for beams subjected to different loading conditions. Evaluate the bending stress and shear stress distribution.
- Estimate the slope and deflection of beams.
- Apply torsion equation in design of circular shafts and helical springs.
- Perform tension test, torsion test, impact test, hardness test, deflection test and spring test on given specimen.

TEXT BOOKS

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, Sixth Edition, 2017
2. Rajput R K., "A Textbook of Strength of Materials (Mechanics of Solids)", S Chand and Company Ltd., New Delhi, Seventh Edition, 2018.
3. F.P. Beer and R.Johnston, "Mechanics of Materials", McGraw Hill Education India (P) Ltd., Seventh Edition, 2017.

REFERENCES

1. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, Third Edition, 2016.
2. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi 2016.
3. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/112/107/112107146 - (Strength of Materials)
2. https://nptel.ac.in/courses/105/105/105105108/ - (Introduction to Strength of Materials)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
2	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
3	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
4	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
5	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
6	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3
AVG.	3	3	3	-	-	3	-	3	2	3	-	3	3	2	3

1- Low 2-Medium 3-High '-' – No Correlation

23GEE301 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To understand the basics of algorithmic problem solving.
- To learn the data types, expressions and the statements in python.
- To study the Python functions and function calls to solve problems.
- To learn python data structures-list, tuples, dictionaries to represent complex data.
- To understand the file modules and python packages.
- To practice various computational operations and develop solutions using python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocksofalgorithms(statements,state,controlflow,functions),notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS,TUPLES,DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

UNIT V FILES, MODULES, PACKAGES& DATA VISUALIZATION 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file - Importing Matplotlib – Introduction to plotting – visualizing errors – density and contour plots – Histograms.

TOTAL :45 PERIODS

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops.(Number series,Number Patterns, pyramid pattern)
4. Implementation of real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementation of real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementation of programs using Functions.(Factorial,largest number in a list,area of shape)
7. Implementation of programs using Strings. (reverse,palindrome,charactercount, replacingcharacters)
8. Implemenation of programs using written modules and Python Standard Libraries(p and as, numpy. Matplotlib, scipy)
9. Implementation of real-time/technical applications using File handling.(copy from one file to another, word count, longest word)
10. Implementation of real-time/technical applications using Exception handling.(divide by zero error, voter's age validity, student mark range validation)

TOTAL : 45 +15 = 60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Develop algorithmic solutions to solve simple computational problems.
- Develop python programs using expressions to solve the problem.
- Deploy functions and function calls to decompose python programs.
- Implement solutions using compound data in Python lists, tuples, dictionaries.
- Utilize file modules and python packages for developing applications
- Implement python programs for solving various computational problems

TEXTBOOKS

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", Second Edition, O'Reilly Publishers, 2016.
2. 2.Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", First Edition, BCS Learning & Development Limited, 2017.

REFERENCES

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, First Edition, 2021.
2. G.Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", First Edition, Notion Press, 2021.

E – RESOURCES

1. https://nptel.ac.in/courses/106104074(Introduction to Algorithms)
2. https://archive.nptel.ac.in/courses/106/106/106106182/ (Joy of Computing)

Mapping of Cos-Pos& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-
AVG	2.33	2.5	1.5	1.83	1.83	-	-	-	-	-	1.5	0.66	2.66	0.5	-

1 - low, 2 - medium, 3 - high, '-"- no correlation

SCHEME

Credit Summary

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023 - 2024 onwards)

CREDIT SUMMARY

B.E. MECHANICAL ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	7	-	-	-	-	3	-	14
BS	12	7	4	-	-	-	-	-	23
ES	4	6	4	4	-	-	-	-	18
PC	-	3	16	18	12	8	-	-	57
PE	-	-	-	-	9	9	-	-	18
GE	-	-	-	-	-	-	3	-	03
OE	-	-	-	-	-	3	6	-	09
EEC	1	2	1	2	2	5	2	9	24
MC	-	-	-		-	-	-	-	-
Total	21	25	25	24	23	25	14	09	166

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

MINOR DEGREE/HONOURS

B.E. – MECH (MECHANICAL)

DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION - 2023

MINOR DEGREE / HONOURS

INDUSTRIAL SAFETY ENGINEERING

CURRICULUM AND SYLLABI

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS - INDUSTRIAL SAFETY ENGINEERING)

B.E - MECHANICAL ENGINEERING

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MEIT01	Safety Management	PC	3	0	0	3	40	60	100
23MEIT02	Industrial Safety, Health and Environment (SHE) Acts	PC	3	0	0	3	40	60	100
23MEIT03	Fire Engineering and Explosion Control	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23MEIE01	Safety in Engineering Industry	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23MEIP01	Project Work	EEC	0	0	12	6	40	60	100
		TOTAL CREDITS	19						

PC : Professional Core
EEC : Employability Enhancement Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

SEMESTER III

23MEIT01 **SAFETY MANAGEMENT** **LT P C**
3 0 0 3

OBJECTIVES

- To learn the safety management function and techniques
- To understand the basic principles of safety audit
- To know the accident reporting and investigation procedure
- To study the safety performance monitoring and accident data analysis.
- To learn the safety education and training, evaluation of safety performance in an organization.

UNIT I CONCEPTS AND TECHNIQUES **9**

Content Evolution of modern safety concept - Safety Management functions - planning for safety for optimization of productivity - productivity, quality and safety - line and staff functions for safety - safety committee - budgeting for safety - safety policy - Statutory Provisions for safety management. Incident Recall Technique (IRT), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT II SAFETY **AUDIT** **9**

Components of safety audit, types of audit, audit methodology, non conformity reporting (NCR), audit checklist and report - review of inspection, remarks by government agencies, consultants, experts - perusal of accident and safety records, formats - implementation of audit indication - identification of unsafe acts of workers and unsafe conditions in the shop floor

UNIT III ACCIDENT INVESTIGATION AND REPORTING **9**

Basic Principle of Accident & Prevention concept of an accident, reportable and non reportable accidents, reporting to statutory authorities - principles of accident prevention - accident investigation and reporting - Accident analysis - based on causes & injury - records for accidents, departmental accident reports, documentation of accidents - unsafe act and condition - Accident causation theories - domino sequence - supervisory role - role of safety committee - cost of accident

UNIT IV SAFETY PERFORMANCE MONITORING **9**

Reactive and proactive monitoring techniques, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate) Recommended practices for compiling and measuring work injury experience - permanent total disabilities, permanent partial disabilities – accident data analysis.

UNIT V SAFETY EDUCATION AND TRAINING **9**

Importance of training - identification of training needs - training methods such as hands on training and tabletop exercise - Programme, seminars, conferences, competitions - method of promoting safe practice - motivation -

communication -safety attitude and culture - role of government agencies and private consulting agencies in safety training - creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign - Domestic Safety and Training.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply principles of safety management, its function and technique in any organization.
- Recall about safety audit and to prepare a report for the audit.
- Identify the knowledge on the principles of accident and its control methods.
- Evaluate the accident cost using supervisors report and data.
- Recall the role of various agencies in safety education and training.

TEXT BOOKS

1. Blake, R.B., "Industrial Safety," Prentice Hall Inc, Third Edition, 2009.
2. Heinrich, H.W., "Industrial Accident Prevention", McGraw-Hill Company, Fifth Edition, 2019.
3. R.K Jain , "Industrial Safety, Health and Environment management systems", Khanna Publications, Second Edition, 2015

REFERENCES

1. Krishnan, N.V., "Safety Management in Industry", Jaico Publishing House", Second Edition, 2017.
2. Lees, F.P., "Loss Prevention in Process Industries", Butterworth publications, Second Edition,2001.
3. Gupta, R.S., "Hand Book of Safety Management" Orient Longman, 2016.

E-RESOURCES

1. https://www.youtube.com/watch?v=M0fjtV9nPJY – (Theories of accident causation)
2. https://www.safetyproresources.com/blog/9-steps-for_accident-investigations-(OSHA inspection process)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
2	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
3	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
4	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
5	2	1	1	-	-	1	2	-	-	-	1	1	2	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2	1	1	-	-	1	2	-	-	-	1	1	2	2	2

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER IV

23MEIT02 INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENT (SHE) ACTS **L T P C**
3 0 0 3

OBJECTIVES

- To learn the health and welfare provisions as given in factories act.
- To understand the environment act with respect to air and water pollution.
- To know about the Manufacture, storage and import of chemical rules.
- To study the other acts and rules pertaining to health and safety.
- To learn the various International acts and standards

UNIT I FACTORIES ACT - 1948 **9**

Statutory authorities - inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young person's - special provisions - penalties and procedures - Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948, forms, registers and notices - Amendments.

UNIT II ENVIRONMENT ACT - 1986 **9**

General powers of the central government, prevention, control and abatement of environmental pollution - Biomedical waste (Management and Handling) Rules, 1989 - The Noise Pollution (Regulation and control) Rules, 2000 - The Batteries (Management and Handling) Rules, 2001 - No Objection certificate from statutory authorities like pollution control board.

UNIT III MANUFACTURE, STORAGE AND IMPORT OF CHEMICAL RULES 1989 **9**

Definitions - duties of authorities - responsibilities of occupier - notification of major accidents - information to be furnished - preparation of offsite and onsite plans - list of hazardous and toxic chemicals - safety reports - safety data sheets.

UNIT IV OTHER ACTS AND RULES **9**

Indian Boiler Act 1923, Static and Mobile Pressure Vessel Rules (SMPV), Motor Vehicle Rules, Mines Act 1952, Workman Compensation Act, Rules - Electricity Act and Rules - Hazardous Wastes (Management and Handling) Rules, 1989, with amendments in 2000 - The Building and Other Construction Workers Act 1996., Petroleum rules, Gas cylinder rules - Explosives Act 1983 - Pesticides Act.

UNIT V INTERNATIONAL ACTS AND STANDARDS **9**

Occupational Safety and Health Act of USA (The Williams - Steiger Act of 1970) - Health and Safety Work Act (HASAWA) 1974, UK - SHAS 18001 - ISO 45001 - American National Standards Institute (ANSI).

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Identify the health and welfare provisions as given in factories act
- Examine the knowledge on environment act with respect to air and water pollution.
- Analyze the responsibilities of occupier according to manufacture, storage and import of chemical rules.
- Evaluate the other legislation acts pertaining to health and safety.
- List out the various international acts and rules.

TEXT BOOKS

1. The Factories Act 1948, Madras Book Agency, Chennai, Second Edition, 2015.
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt. Ltd., New Delhi, Second Edition, 2019.
3. Danuta Koradecka, "Handbook of Occupational Health and Safety", CRC, 2015.

REFERENCES

1. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt. Ltd., Allahabad, Second Edition, 2016.
2. The Mines Act 1952, Commercial Law Publishers (India) Pvt. Ltd., Allahabad, Second Edition, 2019.
3. S.P.Mahajan, "Pollution control in process industries", Tata McGraw Hill Publishing Company, 2015.

E-RESOURCES

1. https://nptel.ac.in/courses/120108004 - (Environment Management)
2. https://www.youtube.com/watch?v=9QM-3LMeBQA – (Factories Act)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	1	-	1	2	-	2	-	1	1	3	2	2
2	2	2	-	1	-	1	2	-	2	-	1	1	3	2	2
3	2	2	-	1	-	1	2	-	2	-	1	1	3	2	2
4	2	2	-	1	-	1	2	-	2	-	1	1	3	2	2
5	2	2	-	1	-	1	2	-	2	-	1	1	3	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2	2	-	1	-	1	2	-	-	-	1	1	3	2	2

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER V

23MEIT03 FIRE ENGINEERING AND EXPLOSION CONTROL LT P C 3 0 0 3

OBJECTIVES

- To Study the principles of fire and explosion and characteristics of various materials.
- To Understand the Design of fire prevention and suppression systems.
- To Study the Variety of industrial fire protection systems.
- To Know Different building fire safety and structural fire protection.
- To Learn Various explosion protecting systems.

UNIT I PHYSICS AND CHEMISTRY OF FIRE 9

Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion - vapour clouds - flash fire - pool fires - unconfined vapour cloud explosion, shock waves - auto – ignition - boiling liquid expanding vapour explosion - case studies - Flixborough, Mexico disaster, Piper Alpha, Peterborough & Bombay Victoria dock ship explosions.

UNIT II FIRE PREVENTION AND PROTECTION 9

Sources of ignition - fire triangle - principles of fire extinguishing - active and passive fire protection systems - various classes of fires - A, B, C, D - types of fire extinguishers - fire stoppers - hydrant pipes – hoses - monitors - fire watchers - layout of stand pipes - fire station - fire alarms and sirens - maintenance of fire trucks - foam generators - escape from fire rescue operations - fire drills - notice - first aid for burns.

UNIT III INDUSTRIAL FIRE PROTECTION SYSTEMS 9

Sprinkler - hydrants - stand pipes - special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards - alarm and detection systems. Other suppression systems - CO_2 system, foam system, dry chemical powder (DCP) system and halon system - need for halon replacement - smoke venting. Portable extinguishers - flammable liquids - tank farms - indices of inflammability - fire fighting

UNIT IV BUILDING FIRE SAFETY 9

Objectives of fire safe building design, fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of egress design - exits - width calculations - fire certificates - fire safety requirements for high rise buildings - snookers.

UNIT V EXPLOSION PROTECTING SYSTEMS **9**

Principles of explosion - detonation and blast waves - explosion parameters - Explosion Protection, Containment, Flame Arrestors, , suppression, venting, explosion relief of large enclosure – explosion venting - inert gases, plant isolation for generation of inert gas - rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO_2) and halons - hazards in LPG, ammonia (NH_3), sulphur dioxide (SO_3), chlorine (Cl_2) etc.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, Students will be able to:

- Recall about the fire properties of solid, liquid and gases and understand the principle of fire and combustion theory.
- Gain knowledge about the fire prevention and fire protection systems.
- Observe knowledge on different sources of ignition, classes of fires and their extinguishing medium
- Ability to know the objective of building fire safety and relevant standards.
- Apply the principles of explosion and understand about their protecting systems.

TEXT BOOKS

1. Venkatesh Kodur, Mohammad Naser, “Structural fire engineering”, McGraw-Hill Publishing Company, Twentieth Edition, 2020.
2. National Fire Protection Association, “Guide for Fire and explosion Investigations”, NFPA, Sixteenth Edition, 2016.
3. Lon H. Ferguson, Christopher A Janicak, “Fundamentals of Fire Protection for the safety professionals”, Government Institutes, Inc, Second Edition, 2015.

REFERENCES

1. Dennis P. Nolan, “Fire pump arrangements at industrial facilities”, Elsevier science, Third Edition, 2017
2. Derek, James, “Fire Prevention Hand Book”, Butter Worths and Company, London, Nineth Edition, 2016.
3. Martin Gillie, Yong Wang, “Applications of Fire Engineering”, CRC Press, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/105102176 - (Fire Protection, Services and Maintenance Management of Building)
2. https://onlinecourses.nptel.ac.in/noc21_me28/preview - (Explosions and Safety)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	-	1	2	-	2	1	-	1	3	2	2
2	3	2	1	2	-	1	2	-	2	1	-	1	3	2	2
3	3	2	1	2	-	1	2	-	2	1	-	1	3	2	2
4	3	2	1	2	-	1	2	-	2	1	-	1	3	2	2
5	3	2	1	2	-	1	2	-	2	1	-	1	3	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	1	2	-	1	2	-	-	1	-	1	3	2	2

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER VI

23MEPS301 SAFETY IN ENGINEERING INDUSTRY L T P C
3 0 0 3

OBJECTIVES

- To study the Workplace hazards in a manufacturing engineering industry
- To Understand the control of hazards and usage of proper personal protective equipment.
- To Know Safety in welding and gas cutting.
- To know Safety in cold farming and hot working of metals.
- To learn Safety In finishing, inspection and testing.

UNIT I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES 9

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes - saws, types, Hazards.

UNIT II PRINCIPLES OF MACHINE GUARDING 9

Design aspects of machine guarding, Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.

UNIT III SAFETY IN WELDING AND GAS CUTTING 9

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing - explosive welding, selection, care and maintenance of the associated equipment and instruments - safety in generation, distribution and handling of industrial gases - colour coding

UNIT IV SAFETY IN COLD FARMING AND HOT WORKING OF METALS 9

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot - operated presses, power press electric controls, power press set up and die removal, inspection and maintenance - metal shears-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills - hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

UNITV SAFETY IN FINISHING, INSPECTION AND TESTING **9**

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry - pollution control in engineering industry - industrial waste disposal.

LIST OF EXPERIMENTS

1. Carryout the Noise level Measurement for a given area and compare with the standards.
2. Find the illumination level of a given area using the Lux meter.
3. Find the percentage of CO_2, CO, SO_2 and O_2 present in the exhaust gas of a given diesel/petrol engine using Exhaust gas analyzer under different loading conditions.
4. Find the total mass of the suspended particulate matter in a given area using the respirable dust sampler.
5. Determine the earth resistance and resistivity by using the earth resistance for the given soil.
6. Find the insulation resistance for the given motor and cable using insulation tester.
7. Identify the given PPE's and explain in detail about its usage.
8. Identify the various types of fire extinguishers and elaborate in detail about its operation and method of extinguishing.
9. Find the toxic and flammable level of the given chemical using dispersion modeling (ALOHA) software.
10. What is meant by First-aid and what are the items to be kept in the first-aid box? Explain briefly.

TOTAL : 45+15 : 60 PERIODS

LIST OF EQUIPMENTS

1.	Noise level meter	- 1 no.
2.	Lux meter	- 1 no.
3.	Exhaust gas analyzer	- 1 no.
4.	Respirable dust sampler	- 1 no.
5.	Earth resistance tester	- 1 no.
6.	Insulation tester	- 1 no.
7.	PPE set	- 1 no.
8.	Fire extinguisher set	- 1 no.
9.	ALOHA Software (*on-line – trial version)	- 1 no.
10	First-aid kit	- 1 no.

OUTCOMES

Upon completion of the course, Students will be able to

- Determine the General safety rules, principles, maintenance, Inspections of metal and wood working machinery
- Apply the concepts of safety in design, use and maintenance of machines.
- Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.
- Analyze the safety in cold working and hot working of metals.
- Prepare on safety in finishing, inspection and testing of machines.

TEXT BOOKS

1. Frank R Spellman, "Safety Engineering principles and practices", Rowman & Littlefield, Third Edition, 2018.
2. C Ray Ashafl, David W. Rieske, "Industrial Safety and Health Management", Pearson, Seventh Edition, 2018.
3. David Goetsch, "The Basics of Occupational Safety", Pearson, Third Edition, 2018.

REFERENCES

1. Wiley, "Process Safety for Engineers An Introduction", Wiley Al-che, Second Edition, 2022.
2. W. David Yates, "Safety Professionals Reference and Study Guide", CRC Press, Third Edition, 2020.
3. Alan J Stolzer"Safety Management Systems In Aviation" CRC Press, Third Edition ,2023

E-RESOURCES

1. https://nptel.ac.in/courses/110105094 - (Industrial Safety Engineering)
2. https://onlinecourses.nptel.ac.in/noc21_me16/preview-(Inspection and Quality Control In Manufacturing)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	2	-	1	2	2	2	1	-	1	2	2	2
2	2	2	2	2	-	1	2	2	2	1	-	1	2	2	2
3	2	2	2	2	-	1	2	2	2	1	-	1	2	2	2
4	2	2	2	2	-	1	2	2	2	1	-	1	2	2	2
5	2	2	2	2	-	1	2	2	2	1	-	1	2	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2	2	2	2	-	1	2	2	-	1	-	1	2	2	2

1 - Low 2 - Medium 3 - High '-' – No Correlation

SEMESTER VII

23METP01 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES

- To know the various skills to formulate a technical project.
- To understand the ability to solve specific problem.
- To study the use of new tools, algorithms and techniques required to carry out the projects.
- To study the guidance on the various procedures for validation of the product and analyze the costeffectiveness.
- To know the guidelines to prepare technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES

At the end of the project, the students will be able to:

- Define a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Develop the test and validate through conformance of the developed prototype and analysis the costeffectiveness.
- Adapt technical report and oral presentations.
- Solve any challenging practical problem in the field of engineering and find better solutions to it.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
2	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
3	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
4	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
5	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
6	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
AVG	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2

1-Low 2-Medium 3-High '-' – No Correlation

DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION - 2023

MINOR DEGREE/ HONOURS

3D PRINTING

CURRICULUM AND SYLLABI

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS - 3D PRINTING)

B.E- MECHANICAL ENGINEERING

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23METT01	3D Printing Machines and Systems	PC	3	0	0	3	40	60	100
23METT02	Rapid Tooling and Industrial Applications	PC	3	0	0	3	40	60	100
23METT03	Print Operations Management	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23METE01	3D Printing Design Process	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23METP01	Project Work	EEC	0	0	12	6	40	60	100
		TOTAL CREDITS	19						

PC : Professional Core
EEC : Employability Enhancement Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

SEMESTER III

23METT01	**3D PRINTING MACHINES AND SYSTEMS**	**LT P C**
		3 0 0 3

OBJECTIVES

- To Learn the construction of basic 3D Printing machines
- To Understand the Energy delivery, Material delivery, Nozzle and Heating Systems
- To Know the Optical & Optoelectronic components in 3D Printing
- To Study the environmental control systems
- To Understand the Pre-processing & Post processing techniques in 3D printing

UNIT I INTRODUCTION TO 3D PRINTING MACHINES & PROCESSES 9

Introduction to 3D Printing Machines: Historical Perspectives, Rapid Prototyping - An Integral Part of Time Compression Engineering, RP Information Workflow.

Rapid Prototyping Processes: Classification of Rapid Prototyping Processes, Processes Involving a Liquid - Solidification of a Liquid Polymer

UNIT II RAPID PROTOTYPING SYSTEMS 9

Stereolithography Apparatus, Solid Ground Curing Systems, Fused Deposition Modelling Systems, SelectiveLaser Sintering Systems, Laminated Object Manufacturing Systems, Paper Lamination Technology

UNIT III TECHNICAL, TECHNOLOGICAL CAPABILITIES & APPLICATIONS OF RAPID PROTOTYPING TECHNOLOGY 9

Technical Characteristics and Technological Capabilities of Concept: Modellers, 3D Sys tems Thermo JetPrinter, Sanders Model Maker II, Stratasys Genisys Xs 3D Printer, JP System,

Applications of Rapid Prototyping Technology: Functional Models, Pattern for Investment and Vacuum Casting,Art Models, Engineering Analysis Models.

UNIT IV INDIRECT & DIRECT METHODS FOR RAPID TOOL PRODUCTION 9

Indirect Methods for Rapid Tool Production: Role of Indirect Methods in Tool Production, Metal Deposition Tools, Epoxy Tools, Ceramic Tools, Cast Metal Tools, Investment Casting, Fusible Metallic Core, Sand Casting Process.

Direct Methods for Rapid Tool Production: Classification of Direct Rapid Tool Methods, Direct ACESTM Injection Molds, DTM RapidToo1 Process, Sand Form EOS Direct tool Process, , Topographic Shape Formation.

UNIT V APPLICATIONS OF RAPID TOOLING TECHNOLOGY & PROCESS OPTIMISATION 9

RPT Optimization - Factors Influencing Accuracy - Data Preparation, Errors due to Tessellation and Slicing, Part Building, Part Building Errors in the SL Process and SLS Process, Part Finishing, Selection of Part Build Orientation, Orientation Constraints of the SL and SLS Process.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Utilize the construction of basic 3D printing machines.
- Identify the Energy delivery, Material delivery, Nozzle and Heating Systems.
- Examine the Optical & Optoelectronic components in 3D Printing.
- Discover the environmental control systems.
- Develop the Pre-processing & Post processing techniques in 3D printing.

TEXT BOOKS

1. D.T. Pham, S.S. Dimov, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer Science & Business Media, Second Edition, 2018.
2. Clifford T Smyth, "Functional Design for 3D Printing Machines", Third Edition, 2017.
3. Rafiq Noorani, "3D Printing Technology, Applications, and Selection", Fourth Edition 2019.

REFERENCES

1. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Third Edition, 2018.
2. Peter Hilton & Paul Jacobs, "Rapid Tooling: Technologies and Industrial Applications", Second Edition, 2017.
3. Paul F. Jacobs, "Rapid Tooling: Technologies and Industrial Applications", Third Edition, 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/116102052 - (Advanced Textile printing technology)
2. https://nptel.ac.in/courses/116102053 - (3 D Printing machine)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	2	-	-	-	-	1	3	1	3
2	3	2	2	-	-	-	2	-	-	-	-	1	3	1	3
3	3	2	2	-	-	-	2	-	-	-	-	1	3	1	3
4	3	2	2	-	-	-	2	-	-	-	-	1	3	1	3
5	3	2	2	-	-	-	2	-	-	-	-	1	3	1	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	-	-	-	2	-	-	-	-	1	3	1	3

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER IV

23METT02	RAPID TOOLING AND INDUSTRIAL APPLICATIONS	LT P C
		3 0 0 3

OBJECTIVES

- To know the suitable rapid tooling technique for rapid product development.
- To learn the suitable tooling method for the given industrial application.
- To study the errors during development of tool and minimize them.
- To study the tool for the given medical application.
- To understand the tool for the given automobile application.

UNIT I BASICS, DEFINITIONS, AND APPLICATION LEVELS 9

Additive Manufacturing - Layer Manufacturing, Principle of layer-based technology, Application Levels, Indirect processes, Classes of machines for additive manufacturing.

UNIT II LAYER MANUFACTURING PROCESSES 9

Direct Layer Manufacturing Processes, Polymerization - Laser-Stereolithography, Polymer Printing and Jetting, Digital Light Processing, Micro Stereolithography. Sintering and Melting - Laser Sintering - Laser Melting - Selective Laser Melting (SLM), Electron Beam Melting. Extrusion - Fused Layer Modeling, Powder - Binder Bonding - Three-Dimensional Printing - Z-Corporation, Prometal - LLM

UNIT III APPLICATIONS OF RAPID PROTOTYPE TOOLING 9

Data Processing and Application Workflow - AM Process Chain, Applications of AM - Automotive Industries and Suppliers. Aerospace Industry, Consumer Goods, Toy Industry, Art and History of Art, Foundry and Casting Technology, Mold and Die Making for Plastic Injection Molding and Metal Die Casting, Medical, Architecture and Landscaping.

UNIT IV ADDITIVE MANUFACTURING DESIGN AND STRATEGIES 9

Potential of AM, Potentials and Resulting Perspectives - Complex Geometries, Integrated Geometry, Integrated Functionalities, Multi-Material Parts and Graded Materials. AM-Based New Strategies – Customization.

UNIT V MATERIALS, DESIGN, AND QUALITY ASPECTS FOR ADDITIVE MANUFACTURING 9

Materials for AM - Anisotropic and Isentropic properties material, Graded and Composite Materials. Engineering Design Rules for AM - Tolerances – Digital to Object, Relative Fit, Flexures, Hinges, and Snap-Fits, Orientation and Clamping, Drillings (Bores), Gaps, Pins, and Walls. AM Properties, Selection, Build Management

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Identify suitable rapid tooling technique for rapid product development.
- Model the suitable tooling method for the given industrial application.
- Identify the errors during development of tool and minimize them.
- Design and fabricate the tool for the given medical application
- Design and fabricate the tool for the given automobile application

TEXT BOOKS

1. Andreas Gebhardt, "Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture", Third Edition, 2018.
2. Kaushik Kumar, Divya Jindani," Rapid prototyping and tooling", Second Edition, 2020.
3. Ali K. Kamrani, Emad Abouel Nasr, "Rapid Prototyping : Theory and Practice", Second Edition, 2020.

REFERENCES

1. Chee Kai Chua, Kah Fai Leong, Chu Sing Lim, "Rapid Prototyping: Principles and Applications", Second Edition, 2018.
2. D.T. Pham and S.S Dimov, Rapid Manufacturing: The Technogies and Applications of Rapid Prototyping & Rapid Tooling, Springer, 2019.
3. Wanlong Wang, Henry W. Stoll and James G. Conley, Rapid Tooling Guidelines for Sand Casting, Springer, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/112104265 - (Rapid Manufacturing)
2. https://archive.nptel.ac.in/courses/112/104/112104265/ - (Rapid Manufacturing process)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	-	-	2	1	-	-	-	-	-	3	1	2
2	2	3	2	-	-	2	1	-	-	-	-	-	3	1	2
3	2	3	2	-	-	2	1	-	-	-	-	-	3	1	2
4	2	3	2	-	-	2	1	-	-	-	-	-	3	1	2
5	2	3	2	-	-	2	1	-	-	-	-	-	3	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2	3	2	-	-	2	1	-	-	-	-	-	3	1	2

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER V

23METT03	PRINT OPERATIONS MANAGEMENT	LT P C 3 0 0 3

OBJECTIVES

- To apply the Basic concepts of print operations.
- To understand the concepts of Scheduling and its importance in the printing Industry.
- To acquire knowledge of the various applications of inventory and project management withrespect to the Printing Industry.
- To analyze and select an materials & capacity requirement planning.
- To scrutinize and design the network models in print operations.

UNIT I INTRODUCTION **9**

Organization Structure - Sole Proprietor, Partnership, Limited Company, Administrative office routine, Forms used, Processing orders; Facility location decision making - Economic analysis - Qualitative factor Analysis - Layout of the factory - Analysis & selection; Human Factors - Consideration of man & machine job-design, Ergonomics -Working environment - Worker safety.

UNIT II SEQUENCING **9**

Gantt chart, Algorithms for solving sequencing problems - Processing of N jobs through 2 machines, n jobs through 3 and K machines, Assignments and transportation algorithms

UNIT III INVENTORY MANAGEMENT **9**

Definition & purpose, Inventory classification, EOQ, Materials handling and Warehousing.

UNIT IV MATERIALS & CAPACITY REQUIREMENT PLANNING **9**

MRP, CRP - Concepts & applications, Aggregate planning & Master Scheduling, ERP - Concepts and systems.

UNIT V NETWORK MODELS **9**

Introduction, PERT and CPM models, Network construction, Problems, Resource analysis and allocation, Replacement analysis, Application & case studies.

TOTAL: 45 PERIODS

OUTCOMES

- Discuss the working of printing organization.
- Apply various management concepts in managing a print establishment.
- Critically analyze the print operations management concepts to solve management problems.
- Summarize the materials and capacity requirement planning.
- Illustrate about various network models.

TEXT BOOKS

1. N.D.Vohra, "Quantitative techniques in management", Tata McGraw Hill Publishing Co. Ltd., 2017.
2. Joseph G.Monks, " Operations Management – Theory and Problems", McGraw Hill International Ltd., 2016.
3. Chase, R.B., Ravi Shankar & Jacobs, F.R. Operations & Supply Management. Fifteenth Edition, McGraw Hill

REFERENCES

1. U.K.Srivastava, G.V.Shenory & S.C.Sharma, "Quantitative techniques for Managerial decisions", NewAge international (P) Ltd., Publishers - Formerly Wiley Eastern Ltd., Third Edition 2016.
2. Ravi Anupindi, Sunil Chopra, Managing Business Process Flows: Principles of Operations Management, Pearson, Fourth Edition 2015
3. Slack N, Chambers S, Johnston R, "Operations management", Prentice Hall, Third Edition 2016

E-RESOURCES

1. https://www.digimat.in/nptel/courses/video/110106045/L34.html - (Operation and supply chain management)
2. https://archive.nptel.ac.in/courses/112/103/112103306/ (Fundamental of Additive manufacturing Technology)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	2	-	-	-	1	-	-	1	2	1	3
2	3	2	2	1	2	-	-	-	1	-	-	1	2	1	3
3	3	2	2	1	2	-	-	-	1	-	-	1	2	1	3
4	3	2	2	1	2	-	-	-	1	-	-	1	2	1	3
5	3	2	2	1	2	-	-	-	1	-	-	1	2	1	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	1	2	-	-	-	1	-	-	1	2	1	3

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER VI

23METE01	**3D PRINTING PROCESSES** (Lab Embedded Theory Course)	**L T P C** **3 0 2 4**

OBJECTIVES

- To know the importance of 3D printing in Manufacturing.
- To know the different 3D Printing Technologies.
- To select a suitable material for 3D Printing.
- To observe the different methods for Post-processing of 3D Printing parts.
- To understand the applications of 3D Printing in Automobile, Aerospace, Bio-medical etc.
- To gain practical experience in handling 3D printing software systems.

UNIT I INTRODUCTION AND BASIC PRINCIPLES **9**

3D Printing, Generic 3D Printing Process, Benefits of 3D Printing, Distinction Between 3D Printing and CNC Machining, Other Related Technologies

Development of 3D Printing Technology: Introduction, Computers, Computer-Aided Design Technology, Other Associated Technologies, The Use of Layers, Classification of 3D Printing Processes, Metal and Hybrid Systems.

UNIT II 3D PRINTING PROCESS CHAIN & PHOTO POLYMERIZATION PROCESSES **9**

Eight Steps in Additive Manufacture, Variations from One 3D Printing Machine to Another, Metal Systems, Maintenance of Equipment, Materials Handling Issues, Design for 3D Printing.

Introduction to Photo polymerization Processes: Photo polymerization Materials, Reaction Rates, Vector Scan SL, SL Resin Curing Process, SL Scan Patterns, Vector Scan Micro stereo lithography, Mask Projection Photo polymerization technologies and processes.

UNIT III POWDER BED FUSION PROCESSES & EXTRUSION-BASED SYSTEMS **9**

Powder Bed Fusion Processes: Introduction, SLS Process Description, Powder Handling, Approaches to Metal and Ceric Part Creation, Variants of Powder Bed Fusion Processes, Process Par 3D Printing, Applied Energy Correlations and Scan Patterns, Typical Materials and Applications, Materials - Capabilities and Limitations.

Extrusion - Based Systems: Introduction, Basic Principles, Plotting and Path Control, Materials, Limitations of FDM, Bio extrusion, Other Systems.

UNIT IV DESIGN, GUIDELINES FOR PROCESS SELECTION & SOFTWARE ISSUES **9**

Design for 3D Printing - Design for Manufacturing and Assembly, Core DFM for 3D Printing Concepts and Objectives, 3D Printing Unique Capabilities, Exploring Design Freedoms, Design Tools for 3D Printing. Guidelines for Process Selection - Selection Methods for a Part, Challenges of Selection, Preliminary

Selection, Production Planning and Control. Software Issues for 3D Printing - Preparation of CAD Models - the STL File, Problems with STL Files, STL File Manipulation, Beyond the STL File, Additional Software to Assist 3D Printing.

UNIT V MEDICAL APPLICATIONS & FUTURE DIRECTIONS FOR 3D PRINTING **9**

Medical Applications for 3D Printing - Use of 3D Printing to Support Medical Applications, Software Support for Medical Applications, Limitations and Further Development of Medical 3D Printing Applications. Use of Multiple Materials in 3D Printing - Discrete, Porous and Blended Multiple Material Processes, Embedded Component 3D Printing, Commercial Applications Using Multiple Materials

LIST OF EXPERIMENTS

1. 3D printing of Shaft Support
2. 3D printing of Spur Gear
3. 3D printing of Helical Gear
4. 3D printing of lock nut
5. 3D printing of ratchet
6. 3D printing of Cam
7. 3D printing of sprocket gear with holes

OUTCOMES

- Importance of 3D printing in Manufacturing.
- Different 3D Printing Technologies.
- Select suitable materials for 3D Printing.
- Different methods for Post-processing of 3D Printing parts.
- Applications of 3D printing in Automobile, Aerospace, Bio-medical etc.
- Demonstrate 3D printing models using software.

TEXT BOOKS

1. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, Third Edition 2015
2. 3D Printing Technology and Applications, Rafiq Noorani, Fifth September 2017
3. Mastering 3D Printing, Joan Horvath, Second Edition,2015

REFERENCES

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, Second Edition 2015.
2. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory & Practice", Springer, Third Edition 2016.
3. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer, Second Edition 2015.

E-RESOURCES

1. https://nptel.ac.in/courses/112103306 - (Manufacturing Process and technology)
2. https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/additive-manufacturing-technologies-for-practicing-engineers/ (Additive Manufacturing Technologies for Practicing Engineers)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2
2	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2
3	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2
4	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2
5	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2
6	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2
AVG	3	2	2	2	2	-	-	-	1	-	-	1	3	3	2

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER VII

23METP01 **PROJECT WORK** **L T P C**

0 0 12 6

OBJECTIVES

- To know the various skills to formulate a technical project.
- To understand the ability to solve specific problem.
- To study the use of new tools, algorithms and techniques required to carry out the projects.
- To study the guidance on the various procedures for validation of the product and analyze the costeffectiveness.
- To know the guidelines to prepare technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES

At the end of the project, the students will be able to:

- Define a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Develop the test and validate through conformance of the developed prototype and analysis the costeffectiveness.
- Adapt technical report and oral presentations.
- Solve any challenging practical problem in the field of engineering and find better solutions to it.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
2	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
3	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
4	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
5	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
6	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2
AVG	3	2	2	2	2	-	-	1	-	1	-	1	3	3	2

1-Low 2-Medium 3-High '-' – No Correlation

CREDIT SUMMARY

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS - INDUSTRIAL SAFETY ENGINEERING/3D PRINTING)

B.E. MECHANICAL ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	-	-	-	-	-	-	-	-	-
BS	-	-	-	-	-	-	-	-	-
ES	-	-	-	-	-	-	-	-	-
PC	-	-	3	3	3	4	-	-	13
PE	-	-	-	-	-	-	-	-	-
OE	-	-	-	-	-	-	-	-	-
EEC	-	-	-	-	-	-	6	-	6
MC	-	-	-	-	-	-	-	-	-
Total	-	-	3	3	3	4	6	-	19