



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 ENGINEERING (CHOICE BASED CREDIT SYSTEM) REGULATIONS-2023

(REVISION I)

(I - VI SEMESTER)

(For the students admitted from the Academic year 2023-24 and 2024-25)



Note: The regulations here under 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 under going the programme under the same Regulation as may be decided by the Academic Council.





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Chairman - BoS


DEAN (ACADEMICS)
SENGUNTHAR ENGINEERING COLLEGE
TIRUCHENGODE-637 205


PRINCIPAL
SENGUNTHAR ENGINEERING COLLEGE
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REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

B. E. MECHANICAL ENGINEERING

VISION

To be a centre of excellence for producing skilled mechanical engineers with strong ethical values, entrepreneurial spirit and expertise in advanced technologies, including sustainable engineering solutions.

MISSION

M1: To equip mechanical engineers with knowledge, skills, and ethical values to address global challenges.

M2: To foster sustainable growth by conducting research and development activities

M3: To cultivate a culture of creativity, entrepreneurship and industry-focused collaboration, driving impactful advancements in mechanical engineering.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

- Acquire a strong foundation in engineering principles, enabling them to design, analyze, and implement innovative solutions to society.
- Engage in higher education and continuous professional development to stay updated with emerging technologies and global trends.
- Develop the capability to design, execute, and expand cost-effective entrepreneurial solutions that drive long-term economic stability and sustainable growth.





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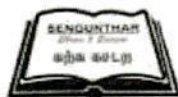
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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	Engineering knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design / development of solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct investigations of complex problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Modern tool usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The engineer and the World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project management and finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-long learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)





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PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Apply the principles of mechanical engineering to design complex problems using solid works and automation.
PSO2	Utilize DFMA techniques to manufacture and assemble components designed to address tangible challenges across various industries.

□





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MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
I	I	23HST101 - Professional English	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-
		23HST102 - தமிழ்மரபு / Heritage of Tamils	-	-	-	-	-	-	2	1	2	-	1	-	-
		23MAT101 - Matrices and Calculus	3	3	2	-	-	-	-	-	-	-	2	-	-
		23PHE101 - Engineering Physics	3	3	1	1	-	-	-	-	-	-	-	-	-
		23CYE101 - Chemistry for Engineers	2.5	2.17	2.67	2.2	2	2	1.83	1.6	1.6	1.33	2.33	-	-
		23GEE101 - Programming in C	2.83	2.67	2.17	1.5	2.83	-	1	1	1.5	1	2	-	-
		23EEC101 - Soft Skills & Life Skills	1.25	1.6	1	1	3	1.4	2	2.6	2.8	2.6	2	-	-
		23MDC101 - Induction Program (2 Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-
I	II	23MAT201 - Statistics and Numerical Methods	3	3	2	2	2	-	-	-	-	-	1	-	-
		23PHT201 - Advanced Physics of Materials	2	3	2	1	1.8	1	1	-	-	-	-	-	-
		23CYT201 - Environmental Sciences and Sustainability	2	1.4	3	1.6	2.2	3	3	0.8	1.6	2.4	2.2	-	-





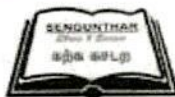
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Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
I	II	23MET201 - Manufacturing Processes	3	2.4	2.0	1.2	1.2	-	-	-	-	-	-	3	2.6
		23GET201- Engineering Graphics	3	2	2	-	3	1	-	-	-	-	2	2	-
		23HST202 - தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	-	-	-	-	-	-	2	1	2	-	1	-	-
		23HSE201 - English for Engineers: Theory and Practice	1	2	-	2	1	2	1.5	2.33	3	2	1.66	-	-
		23GEL201 - Engineering Practice Laboratory	3	2	-	-	1	1	1	-	-	-	-	2	-
		Indian Language (Except Mother Tongue)/Foreign Language													
		23EEEC201 - Hindi	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-
		23EEEC201 - German	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	-	-
		23EEEC201 - Japanese	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-
		23MDC201 - Aptitude skills	-	-	-	-	-	-	-	-	-	-	-	-	-
II		23MAT304 - Transforms and Partial Differential Equations	3	3	2	2	2	-	-	-	-	-	2	-	-
		23MET301 - Engineering Thermodynamics	3	2	2	-	3	-	-	-	3	-	2	3	2
		23MET302 - Engineering Mechanics	3	2	2	-	-	-	-	-	-	-	2	-	2





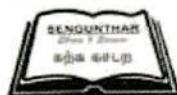
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Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
II	III	23MEE301 - Manufacturing Technology	3	2.67	2.0	2.0	2.3	-	-		-	-	-	3.0	2.3
		23MEE303 - Metrology and Measurement	3	1	-	-	2	-	-	2	-	-	2	-	2
		23CEE402 - Fluid Mechanics and Machinery	3	3	2	2	-	2	2	-	2	-	2	3	2
		23EEC301 - Professional Development	2.3	1.6	2	2	3	-	-	-	1.5	2.6	1	2	2
II	IV	23MET402 - Kinematics of Machinery	3	2	2	-	-	-	-	-	-	-	2	1	2
		23MET403 - Engineering Materials and Metallurgy	3	2	-	-	-	-	-	-	-	-	2	1	2
		23MEE401 - Thermal Engineering	3	3	2	-	-	1	-	2	-	-	3	2	2
		23MEE402 - Strength of Materials	3	3	1	-	-	1	-	2	-	-	3	2	2
		23GEE301 - Problem solving and Python Programming	2.83	2.67	2.17	1.5	2.83	-	1	1	1.5	1	2	-	-
		23EEC401 - Online Certification Courses	-	-	-	-	-	-	-	-	-	-	-	-	-
III	V	23MET501 - Design of Machine Elements	3	2	3	2	-	-	-	-	-	-	2	2	2
		23MEE501 - Dynamics of Machinery	3	3	-	2	-	1	-	2	2	-	2	2	2
		23MEE502 - Heat and Mass Transfer	3	3	3	2	-	-	-	2	-	-	2	2	2
		23EEC501 - Industrial Training	3	3	3	3	3	3	3	3	3	3	3	3	3





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			1	2	3	4	5	6	7	8	9	10	11	1	2
III	V	Professional Elective - I													
		23MEP501 – Welding Technology	3	-	1	-	-	1	-	-	-	-	2	2	1
		23MEP502 Non-Destructive Testing and Evaluation of Materials	3	2	1	-	-	-	-	-	-	-	-	2	1
		23MEP503 - Composite Materials	3	-	-	2	-	-	-	-	-	-	-	-	1
		23MEP504 - Green Manufacturing	3	1	2	-	-	-	-	-	-	-	-	1	1
		23MEP505 - Unconventional Machining Processes	3	1	-	-	-	-	-	-	-	-	2	2	2
		23MEP506 - Metal Casting Process	3	1	-	-	-	2	-	-	-	-	-	1	1
		Professional Elective - II													
		23MEP507 - Hybrid and Vehicle Technology	3	1	-	1	-	2	-	-	-	-	-	1	-
		23MEP508 - Automobile Engineering	3	2.6	2.0	1	2	-	-	-	-	-	2	3	2.4
		23MEP509 - Design of Heat Exchangers	3	-	2	-	-	-	-	-	-	-	-	1	1
		23MEP510 - Computational Fluid Dynamics	3	1	-	1	-	-	-	-	-	-	-	-	1
		23MEP511 - Refrigeration and Air Conditioning	3	1	-	1	-	-	-	-	-	-	-	-	1
		23MEP512 - Solar Thermal Systems	3	-	1	1	-	-	-	-	-	-	-	1	1





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			1	2	3	4	5	6	7	8	9	10	11	1	2
III	V	Professional Elective - III													
		23MEP513 - Product Design and Development	3	-	3	2	-	-	-	-	-	-	-	2	2
		23MEP514 - Computer Applications in Design	3	-	1	2	-	-	-	-	-	-	-	1	2
		23MEP515 - Fluid Power Systems	3	-	2	-	-	-	-	-	-	-	-	2	2
		23MEP516 - Process Planning and Cost Estimation	3	-	-	-	-	-	-	-	-	-	2	2	-
		23MEP517 - Power Plant Engineering	3	1	-	-	-	-	-	-	-	-	2	2	-
		23MEP518 - Additive Manufacturing	3	-	2	1	-	-	-	-	-	-	2	2	2
		Mandatory Course I													
		23MDC501 Introduction to Women And Gender Studies	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC502 Elements of Literature	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC503 Film Appreciation	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC504 Disaster Risk Reduction and Management	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC505 Constitution of India	-	-	-	-	-	-	-	-	-	-	-	-	-
III	VI	23MEE601 - Finite Element Analysis	3	3	3	3	3	-	-	2	-	-	2	3	3
		23MEE602 - Mechatronics and IoT	3	-	-	-	2	-	-	2	-	-	2	3	1





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			1	2	3	4	5	6	7	8	9	10	11	1	2
III	VI	Professional Elective - IV													
		23MEP601 - CAD/CAM	3	-	3	-	3	-	-	-	-	-	-	2	2
		23MEP602 - Design for X	3	-	3	-	-	-	-	-	-	-	-	2	-
		23MEP603 - Lean Manufacturing	3	1	-	-	-	-	-	-	-	-	1	2	1
		23MEP604 - Production Planning and Control	3	-	1	-	-	1	-	-	-	-	-	2	1
		23MEP605 - Computer Integrated Manufacturing Systems	3	2.6	2	2	2.6	-	-	-	1	2	2	3	3
		23MEP606 - Sustainable Manufacturing	3	2	-	-	-	-	-	-	-	-	2	-	-
		Professional Elective - V													
		23MEP607 - Industry 4.0	3	3	-	-	-	-	-	-	-	-	-	1	1
		23MEP608 - Instrumentation and Control Engineering	2	1	-	-	-	-	-	-	-	-	-	1	3
		23MEP609 - Surface Engineering	3	2	-	-	-	-	-	-	-	-	-	2	1
		23MEP610 - Maintenance Engineering	3	2	-	-	-	-	-	-	-	-	2	1	1
		23MEP611 - Electronics Manufacturing Technology	3	2	-	-	-	-	-	-	-	-	-	2	2
		23MEP612 - Design for Additive Manufacturing	3	2	3	-	-	-	-	-	-	-	-	2	1





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Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
III	VI	Professional Elective - VI													
		23MEP613 - Machine Drawing	3	-	3	-	-	-	-	-	-	-	-	3	3
		23MEP614 - Material Handling and Solid Processing Equipment	3	2	-	-	-	-	-	-	-	-	-	3	2
		23MEP615 - Design of Jigs and Fixtures	3	3	-	-	-	-	-	-	-	-	1	2	1
		23MEP616 - Gas Dynamics and Jet Propulsions	3	3	1	1	2	-	-	-	2	1	-	1	3
		23MEP617 - Design of Transmission systems	3	3	3	-	-	-	-	-	-	-	-	3	2
		23MEP618 - Fuel Cells	3	-	-	-	-	-	-	-	-	-	-	2	-
		23EEJ601 - Project Work (Phase - I)	3	3	3	3	3	3	3	3	3	3	3	3	3
		Open Elective - I													
		23CEO607 - Environmental and Social Impact Assessment	3.0	3.0	2.4	2.0	2.0	2.2	3.0	-	-	-	2.3	-	-
		23CSO610 - Introduction to Drone Technologies	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-
		23ECO602 - Fundamentals of Electronic Devices and Circuits	3	3	3	3	2.8	2.4	-	-	-	-	2.4	-	-
		23EEO603 - Electric Vehicle Technology	3	3	3	3	3	-	-	-	-	-	2	-	-
		23EEO604 - Renewable Energy Systems	3	3	3	3	3	1	1	-	1	-	2	-	-





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			1	2	3	4	5	6	7	8	9	10	11	1	2
III	VI	23MEO601 - Introduction to Industrial Engineering	3	3	2	-	-	-	-	-	-	-	2	-	-
		23MEO605 - CNC Machining Technology	3	3	2	2	3	-	-	-	-	-	1	-	-
		23MDO611 - Hospital Management	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-
		23RAO609 - Fundamentals of Robotics	3	2	-	2.8	3	2	1	2	2	2.3	2	-	-
		23CSO612 - Cyber Forensics and Ethical Hacking	3	2.6	1.8	1.8	2.6	1.6	2.2	1	1.5	1	2	-	-
		23PMO608 - Pharmaceutical Nanotechnology	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-
		23MAO606 - Graph Theory	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-
		NCC Airforce / Army Wing - II L1/L3													
		23NCCL01 - NCC Airforce Level - 1	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	-	-
		23NCCL03 - NCC Army Wing Level - 3	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-
		Mandatory Course - II													
		23MDC601 Well-being with Traditional Practices - Yoga, Ayurveda and Siddh	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC602 History of Science and Technology In India	-	-	-	-	-	-	-	-	-	-	-	-	-





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Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
III	VI	23MDC602 History of Science and Technology in India	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC603 Political and Economic Thought for a Humane Society	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC604 State, Nation Building and Politics in India	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC605 Industrial Safety	-	-	-	-	-	-	-	-	-	-	-	-	-





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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
THEORY									
23HST101	Professional English	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
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
EMBEDDED COURSE									
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills & Life Skills	EEC	1	0	0	1	100	-	100
MANDATORY COURSE									
23MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
TOTAL CREDITS IN SEMESTER - I						21			

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PE	:	Professional Elective
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OE	:	Open Elective
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MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
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B.E - MECHANICAL ENGINEERING - SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
THEORY									
23MAT201	Statistics and Numerical Methods	BS	3	1	0	4	40	60	100
23PHT201	Advanced Physics of Materials	BS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23MET201	Manufacturing Processes	PC	3	0	0	3	40	60	100
23GET201	Engineering Graphics	ES	3	1	0	4	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
PRACTICALS									
23GEL201	Engineering Practice Laboratory	ES	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Indian Language (Except Mother Tongue) / Foreign Language	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC201	Aptitude Skills	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - II						26			

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BS	:	Basic Sciences
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MC	:	Mandatory Courses
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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
THEORY									
23MAT304	Transforms and Partial Differential Equations	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	PC	3	0	2	4	50	50	100
23MEE302	Metrology and Measurements	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
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(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
THEORY									
23MET401	Kinematics of Machinery	PC	3	1	0	4	40	60	100
23MET402	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	Online Certification Courses	EEC	3	0	0	3	100	-	100
TOTAL CREDITS IN SEMESTER - IV						22			

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PE	:	Professional Elective
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EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
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T	:	Tutorial
P	:	Practical
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(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
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	Industrial Training	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
	Mandatory Course - I	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - V						23			

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OE	:	Open Elective
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P	:	Practical
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B.E - MECHANICAL ENGINEERING - SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
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 and IoT	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ601	Project Work - Phase I	EEC	0	0	8	4	60	40	100
MANDATORY COURSE									
	Mandatory Course - II	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - VI						24			

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GE	:	General Elective
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P	:	Practical
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B.E - MECHANICAL ENGINEERING - SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
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									
23EEJ701	Project Work - Phase II	EEC	0	0	8	4	60	40	100
TOTAL CREDITS IN SEMESTER - VII					16				

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
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CURRICULUM AND SYLLABI

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B.E - MECHANICAL ENGINEERING - EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ801	Product Development	EEC	0	0	12	6	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VIII						08			

HS	:	Humanities and Social Sciences
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ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
GE	:	General Elective
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MC	:	Mandatory Courses
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LIST OF HUMANITIES AND SOCIAL SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23HST101	Professional English	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	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

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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	Advanced Physics of Materials	BS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	BS	3	0	0	3	40	60	100
23MAT304	Transforms and Partial Differential Equations	BS	3	1	0	4	40	60	100





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LIST OF ENGINEERING SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23GET201	Engineering Graphics	ES	3	0	2	4	50	50	100
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23CEE402	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

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23MET201	Manufacturing Processes	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	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





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LIST OF PROFESSIONAL ELECTIVE COURSES

Professional Elective - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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		CIA	ESE	TOT
23MEP507	Hybrid and Vehicle Technology	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





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Professional Elective - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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	Fluid Power Systems	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	Additive Manufacturing	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		CIA	ESE	TOT
23MEP601	CAD/CAM	PE	3	0	0	3	40	60	100
23MEP602	Design for X	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	Sustainable Manufacturing	PE	3	0	0	3	40	60	100





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Professional Elective - V

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23MEP607	Indutstry 4.0	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	Electronics Manufacturing Technology	PE	3	0	0	3	40	60	100
23MEP612	Design for Additive Manufacturing	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		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 Jigs and Fixtures	PE	3	0	0	3	40	60	100
23MEP616	Gas Dynamics and Jet Propulsion	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





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LIST OF OPEN ELECTIVE COURSES

OPEN ELECTIVES - I

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO607 / Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
CSE	23CSO610 / Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
ECE	23ECO602 / Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
EEE	23EEEO603 / Electric Vehicle Technology	OE	3	0	0	3	40	60	100
	23EEEO604 / Renewable Energy Systems	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO601 / Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
	23MEO605 / CNC Machining Technology	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO611 / Hospital Management	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO609 / Fundamentals of Robotics	OE	3	0	0	3	40	60	100
CSE (Cyber Security)	23CSO612 / Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO608 / Pharamaceutical Nanotechnology	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO606 / Graph Theory	OE	3	0	0	3	40	60	100





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OPEN ELECTIVES- II



Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
CIVIL	23CEO704 / Remote Sensing Concepts	OE	3	0	0	3	40	60	100
ECE	23ECO708 / Energy Technology	OE	3	0	0	3	40	60	100
EEE	23EEO709 / Sensors, Actuators and its Application	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO703 / Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
	23MEO704 / Nano Technology	OE	3	0	0	3	40	60	100
	23MEO712 / Smart Manufacturing	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO707 / Mobile Robots	OE	3	0	0	3	40	60	100
CSE (Cyber Security)	23CSO711 / Introduction to Cyber Security	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO706 / Intellectual Property Rights for Pharma Industry	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO710 / Operations Research	OE	3	0	0	3	40	60	100





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OPEN ELECTIVES – III

Offered by the Departments	Course Code / Course Name	Category	Periods / Week				Credit	Maximum Marks		
			L	T	P	C		CIA	ESE	TOT
CIVIL	23CEO717 / Geographical Information System	OE	3	0	0	3		40	60	100
CSE	23CSO715 / Fundamentals of Blockchain Technology	OE	3	0	0	3		40	60	100
ECE	23ECO718 / VLSI Design	OE	3	0	0	3		40	60	100
EEE	23EEO716 / Electrical, Electronic and Magnetic Materials	OE	3	0	0	3		40	60	100
MECHANICAL	23MEO720 / Marine Vehicles	OE	3	0	0	3		40	60	100
MEDICAL ELECTRONICS	23MDO719 / Wearable Technology	OE								
	23MDO723 / Medical Waste Management		3	0	0	3		40	60	100
	23MDO724 / Lifestyle Diseases									
ROBOTICS AND AUTOMATION	23RAO721 / Robotics Process Automation	OE	3	0	0	3		40	60	100
MATHEMATICS	23MAO714 / Advanced Numerical Methods	OE	3	0	0	3		40	60	100
MANAGEMENT	23MGO722 / Cost management of Engineering Projects	OE	3	0	0	3		40	60	100





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GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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 WING LEVEL - 3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY WING 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		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	Supply Chain Management	GE	3	0	0	3	40	60	100
23MGT708	e-Waste Management	GE	3	0	0	3	40	60	100





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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 & Life Skills	EEC	1	0	0	1		100	-	100
23EEC201	Indian Language (Except Mother Tongue) / Foreign Language	EEC	0	0	4	2		100	-	100
23EEC301	Professional Development	EEC	0	0	2	1		100	-	100
23EEC401	Online Certification Courses	EEC	3	0	0	3		100	-	100
23EEC501	Industrial Training	EEC	0	0	4	2		100	-	100
23MEJ601	Project Work - Phase I	EEC	0	0	8	4		60	40	100
23EEJ701	Project Work - Phase II	EEC	0	0	8	4		60	40	100
23MEJ801	Product Development	EEC	0	0	12	6		40	60	100
23EEC801	Internship	EEC	0	0	4	2		100	-	100





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LIST OF MANDATORY COURSES

MANDATORY COURSES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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		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	-	-	-





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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	8	-	-	-	-	3	-	15
BS	12	7	4	-	-	-	-	-	23
ES	4	6	4	4	-	-	-	-	18
PC	-	3	16	15	12	8	-	-	54
PE	-	-	-	-	9	9	-	-	18
GE	-	-	-	-	-	-	3	-	03
OE	-	-	-	-	-	3	6	-	09
EEC	1	2	1	3	2	4	4	8	25
MC	-	-	-	-	-	-	-	-	-
Total	21	26	25	22	23	24	16	08	165





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SEMESTER I

23HST101

PROFESSIONAL ENGLISH

L T P C

(Common to all B.E. & B.Tech. Branches)

3 0 0 3

OBJECTIVES

- To build vocabulary proficiency and familiarity with varied lexical and contextual usages.
- To strengthen grammatical accuracy for effective sentence construction and language application.
- To develop clarity and coherence in written communication across academic and business contexts.
- To enhance oral fluency, confidence, and interactive communication skills.
- To promote efficient reading strategies for comprehension, analysis, and note-making.

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





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OUTCOMES

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

- Use a wide range of vocabulary effectively in oral and written communication.
- Frame grammatically and meaningful sentences.
- Write formal and informal letters, develop coherent paragraphs and essays, and engage in meaningful dialogues.
- Apply speaking skills for self-introduction, speeches, and technical presentations.
- Read, comprehend, and take organized notes from passages and technical content.

TEXT BOOKS

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

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", First Edition, Orient Black Swan, 2012.
2. Krishna Mohan, Meera Banerji, "Developing Communication Skills", Paperback, MacMillan, 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	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	-	-	-	1	-	-	2	3	-	2	-	-
3	-	1	2	-	1	-	-	2	3	1	2	-	-
4	-	-	1	-	-	-	-	2	3	2	2	-	-
5	1	1	-	2	1	-	-	1	3	-	2	-	-
Avg.	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-

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

[Signature]
Chairman - BoS





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23HST102

HERITAGE OF TAMILS

L T P C
1 0 0 1

OBJECTIVES

- To familiarize the students on extensive literature of classical Tamil.
- To analyze rock art paintings to modern art.
- To acquire knowledge on folk and martial arts.
- To apply the concepts of Thina in Tamils.
- To realize the contribution of Tamils in Indian freedom struggle.

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, Villu Pattu, 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

OUTCOMES

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

- Analyze the extensive literature Tamil and classical nature.
- Understand the heritage of sculpture, painting and musical instruments.
- Classify the folk and martial arts of Tamil people.
- Examine Thina concepts, trade and victory of Chozha dynasty.
- Interpret the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine.





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TEXT-CUM-REFERENCE BOOKS

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

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23HST102

தமிழர் மரபு

L T P C
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நோக்கங்கள்

மாணவர்கள்கண்டிப்பாக அறியவேண்டுவன:

- செம்மொழியான தமிழ்மொழியின் விரிவான இலக்கியத்தைப்பற்றி அறிதல்.
- பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை உள்ள கலைகளை பகுப்பாய்வு செய்தல்.
- நாட்டுப்புறக்கலைகள் மற்றும் வீர விளையாட்டுகளைப் புரிந்து கொள்ளுதல்.
- தமிழர்களின் திணைக்கோட்பாடுகளைச் செயல்படுத்துதல்.
- இந்திய விடுதலைப் போராட்டத்திற்கும் பண்பாட்டிற்கும் தமிழர்களின் பங்களிப்பை உணருதல்.

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 இலக்கியத்தின் 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 திருவள்ளூர் 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, ஓயிலாட்டம், தோல்பாவை கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

UNIT IV தமிழர்களின் திணைக்கோட்பாடுகள்

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 விடுதலைப் போரில் தமிழர்களின் பங்கு- இந்தியாவின் பிற்பகுதிகளில் தமிழ்பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு- கல்வெட்டுகள், கையெழுத்துப்படிிகள் -தமிழ் புத்தகங்களின் வரலாறு

TOTAL: 15 PERIODS





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முடிவுகள்

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- தமிழ்மொழியின் செம்மொழி தன்மையையும் சங்கஇலக்கியத்தின் முக்கியத்துவத்தையும் உணர்வார்கள்.
- தமிழர்களின் சிற்ப, ஓவிய, இசை மரபுகளை புரிந்து கொள்வார்கள்.
- நாட்டுப்புறக் கலைகளையும் வீர விளையாட்டுகளையும் வகைப்படுத்துவார்கள்.
- தமிழர்களின் திணைக்கோட்பாடுகளும் சங்ககாலவர்த்தகமும் புரிந்து கொள்வார்கள்.
- இந்திய விடுதலைப்போராட்டம், சுயமரியாதை இயக்கம், சித்தமருத்துவம் ஆகியவற்றில் தமிழர்களின் பங்களிப்பை விளக்குவார்கள்.

உரைமற்றும் குறிப்புத்தகங்கள்

- தமிழகவரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
- கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
- கீழடி - வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல் துறை வெளியீடு)
- பொருளை - ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
- Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
- Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
- Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
- The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
- Keeladi - 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
- Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
- Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23MAT101

MATRICES AND CALCULUS
(Common to all B.E./ B.Tech. Branches)

L T P C

3 1 0 4

OBJECTIVES

- To develop the use of matrix algebra and its properties.
- To explore the techniques of differential and integral calculus.
- To categorize methods for functions of several variables.
- To introduce the use of multiple integrals and their applications.
- To provide knowledge of vector calculus.

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:

- Apply matrix algebra methods to solve practical problems.
- Apply the concepts of differential and integral calculus.
- Analyze the ideas of differential calculus for functions of several variables.
- Apply multiple integral ideas in solving areas and volumes.
- Solve the engineering problems using the concepts of vector calculus.





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LIST OF TUTORIALS

1. Computation of Eigen values and Eigenvectors.
2. Matrix addition and multiplications.
3. Calculate differentiations of simple functions.
4. Calculate integrations of simple functions.
5. Determining Maxima and minima of functions for one variable.
6. Determining Maxima and minima of functions for two variables.
7. Evaluating double integral with constant limits.
8. Evaluating triple integral with constant limits.
9. Computing Gradient, divergence and curl of point functions.
10. Evaluating line integral in vector calculus.

TOTAL: 45+15 PERIODS

TEXT BOOKS

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

REFERENCES

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

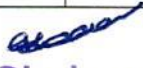
E-RESOURCES

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	PSO1	PSO2
1	3	3	2	-	-	-	-	-	-	-	2	-	-
2	3	3	2	-	-	-	-	-	-	-	2	-	-
3	3	3	2	-	-	-	-	-	-	-	2	-	-
4	3	3	2	-	-	-	-	-	-	-	2	-	-
5	3	3	2	-	-	-	-	-	-	-	2	-	-
Avg.	3	3	2	-	-	-	-	-	-	-	2	-	-

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23PHE101

ENGINEERING PHYSICS

L T P C

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

3 0 2 4

OBJECTIVES

- To impart knowledge of the structure of crystalline materials using crystallographic techniques.
- To enable students to understand the concepts of elasticity, plasticity, stress, and strain and their significance in industrial applications.
- To introduce the fundamentals of ultrasonics and sound waves, along with their practical engineering applications.
- To explain complex physical phenomena through the principles of quantum mechanics and Schrödinger's wave equation.
- To provide an understanding of the modes of heat transmission, thermal conduction in solids, and their engineering applications.
- To determine the optical, mechanical, acoustic, thermal, and electrical properties of materials through laser, interferometric, bending, and thermal methods.

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 (Concept only) - 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.

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 - 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 - Geothermal Energy - Geothermal power - Thermal battery - Thermal Energy Storage.





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LIST OF EXPERIMENTS

(Any Eight experiments to be conducted)

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 –Poiseuille'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:45+15=60PERIODS

OUTCOMES

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

- Apply crystallographic knowledge to get familiar with the structure of crystalline solids.
- Analyze the mechanical properties of solids and fluids.
- Explain the fundamentals of sound waves and ultrasonic's and their engineering applications.
- Analyze the principles of quantum mechanics and Schrödinger's wave equation to identify complex physical phenomena.
- Analyze the concept of thermal conductivity and its engineering applications.
- Evaluate fundamental properties of materials—such as wavelength, particle size, elastic constants, ultrasonic velocity, viscosity, thermal conductivity and electrical resistance.

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", McGraw Hill, 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-RESOURCES

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





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Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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


Chairman - BoS





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23CYE102

CHEMISTRY FOR ENGINEERS

(Common to CIVIL, MECH, R&A)

L T P C

3 0 2 4

OBJECTIVES

- To apply water quality analysis and treatment methods for industrial applications.
- To explain the classification, properties, manufacture, and applications of fuels.
- To utilize spectroscopic and chromatographic techniques for chemical analysis.
- To familiarize students with the principles of energy conversion in nuclear reactors, solar cells, batteries, and fuel cells.
- To apply electrochemical principles to understand corrosion and corrosion control methods.
- 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 (phosphate, calgon and carbonate conditioning methods) - External conditioning - Zeolite process, Demineralization process - Desalination of brackish water by reverse osmosis.

UNIT II FUELS AND COMBUSTION

9

Fuels: Introduction - Classification of fuels - Coal - 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) - Power Alcohol and Biodiesel. Combustion of fuels: Introduction - Calorific value - Higher and lower calorific values - 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 - Gas 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 - lead acid battery, lithium-ion-battery Fuel Cells - H₂ - O₂ fuel cell.

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, 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.





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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.

TOTAL: 45 + 15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the quality parameters of water and suitable methods for removing impurities in domestic and industrial applications.
- Interpret the characteristics of fuels and their role in efficient and eco-friendly combustion systems.
- Analyze the interaction of light with matter and the use of analytical techniques to characterize molecules.
- Explain the energy resources and their applications in the energy sector.
- Analyze the causes of corrosion and effective methods for its prevention and control.
- Determine the water quality parameters and perform quantitative chemical analysis by pH meter, flame photometry, conductometry and potentiometry

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company (P) Ltd., 2015.
2. 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, 2015.
2. Shobha Ramakrishnan, Banani Mukhopadhyay, "Essentials of Analytical Chemistry" Pearson Education India, 2018.

E-RESOURCES

1. <https://nptel.ac.in/courses/104105084> - (Analytical Chemistry)
2. <http://library.iitbbs.ac.in/open-access-e-resources.php>





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Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	1	3	-	1	-	3	-	-	-	-	-	-
2	2	2	3	2	1	2	2	2	2	1	2	-	-
3	3	3	3	3	3	2	2	2	2	2	3	-	-
4	2	2	2	3	3	2	2	1	1	1	-	-	-
5	3	2	3	2	3	2	1	2	1	-	2	-	-
6	3	3	2	1	1	2	1	1	2	-	-	-	-
Avg.	2.50	2.17	2.67	2.20	2.00	2.00	1.83	1.60	1.60	1.33	2.33	-	-

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


Chairman - BoS





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23GEE101

PROGRAMMING IN C
(Lab Embedded Theory Course)

L T P C

3 0 2 4

OBJECTIVES

- To impart fundamental knowledge of C programming concepts, syntax, data types, operators, control structures, and program development.
- To develop students' understanding of arrays, strings, searching, and sorting techniques for solving computational problems.
- To train students in designing modular programs using functions, recursion, pointers, and parameter passing mechanisms.
- To familiarize students with structures, unions, dynamic memory allocation, and their applications in software development.
- To enable students to perform file handling operations and develop efficient C programs using sequential and random file processing.
- To develop C programs to solve real-world programming problems.

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.

Coding practices :

1. Develop a program to find the largest of three numbers using nested if statements.
2. Develop a program to generate multiplication tables using loops.

Problem - solving assignments :

1. Write a program to calculate the area and perimeter of a rectangle, circle, and triangle.
2. Write a program to calculate simple interest and compound interest.

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.





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Coding practices :

1. Develop a program to perform matrix addition and transpose using two-dimensional arrays.
2. Write a program to sort an array using Insertion Sort.

Problem - solving assignments :

1. Develop a program to perform matrix operations such as addition and transpose using two-dimensional arrays.
2. Write a program to search for an element in an array using Linear Search 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.

Coding practices :

1. Develop a recursive program to generate the Fibonacci series.
2. Develop a program to implement a scientific calculator using built-in mathematical functions.

Problem - solving assignments :

1. Write a program to perform arithmetic operations using user-defined functions.
2. Write a program to swap two numbers using pass-by-value and 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

Coding practices :

1. Develop a program to generate an employee salary slip using structures and pointers.
2. Develop a program using nested structures to represent student academic details.

Problem - solving assignments :

1. Write a program to store and display employee details using an array of structures.
2. Develop a program to demonstrate dynamic memory allocation using structures.

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.





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Coding practices :

1. Write a program to create, write, and read a text file.
2. Develop a program to copy the contents of one file to another.

Problem - solving assignments :

1. Write a program to create, write, and read student records using sequential file processing.
2. Write a program to implement command-line arguments for performing arithmetic operations or file processing.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Programs using I/O statements, expressions and decision-making construct.
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,

- Explain the fundamental concepts of C programming and develop programs using data types, operators, expressions, and control structures.
- Develop C programs using arrays, strings, searching, and sorting techniques to solve computational problems.
- Construct modular C programs by applying functions, recursion, pointers, and parameter passing techniques.
- Develop applications using structures, unions, pointers, and dynamic memory allocation for efficient data organization and manipulation.
- Analyze file processing techniques using sequential and random access methods to perform data storage and retrieval operations.
- Develop reliable software solutions using C programming for real-world applications.





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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. Reema Thareja, "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	PSO1	PSO2
1	3	2	2	–	3	–	–	–	–	–	2	3	2
2	3	3	2	1	3	–	–	–	–	–	2	3	3
3	3	3	3	2	3	–	–	–	–	–	2	3	3
4	3	3	3	2	3	–	–	–	1	–	2	3	3
5	2	3	2	2	3	–	–	–	1	–	2	3	2
6	3	3	3	2	3	–	1	1	2	1	2	3	3
Avg.	2.83	2.83	2.5	1.8	3		1	1	1.33	1	2	3	2.66

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23EEEC101

SOFTSKILLS & LIFE SKILLS

L T P C

1 0 0 1

(Common to all First year / First Semester B.E., B.Tech., Branches)

OBJECTIVES

- To understand the Universal Human Values
- To have an overview on Life skills required in their profession
- To manage the behavior with emotional intelligent skills
- To learn professional Skills required for 21st century
- To formulate and implement effective leadership strategies.

UNIT I UNIVERSAL HUMAN VALUES

3

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS

3

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS

3

Self-Awareness - Interpersonal Relationship - Stress – Stress management - Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS

3

21st century skills – Hard Skills - General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS

3

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS

OUTCOMES

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

- Treat and respect the human beings with harmony,
- Develop the capabilities needed to utilize their potential wherever required.
- Control their emotional feelings and manage the stress.
- Explore the career & professional skills.
- Become highly confident as a leader and find new ways of influencing the teams they lead.





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TEXT BOOKS

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

E-RESOURCES

1. <https://uhv.org.in/>
2. <https://nptel.ac.in>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	1	-	-	-	2	2	3	2	1	-	-	-
2	1	3	1	1	-	1	-	2	3	3	1	-	-
3	-	1	-	-	-	1	-	3	3	3	1	-	-
4	2	2	1	1	3	1	-	2	3	3	3	-	-
5	1	1	1	-	-	2	-	3	3	3	3	-	-
Avg.	1.25	1.6	1	1	3	1.4	2	2.6	2.8	2.6	2	-	-

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

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23MDC101

INDUCTION PROGRAMME (2 Weeks)

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Physical Activity

This would involve a daily routine of physical activity with games and sports etc.

Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.





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Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE


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SEMESTER II

23MAT201

STATISTICS AND NUMERICAL METHODS

L T P C

(Common to Mechanical, R&A and PT)

3 1 0 4

OBJECTIVES

- To introduce basic concepts in testing of hypothesis.
- To explore the knowledge of classifications of design of experiments.
- To develop the concepts of solving algebraic, transcendental and system of linear equations.
- To introduce the numerical techniques of interpolation and integration.
- To explain various numerical methods of 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 variance 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:

- Apply the concepts of hypothesis testing to analyze small and large sample data.
- Analyze the basic concepts of classifications of design of experiments.
- Compute the numerical solution of algebraic, transcendental and system of linear equations.
- Apply the numerical techniques of interpolation and integration.
- Evaluate the numerical solution of ordinary differential equations.





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LIST OF TUTORIALS

1. Solving one sample and paired sample 't' Test.
2. Statistical Analysis Using Chi-Square Test.
3. One-Way ANOVA Table
4. Two-Way ANOVA Table
5. Solution of simultaneous algebraic equations by Gauss Seidel method.
6. Find the Eigen values of a matrix by Power method.
7. Illustrate Lagrange's interpolation formula.
8. Evaluation of line integral by Simpson's one-third rule.
9. Solving ordinary differential equations by Euler's method.
10. Solving ordinary differential equations by Runge-Kutta method.

TOTAL: 45+15 PERIODS

TEXT BOOKS

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

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, Ninth Edition, 2016.
2. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, Twelveth Edition, 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	PSO1	PSO2
1	3	3	2	2	2	-	-	-	-	-	1	-	-
2	3	3	2	2	2	-	-	-	-	-	1	-	-
3	3	3	2	2	2	-	-	-	-	-	1	-	-
4	3	3	2	2	2	-	-	-	-	-	1	-	-
5	3	3	2	2	2	-	-	-	-	-	1	-	-
6	3	3	2	2	2	-	-	-	-	-	1	-	-
Avg.	3	3	2	2	2	-	-	-	-	-	1	-	-

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23PHT201

ADVANCED PHYSICS OF MATERIALS

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 know the application of physics concepts to microscopic and NDT Testing.
- To understand different kind of nano materials and synthesis of nano materials, applications.
- To acquire 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 t_c superconductors - General applications of Superconductors.

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.

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: Types, Properties and applications - Micro Electro Mechanical Systems (MEMS)

UNIT IV SMART MATERIALS

9

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.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the potential applications of superconductors.
- Develop knowledge on various materials characterization techniques.
- Discuss the fundamentals of nano materials and various synthesise methods.
- Develop knowledge about smart materials and their applications.
- Design methodologies and develop the principles of composite materials.

TEXT BOOKS

1. P.Mani, "A Text book of Engineering Physics" Dhanam Publications, 2018
2. Rajendran V. "Engineering Physics". Tata McGraw Hill Publications, 2017.
3. Sam Zhang, Lin Ki, Ashok Kumar, "Materials Characterization Techniques", CRC Press, Taylor & Francis Group, 2019.

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2015.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2017.
3. P.Santhana Ragavan and P. Ramasamy, "Crystal Growth Processes and Methods", KRU Publications, 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	PSO1	PSO2
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

Chairman - BoS





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23CYT201

ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

L T P C

(Common to All B.E /B.Tech Branches)

3 0 0 3

OBJECTIVES

- To familiarize students with the concepts of environment, ecosystems, biodiversity, and their conservation.
- To create awareness about environmental pollution, individual responsibilities in pollution prevention, and basic disaster management.
- To impart knowledge about major social and environmental issues, environmental protection laws, and green chemistry principles.
- To analyze population-related issues, human health, social welfare, and the role of information technology in environmental and human health.
- To develop an understanding of sustainability concepts, climate change issues, and sustainable management practices for addressing environmental challenges.

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) aquatic ecosystems (oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity –Value 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 – 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 – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Green Chemistry and principles - Environment production act – Air (Prevention and Control of Pollution) act –Water (Prevention and control of Pollution) act

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.





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UNIT V SUSTAINABLE MANAGEMENT

9

Sustainability-Concept, needs and challenges-economic, social and aspects of sustainability- From unsustainability to sustainability- Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-Case studies. Zero waste, Material Life cycle 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

- Explain the basics of environment, ecosystems, biodiversity, and conservation.
- Identify major sources of pollution and understand individual responsibilities in pollution prevention and disaster management.
- Describe key social and environmental issues, environmental laws, and green chemistry principles.
- Analyse population growth, human health, social welfare, and the role of IT in environmental and health management.
- Apply sustainability concepts, climate change mitigation, and sustainable management practices to environmental challenges.

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2019.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education, Eighth Edition, 2021.
3. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", Prentice Hall, Third Edition, 2018.

REFERENCES

1. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt Ltd, 2016.
2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt Ltd, 2018.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2019.

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	PSO1	PSO2
1	2	2	3	-	-	3	3	-	-	2	1	-	-
2	2	2	3	2	3	3	3	-	-	3	3	-	-
3	2	1	3	2	2	3	3	-	2	3	3	-	-
4	2	1	3	2	3	3	3	2	3	2	2	-	-
5	2	1	3	2	3	3	3	2	3	2	2	-	-
Avg.	2	1.4	3	1.6	2.2	3	3	0.8	1.6	2.4	2.2	-	-

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

Chairman - BoS





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23MET201

MANUFACTURING PROCESSES

L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamentals of metal casting processes, pattern design, moulding materials, and casting defects.
- To teach the principles and applications of metal joining processes, including conventional and advanced welding methods.
- To explain bulk deformation processes such as forging, rolling, and drawing, along with their characteristics and defects.
- To teach the principles of sheet metal forming operations and special forming processes used in manufacturing.
- To familiarize learners with plastic materials and the processing techniques used for manufacturing plastic components

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 - CO₂ 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





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OUTCOMES

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

- Categorize metal casting processes, associated defects, merits and demerits.
- Classify the different metal joining processes.
- Compare various hot working and cold working methods of metals.
- Analyze the various sheet metal making processes.
- Classify the methods of manufacturing plastic components.

TEXT BOOKS

1. Hajra Choudhury S. K, "Elements of Workshop Technology", Vol. II, Media Promoters & Publishers Pvt Ltd., Fifteenth Edition, 2023
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India, Eighth Edition, 2020.

REFERENCES

1. Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw Hill Publishing Company Pvt Ltd., Fourth Edition, 2020.
2. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, Sixth Edition, 2020.

E-RESOURCES

1. http://nptel.ac.in/courses/1121_05126/ - (Manufacturing Technology - Metal Cutting and Machine Tools)
2. <https://freevideolectures/A0dTvfQ8BA/> - (Manufacturing Process)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	1	-	-	-	-	-	-	3	2
2	3	2	2	1	1	-	-	-	-	-	-	3	2
3	3	3	2	1	1	-	-	-	-	-	-	3	3
4	3	3	2	2	1	-	-	-	-	-	-	3	3
5	3	2	2	1	2	-	-	-	-	-	-	3	3
Avg.	3	2.4	2.0	1.2	1.2	-	-	-	-	-	-	3	2.6

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


Chairman - BoS





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23GET201

ENGINEERING GRAPHICS

(Common to Mech, Civil and Robotics Department)

L T P C

3 1 0 4

OBJECTIVES

- To introduce the fundamental principles of engineering graphics, drawing instruments, and construction of plane curves.
- To teach methods for projecting points, lines, and plane surfaces, including determination of true lengths and inclinations.
- To explain projection techniques of simple solids and handling axes inclined to reference planes using change of position method.
- To train learners in sectioning of solids and development of lateral surfaces of regular and truncated solids.
- To present conversion between orthographic and isometric projections and their practical applications in engineering drawing.

UNIT I PLANE CURVES

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

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 PROJECTION OF SOLIDS

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 IV SECTION OF SIMPLE SOLIDS AND DEVELOPMENT OF SURFACES

9+3

Sectioning of simple solids like prisms and cone - Inclined to one reference plane. Development of lateral surfaces of simple and truncated solids: pyramids and cylinders.

UNIT V ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS

9+3

Conversion of isometric projection into orthographic projection, Conversion of orthographic projection into isometric projection.

TOTAL : 45+15=60 PERIODS





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OUTCOMES

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

- Construct multiple views of engineering components.
- Construct the pictorial drawings as per the standards.
- Develop the projection of solids.
- Draw the section of solids drawings and development of surfaces of given objects.
- Apply free hand sketching and concept of isometric in engineering practice.

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, Fourth Edition, 2019.
2. Natarajan K.V., "Engineering Graphics", Dhanalakshmi Publishers, Thirty Second Edition, 2019.

REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", Subhas Publications, Thirteenth Edition, 2021.
2. T.Jeyapoovan. "Engineering Graphics using Auto CAD" Vikas publishing house Pvt Ltd, Sixth Edition, 2022 .

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	PSO1	PSO2
1	3	2	2	-	3	1	-	-	-	-	2	2	-
2	3	2	2	-	3	1	-	-	-	-	2	2	-
3	3	2	2	-	3	1	-	-	-	-	2	2	-
4	3	2	2	-	3	1	-	-	-	-	2	2	-
5	3	2	2	-	3	1	-	-	-	-	2	2	-
Avg.	3	2	2	-	3	1	-	-	-	-	2	2	-

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


Chairman - BoS





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23HST202

TAMILS AND TECHNOLOGY

L T P C

1 0 0 1

OBJECTIVES

- To gain knowledge about weaving and ceramic Technology
- To create a design and construction Technology
- To analyze manufacturing Technology
- To apply agriculture and irrigation Technology
- To remember scientific and scientific Tamil and Tamil computing

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)- Thirumalai Nayakar 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





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OUTCOMES

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

- Understand weaving under ceramic Technology.
- Develop new design and construction Technology.
- Identify the manufacturing Technology.
- Understand agriculture and irrigation.
- Knowledge of scientific Tamil and Tamil computing.

TEXT-CUM-REFERENCE BOOKS

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

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23HST202

தமிழரும் தொழில்நுட்பமும்
(அனைத்து துறைகளுக்கும் பொதுவானது)

L T P C

1 0 0 1

நோக்கம்

மாணவர்கள்கண்டிப்பாக அறியவேண்டுவன:

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுதல்.
- வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்.
- உற்பத்தி தொழில்நுட்பத்தைப் பகுப்பாய்வு செய்தல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத்தைப் பயன்படுத்துதல்.
- அறிவியல் மற்றும் அறிவியல் தமிழ் மற்றும் தமிழகணிப்பொறி தொடர்பான அறிவை நினைவில் கொள்ளுதல்.

அலகு 1 நெசவு மற்றும் பாணை தொழில்நுட்பம்

3

சங்ககாலத்தில் நெசவுத் தொழில் - பாணை தொழில்நுட்பம் - கருப்பு, சிவப்பு பாண்டங்கள் - பாண்டுகளில் கீறல் குறியீடுகள்.

அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்கள், கோவில்களும் - சோழர்காலத்தாபெருங்கோயில்கள் மற்றும் பிறவழிபாட்டுத்தலங்கள் நாயக்கர்கால கோயில்கள் - மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக்கட்டிடக்கலை.

அலகு 3 உற்பத்தித் தொழில்நுட்பம்

3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடிகள் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண்மணிகள் - சங்குமணிகள் - எலும்புதுண்டுகள் - தொல்லியல்சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்

3

அணை, குளங்கள், மடகு - சோழர்காலகுமுளிதாம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்து குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.





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அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்

3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ்நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென் பொருட்கள் உருவாக்கம் - தமிழ் இணையக்கல்விக்கழகம் - தமிழின்நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத்திட்டம்.

TOTAL: 15 PERIODS

முடிவுகள்

பாடத்தின்முடிவில், மாணவர்கள்அறிந்துகொள்வன:

- பீங்கான்மற்றும்நெசவுதொழில்நுட்பத்தைப்புரிந்துகொள்ளுதல்.
- புதியவடிவமைப்புமற்றும்கட்டுமானதொழில்நுட்பத்தைஉருவாக்குதல்.
- உற்பத்தித்தொழில்நுட்பத்தைஅடையாளம்காணுதல்.
- விவசாயம்மற்றும்நீர்ப்பாசனத்தைப்புரிந்துகொள்ளுதல்.
- அறிவியல்தமிழ்மற்றும்தமிழ்கணிப்பொறிதொடர்பானஅறிவைபெறுதல்.

உரைமற்றும்குறிப்புத்தகங்கள்

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





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Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23HSE201

ENGLISH FOR ENGINEERS: THEORY AND PRACTICE

L T P C

(Common to all B.E. & B.Tech. Branches)

3 0 2 4

OBJECTIVES

- To strengthen grammatical accuracy for effective communication.
- To develop listening and reading comprehension skills.
- To improve writing proficiency for academic and formal purposes.
- To train in business and professional correspondence.
- To enhance speaking abilities for social and professional contexts.
- To provide practical exposure through interactive language activities.

UNIT I GRAMMAR

9

Articles - Prepositions - Conditionals - Subject verb agreement - Error Spotting - Active and Passive voice.

UNIT II LISTENING & READING

9

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

UNIT III WRITING

9

Checklist - Recommendations - Formal letters - inviting guests - acceptance/declining letters

UNIT IV BUSINESS WRITING

9

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

UNIT V SPEAKING

9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting - Situational Role-play.

TOTAL: 45 PERIODS

LIST OF EXERCISES

1. Stage Dynamics (Body Language and Paralanguage - Presentation)
2. Day today real time speaking exposures - Story narration, simple, general topics and incidents.
3. Group Discussion
4. Power Point Presentation (Corporate Skills & Public Speaking)
5. Loud Reading
6. Picture Description
7. Interview Skills (Mock Interview & Interview Etiquette)
8. Case Study Report

TOTAL: 15 PERIODS





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OUTCOMES

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

- Use correct grammar in speech and writing.
- Understand and interpret information from various audio and reading sources.
- Write clear, structured, and formal documents.
- Prepare professional emails, résumés, and job-related letters.
- Communicate effectively in group discussions and presentations.
- Apply communication skills confidently in real-time situations.

TEXT BOOKS

1. S. Sumant, "Technical English" Maven Learning Private Limited,
2. Joshi, Manmohan, Soft Skills, Bookboon, First Edition, 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, First Edition, 2013.
2. Seely, John "Oxford Guide to Effective Writing and Speaking", Indian ed., New Delhi, Oxford University Press, 2005.

E-RESOURCES

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

EXTENSIVE READING

1. Stephen R. Covey, "The 7 Habits of Highly Effective People", Simon & Schuster, 2019.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	2	-	2	-	-	-	-	3	-	1	-	-
3	1	-	-	-	-	-	1	-	3	2	2	-	-
4	-	-	-	-	1	-	2	-	3	2	2	-	-
5	-	-	-	-	-	-	1	3	3	2	1	-	-
6	-	-	-	-	-	2	2	2	3	-	2	-	-
Avg.	1	2	-	2	1	2	1.5	2.33	3	2	1.66	-	-

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


Chairman - BoS





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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:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- 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.
- 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 inhouse hold appliances.

WOOD WORK:

- a) Sawing,
- b) Planning 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.





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PART II ELECTRICAL ENGINEERING PRACTICES 15

- a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring 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 using Diac / 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 air conditioner.

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.





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ELECTRONIC EQUIPMENT STUDY

- Study an elements of smart phone.
- Assembly and dismantle of LED TV.
- Assembly and dismantle of computer/ laptop

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- 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.
- Wire various electrical joints in common household electrical wire work.
- 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.
- 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
1	3	2	-	-	1	1	1	-	-	-	-	2	-	2
2	3	2	-	-	1	1	1	-	-	-	-	2	-	2
3	3	2	-	-	1	1	1	-	-	-	-	2	-	2
4	3	2	-	-	1	1	1	-	-	-	-	2	-	2
Avg.	3	2	-	-	1	1	1	-	-	-	-	2	-	2

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


Chairman - BoS





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23EEC201

INDIAN LANGUAGE

L T P C

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE

0 0 4 2

(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the Hindi alphabet, pronunciation, and basic writing.
- To understand and use basic Hindi grammar correctly.
- To develop basic reading, writing, listening, and speaking skills in Hindi.
- To use Hindi for simple everyday communication.
- To prepare learners to successfully clear the Hindi Examination.

UNIT I वर्णमालाएवंमूलभूतव्याकरण (ALPHABET AND BASIC GRAMMAR)

5

Hindi Vowels (स्वर)- Hindi Consonants (व्यंजन) -Matras (मात्राएँ)- Barakhadi (बारहखड़ी)-Word Formation (शब्दनिर्माण)- Gender (लिंग)- Number (वचन)- Basic Sentence -Formation (सरलवाक्यरचना)

UNIT II शब्दभंडारएवंव्याकरण (VOCABULARY AND GRAMMAR)

7

Nouns (संज्ञा)- Pronouns (सर्वनाम) -Adjectives (विशेषण) -Verbs (क्रिया) -Tenses (काल- Present, Past, Future) - Opposite Words (विलोमशब्द) -Synonyms (पर्यायवाची) -One-word Substitutions (अनेकशब्दोंकेलिएएकशब्द)

UNIT III पठनएवंलेखनकौशल (READING AND WRITING SKILLS)

7

Reading Simple Hindi Passages -Comprehension (गद्यांश) -Paragraph Writing (अनुच्छेदलेखन)- Letter Writing (पत्रलेखन)- Dialogue Writing (संवादलेखन) -Picture Description (चित्रवर्णन) -Dictation Practice (श्रुतिलेख)

UNIT IV दैनिकजीवनमेंहिंदी (HINDI FOR EVERYDAY COMMUNICATION)

7

Greetings and Introductions -Family Members (परिवार)- Days, Months, Seasons -Numbers (१-१००) -Time and Date - Colours, Fruits, Vegetables - Shopping Conversations - School and Classroom Vocabulary -Common Everyday Conversations

UNIT V साहित्यएवंपुनरावृत्ति (LITERATURE AND REVISION)

4

Simple Poems (कविताएँ)- Short Stories (लघुकथाएँ)- Proverbs and Idioms (मुहावरेएवंलोकोक्तियाँ- basic) -Moral Stories - Translation (English/Tamil to Hindi - Simple Sentences) - Revision of Grammar - Model Question Papers and Practice Tests

TOTAL: 30 PERIODS





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OUTCOMES

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

1. Write basic Hindi words and sentences.
2. Apply fundamental Hindi grammar in simple communication.
3. Develop basic reading, writing, listening, and speaking skills in Hindi.
4. Use Hindi confidently in day-to-day conversations.
5. Develop proficiency required to successfully clear the **Hindi Examination**.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	-	-	-	3	-	1	-	-
2	-	-	-	-	-	-	1	1	3	-	1	-	-
3	-	-	-	-	-	-	1	2	3	-	2	-	-
4	-	-	-	-	-	1	2	2	3	-	1	-	-
5	-	-	-	-	-	-	-	-	2	-	3	-	-
Avg.	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-

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

P. Chaitanya
Chairman - BoS





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23EEC201

INDIAN LANGUAGE

L T P C

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE

0 0 4 2

(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the German alphabet, pronunciation, and basic communication.
- To understand and use basic German grammar and vocabulary.
- To communicate in German in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in German.
- To apply basic German language skills confidently through practice and revision.

UNIT I INTRODUCTION TO GERMAN LANGUAGE

6

German alphabet and pronunciation -Greetings -Self-introduction (Name, age, nationality, profession) - Numbers (0-100) -Days, months, seasons, and dates - Basic classroom expressions - Personal pronouns - Verb **sein** (to be) -Simple sentence formation

UNIT II BASIC GRAMMAR AND VOCABULARY

7

Definite and indefinite articles (der, die, das; ein, eine) - Nouns and gender - Singular and plural forms - Verb conjugation (regular verbs) - Present tense - Question words (Wer, Was, Wo, Wann, Wie, Warum) - Negation (nicht, kein) - Vocabulary: Family, occupations, countries, languages, colors

UNIT III EVERYDAY COMMUNICATION

7

Daily routine - Time and clock reading - Food and beverages - Shopping conversations - Asking for and giving directions -Making simple requests -Modal verbs (möchten, können) -Vocabulary: Home, school, transportation, weather

UNIT IV READING, WRITING, LISTENING, AND SPEAKING SKILLS

5

Reading short dialogues - Listening to simple conversations - Writing short paragraphs- Describing people, places, and objects - Introducing family and friends

UNIT V PRACTICAL APPLICATIONS AND REVISION

5

Travel and tourism vocabulary - At the restaurant - At the railway station and airport -Revision of grammar topics - Translation of simple sentences (English to German and German to English)

TOTAL: 30 PERIODS





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OUTCOMES

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

- Identify the German alphabet and pronounce basic German words correctly.
- Use basic German vocabulary and simple grammar in sentences.
- Practice in simple German for everyday situations.
- understand basic German texts and conversations.
- Apply basic German language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	-	-	-	3	-	1	-	-
2	-	-	-	-	-	-	1	1	3	-	1	-	-
3	-	-	-	-	-	1	2	2	3	-	2	-	-
4	-	-	-	-	-	-	1	2	3	-	2	-	-
5	-	-	-	-	-	1	2	2	3	-	2	-	-
Avg.	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	-	-

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

P. Chandy
Chairman - BoS





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23EEC201

INDIAN LANGUAGE

L T P C

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE

0 0 4 2

(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the Japanese writing system, pronunciation, and basic vocabulary.
- To understand and use basic Japanese grammar and sentence patterns.
- To communicate in Japanese in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in Japanese.
- To apply basic Japanese language skills confidently through practice and real-life communication.

UNIT I WRITING SYSTEMS & PRONUNCIATION

5

Hiragana chart reading and writing - Katakana chart reading and writing - Basic pronunciation rules (long vowels, double consonants) - Numbers - Colours, body parts, pets description

UNIT II KANJI & BASIC GRAMMAR

7

First 50 Kanji (Numbers, Time & Days, Basic Directions & People) - Topic marker は (wa) - Identification sentences: Noun + です (desu) - Possession particle の (no) - Inclusion particle も (mo) - Subject marker が (ga) - Direction particles へ (he) and に (ni) - Self-introductions and greetings (Aisatsu) - Numbers, prices, shopping terms - Days, months, relative time - Family members and occupations

UNIT III KANJI & FUNCTIONAL GRAMMAR

8

Next 50 Kanji (Nature, Core Verbs, Adjectives & Nouns) - Verb groups (Group 1, Group 2, Group 3) - Masu forms (Present, Past, Positive & Negative) - Te-form (~て): requests, connecting sentences, continuous actions (~ている) - Adjective conjugation (い & な adjectives) - Desires (~たい) and Invitations (~ましょう)

UNIT IV VOCABULARY & FUNCTIONAL COMMUNICATION

5

Action verbs (daily routine, hobbies) - Adjectives for people, food, and places - Positional words (inside, outside, next to, between) - Transport, travel, and location vocabulary - Simple conversations in everyday situations

UNIT V READING & LISTENING COMPREHENSION

5

Reading short sentences in Hiragana, Katakana, and basic Kanji - Understanding classroom instructions - Listening to slow, clear daily-life conversations - Understanding simple shopping dialogues

TOTAL: 30 PERIODS





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OUTCOMES

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

- Identify the Japanese writing system and pronounce basic Japanese words correctly.
- Use basic Japanese vocabulary and simple grammar in sentences.
- Communicate in simple Japanese for everyday situations.
- Read, write, listen to, and understand basic Japanese texts and conversations.
- Apply basic Japanese language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	1	1	-	1	2	-	-	-	-
2	-	-	-	-	1	2	-	2	2	-	-	-	-
3	-	-	-	-	2	2	1	2	3	-	1	-	-
4	-	-	-	-	2	2	1	3	3	-	1	-	-
5	-	-	-	-	1	1	1	2	3	-	1	-	-
Avg.	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-

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

P. Sangeetha
Chairman - BoS





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23MDC201

APTITUDE SKILLS

L T P C

(Common to all Branches)

3 0 0 0

OBJECTIVES

- To introduce the basics concepts and techniques of numbers, Highest common factor and Least common multiple.
- To develop the use of decimal fraction and problems on ages.
- To introduce the basic concepts of time, work, distance, calendar and clock.
- To explain the student with the concept of simple and compound interest.
- To provide the knowledge of polynomial and quadratic equations.

UNIT I NUMBERS, HIGHEST COMMON FACTOR AND LEAST COMMON MULTIPLE

9

Numbers and their basic classification – Types of number – Basic operations of numbers – Progression – Tests of divisibility – Highest common factor – Least common multiple

UNIT II DECIMAL FRACTION AND PROBLEMS BASED ON AGES

9

Decimal fraction – Types of fraction – Comparison of fractions – Inserting fractions in between two given fractions – Relation between decimal fraction and normal fraction – Conversion of a decimal fraction into a vulgar fraction – Types of decimals – Conversion of mixed recurring decimal into a vulgar fraction – Standard form of decimal – Problems based on ages.

UNIT III TIME, WORK, DISTANCE, CALENDER AND CLOCK

9

General rule for time and work – General rule for work and wages – Speed – Unit of speed – Average speed – Some useful relations – Problems on Trains – Calendars and clocks – Odd days – Ordinary year – Leap year.

UNIT IV SIMPLE INTEREST, COMPOUND INTEREST AND ELEMENTARY ALGEBRA

9

Simple interest – Compound interest – Some useful relations – Difference between compound interest and simple interest – Short cut methods to solve special types of problems – Elementary Algebra and averages

UNIT V POLYNOMIAL AND QUADRATIC EQUATIONS

9

Polynomial introduction – Degree of a polynomial – Types of polynomial – Operations on polynomial – Remainder and factor theorem – Quadratic equation – Pure Quadratic equation – Discriminant – Roots of the Quadratic equations – Solution of Quadratic equation – Framing of a Quadratic equation – Special types of roots.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply basic concepts and techniques highest common factor and least common multiple on numbers.
- Apply the concept of decimal fraction and problems on ages.
- Apply the concept of time, work, distance, calendar and clock.
- Develop proficiency in simple interest, compound interest and basic algebraic skills.
- Explain the concepts and properties of polynomial and quadratic equations.

TEXT BOOKS

1. Agarwal R.S., "Quantitative Aptitude", S. Chand & Company Ltd, New Delhi, 2012.
2. Dinesh Khattar, "Quantitative Aptitude for competitive examinations ", Pearson India Education Services Pvt. Ltd., New Delhi, 2019.

REFERENCES

1. Praveen R.V., "Quantitative Aptitude and Reasoning", PHI Learning Private Limited, Delhi, 2013.
2. Gupta P, "A unique Approach to Quantitative Aptitude ", Unique Publishers (I) Pvt. Ltd, New Delhi, 2017.

E-RESOURCES

1. <https://youtube.com/playlist?list=RDQM5XI256aOq24>
2. <https://youtu.be/KE7tQf9spPg>


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MAT304

SEMESTER III TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L P T C

[Common to Civil, Mech, R&A and PT]

3 1 0 4

OBJECTIVES

- To introduce the basics of Fourier transforms and their properties.
- To compute the Z-transforms of standard functions and their properties.
- To provide knowledge of Fourier series and half-range series.
- To explore the basic concepts of partial differential equation.
- To explain the classification and applications of partial differential equations.

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 PARTIAL DIFFERENTIAL EQUATIONS

9+3

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

9+3

Classification of partial differential equations – Method of separation of variables – Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.





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OUTCOMES

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

- Apply various Fourier transform techniques in physical problems of engineering.
- Solve engineering problems using the concept of Z transforms.
- Analyze Fourier series for periodic functions and functions with discrete data.
- Apply the standard types of partial differential equations.
- Evaluate the Fourier series techniques in application of partial differential equations.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, Forty fourth Edition, 2022.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G., "Advanced Mathematics for Engineering Students", S.Viswanathan Publishers, Fourth Edition, 1998.

REFERENCES

1. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt. Ltd, Ninth Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Tenth Edition, 2016.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/111/102/111102129/#> (Transforms)
2. <https://archive.nptel.ac.in/courses/111/103/111103021/> (Partial differential equations)

Mapping of COs-POs & PSOs

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

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

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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 train students in the basic concepts of thermodynamics, thermodynamic systems, processes, and the First Law of Thermodynamics for closed and open systems.
- To teach the Second Law of Thermodynamics, heat engines, refrigerators, heat pumps, and the concept of entropy.
- To develop students' understanding of the properties of pure substances, phase changes, and the use of steam tables and thermodynamic diagrams.
- To explain the behavior of ideal and real gases and the basic thermodynamic relations.
- To develop understanding of psychrometric properties and processes of air - vapour mixtures using psychrometric charts.

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 thermodynamics - 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





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OUTCOMES

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

- Apply the basic concepts and apply the First Law of Thermodynamics to thermodynamic systems and processes.
- Examine the Second Law of Thermodynamics and the concept of entropy in heat engines, refrigerators, and heat pumps.
- Apply thermodynamic properties of pure substances using steam tables, thermodynamic diagrams, and Mollier charts in engineering calculations
- Compare the behavior of ideal and real gases using thermodynamic relations and equations of state.
- Analyze the psychrometric properties and processes of air-vapour mixtures using psychrometric charts and equations.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Sixth Edition, Tata McGraw-Hill, 2017.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", Ninth Edition, Tata McGraw Hill, 2019.
3. Rajput.R.K, "A Textbook of Engineering Thermodynamics", Ninth Edition, Laxmi Publications, 2017.

REFERENCES

1. Arora C.P, "Refrigeration and Air Conditioning", Tata McGraw-Hill, Fourth Edition, 2020.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam publications, 2019.
3. Holman.J.P, "Thermodynamics", McGraw Hill Education, Tenth Edition, 2019.

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	PSO1	PSO2
1	3	2	2	-	3	-	-	-	3	-	2	3	2
2	3	2	2	-	3	-	-	-	3	-	2	3	2
3	3	2	2	-	3	-	-	-	3	-	2	3	2
4	3	2	2	-	3	-	-	-	3	-	2	3	2
5	3	2	2	-	3	-	-	-	3	-	2	3	2
Avg.	3	2	2	-	3	-	-	-	3	-	2	3	2

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


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23MET302

ENGINEERING MECHANICS

L T P C

(Common to Mechanical Engineering and Robotics and Automaton Engineering)

3 1 0 4

OBJECTIVES

- To train students in the fundamental concepts of mechanics, including scalars, vectors, laws of mechanics, forces, and equilibrium of particles.
- To teach the principles of equilibrium of rigid bodies, moments, couples, and reactions at supports in two and three dimensional systems.
- To develop understanding of friction and its applications in engineering systems such as inclined planes, belts, ladders, and wedges.
- To explain the concepts of centroids and area moments of inertia for simple and composite plane areas.
- To train students in the dynamics of particles, including rectilinear and curvilinear motion, impulse, momentum, and impact of 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 CENTRIDS 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





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OUTCOMES

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

- Apply the fundamental concepts of mechanics to resolve forces and determine equilibrium of particles.
- Analyze the equilibrium of rigid bodies by calculating moments, couples, and support reactions in two and three dimensions.
- Examine the effects of friction in engineering applications such as inclined planes, belts, ladders, and wedges.
- Calculate the centroids and area moments of inertia for simple and composite plane areas using relevant theorems.
- Analyze the motion of particles using principles of kinematics, impulse, momentum, and impact.

TEXT BOOKS

1. Dr.N.Kottiswaran, "Engineering Mechanics", Sri Balaji Publications, Eleventh Edition, 2018.
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, Twelfth Edition, 2019.
3. Vela Murali, "Engineering Mechanics", Oxford University Press, Second Edition, 2018.

REFERENCES

1. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", Eleventh Edition, Pearson Education, 2017.
2. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, Ninth Edition, Wiley student edition, 2019.
3. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, Fifth Edition, McGraw Hill Higher Education, 2020.

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	PSO1	PSO2
1	3	2	2	-	-	-	-	-	-	-	2	-	2
2	3	2	2	-	-	-	-	-	-	-	2	-	2
3	3	2	2	-	-	-	-	-	-	-	2	-	2
4	3	2	2	-	-	-	-	-	-	-	2	-	2
5	3	2	2	-	-	-	-	-	-	-	2	-	2
Avg.	3	2	2	-	-	-	-	-	-	-	2	-	2

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

 Chairman - BoS





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23MEE301

MANUFACTURING TECHNOLOGY

L T P C

3 0 2 4

OBJECTIVES

- To provide knowledge on the principles of metal cutting, chip formation, machining forces, cutting fluids, tool wear, and tool life.
- To introduce the construction, specifications, and operations of lathe and milling machines, including machining time and power estimation.
- To familiarize students with different machine tools and hole making processes such as drilling, reaming, boring, counter boring, counter sinking, and tapping.
- To impart understanding of grinding processes, finishing operations, and gear generation methods used in manufacturing.
- To introduce the fundamentals of CNC machine tools and basic CNC part programming used in modern machining.
- To provide hands-on experience in basic manufacturing processes such as moulding, machining, welding, grinding, and CNC programming.

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





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OUTCOMES

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

- Apply the principles of metal cutting including chip formation, machining forces, tool wear, and tool life.
- Examine the working and operations of lathe and milling machines for different machining processes and machining time estimation.
- Apply the machine tool operations and hole making processes such as drilling, reaming, boring, and tapping.
- Differentiate the grinding and gear generation processes used in manufacturing applications.
- Construct basic CNC part programs for machining operations.
- Apply basic manufacturing processes such as moulding, machining, welding, grinding, and CNC programming to produce simple components.

TEXT BOOKS

1. Rajput R. K, "Manufacturing Technology", Laxmi Publications (P) Ltd., Third Edition, 2021.
2. Richard R Kibbe, John E Neely, Roland O Merges and Warren T White, "Machine Tool Practices", Prentice Hall of India, Tenth Edition, 2020.
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., Fifteenth Edition, 2023
2. Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw Hill Publishing Company Pvt Ltd., Fourth Edition, 2020
3. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, Second edition, 2017.

E-RESOURCES

1. <http://nptel.ac.in/courses/112105126/> - (Manufacturing Technology-Metal Cutting and Machine Tools)
2. https://freevideolectures/A0dTvf_Q8BA/ - (Manufacturing Process)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	-	2	-	-	-	-	-	-	-	3	2
2	3	3	2	2	2	-	-	-	-	-	-	3	2
3	3	2	2	2	2	-	-	-	-	-	-	3	2
4	3	3	2	2	2	-	-	-	-	-	-	3	2
5	3	3	3	2	2	-	-	-	-	-	-	3	3
6	3	2	3	2	2	-	-	-	-	-	-	3	3
Avg.	3	2.67	2.0	2.0	2.3	-	-	-	-	-	-	3.0	2.3

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

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23MEE302

METROLOGY AND MEASUREMENTS

(Lab Embedded Theory Course)

L T P C

3 0 2 4

OBJECTIVES

- To introduce students to the basic concepts of metrology, measurement systems, errors, calibration, limits, fits, and tolerances.
- To provide knowledge on linear and angular measuring instruments such as vernier instruments, micrometers, comparators, and sine bars.
- To familiarize students with advanced metrology techniques including interferometers, coordinate measuring machines, and machine vision systems.
- To impart knowledge on form measurement methods such as straightness, flatness, thread, gear, and surface finish measurement.
- To explain the measurement of mechanical parameters such as force, torque, power, and flow using different measuring instruments.
- Analyze calibration and measurement of dimensional and mechanical parameters using precision measuring 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.

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.





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- Comparison of gear/screw parameter using Profile projector/Tool Maker's microscope.
- Measurement of force
- Measurement of torque
- Measurement of temperature.
- Inspection of specimen using Mechanical/Electrical comparator.
- Measurement of screw thread parameter using Floating Carriage Micrometer.
- 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:

- Apply the basic principles of metrology and measurement systems, including errors, calibration, limits, fits, and tolerances.
- Examine the working and applications of linear and angular measuring instruments such as vernier instruments, micrometers, comparators, and sine bars.
- Apply advanced metrology techniques such as interferometers, coordinate measuring machines, and machine vision systems for dimensional measurement.
- Compare various form measurement methods such as straightness, flatness, thread, gear, and surface finish measurements.
- Analyze mechanical parameters such as force, torque, power, and flow using appropriate instruments.
- Evaluate metrology experiments to measure, calibrate, and inspect dimensional and mechanical parameters with accuracy and precision.

TEXT BOOKS

- R.K. Rajput, "A textbook of Measurements and Metrology", Katson Publishers, 2019.
- Venkateshan, S. P., "Mechanical Measurements", John Wiley & Sons, Fourth Edition, 2020.
- Jain R.K. "Engineering Metrology", Khanna Publishers, Twenty first Edition, 2020.

REFERENCES

- Raghavendra, Krishnamurthy "Engineering Metrology & Measurements", Oxford Univ. Press, First Edition, 2020.
- Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, Fourth Edition, 2021.
- Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2019.

E-RESOURCES

- <https://nptel.ac.in/courses/112/104/112104250/> - (Introduction to Measurements and Metrology)
- <http://www.downloadmela.com/video-lectures/engineering5/mechanicalengineering6/mechanicalmeasurements-and-metrology/> - (Metrology and Measurements)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23CEE402

FLUID MECHANICS AND MACHINERY

(Lab Embedded Theory Course)

L T P C

3 0 2 4

OBJECTIVES

- To inculcate the properties of fluid flow characteristics and its dynamics.
- To impart knowledge on the laminar and turbulent flow through circular conduits and losses in pipe flow.
- To familiarize with the dimensional and model analysis.
- To enhance the types of pumps, working principle, application and performance analysis of fluid pumps.
- To acquire knowledge on types of turbines, working principle, velocity triangle and performance curves of hydraulic turbines.
- To foster 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 pipes (Loss of energy in pipes) - Major losses - Darcy-Weisbach equation and Chezy's formula - Minor losses - Moody diagram (Qualitative treatment) - Flow through 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 its 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





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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 concept of flow characteristics and calculate major and minor losses associated with pipe flow in piping networks.
- Examine the concept of model analysis, including how physical models are scaled and tested to simulate the real world fluid flow problems.
- Develop the performance of pumps.
- Construct the operating principles of various turbines and how they convert energy from fluids into mechanical work.
- 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, Seventh Edition, 2019.
2. Modi P.N and Seth S.M, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, Sixth Edition, 2019.
3. Rajput R.K, "Fluid Mechanics and Hydraulic Machines", S. Chand Publishing Limited, Third Edition, 2021.

REFERENCES

1. K.L Kumar, "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., Seventh Edition, 2019.
2. Giles, R.V, Evett, J.B & Liu C, "Fluid Mechanics and Hydraulics", Tata McGraw Hill, Second Edition, 2020.
3. Khurmi R S, "Fluid mechanics & hydraulic Machines. (in S.I. units)", S Chand & Company Limited, Third Edition, 2019.

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	PSO1	PSO2
1	3	3	2	2	-	2	2	-	2	-	2	3	2
2	3	3	2	2	-	2	2	-	2	-	2	3	2
3	3	3	2	2	-	2	2	-	2	-	2	3	2
4	3	3	2	2	-	2	2	-	2	-	2	3	2
5	3	3	2	2	-	2	2	-	2	-	2	3	2
6	3	3	2	2	-	2	2	-	2	-	2	3	2
Avg.	3	3	2	2	-	2	2	-	2	-	2	3	2

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

Chairman - BoS





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23EEC301

PROFESSIONAL DEVELOPMENT

L T P C

0 0 2 1

OBJECTIVES

To be proficient in important Microsoft Office tools: MS WORD, EXCEL and POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD:

10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL:

10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate and Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)
Work with Lookup and reference formulae
Create and Work with different types of charts





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- Use pivot tables to summarize and analyze data
- Perform data analysis using own formulae and functions
- Combine data from multiple worksheets using own formulae and built-in functions to generate results
- Export data and sheets to other file formats
- Working with macros
- Protecting data and Securing the workbook

MS POWERPOINT:

10 Hours

- Select slide templates, layout and themes
- Formatting slide content and using bullets and numbering
- Insert and format images, smart art, tables, charts
- Using Slide master, notes and handout master
- Working with animation and transitions
- Organize and Group slides
- Import or create and use media objects: audio, video, animation
- Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES

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

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements.
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding.
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	1	2	-	3	-	-	-	1	3	-	2	2
2	3	3	2	2	3	-	-	-	-	2	1	2	2
3	2	1	2	-	3	-	-	-	2	3	-	2	2
Avg.	2.3	1.6	2	2	3	-	-	-	1.5	2.6	1	2	2

1-Low, 2-Medium, 3-High, "-" - No Correlation


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



SEMESTER IV

23MET401

KINEMATICS OF MACHINERY

L T P C

3 1 0 4

OBJECTIVES

- To introduce the basic concepts of mechanisms, including classification, degree of freedom, Grashof's Law, and mechanical advantage.
- To teach methods for displacement, velocity, and acceleration analysis of linkages using graphical and analytical techniques.
- To explain the principles of cam mechanisms, including follower motions, displacement diagrams, and cam profile layouts.
- To familiarize learners with gears and gear trains, covering tooth profiles, gear terminology, speed ratios, and epicyclic gear systems.
- To present the fundamentals of friction in machine elements, including sliding and rolling friction, friction drives, screw threads, and clutches.

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 - Involute 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





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OUTCOMES

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

- Apply the principles of kinematics, including how they apply to different types of mechanical systems and machines.
- Analyze displacement, velocity, and acceleration in linkage systems..
- Develop cam profiles and follower motion diagrams for various motions.
- Examine gear systems and gear trains to find speed ratios and check for interference.
- Analyze friction effects in machine elements like clutches, drives, and screw threads

TEXT BOOKS

1. Rattan, S.S, "Theory of Machines", Tata McGraw-Hill, Fifth Edition, 2019.
2. R.S.Khurmi and J.K.Gupta, "Theory of Machines" S.Chand and Co Ltd., Fourteenth Edition, 2022.
3. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, Third Edition, 2021.

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., Fifth Edition, 2020.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, Fourth Edition, 2020.

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	PSO1	PSO2
1	3	2	2	-	-	-	-	-	-	-	2	1	2
2	3	2	2	-	-	-	-	-	-	-	2	1	2
3	3	2	2	-	-	-	-	-	-	-	2	1	2
4	3	2	2	-	-	-	-	-	-	-	2	1	2
5	3	2	2	-	-	-	-	-	-	-	2	1	2
Avg.	3	2	2	-	-	-	-	-	-	-	2	1	2

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


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23MET402

ENGINEERING MATERIALS AND METALLURGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce alloys, phase diagrams, and types of steels and cast irons with their properties and applications.
- To teach heat treatment processes like annealing, hardening, tempering, and surface treatments.
- To explain ferrous and non-ferrous metals, alloying effects, and their applications.
- To familiarize learners with polymers and ceramics, their properties, and engineering uses.
- To train learners in mechanical properties and testing methods, including hardness, impact, fatigue, and creep.

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, 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





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OUTCOMES

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

- Analyze the structures of materials and interpret the phase diagrams.
- Analyze the concept of heat treatment of steels and the mechanisms of hardening.
- Examine the fundamental principles behind tailoring material properties of ferrous and non-ferrous metals.
- Compare 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, Eighth Edition, 2020.
2. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials properties and selection" Pearson India Education Services Pvt Ltd, Ninth edition, 2019.
3. William D.Callister,Jr and David G.Rethwisch " Materials science and Engineering, An introduction" Wiley, Tenth Edition, 2020.

REFERENCES

1. Jindal U.C, "Material Science and Metallurgy", Dorling Kindersley Publication, Third Edition, 2019.
2. Raghavan.V, "Materials Science and Engineering: A First Course", Prentice Hall of India Pvt. Ltd., Seventh Edition, 2019.
3. T.DebRoy, H.K.D.H. Bhadeshia "Innovations in Everyday Engineering Materials" Springer International Publishing, First Edition, 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	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	2	1	2
2	3	2	-	-	-	-	-	-	-	-	2	1	2
3	3	2	-	-	-	-	-	-	-	-	2	1	2
4	3	2	-	-	-	-	-	-	-	-	2	1	2
5	3	2	-	-	-	-	-	-	-	-	2	1	2
Avg.	3	2	-	-	-	-	-	-	-	-	2	1	2

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEE401

THERMAL ENGINEERING

(Lab Embedded Theory Course)

L T P C

3 0 2 4

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

OBJECTIVES

- To teach the components, systems, and performance of internal combustion engines, including valve and port timing, fuel injection, and ignition.
- To guide learners in gas power cycles and calculations of efficiency and mean effective pressure.
- To explain the working of steam nozzles, turbines, and governors.
- To familiarize learners with types, working, and efficiencies of air compressors.
- To train learners in refrigeration and air conditioning systems, including vapor compression, absorption cycles, and cooling load calculations.
- To guide students in performing experiments on IC engines, air compressors, and refrigeration systems.

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.

TOTAL: 45+15=60 PERIODS





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OUTCOMES

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

- Analyze the components, working, and performance of internal combustion engines, including SI and CI engines, ignition, fuel systems, and cooling/lubrication systems.
- Compare the performance of gas power cycles such as Otto, Diesel, Dual, and Brayton cycles, including air standard efficiency and mean effective pressure.
- Examine the flow of steam through nozzles and turbines, and analyze impulse and reaction principles, compounding, velocity diagrams, and speed regulation.
- Analyze the operation and performance of air compressors, including single-stage and multistage compressors, volumetric efficiency, and isentropic/isothermal efficiency.
- Analyze the performance of refrigeration and air conditioning systems, including vapour compression and absorption cycles, superheating, sub-cooling, and cooling load calculations.
- Conduct performance tests on petrol engines, diesel engines, and compressors, and apply standard methods for evaluation.

TEXT BOOKS

- Kothandaraman.C.P, Domkundwar.S, Domkundwar.A.V., "A course in thermal Engineering" Dhanpat Rai & sons, Sixth Edition, 2020.
- Rajput. R. K., "Thermal Engineering" S.Chand Publishers, Eighth Edition, 2019.
- Michael A. Boles, Yunus A. Cengel, "Thermodynamics: An Engineering Approach", Tata McGraw - Hill Education, Eighth Edition, 2021.

REFERENCES

- Arora.C.P, "Refrigeration and Air Conditioning", Tata McGraw-Hill Publishers, Fifth Edition, 2021.
- Ganesan.V "Internal Combustion Engines", Tata McGraw-Hill, Third Edition, 2019.
- Manohar Prasad, "Refrigeration and Air Conditioning", New Age International publications, Third Edition, 2021.

E-RESOURCES

- <https://nptel.ac.in/courses/112/103/112103262/> - (Engine and Gas Turbines)
- <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	PSO1	PSO2
1	3	3	2	-	-	1	-	2	-	-	3	2	2
2	3	3	2	-	-	1	-	2	-	-	3	2	2
3	3	3	2	-	-	1	-	2	-	-	3	2	2
4	3	3	2	-	-	1	-	2	-	-	3	2	2
5	3	3	2	-	-	1	-	2	-	-	3	2	2
6	3	3	2	-	-	1	-	2	-	-	3	2	2
Avg.	3	3	2	-	-	1	-	2	-	-	3	2	2

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

Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEE402

STRENGTH OF MATERIALS

(Lab Embedded Theory Course)

(Common to Mechanical and Robotics and Automation)

L T P C

3 0 2 4

OBJECTIVES

- To teach different types of stresses and strains, axial and thermal effects, elastic constants, and factor of safety in solids.
- To explain principal stresses, stresses on inclined planes, Mohr's circle, and stresses in thin and thick-walled cylinders.
- To familiarize learners with bending and shear stress distribution, load carrying capacity, and proportioning of beam sections.
- To guide learners in evaluating beam deflections and column strength using standard methods and formulas.
- To teach torsion in shafts, stresses in helical and carriage springs, and related practical examples
- To guide students in performing experiments and demonstrate practical measurements of stress, strain, hardness, deflection, torsion, and heat treatment effects.

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 AND COLUMNS

9

Evaluation of slope and deflection of cantilever and simply supported beams - Double integration method - Macaulay's method. Types of Columns, Equivalent length, Euler and Rankine formulae, Slenderness ratio.

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

- Tension test on steel rod in U.T.M.
- Torsion test on steel rod.
- Impact test on metal specimen.
- Hardness test on metals - Brinell and Rockwell Hardness.
- Deflection test on beams.
- Spring Test - Open coil and Closed coil.
- Effect of Hardening - improvement of hardness and impact resistance of steels
- Tempering- Improvement Mechanical properties Comparison
 - Unhardened specimen
 - Quenched Specimen and
 - Quenched and tempered specimen.





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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:

- Examine how variations in material properties and structure configurations affect the overall stress and strain responses.
- Analyze the importance of two dimensional stress systems and stresses in thin and thick cylinders.
- Draw the shear force and bending moment diagrams for beams subjected to various loading conditions, such as point loads, distributed loads, and moments.
- Apply the impact of estimated slopes and deflections on the overall design and safety of structural components.
- Apply torsion equation in design of circular shafts and helical springs.
- Examine how the results from different tests compare and what they reveal about the specimen's overall mechanical behavior.

TEXT BOOKS

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, Sixth Edition, 2021
2. Rajput R K., "A Textbook of Strength of Materials (Mechanics of Solids)", S Chand and Company Ltd., Fourth Edition, 2020.
3. F.P. Beer and R.Johnston, "Mechanics of Materials", McGraw Hill Education India (P) Ltd., Seventh Edition, 2023.

REFERENCES

1. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, Second Edition, 2021.
2. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, Fourth Edition, 2023.
3. Rattan.S.S, "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., Fourth Edition, 2023.

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	PSO1	PSO2
1	3	3	1	-	-	1	-	-	-	-	3	2	2
2	3	3	1	-	-	1	-	-	-	-	3	2	2
3	3	3	1	-	-	1	-	-	-	-	3	2	2
4	3	3	1	-	-	1	-	-	-	-	3	2	2
5	3	3	1	-	-	1	-	-	-	-	3	2	2
6	3	3	1	-	-	1	-	2	-	-	3	2	2
Avg.	3	3	1	-	-	1	-	2	-	-	3	2	2

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23GEE301

PROBLEM SOLVING AND PYTHON PROGRAMMING

L T P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart the fundamentals of computational thinking, algorithm design, and problem-solving techniques for developing efficient software solutions.
- To develop students proficiency in Python programming using data types, expressions, operators, statements, and debugging techniques.
- To enable students to apply control structures, functions, recursion, and string manipulation for solving computational problems.
- To train students to use lists tuples, dictionaries, and advanced data processing techniques for structured programming.
- To inculcate the knowledge of file handling, exception handling, modules, packages, and data visualization for developing robust Python applications.
- To develop the students in analytical, programming, and computational skills through coding practices, and to solve real-world problems using Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING

9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, 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.

Coding practices:

1. Develop Algorithm and flowchart to find the greatest of three numbers.
2. Develop Algorithm and flowchart to find a minimum number in a List.

Problem-solving Assignments:

1. Develop Algorithm and Flowchart to solve Towers of Hanoi Problem.
2. Develop Algorithm, Pseudo code and flowchart for finding factorial of a given number using recursion.

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.





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Coding practices:

1. Develop python program to find area of a Circle
2. Develop python program to convert Fahrenheit to Celsius.

Problem-solving Assignments:

1. Develop Python program to find Quadratic Equation
2. Develop Python program to find Student mark statement based on 5 subjects.

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.

Coding practices:

1. Develop python program to find GCD of a given number.
2. Develop python program to find factorial of a number.
3. Develop Python program to find sum of array of given numbers.

Problem-solving Assignments:

1. Develop Python program to find whether an element is found in the List by using (A) Linear Search and (B) Binary Search method
2. Develop Python program to print Fibonacci Series

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 and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

Coding practices:

1. Develop python program for Insertion Sorting & Selection Sorting.
2. Develop python program for Histogram

Problem-solving Assignments:

1. Develop Python program for student mark statement using List
2. Develop Python program to print Retail bill statement





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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.

Coding practices:

1. Develop python program to append the contents of one file to another.
2. Develop python program to copy contents of one file to another file using command Line Arguments

Problem-solving Assignments:

1. Develop a python program for calculator using python packages.
2. Develop a suitable python program to demonstrate each case in Exceptional Handling
3. Develop a suitable python program using Matplotlib for Visualizing Errors

LIST OF EXPERIMENTS

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, character count, replacing characters)
8. Implementation 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





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OUTCOMES

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

- Analyze computational problems to develop effective problem-solving strategies.
- Apply python constructs to develop programs for python applications.
- Apply control structures and functions to solve computational problems.
- Apply Python built-in data structures such as lists, tuples, and dictionaries to process and manipulate data efficiently.
- Analyze the operations of file handling, exception handling, modules, packages, and data visualization techniques for real-world applications.
- Implement python programs for solving various computational problems.

TEXTBOOKS

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

REFERENCES

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

E – RESOURCES

- [https://nptel.ac.in/courses/106104074/Introduction to Algorithms](https://nptel.ac.in/courses/106104074/Introduction%20to%20Algorithms)
- [https://archive.nptel.ac.in/courses/106/106/106106182/ Joy of Computing](https://archive.nptel.ac.in/courses/106/106/106106182/Joy%20of%20Computing)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	2	-	-
2	3	2	2	-	3	-	-	-	-	-	2	-	-
3	3	3	2	1	3	-	-	-	-	-	2	-	-
4	3	2	2	-	3	-	-	-	-	-	2	-	-
5	2	3	2	2	3	-	-	-	1	-	2	-	-
6	3	3	3	2	3	-	1	1	2	1	2	-	-
Avg.	2.83	2.667	2.16	1.5	2.83	-	1	1	1.5	1	2	-	-

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

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23EEC401

ONLINE CERTIFICATION COURSES

L T P C
3 0 0 3

Students may be permitted to study online courses (NPTEL, SWAYAM or any Proctored Assessment Certification Courses) with 3 credits during the 4th semester curriculum for all B.E./B.Tech. Programmes. Such courses offered to students shall be recommended by the Department Academic Committee (DAC). The DAC shall ensure that the courses offered are not core courses in their respective curriculum.

The number of credits and transfer of credits are based on the procedure explained in following Table. The mapping of marks with grades is applicable only if the student passes the course as per the guidelines of NPTEL.

S.No.	No. of Weeks	Credits
1	4	1
2	8	2
3	12	3
4	16	4


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Semester - V

23MET501

DESIGN OF MACHINE ELEMENTS

L T P C

(Use of Approved Design Data Book is Permitted)

3 1 0 4

OBJECTIVES

- To introduce the fundamental concepts of the mechanical design process and stress analysis under various loading conditions.
- To explain theories of failure, fatigue behavior, and design considerations for components subjected to static and variable loads.
- To teach the design of shafts, couplings, keys, and splines based on strength, rigidity, and functional requirements.
- To explain the design principles of bolted, welded, and riveted joints under different loading conditions.
- To describe the design and application of springs.
- To explain the various types of bearings used in mechanical systems.

UNIT I FUNDAMENTAL CONCEPTS IN DESIGN

9+3

Introduction to the design Process - Direct, Bending and Torsional Stress Equations - Eccentric Loading - Calculation of principle stresses for various Load Combinations - Theories of failure - Design of curved Beams - Crane hook and C frame - Stress Concentration - Design for variable loading - Soderberg, Goodman and Gerber Relations.

UNIT II DESIGN OF SHAFTS AND COUPLINGS

9+3

Design of solid and hollow shafts based on strength, rigidity and critical speed - Keys, keyways and splines - Rigid and flexible couplings.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS

9+3

Threaded fasteners - Design of bolted joints under eccentric loading - Design of welded joints - Design of riveted joints for structures.

UNIT IV DESIGN OF SPRINGS

9+3

Springs -Types- Helical springs, materials, end connections, terms used in compression springs - Stresses and deflection in helical springs of circular wire - Surge in springs - Design of leaf springs - Stress and deflection equation - Advantage and Applications.

UNIT V DESIGN OF BEARINGS

9+3

Sliding Contact bearing - Design of journal Bearings - Rolling contact bearings - Selection of rolling contact bearings.

TOTAL : 45 +15 PERIODS



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OUTCOMES

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

- Analyze the various stresses in machine elements.
- Apply design principles to determine appropriate shaft dimensions and coupling types for specific power transmission requirements.
- Classify the design considerations for joints under different loading conditions.
- Apply design principles to develop energy-storing elements suitable for specific loading conditions.
- Analyze appropriate bearings for specific mechanical applications based on load requirements and operational conditions.

TEXT BOOKS

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", McGraw-Hill, Eleventh Edition, 2020.
2. R.S.Khurmi and J.K.Gupta, "A Text Book of Machine Design", S.Chand Publications, 2020.
3. Bhandari V B, "Design of Machine Elements", Tata McGraw-Hill Book Co, Fifth Edition, 2020

REFERENCES

1. Sundararajamoorthy T. V, Shanmugam .N, Machine Design, Anuradha Publications, Second Edition, 2019.
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design", Wiley, Seventh Edition, 2021.
3. M. F. Spotts, Terry E. Shoup, Design of Machine Elements, Eighth Edition, 2019

E-RESOURCES

1. <https://nptel.ac.in/courses/112/105/112105124/> (Design of Machine Elements - I)
2. <https://archive.nptel.ac.in/courses/112/106/112106137/> (Machine Design II)

Mapping of COs-POs & PSOs

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

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23MEE501

DYNAMICS OF MACHINERY (Lab Embedded Theory Course)

L T P C
3 0 2 4

OBJECTIVES

- To teach the concepts of dynamic force analysis, inertia forces, and inertia torque in mechanical systems.
- To train learners in static and dynamic balancing of rotating and reciprocating masses in engines.
- To teach the fundamentals of free and forced vibrations, including damping, natural frequency, and critical speeds of shafts.
- To explain the response of mechanical systems to harmonic excitation, unbalance, support motion, and vibration isolation.
- To familiarize learners with the working principles of governors and gyroscopes used in machine control.
- To demonstrate experimental methods related to inertia determination, balancing, vibration analysis, and gyroscopic effects.

UNIT I FORCE ANALYSIS

9

Dynamic force analysis - Inertia force and Inertia torque - D Alemberts principle - Dynamic analysis in reciprocating engines - Inertia effect of connecting rod - Crank shaft torque - Turning moment diagrams.

Unit II BALANCING

9

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder engine - Balancing of multi-cylinder inline - Partial balancing in engines - Balancing machines.

Unit III FREE VIBRATION

9

Basic features of vibratory systems - Free vibration - Equations of motion - Natural frequency - Types of damping - Damped vibration - Critical speeds of shafts - Torsional vibration - Two and three rotor torsional systems.

Unit IV FORCED VIBRATION

9

Response of one degree freedom systems to periodic forcing - Harmonic disturbances - Disturbance caused by unbalance - Support motion - Transmissibility - Vibration isolation

Unit V MECHANISM FOR CONTROL

9

Governors and its types - Gyroscopes - Gyroscopic forces and torques - Gyroscopic effects in ships and airplanes.

LIST OF EXPERIMENTS

1. Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
2. a) Balancing of rotating masses. b) Balancing of reciprocating masses.
3. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
4. Determination of transmissibility ratio using vibrating table.
5. Motorized gyroscope – Study of gyroscopic effect and couple.
6. Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
7. Vibration of Equivalent spring mass system.

TOTAL: 45+15=60 PERIODS



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OUTCOMES

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

- Analyze the dynamic force effects in mechanisms including inertia forces, inertia torque, D'Alembert's principle and turning moment diagrams.
- Examine the static and dynamic balancing of rotating and reciprocating masses in single and multi-cylinder engines.
- Analyze the characteristics of free vibration in mechanical systems including natural frequency, damping and torsional vibration.
- Analyze the response of single degree of freedom systems subjected to forced vibration and unbalanced forces.
- Categorize the different types of governors and gyroscopic systems and their engineering applications.
- Analyze the performance and dynamic characteristics of mechanical systems related to inertia, balancing, vibration, gyroscopic effects, and governor mechanisms through experimental investigation.

TEXT BOOKS

1. Rattan, S.S., "Theory of Machines", Tata McGraw-Hill, First Edition, 2020.
2. Khurmi, R.S., "Theory of Machines", S Chand Publications, Tenth Edition, 2022.
3. Sadhu Singh, "Theory of Machines," Pearson Education Pvt. Ltd., Indian Branch, Third Edition 2020.

REFERENCES

1. Uicker, J.J., Pennock, G.R. and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, Fifth Edition, 2021.
2. R L Norton, "Kinematics and Dynamics of Machinery", McGraw-Hill Education, Fifth Edition, 2021
3. A.S. Ravindra, "Theory of Machines - I", Sudha Publications, Third Edition, 2021

E-RESOURCES

1. <https://nptel.ac.in/courses/112104114/> - (Dynamics of Machines)
2. <http://www.digimat.in/nptel/courses/video/112104114/L01.html> - (Dynamics of Machines)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEE502

HEAT AND MASS TRANSFER

L T P C

3 0 2 4

OBJECTIVES

- To provide fundamental knowledge of heat transfer mechanisms including conduction, convection, and radiation.
- To guide students in analyzing heat transfer in different systems and geometries under steady and unsteady conditions.
- To provide knowledge on phase change heat transfer processes such as boiling and condensation and their engineering applications.
- To introduce the principles and analysis of heat exchangers using LMTD and NTU methods.
- To introduce basic concepts of mass transfer and their relationship with momentum and heat transfer.
- To train heat transfer principles to determine thermal properties through experiments, connecting theoretical concepts with practical engineering applications.

UNIT I CONDUCTION

9

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces - Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids

UNIT II CONVECTION

9

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

9

Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling - Correlations in boiling and condensation - Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

UNIT IV RADIATION

9

Black Body Radiation – Grey body radiation - Absorptivity, Reflectivity and Transmissivity – Kirchoff's Law of Radiation -Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

UNIT V MASS TRANSFER

9

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

LIST OF THE EXPERIMENTS

1. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus
2. Determination of heat transfer coefficient under natural convection from a vertical cylinder
3. Determination of heat transfer coefficient by forced convection inside tube
4. Efficiency calculation of a pin-fin apparatus (natural and forced convection modes)
5. Determination of emissivity of a given grey surface
6. Determination of Stefan - Boltzmann constant
7. Thermal conductivity measurement using guarded plate apparatus.

TOTAL: 45 + 15 PERIODS



OUTCOMES

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

- Compare heat conduction characteristics of various surface configurations under steady-state conditions using heat conduction equations.
- Analyze free and forced convective heat transfer correlations to internal and external flow.
- Classify the various types of condensation processes in the heat exchangers.
- Compare the thermal radiation exchange between black and gray surfaces to understand the differences in heat transfer.
- Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications.
- Analyze heat transfer to find thermal conductivity, heat transfer coefficient, and emissivity of materials.

TEXT BOOKS

1. Holman.J.P, "Heat Transfer", McGraw Hill Education (India) Pvt Ltd, Eleventh Edition, 2020.
2. Yunus A. Cengel, Afshin J.Ghajar, "Heat and Mass Transfer: Fundamentals and Applications", McGraw Hill Education, Sixth Edition, 2020.
3. John H. Lienhard, "A Heat Transfer", Fifth Edition, Phlogiston Press, 2022

REFERENCES

1. Kothandaraman.C.P, "Fundamentals of Heat and Mass transfer", New age international publishers, Fifth Edition, 2022
2. Nag, P.K., "Heat Transfer", Fifth Edition, Tata McGraw Hill, 2021.
3. Anthony F Mills, "" Basic Heat and Mass Transfer", Pearson College, Second Edition, 2020

E-RESOURCES

1. <http://nptel.ac.in/courses/112101097/> - (Introduction to Heat and Mass Transfer)
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ch65 - (Heat Transfer)

Mapping of COs-POs & PSOs

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

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

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23EEEC501

INDUSTRIAL TRAINING

L T P C

0 0 4 2

The students shall undergo Industrial Training during summer / winter vacation. The industry/organization shall be selected with the approval of the Head of the Department. A faculty member nominated by the Head of the Department shall act as the faculty coordinator and shall be responsible for monitoring and evaluation of the student's progress.

OUTCOMES

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

- Participate in the projects in industries during his or her industrial training.
- Describe the use of advanced tools and techniques encountered during the industrial training and visit.
- Interact with industrial personnel and follow engineering practices and discipline prescribed in the industry.
- Develop awareness about general workplace behaviour and build interpersonal and team skills.
- Prepare professional work reports and presentations.



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SEMESTER VI

23MEE601

FINITE ELEMENT ANALYSIS

L T P C

3 0 2 4

OBJECTIVES

- To introduce the concepts of mathematical modeling and numerical solution of engineering problems.
- To develop the ability to formulate governing equations using variational and weighted residual approaches.
- To gain knowledge related to two dimensional scalar variable problems with heat transfer.
- To train elasticity equations for plane stress, plane strain and axisymmetric finite element problems.
- To teach Isoparametric formulation and advanced topics in FEM.
- To train students in the application of finite element method principles for the simulation and analysis of structural, thermal, and modal behavior of engineering components.

UNIT I INTRODUCTION

9

Historical background - Mathematical modeling of field problems in Engineering - Governing equations Discrete and continuous models - Boundary, Initial and Eigen value problems - Weighted Residual methods - Variational formulation of boundary value problems - Ritz technique - Basic concepts of the Finite Element Method.

UNIT II ONE DIMENSIONAL PROBLEMS

9

One Dimensional second order equations - Discretization - Element types - Linear and Higher order elements - Derivation of shape functions and stiffness matrices and force vectors - Assembly of Matrices - Solution of problems from solid mechanics and heat transfer - Fourth order beam equation - Transverse deflections and natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

9

Second order 2D Equations involving scalar variable functions - Variational formulation - Finite Element formulation - Triangular elements - Shape functions and element matrices and vectors - Application to field problems - Thermal problems - Higher order elements.

UNIT IV AXISYMMETRIC PROBLEMS

9

Equations of elasticity - Plane stress, plane strain and axisymmetric problems - Body forces and temperature effects.

UNIT V ISOPARAMETRIC FORMULATION

9

Natural co-ordinate systems - Isoparametric elements - Shape functions for isoparametric elements - One and two dimensions - Serendipity elements - Numerical integration and application to plane stress problems.





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LIST OF EXPERIMENTS

1. Force and Stress Analysis of Trusses.
2. Stress Analysis of Beam - Cantilever Beam with Point Load
3. Stress Analysis of Beam - Simply Support Beam with Uniformly Distributed Loads
4. Stress Analysis of a Plate with Circular Hole.
5. Stress Analysis of Rectangular "L" Bracket.
6. Stress Analysis of an Axi-Symmetric Component.
7. Conductive Heat Transfer Analysis of a 2D Component.
8. Convective Heat transfer analysis of a 2D Component.
9. Mode Frequency Analysis of Cantilever Beam.
10. Mode Frequency Analysis of a Simply Support Beam.

TOTAL:45+15=60PERIODS

OUTCOMES

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

- Apply the Finite Element Method to solve engineering problems.
- Apply the finite element method to solve problems related to one-dimensional solid mechanics, heat transfer, and beam equations.
- Analyze the two-dimensional field problems using triangular elements, shape functions, and element matrices.
- Solve the finite element method in axisymmetric field problems involving elasticity, temperature effects and body forces.
- Examine engineering problems using isoparametric finite elements in one- and two-dimensional domains.
- Analyze structural, thermal, and vibration problems using finite element software and interpret results for engineering applications.

TEXTBOOKS

1. Reddy. J.N., "An Introduction to the Finite Element Method" Tata McGraw-Hill, Third Edition, 2018.
2. David V. Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2019.
3. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2018.





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REFERENCES

1. Chandrupatla and Belagundu, "Introduction to Finite Elements in Engineering", Pearson Education India, New Delhi, Fourth Edition, 2019
2. Rao, S.S., "The Finite Element Method in Engineering", Butter worth Heinemann, Elsevier India, Third Edition, 2020.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", Fourth Edition, Wiley Student Edition, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/104/112104193/> - (Basic Finite Element Analysis - I)
2. <https://nptel.ac.in/courses/112/103/112103295/> - (Finite Element Method: Variation Methods to Computer Programming)

Mapping of COs-POs & PSOs

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

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


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23MEE602

MECHATRONICS and IoT

L T P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To provide students with a foundational understanding of mechatronics, sensors, and transducers essential for automation.
- To develop knowledge of 8085 microprocessor and 8051 microcontroller architecture, operation, and programming.
- To enable understanding of interfacing techniques for sensors, actuators, and display systems.
- To familiarize students with PLC systems, electrical, and electronic circuits for automation and control.
- To introduce IoT frameworks, embedded systems, and their hardware/software components.
- To train students to program microprocessors and design, model, and analyze basic electrical, hydraulic, and pneumatic systems.

UNIT I INTRODUCTION

9

Introduction to Mechatronics - Systems - Concepts of Mechatronics approach - Need for Mechatronics - Emerging areas of Mechatronics - Classification of Mechatronics. Sensors and Transducers: Static and dynamic characteristics of sensor, Potentiometers - LVDT - Capacitance sensors - Strain gauges - Eddy Current sensor - Hall Effect sensor - Temperature sensors - Light sensors.

UNIT II 8085 MICROPROCESSOR AND 8051 MICROCONTROLLER

9

Introduction - Architecture of 8085 - Pin configuration - Addressing Modes - Instruction set, Timing diagram of 8085 - Concepts of 8051 microcontroller - Block diagram.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE

9

Introduction - Architecture of 8255, Keyboard interfacing, LED display - Interfacing, ADC and DAC interface, and Temperature Control - Stepper motor control - Traffic control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER

9

Introduction - Basic structure - Input and output processing - Programming - Mnemonics - Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V FUNDAMENTALS OF IoT AND EMBEDDED SYSTEMS

9

The Internet of Things (IoT) - Introduction to the IoT Framework - IoT Enabling Technologies - The Effective Implementation of IoT - The Detailed Procedure - Embedded Systems - An Introduction - Single-Chip Microcontroller Systems - Single-Board Microcontroller Systems - Single-Board Computer Systems - Embedded Systems: Peripherals - Software Considerations





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LIST OF EXPERIMENTS

1. Manual control of single and double acting cylinders with direction control valves using pneumatic trainer kit.
2. Pneumatic cylinder sequencing using electrical control with internal relay.
3. Control of double acting cylinder using Timer, DPDT relay with solenoid operated valves.
4. Stepper motor interfacing using 8051 microcontroller.
5. PLC based Conveyor Model.
6. PLC based Traffic Light Control
7. PLC based Automatic Water Flow Control

TOTAL: 45 +15 PERIODS

OUTCOMES

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

- Analyze the Mechatronics concepts and sensor characteristics to select and integrate appropriate sensors in practical systems.
- Apply the microprocessor and microcontroller operations to develop and troubleshoot embedded control programs.
- Examine 8255 PPI architecture and interfacing techniques to design and implement real-time control systems for sensors, displays, and actuators.
- Classify actuators and design Mechatronics systems with the help of microprocessor, PLC and other Electrical and Electronics circuits.
- Analyze IoT implementation procedures and embedded system components to develop integrated automation solutions.
- Analyze the interaction of pneumatic, hydraulic, electrical, and control systems using PLCs and microcontrollers.

TEXT BOOKS

1. Zoran Gacovski, "Mechatronics and Robotics", Arcler Press, First Edition, 2020.
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Prentice Hall, Fifth Edition, 2018.
3. Sami S.H. and Kisheen Rao G, "The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers, CRC Press, First Edition, 2022

REFERENCES

1. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall, Second Edition, 2019.
2. Shawn A. Ballee and Gary R. Shearer, "Industrial Maintenance and Mechatronics", Goodheart-Willcox, Second Edition, 2022.
3. David G Alciatore, "Introduction to Mechatronics Measurement", McGraw Hill, Fifth Edition, 2019.





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E-RESOURCES

1. <https://nptel.ac.in/courses/112/103/112103293/> - (Automation in Manufacturing)
2. <https://nptel.ac.in/courses/112/103/112103174/> - (Mechatronics and Manufacturing Automation)

Mapping of COs-POs & PSOs

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

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


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23EEJ601

PROJECT WORK - PHASE I

L T P C

0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work may be assigned to a single student or to a group of students, not exceeding 4 per group.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester VI is 4.
- There shall be three reviews (Zeroth Review, (Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- Sixty percentage of Project work to be completed in this Project Work - Phase I.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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


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PROFESSIONAL ELECTIVE - I

23MEP501

WELDING TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce various welding techniques like Air Acetylene, Oxyacetylene, Carbon Arc, Shielded Metal Arc, Submerged Arc, TIG, MIG, Plasma Arc, and Electro slag welding.
- To show their practical use in manufacturing and quality control.
- To introduce solid-state welding methods like cold, diffusion, explosive, ultrasonic, friction, forge, roll, and hot pressure welding.
- To highlight the challenges and industrial applications of these welding processes.
- To develop understanding of weld joint design and weldability of Aluminum, Copper, and Stainless Steel.

UNIT I GAS AND ARC WELDING PROCESSES

9

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electro slag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES

9

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT III SOLID STATE WELDING PROCESSES

9

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and hot pressure welding processes - advantages, limitations and applications.

UNIT IV OTHER WELDING PROCESSES

9

Thermit welding, Atomic hydrogen welding, CNC Welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING

9

Various weld joint designs – Welding defects – causes and remedies - Weld ability of Aluminum, Copper, and Stainless steels.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the principles and sequence of operations in gas and arc welding processes.
- Compare the different types of resistance welding processes and their specific applications.
- Apply knowledge of solid-state welding processes to select appropriate methods for welding
- Compare special welding processes with conventional welding methods based on their features and applications.
- Apply knowledge of weld joint design to create effective weld joint configurations.





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TEXT BOOKS

1. Little R.L., "welding Technology", Tata McGraw Hill Publishing Co., Ltd., Fifth Edition, 2019.
2. Parmer R.S., "Welding Engineering and Technology", Khanna Publishers, Third Edition, 2020
3. O.P., Khana, "Welding Technology", Thirteenth Edition, Dhanpat Rai Publication, Thirteenth Edition, 2020

REFERENCES

1. Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, Fourth Edition, 2020.
2. Nadkarni S.V. "Modern Arc Welding Technology", Oxford IBH Publishers, Second Edition, 2020
3. Gower.A.Kennedy, "Welding Technology", Mac Millan Publisher, Fourth Edition, 2019

E-RESOURCES

1. <http://www.weld.com> - (TIG & MIG welding)
2. <https://go.ipgphotonics.com/laser-welder> - (Atomic hydrogen welding).

Mapping of COs-POs & PSOs

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

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


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23MEP502

NON-DESTRUCTIVE TESTING AND EVALUATION OF MATERIALS

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the role of NDT in industry, emphasizing material evaluation and defect detection through visual inspection techniques.
- To train students in applying liquid penetrant and magnetic particle testing methods for accurate surface defect detection.
- To develop students' ability to apply eddy current testing for assessing material integrity and detecting surface and near-surface flaws.
- To equip students with the knowledge and skills to perform ultrasonic testing for internal defect detection and material evaluation.
- To enable students to use radiographic techniques to inspect and evaluate materials for internal defects using X-ray and digital imaging methods.

UNIT I INTRODUCTION TO NDT AND VISUAL INSPECTION

9

NDT versus Mechanical testing- Non Destructive Testing Methods - Detection of manufacturing defects - Material characterization - Relative merits and limitations - Various physical characteristics of materials - applications in NDT- Visual inspection - Unaided and aided.

UNIT II PENETRANT TESTING

9

Liquid Penetrant Testing - Principles, types and properties of liquid penetrates - Developers - Advantages and limitations of various methods - Testing Procedure - Interpretation of results - Magnetic Particle Testing -Theory of magnetism, inspection materials, Magnetization methods.

UNIT III EDDY CURRENT TESTING

9

Eddy Current Testing - Generation of eddy currents - Properties of Eddy currents - Eddy current sensing elements, Probes, Instrumentation - Types of arrangement - Applications, advantages, limitations.

UNIT IV ULTRASONIC TESTING

9

Ultrasonic Testing - Principle - Transducers - Transmission and pulse-echo method - Straight beam and angle beam - Instrumentation, data representation - A-Scan, B-scan, C-scan - Phased Array Ultrasound - Time of flight diffraction.

UNIT V RADIOGRAPHY (RT)

9

Principle, interaction of X-Ray with matter, imaging, film and film less techniques - Types and use of filters and screens - Geometric factors - Inverse square law - Characteristics of films - Graininess, density, speed, contrast - Characteristic curves - Penetrameters - Exposure charts, Radiographic equivalence - Fluoroscopy- Xero-Radiography - Computed Radiography - Computed Tomography.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Compare various types of defects and their characteristics.
- Analyze the theoretical principles behind penetrants and penetrant testing.
- Examine the principles and effectiveness of ultrasonic testing methods.
- Apply the concept of ultrasonic testing and acoustic emission.
- Apply principles of radiation to inspect and analyze materials.

TEXT BOOKS

1. Osama Lari, Rajeev Kumar, "Basics of Non -Destructive testing", S.K.Kataria and Sons, First Edition, 2020.
2. Don E Bray and Roderick K Stanley, "Non-Destructive Evaluation: A Tool in Design, Manufacturing and Service", CRC Press, Second Edition, 2021.
3. Ekantha moorthy J, Perumal S, Mohanraj M, "Non Destructive Testing and Evaluation" Second Edition, 2023

REFERENCES

1. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Eleventh Edition, 2020.
2. Prasad.J and Nair.C.G.K, "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Publishing company Limited, Second Edition, 2022.
3. Giovanni Bruno, "Micro Non-destructive Testing and Evaluation" MDPI Publisher, First Edition, 2023

E-RESOURCES

1. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-mm04/> - (Theory and Practice of Non Destructive Testing)
2. <https://nptel.ac.in/courses/113/106/113106070/> -(Introduction to Non Destructive Testing)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP503

COMPOSITE MATERIALS

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the role of NDT in industry, emphasizing material evaluation and defect detection through visual inspection techniques.
- To train students in applying liquid penetrant and magnetic particle testing methods for accurate surface defect detection.
- To develop students' ability to apply eddy current testing for assessing material integrity and detecting surface and near-surface flaws.
- To familiarize students with the knowledge and skills to perform ultrasonic testing for internal defect detection and material evaluation.
- To acquire radiographic techniques to inspect and evaluate materials for internal defects using X-ray and digital imaging methods.

UNIT I INTRODUCTION TO COMPOSITES

9

Fundamentals of composites - Need for composites - Enhancement of properties - Classification of composites - Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) - Reinforcement - Particle reinforced composites, Fibre reinforced composites. - Applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES

9

Polymer matrix resins - Thermosetting resins, thermoplastic resins - Reinforcement fibres - Rovings - Woven fabrics - Non woven random mats - various types of fibres - PMC processes -Hand layup processes - Spray up processes - Compression moulding - Reinforced reaction injection moulding - Resin transfer moulding - Pultrusion - Filament winding - Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNIT III METAL MATRIX COMPOSITES

9

Characteristics of MMC - Various types of Metal matrix composites - Alloy vs. MMC - Advantages of MMC - Limitations of MMC - Metal Matrix, Reinforcements - Particles - Fibres - Effect of reinforcement - Volume fraction - Rule of mixtures - Processing of MMC - Powder metallurgy process - Diffusion bonding - Stir casting - Squeeze casting.

UNIT IV CERAMIC MATRIX COMPOSITES

9

Engineering ceramic materials - Properties - Advantages - Limitations - Monolithic ceramics - Need for CMC - Ceramic matrix - Various types of Ceramic Matrix composites- Oxide ceramics - Non oxide ceramics - Aluminium oxide - Silicon nitride - Reinforcements - Particles- Fibres- Whiskers - Sintering - Hot pressing - Cold isostatic pressing (CIPing) - Hot Isostatic Pressing (HIPing).

UNIT V ADVANCES IN COMPOSITE MATERIALS

9

Carbon /carbon composites - Advantages of carbon matrix - limitations of carbon matrix Carbon fibre - chemical vapour deposition of carbon on carbon fibre perform. Solgel technique. Composites in aerospace applications.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project.
- Compare the properties of fibre reinforcements, polymer matrix materials and commercial composites.
- Apply the knowledge in metal matrix composites and its processing methods.
- Apply knowledge of ceramic matrix composites to analyze their use in specific applications
- Compare the properties and applications of different composite materials in industrial settings.

TEXT BOOKS

1. Chawla, K.K, "Composite Materials", Fourth Edition, Springer Science in progress, Fourth Edition, 2022.
2. Balasubramaniam, "Composite Materials", John Wiley & Sons, Indian Ed., Second Edition, 2022.
3. A.K.Shrivastava, 'Fundamentals of Composite Materials'. Sankal publications, Second Edition, 2023.

REFERENCES

1. Sharma S.C., "Composite materials", Narosa Publications, Third Edition, 2023.
2. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press - 2006, Third Edition, 2021.
3. Vikram M. Ghule , Kunal S. Marathe & Amit A. Shinde, "Composite Materials" Pragati Books, First Edition 2023.

E-RESOURCES

1. <http://nptel.ac.in/courses/101104010/> - (Composite Materials and Structures)
2. <https://www.digimat.in/nptel/courses/video/112104229/L01.html> - (Introduction to composites)

Mapping of COs-POs & PSOs

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

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


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23MEP504

GREEN MANUFACTURING

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with eco-design principles and life cycle assessment for reducing environmental impact through sustainable materials and recycling.
- To train students in identifying sources of air pollution and methods for measuring and analyzing air pollutants.
- To develop students' awareness of noise pollution, its sources, effects on health, and control techniques.
- To guide students in understanding water demand, water quality parameters, and major water pollutants.
- To familiarize students with Green Co-Rating concepts and sustainable industrial practice

UNIT I DESIGN FOR ENVIRONMENT AND LIFE CYCLE ASSESSMENT

9

Environmental effects of design -selection of natural friendly material - Eco design - Environmental damage Material flow and cycles – Material recycling – Emission less manufacturing- Industrial Ecology – Pollution prevention – Reduction of toxic emission – design for recycle.

UNIT II AIR POLLUTION SAMPLING AND MEASUREMENT

9

Primary and Secondary Pollutants, Automobile Pollutants, Industrial Pollution, Ambient air quality Standards, Metrological aspects of air Pollution, Temperature lapse Rates and Stability-wind velocity and turbulence-Pump behavior dispersion of air Pollutants-solution to the atmosphere dispersion equation the Gaussian Plume Model, Air pollution sampling-collection of gaseous air pollutants-collection of particulate pollutants-stock sampling, analysis of air pollutants-sulfur dioxide-nitrogen dioxide, carbon monoxide, oxidants and ozone.

UNIT III NOISE POLLUTION AND CONTROL

9

Frequency and Sound Levels, Units of Noise based power radio, contours of Loudness. Effect of human, Environment and properties, Natural and Androgenic Noise Sources, Measuring Instruments for frequency and Noise levels, Masking of sound, Types, Kinetics, Selection of different reactors used for waste treatment, Treatment of noise at source, Path and Reception, Sources of noise, Effects of noise occupational Health hazards, thermal Comforts, Heat Island Effects, Radiation Effects.

UNIT IV WATER DEMAND AND WATER QUALITY

9

Factors affecting consumption, Variation, Contaminants in water, Nitrates, Fluorides, Detergents, taste and odour, Radio activity in water, Criteria, for different impurities in water for portable and non-portable use, Point and non-point Source of pollution, Major pollutants of Water, Water Quality Requirement for different uses, Global water crisis issues.

UNIT V GREEN CO-RATING

9

Ecological Footprint - Need for Green Co-Rating – Green Co-Rating System – Intent – System Approach – Weightage- Assessment Process – Types of Rating – Green Co-Benefits – Case Studies of Green Co-Rating

TOTAL: 45 PERIODS





OUTCOMES

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

- Apply environmental design principles to select appropriate eco-friendly materials for specific projects.
- Categorize methods used to reduce or prevent air pollution in manufacturing.
- Analyze the relationship between various manufacturing processes and their noise pollution levels.
- Examine the effectiveness of water treatment and pollution prevention strategies.
- Examine green co-rating and its benefits.

TEXT BOOKS

1. E. J. B. T. O'Rourke, K. S. S. Chiu , "Introduction to Green Manufacturing" Springer, Second Edition, 2021
2. Rao M.N. and Dutta A.K. "Waste water treatment", Oxford & IBH publishing Co. Pvt. Ltd., Third Edition, 2019.
3. A. K. Gupta, B. H. Amaya, "Green Manufacturing and Sustainability of Products", Springer, Second Edition, 2024

REFERENCES

1. David A. Dornfeld, "Green Manufacturing fundamentals and applications", Springer, Second Edition, 2021
2. Rao CS Environmental Pollution Control Engineering-, Wiley Eastern Ltd., Third Edition, 2023.
3. World Commission on Environment and Development (WCED), Our Common Future, Oxford University Press, 2021.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg85 - (Sustainability Through Green Manufacturing)
2. <https://nptel.ac.in/courses/110104119> - (Advanced Green manufacturing Systems)

Mapping of COs-POs & PSOs

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

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


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23MEP505

UNCONVENTIONAL MACHINING PROCESSES

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals, need, and classification of unconventional machining processes.
- To familiarize students with the working principles, equipment, process parameters, and applications of mechanical energy-based machining processes such as AJM, WJM, AWJM, and USM.
- To develop students' understanding of electrical energy-based machining processes including EDM and Wire-cut EDM, along with their tools and control circuits.
- To guide students in learning chemical and electro-chemical machining processes such as CHM and ECM, including maskants, etchants, and process parameters.
- To train students in thermal energy-based machining processes such as LBM, PAM, and EBM and their industrial applications.

UNIT I INTRODUCTION

6

Unconventional machining Process - Need - classification - Brief overview.

UNIT II MECHANICAL ENERGY BASED PROCESSES

9

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES

9

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES

11

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES

10

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications..

TOTAL: 45 PERIODS





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OUTCOMES

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

- Compare unconventional machining processes based on principles, applications, and industrial relevance.
- Categorize mechanical energy-based processes (AJM, WJM, AWJM, USM) to assess process parameters, material removal rate, and suitability for various materials.
- Compare electrical energy-based processes (EDM, Wire-cut EDM) with respect to tool wear, dielectric effects, control circuits, and surface finish.
- Analyze chemical and electro-chemical machining processes (CHM, ECM) by studying etchants, maskants, process parameters, and their influence on material removal and surface quality.
- Compare thermal energy-based processes (LBM, PAM, EBM) regarding principles, equipment, beam control techniques, and industrial applications.

TEXT BOOKS

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., Third Edition 2021.
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, Second Edition 2021.
3. Dr.S.Senthilkumaran, "Unconventional Machining Process" Veda Publication, Second Edition 2021

REFERENCES

1. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd. , Eleventh Edition, 2022.
2. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, London, 2021
3. Vyom Sharma; Mahavir Singh; Amandeep Singh and Janakarajan Ramkumar, "Unconventional Machining Processes - Fundamental Principles and Recent Developments" CBS Publishers, First Edition, 2023

E-RESOURCES

1. <https://nptel.ac.in/courses/112105212-> (Non Traditional Abrasive Machining Processes Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining)
2. [https://nptel.ac.in/courses/112103202 -](https://nptel.ac.in/courses/112103202-) (NOC: Advanced Machining Processes)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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23MEP506

METAL CASTING PROCESS

L T P C
3 0 0 3

OBJECTIVES

- To familiarize students with the fundamentals of casting processes, including patterns, moulds, cores, and allowances.
- To introduce students to special casting processes such as pressure die casting, centrifugal, investment, and shell moulding techniques.
- To develop understanding of solidification processes, defects in castings, and methods for fettling and cleaning.
- To train students in melting and pouring practices, types of furnaces, and melting procedures for different metals and alloys.
- To guide students in casting design principles, including sprue, runner, gate, riser design, shrinkage, and methods for directional solidification and distortion minimization.

UNIT I CASTING PROCESS

9

Introduction to casting – pattern – materials allowances – coding – types – moulds – mould making, sand – properties, types and testing of sands – core making – type of cores – single box, two box and three box moulding processes, runner, riser and gate and chills chaplets.

UNIT II SPECIAL CASTING PROCESS

9

Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO₂ moulding – Plaster Mould castings – Antioch process – Slush casting- Counter gravity low pressure casting – electro-magnetic casting.

UNIT III SOLIDIFICATION PROCESS

9

Solidification – Definition, nucleation, solidification variables. Directional solidification-need and methods. Degasification in liquid metals-sources of gas, degasification methods. Fettling and cleaning of castings – Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process.

UNIT IV MELTING AND POURING

9

Principles of melting practice-fluxing- Degasification and inoculation- Types of furnaces- Crucibles, Cupola, Oil fired furnaces – Electric arc and induction furnaces –Melting practice of cast iron, S G iron, steel, aluminum and copper alloys.

UNIT V CASTING DESIGN

9

Solidification of pure metals and alloys-shrinkage in cast metals-design of sprue, runner, gate and risers-problems in design and manufacture of thin and unequal sections – design for directional solidification, minimum distortion and for overall economy – design problems of L,T,V,X and Y junctions.

TOTAL: 45 PERIODS





OUTCOMES

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

- Construct knowledge of casting fundamentals, including patterns, moulds, cores, and allowances.
- Categorize various special casting techniques such as die casting, centrifugal casting, investment casting, and shell moulding.
- Examine solidification processes to identify casting defects and suggest corrective measures for quality improvement.
- Apply melting and pouring principles to plan and execute casting of different metals and alloys using suitable furnaces.
- Analyze efficient casting systems, including sprues, runners, gates, and risers, to achieve proper solidification and minimal distortion.

TEXT BOOKS

1. Paul R. G. P. Andrews, "Casting: An Introduction to Technology and Design", Springer, Third Edition, 2021
2. Jain. P.L., "Principle of Foundry Technology", Tata McGraw Hill, Eighth Edition, 2023.
3. Anup Goel, "Metal Casting and Welding: Processes and Applications", Technical Publications, First Edition, 2021

REFERENCES

1. Taylor HF Fleming, "Foundry Engineering", M.C. and Wiley Eastern Ltd., First Edition, 2020.
2. Heime, Looper and Rosenthal, "Principle of metal casting", Tata McGraw Hill, Eighth Edition 2019.
3. Mehul Patel, "Metal Casting Processes", Lambert Academic Publication, First Edition 2021

E-RESOURCES

1. <https://nptel.ac.in/courses/112107215> - (Principles of Casting Technology)
2. <https://nptel.ac.in/courses/112107219> - (Fundamentals of Manufacturing Processes)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





PROFESSIONAL ELECTIVE – II

23MEP507

HYBRID AND VEHICLE TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the basics and importance of hybrid and electric vehicles.
- To introduce hybrid and electric drive-train concepts and fuel efficiency analysis.
- To explore electric propulsion units, including DC and induction motor drives.
- To guide students on energy storage systems, including batteries, fuel cells, and hybrid combinations.
- To train students in sizing drive systems, selecting motors, power electronics, and energy storage.

UNIT I INTRODUCTION TO HYBRID ELECTRIC VEHICLES

9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS

9

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRIC PROPULSION UNIT

9

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

UNIT IV ENERGY STORAGE

9

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices

UNIT V SIZING THE DRIVE SYSTEM

9

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power & 20% electronics, selecting the energy storage technology

TOTAL: 45 PERIODS



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OUTCOMES

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

- Apply the concepts of vehicle performance and powertrain characteristics to analyze hybrid and electric vehicles.
- Analyze hybrid and electric drive-train topologies to evaluate power flow control and fuel efficiency.
- Examine DC and induction motor drives in electric propulsion systems for practical vehicle applications.
- Examine energy storage systems, including batteries, fuel cells, and hybrid combinations, to determine suitability for vehicles.
- Analyze drive systems by selecting appropriate motors, power electronics, and energy storage technologies for optimal performance.

TEXT BOOKS

1. A.K.Babu, "Electric and Hybrid Vehicles, Khanna Book Publishers, First Edition, 2022
2. Stefano Longo, Mehrdad Ehsani, Yimin Gao, "Modern Electric Hybrid Electric & Fuel Cell Vehicles", CRC Press, Third Edition, 2019
3. Prof.Shyam M. Ramnani, Prof. Kaustubh R. Kapadani, "Electrical and Hybrid Vehicle" Tech Knowledge Publications, First Edition, 2023

REFERENCES

1. James D. Halderman, Curt Ward, "Electric and Hybrid Electric Vehicles" Pearson Publications, First Edition, 2023
2. Graham Stoakes, "Principles of Electric Vehicle Technology", Second Edition, 2024
3. Mary Murphy, "Electric and Hybrid Vehicles: Principles, Design and Technology", Larsen & Keller Publisher, First Edition, 2019

E-RESOURCES

1. <https://nptel.ac.in/courses/112/103/112103262/> - (IC Engines and Gas Turbines)
2. <https://nptel.ac.in/courses/112/104/112104033/> - (Engine Combustion)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23MEP508

AUTOMOBILE ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with vehicle types, construction, aerodynamics, and engine components.
- To introduce engine auxiliary systems, fuel injection, ignition, turbochargers, and emission control.
- To develop understanding of transmission systems, including clutches, gearboxes, differentials, and rear axle drives.
- To guide students on steering, braking, and suspension systems, including ABS, EBD, and traction control.
- To train students on alternative fuels, electric and hybrid vehicles, and their effect on engine performance and emissions.

UNIT I VEHICLE STRUCTURE AND ENGINES

9

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC Engines - Components - Functions and materials, Variable Valve Timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS

9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system, Ignition system - Types - Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS

9

Clutch - Types and construction - Gear boxes - Types - Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints - Differential and rear axle - Hotchkiss drive and torque tube drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS

9

Steering geometry and types of steering gear box - Power Steering - Types of front Axle, Types of suspension systems, Pneumatic and Hydraulic braking systems, Antilock Braking System (ABS), Electronic Brake force Distribution (EBD) and traction control.

UNIT V ALTERNATIVE ENERGY SOURCES

9

Use of natural gas - Liquefied petroleum gas, bio-diesel, bio-ethanol, gasohol and hydrogen in automobiles - Engine modifications required - Performance, combustion and emission characteristics of SI and CI Engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Categorize the various parts of an automobile, including their functions and materials
- Analyze the role of engine auxiliary systems and engine emission control mechanisms.
- Compare the working of different types of transmission systems.
- Classify the types of steering, brake, and suspension systems.
- Analyze possible alternate sources of energy for IC engines.

TEXT BOOKS

1. Kirpal Singh, "Automobile Engineering", Vol.1&2, Fourteenth Edition, Standard Publishers 2022.
2. R.K.Rajput, "Automobile Engineering", Laxmi Publications, Fifth Edition, 2021.
3. Ramesh Chandra Nayak , Debashree Padhi , "Basics of Automobile Engineering" , Lap Lambert academic Publishing , Second Edition, 2021

REFERENCES

1. Jain and Asthana, "Automobile Engineering", Mc Graw Hill Education, Tenth Edition, 2023.
2. Tom Denton, Automobile Electrical & Electronic Systems, Taylor and Francis, Seventh Edition 2022.
3. S Chand, A Textbook of Automobile Engineering , S Chand & Co Ltd, Thirteenth Edition 2023

E-RESOURCES

1. <https://nptel.ac.in/courses/107/106/107106088/> - (Fundamentals of Automotive Systems)
2. <https://nptel.ac.in/courses/107/106/107106080/> - (Introduction vehicle Dynamics)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	2	3	2
2	3	3	2	1	2	-	-	-	-	-	2	3	2
3	3	3	2	1	2	-	-	-	-	-	2	3	3
4	3	2	2	1	2	-	-	-	-	-	2	3	2
5	3	3	2	1	2	-	-	-	-	-	2	3	3
Avg.	3	2.6	2	1	2	-	-	-	-	-	2	3	2.4

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


Chairman - BoS





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23MEP509

DESIGN OF HEAT EXCHANGERS

L T P C

3 0 0 3

OBJECTIVES

- To guide students in understanding the fundamental principles, types, and temperature distribution characteristics of heat exchangers and their analysis using LMTD and effectiveness methods.
- To train students to analyze fluid flow behavior, turbulence effects, friction factors, pressure losses, and stresses occurring in heat exchanger components.
- To train students in the design aspects of heat exchangers by considering heat transfer, pressure loss, flow configuration, and the effect of baffles and deviations from ideal conditions.
- To familiarize students with compact and plate heat exchangers, including their types, design considerations, performance parameters, advantages, and limitations.
- To guide students in understanding the design principles and performance characteristics of condensers and cooling towers used in thermal systems.

UNIT I FUNDAMENTALS OF HEAT EXCHANGER

9

Temperature distribution and its implications types - Shell and tube heat exchangers - Regenerators and recuperates - Analysis of heat exchangers - LMTD and effectiveness method.

UNIT II FLOW AND STRESS ANALYSIS

9

Effect of turbulence - Friction factor - Pressure loss - Stress in tubes - Header sheets and pressure vessels - Thermal stresses, shear stresses - Types of failures.

UNIT III DESIGN ASPECTS

9

Heat transfer and pressure loss - Flow configuration - Effect of baffles - Effect of deviations from ideality - Design of double pipe - Finned tube - Shell and tube heat exchangers - Simulation of heat exchangers.

UNIT IV COMPACT AND PLATE HEAT EXCHANGERS

9

Types - Merits and Demerits - Design of compact heat exchangers, plate heat exchangers - Performance influencing parameters - Limitations.

UNIT V CONDENSERS AND COOLING TOWERS

9

Design of surface and evaporative condensers - Cooling tower - Performance characteristics.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the fundamental principles and analysis methods such as LMTD and effectiveness - NTU to evaluate the performance of different types of heat exchangers.
- Examine the effects of turbulence, friction factor, pressure loss, and various stresses in heat exchanger components.





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- Compare heat transfer and fluid flow concepts in the design of double pipe, finned tube, and shell-and-tube heat exchangers.
- Analyze the performance characteristics and design parameters of compact and plate heat exchangers.
- Apply design principles to evaluate the performance of condensers and cooling towers used in thermal systems.

TEXT BOOKS

1. Sadik Kakac and Hongtan Liu, Heat Exchangers Selection, Rating and Thermal Design, CRC Press, Fourth Edition, 2020
2. J.E. Hesselgreaves, Richard Law, et al. , "Compact Heat Exchangers: Selection, Design and Operation", Butterworth-Heinemann, Fifth Edition, 2023.
3. Manfred Nitsche and Raji Olayiwola Gbadamosi , "Heat Exchanger Design Guide: A Practical Guide for Planning, Selecting and Designing of Shell and Tube Exchangers", Butterworth-Heinemann , Second Edition, 2022

REFERENCES

1. Kuppan Thulukkanam, "Heat Exchanger Design Handbook (Mechanical Engineering)", CRC Press, Fourth Edition, 2021.
2. Samuel Jorge Marques Cartaxo, "Tubular Heat Exchangers: for Chemical Engineers (De Gruyter Textbook)", De Gruyter, First Edition, 2021.
3. Samuel Cartaxo, " Hairpin Heat Exchangers Explained: Fundamentals of Double-Pipe, Multi-Tube and Finned Tube Heat Exchangers", Kindle Edition, First Edition, 2022

E-RESOURCES

1. <https://nptel.ac.in/courses/112/105/112105248/> - (Heat Exchangers: Fundamentals and Design)
2. <https://nptel.ac.in/courses/103/105/103105140/> - (Introduction to Heat Transfer)

Mapping of COs-POs & PSOs

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

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


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23MEP510

COMPUTATIONAL FLUID DYNAMICS

L T P C

3 0 0 3

OBJECTIVES

- To guide students in understanding the governing equations of fluid flow, boundary conditions, and the mathematical behavior of partial differential equations used in CFD.
- To train students to apply finite difference and finite volume methods for solving one-, two-, and three-dimensional diffusion problems.
- To develop students' ability to analyze convection diffusion problems using different discretization schemes such as central, upwind, hybrid, power-law, and QUICK methods.
- To familiarize students with numerical techniques used in flow field analysis, including pressure-velocity coupling algorithms such as SIMPLE and PISO.
- To guide students in understanding turbulence modeling concepts and mesh generation techniques used in CFD simulations.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

9

Basics of computational fluid dynamics - Governing equations of fluid dynamics - Continuity, momentum and energy equations - Chemical species transport - Physical boundary conditions - Time-averaged equations for Turbulent flow - Kinetic energy equations - Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION

9

Derivation of finite difference equations - Simple methods - General methods for first and second order accuracy - Finite volume formulation for steady state one, two and three dimensional diffusion problems - Parabolic equations - Explicit and implicit schemes.

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION

9

Steady one-dimensional convection and diffusion - Central, upwind differencing schemes properties of discretization schemes - Conservativeness, boundedness, transportiveness, hybrid power-law, QUICK schemes.

UNIT IV FLOW FIELD ANALYSIS

9

Finite volume methods - Representation of the pressure gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure correction equation, SIMPLE algorithm and its variants - PISO algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION

9

Turbulence models, mixing length model, Two equation (k- ϵ) models - High and low Reynolds number models - Structured grid generation - Unstructured grid generation - Mesh refinement - Adaptive mesh - Software tools.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the governing equations of fluid dynamics and appropriate boundary conditions to model fluid flow and heat transfer problems.
- Classify finite difference and finite volume methods to solve one, two, and three-dimensional diffusion problems.
- Analyze convection–diffusion problems using various discretization schemes such as central, upwind, hybrid, power-law, and QUICK schemes.
- Examine pressure–velocity coupling techniques such as SIMPLE and PISO algorithms for flow field analysis.
- Apply turbulence models and mesh generation techniques for computational fluid dynamics simulations.

TEXT BOOKS

1. Joel H. Ferziger, Milovan Perić, et al. , "Computational Methods for Fluid Dynamics", Springer, First Edition, 2022.
2. Jiyuan Tu, Guan Heng and Yeoh Chaoqun Liu, "Computational Fluid Dynamics - A Practical Approach", Butterworth–Heinemann publishers, UK, Third Edition, 2020.
3. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., Third Edition 2019.

REFERENCES

1. Oleg Zikanov , "Essential Computational Fluid Dynamics", Wiley, ", Second Edition, 2021.
2. Jiri Blazek, "Computational Fluid Dynamics: Principles and Applications", Butterworth-Heinemann, Fourth Edition, 2023.
3. Chung, T.J. "Computational Fluid Dynamics", Second Edition, Cambridge University Press, Second Edition, 2022.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/105/112105045/> -(Introduction to Computational Fluid Dynamics)
2. <https://nptel.ac.in/courses/103106119> - (Computational Fluid Dynamics)

Mapping of COs-POs & PSOs

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

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


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23MEP511

REFRIGERATION AND AIR CONDITIONING

L T P C

(Use of Standard Gas Table Book is Permitted)

3 0 0 3

OBJECTIVES

- To introduce the basic principles of refrigeration, units of refrigeration, coefficient of performance (COP), and the properties and environmental impacts of refrigerants.
- To explain the working principle and performance analysis of vapour compression refrigeration systems using p-h and T-s diagrams, including effects of subcooling, superheating, and pressure variations.
- To familiarize students with various alternative refrigeration systems such as vapour absorption, adsorption, steam jet, thermoelectric, air refrigeration, magnetic, vortex, and pulse tube refrigeration.
- To develop understanding of psychrometric properties of moist air and psychrometric processes using psychrometric charts for air-conditioning analysis.
- To enable students to estimate air-conditioning loads and understand system design considerations including indoor air quality, ventilation, and human comfort conditions.

UNIT I INTRODUCTION

9

Introduction to Refrigeration - Unit of Refrigeration and C.O.P - Ideal cycles - Refrigerants desirable properties - Classification - Nomenclature - ODP and GWP.

UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM

9

Vapor compression cycle : p-h and T-s diagrams - Deviations from theoretical cycle - Sub cooling and super heating - Effects of condenser and evaporator pressure on COP - Multipressure system - Low temperature refrigeration - Cascade systems.

UNIT III OTHER REFRIGERATION SYSTEMS

9

Working principles of vapour absorption systems and adsorption cooling systems - Steam jet refrigeration-Ejector refrigeration systems - Thermoelectric refrigeration - Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES

9

Properties of moist air - Gibbs Dalton law - Specific humidity - Dew point temperature - Degree of saturation - Relative humidity - Enthalpy - Humid specific heat - Wet Bulb Temperature - Psychrometric chart.

UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION

9

Air conditioning loads - Outside and inside design conditions - Infiltration and ventilation - internal heat load - Apparatus selection - fresh air load, human comfort and IAQ principles - Calculation of summer and winter air conditioning load.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Examine the basic concepts of refrigeration.
- Analyze the vapor compression refrigeration systems and to solve problems.
- Categorize the various types of refrigeration systems.
- Apply the Psychometric properties and its use in Psychometric processes.
- Apply the concepts of air conditioning and to solve problems.

TEXT BOOKS

1. RS Khurmi, JK Gupta , "Textbook of Refrigeration and Air Conditioning", S chand, Tenth Edition, 2021.
2. Andrew D. Althouse , Carl H. Turnquist, et al., "Modern Refrigeration and Air Conditioning , Good heart - Willcox, Twentyth Edition, 2024.
3. John Tomczyk, Eugene Silberstein , et al., "Refrigeration and Air Conditioning Technology", Cengage Learning, Nineth Edition, 2021.

REFERENCES

1. Dick Wirz , Commercial Refrigeration for Air Conditioning Technicians, Cengage Learning, Third Edition, 2021.
2. Eugene Silberstein , Jason Obrzut, et al. , "Refrigeration & Air Conditioning Technology", Cengage Learning, Tenth Edition, 2024.
3. Chris Johanson "Auto Heating and Air Conditioning", Good heart - Willcox, Seventh Edition, 2023.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/105/112105128/> - (Refrigeration and Air Conditioning)
2. <https://nptel.ac.in/courses/112/105/112105129/> - (History of Refrigeration)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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23MEP512

SOLAR THERMAL SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

- To guide students to understand the basics of solar radiation and its measurement.
- To train students to understand the working and performance of solar thermal collectors.
- To familiarize students with the design and applications of solar thermal utilities such as solar air heaters, dryers, and desalination systems.
- To guide students to understand solar thermal devices such as solar cookers, cooling systems, solar ponds, and solar chimneys.
- To train students to analyze solar concentrators and solar thermal power generation systems.

UNIT I SOLAR RADIATION

9

Solar radiation on the earth surface - Extraterrestrial radiation characteristics - Terrestrial radiation - Solar insulation - Solar radiation measuring devices - Pyrheliometer and Pyranometer - Spectral energy distribution of solar radiation - Depletion of solar radiation - Absorption, scattering.

UNIT II SOLAR THERMAL COLLECTORS

9

Theory of flat plate collectors, evacuated tube collectors and heat pipe based collectors - Performance evaluation - Collector testing - Natural and forced circulation - System configurations - Applications.

UNIT III SOLAR THERMAL UTILITIES - I

9

Solar air heaters - Theory and applications - Solar drying - Theory, design, performance analysis and types - Solar desalination - Solar still - Types - Theory and performance analysis.

UNIT IV SOLAR THERMAL UTILITIES - II

9

Solar cooking devices - Solar cooling - Absorption, adsorption and passive systems - Solar thermal pumps - Energy storage - Solar ponds - Solar chimney.

UNIT V SOLAR CONCENTRATORS AND POWER GENERATION

9

Solar concentrator types - Optics - Performance analysis - Design considerations - Tracking - Solar electric power generation systems - Economics of solar thermal utilities.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the principles of solar radiation and measurement techniques to estimate solar energy availability.
- Examine the theory of solar thermal collectors to evaluate their performance and applications.
- Analyze the design and performance of solar thermal utilities such as solar air heaters, solar dryers, and solar desalination systems.





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- Examine the working principles and applications of solar thermal devices including solar cookers, cooling systems, solar ponds, and solar chimneys.
- Apply the concepts of solar concentrators and solar thermal power generation systems considering design and economic aspects.

TEXT BOOKS

1. Goswami Y, Kreith F and Kreider J. F, "Principles of Solar Engineering", CRC Press, Fourth Edition, 2022.
2. Sukhatme. S. P, "Solar Energy: Principles of Thermal Collection and Storage", Tata Mc Grawill, Third Edition, 2022.
3. Mohsen Sheikholeslami , "Solar Thermal Systems and Applications: New Design Techniques for Improved Thermal Performance (Hybrid Energy Systems)", Academic Press , First Edition, 2024.

REFERENCES

1. Pok Ugalde, "Solar Panel And 12-Volt Power Handbook: Planning And Installing Solar Thermal Systems", Second Edition , 2022.
2. Prakash J and Garg H, "Solar Energy: Fundamentals and Applications", McGraw Hill Education, Third Edition, 2022.
3. Solanki C.S, "Solar Photovoltaics - Fundamentals, Technologies and Applications", Prentice Hall India, Second Edition, 2023.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/105/112105050/> - (Principles and Performance of Solar energy thermal systems)
2. <https://nptel.ac.in/courses/112/105/112105051/> - (Solar Energy Technology)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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PROFESSIONAL ELECTIVE - III

23MEP513

PRODUCT DESIGN AND DEVELOPMENT

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of engineering design and product development.
- To guide students to identify customer needs and convert them into design specifications.
- To familiarize students with material selection and manufacturing considerations in design.
- To develop creative thinking and systematic methods for generating design concepts.
- To introduce product testing, maintenance, and cost considerations in design.

UNIT I INTRODUCTION

9

The importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products – establishing markets- market segments- relevance of market research.

UNIT II PROJECT MANAGEMENT

9

Identification of customer needs- customer requirements- Quality Function Deployment Product Design Specifications- Human Factors in Design – Ergonomics and Aesthetics. Societal consideration - Contracts – Product liability – Protecting intellectual property – Legal and ethical domains – Codes of ethics - Ethical conflicts – Environment responsible design-future trends in interaction of engineering with society.

UNIT III REQUIREMENT ANALYSIS

9

Material Selection Process – Economics – Cost Vs Performance – Weighted property Index – Value Analysis – Role of Processing in Design – Classification of Manufacturing Process – Design for Manufacture – Design for Assembly –Designing for castings, Forging, Metal Forming, Machining and Welding – Residual Stresses – Fatigue, Fracture and Failure.

UNIT IV DESIGN AND DEVELOPMENT

9

creativity and problem solving- creative thinking methods- generating design concepts - systematic methods for designing –functional decomposition – physical decomposition – functional representation – morphological methods-TRIZ- axiomatic design. Decision making theory- utility theory –decision trees – concept evaluation methods

UNIT V TESTING AND MAINTENANCE

9

human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – cost evaluation –categories of cost –overhead costs – activity based costing – methods of developing cost estimates – manufacturing cost –value analysis in costing.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the principles of engineering design and product development in solving design problems.
- Utilize customer requirements and design specifications in developing engineering products.
- Analyze the selection of materials and manufacturing processes for effective product design.
- Examine different creative design methods and decision-making techniques for concept generation.
- Apply testing, maintenance, and cost evaluation methods in product design and development.

TEXT BOOKS

1. Karl T Ulrich, Steven D.Eppinger, Maria C. Yang, "Product design and development", Eighth Edition, McGraw Hill, 2023.
2. Chitale & Gupta "Product Development", Tata McGraw Hill, Third Edition, 2019.
3. Gerhard Pahl, Wolfgang Beitz, Jörg Elmar, "Engineering Design: A Systematic Approach", Third Edition, Springer, 2019

REFERENCES

1. Yousef Haik, T M MShahin "Engineering Design Process", Cengage Learning, Sixth Edition, 2021
2. Niebel & deeper "Product design & process Engineering, McGraw hill, Fourth Edition, 2021.
3. Peter G. Rowe, "Design of Product Systems", Wiley Publications, First Edition, 2021

E-RESOURCES

1. <https://nptel.ac.in/courses/112107217> - (Product Design and Development)
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_me66 - (Product Design and Manufacturing)

Mapping of COs-POs & PSOs

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

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


 Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP514

COMPUTER APPLICATIONS IN DESIGN

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of computer graphics systems, output primitives, and geometric transformations.
- To familiarize students with curve and surface modeling techniques used in computer graphics.
- To guide students to understand NURBS and different solid modeling methods used in design applications.
- To introduce visual realism concepts such as hidden surface removal, shading, coloring, and animation techniques.
- To train students to understand assembly modelling, design for manufacture and assembly (DFMA), and product life cycle management in computer-aided design

UNIT I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS

9

Overview of Graphics systems: Video Display Devices, Raster-Scan System, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard-Copy Devices, Graphics Software.

Output primitives: Line Drawing Algorithm - DDA, Bresenham's and Parallel Line Algorithm. Circle generating algorithm - Midpoint Circle Algorithm.

Geometric Transformations: Coordinate Transformations, Windowing and Clipping, 2D Geometric transformations-Translation, Scaling, Shearing, Rotation and Reflection, Composite transformation, 3D transformations.

UNIT II CURVES AND SURFACES MODELLING

9

Introduction to curves - Analytical curves: line, circle and conics - synthetic curves: Hermite cubic spline-Bezier curve and B-Spline curve - curve manipulations. Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder - synthetic surfaces: Hermitebicubic surface- Bezier surface and B-Spline surface- surface manipulations.

UNIT III NURBS AND SOLID MODELING

9

NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations - constructive solid Geometry - comparison of representations - user interface for solid modeling.

UNIT IV VISUAL REALISM

9

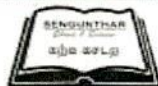
Hidden Line removal, Hidden Surface removal, - Hidden Solid Removal algorithms - Shading - Coloring. Animation - Conventional, Computer animation, Engineering animation - types and techniques

UNIT V ASSEMBLY OF PARTS AND PRODUCT LIFE CYCLE MANAGEMENT

9

Assembly modeling - Design for manufacture - Design for assembly - computer aided DFMA - inferences of positions and orientation - tolerances analysis -Center of Gravity and mass property calculations - mechanism simulation. Graphics and computing standards - Data Exchange standards. Product development and management - new product development -models utilized in various phases of new product development - managing product life cycle..

TOTAL: 45 PERIODS





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OUTCOMES

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

- Solve 2D and 3D transformations for the basic entities like line and circle
- Apply the fundamental mathematical concepts required for CAD systems, ensuring accurate geometric representation and manipulation
- Apply various geometric modeling techniques, such as feature-based modeling, surface modeling, and solid modeling.
- Examine geometric models through animation and transform them into real-world systems.
- Analyze the assembly of parts using Computer-Aided Design software

TEXT BOOKS

1. Chitale A.K and Gupta R.C "Product design and manufacturing "PHI learning private limited, Third Edition, 2021.
2. John W. Stauffer and Edward J. Haug, "Principles of Computer-Aided Design and Manufacturing" Wiley Publication, Second Edition, 2019
3. Milos Sojat, Zeljko Dorđević, "Computer-Aided Design and Manufacturing" Springer Publication, First Edition, 2020

REFERENCES

1. William M Newman and Robert F.Sproull "Principles of Interactive Computer Graphics", McGraw Hill Book Co. First Edition, 2001.
2. Gary R. Gilbert, "Introduction to Computer Numerical Control" Pearson, Fourth Edition, 2020
3. Chris McMahon and Jimmie Browne, "CAD/CAM: Concepts and Applications" McGraw-Hill Education, First Edition, 2019

E-RESOURCES

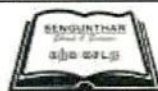
1. <https://nptel.ac.in/courses/112104031> - (Computer Aided Engineering Design)
2. <http://www.digimat.in/nptel/courses/video/112102101/L43.html> - (Computer Aided Design and Manufacturing)

Mapping of COs-POs & PSOs

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

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

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23MEP515

FLUID POWER SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of fluid power systems, fluid properties, and basic hydraulic principles.
- To familiarize students with hydraulic components such as pumps, actuators, motors, and control valves.
- To guide students to understand pneumatic systems, compressors, actuators, and control valves used in industry.
- To train students to understand various hydraulic and pneumatic circuits used for industrial applications.
- To introduce recent trends in fluid power systems including servo systems, fluidics, electro-hydraulic circuits, and PLC-based automation

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 SYSTEMS

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 SYSTEMS

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 TRENDS 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





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OUTCOMES

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

- Categorize fluid power components used in industry and select a suitable pump for a hydraulic power pack.
- Classify the types, working principles, and performance of pumps and actuators in hydraulic systems.
- Categorize the types and functions of control valves in pneumatic systems.
- Design and develop 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, Eighth Edition, 2020.
2. Majumdar S.R., "Oil Hydraulics Systems", Tata McGraw-Hill Education India, Third Edition, 2020.
3. Shanmugasundaram K, Hydraulic and Pneumatic Controls, Chand & Co, Second Edition, 2022.

REFERENCES

1. Ilango S, Soundararajan V, "Introduction to Hydraulics and Pneumatics", Prentice hall of India, New Delhi, Second Edition, 2022.
2. Jagadeesha.T., "Pneumatics Concepts, Design and Applications", Universities Press, First Edition, 2020.
3. Srinivasan.R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints, First Edition, 2021.

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	PSO1	PSO2
1	3	-	2	-	-	-	-	-	-	-	-	2	2
2	3	-	2	-	-	-	-	-	-	-	-	2	2
3	3	-	2	-	-	-	-	-	-	-	-	2	2
4	3	-	2	-	-	-	-	-	-	-	-	2	2
5	3	-	2	-	-	-	-	-	-	-	-	2	2
Avg.	3	-	2	-	-	-	-	-	-	-	-	2	2

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


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23MEP516

PROCESS PLANNING AND COST ESTIMATION

L T P C

3 0 0 3

OBJECTIVES

- To guide students in understanding the fundamentals of process planning and the selection of manufacturing processes, equipment, and tooling.
- To train students to perform process planning activities such as calculation of process parameters, selection of jigs and fixtures, and quality assurance methods.
- To familiarize students with the concepts, elements, and procedures involved in cost estimation in manufacturing industries.
- To train students to estimate production costs for various manufacturing processes such as forging, welding, and foundry operations.
- To guide students to calculate machining time for different machining operations such as turning, drilling, milling, shaping, planning, and grinding.

UNIT I INTRODUCTION TO PROCESS PLANNING

9

Introduction - Methods of process planning - Drawing interpretation - Material evaluation - Steps in process selection - Production equipment and tooling selection.

UNIT II PROCESS PLANNING ACTIVITIES

9

Process parameters calculation for various production processes - Selection jigs and fixtures - Selection of quality assurance methods - Set of documents for process planning - Economics of process planning - Case studies.

UNIT III INTRODUCTION TO COST ESTIMATION

9

Importance of costing and estimation - Methods of costing - Elements of cost estimation - Types of estimates - Estimating procedure - Estimation labor cost, material cost - Allocation of overhead charges - Calculation of depreciation cost.

UNIT IV PRODUCTION COST ESTIMATION

9

Estimation of different types of jobs - Estimation of forging shop - Estimation of welding shop - Estimation of foundry shop.

UNIT V MACHINING TIME CALCULATION

9

Estimation of machining Time - Importance of machine time calculation - Calculation of machining Time for different lathe operations - Drilling and boring - Machining time calculation for milling, shaping and planning - Machining time calculation for grinding.

TOTAL : 45 PERIODS

OUTCOMES

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

- Apply the principles of process planning in selecting appropriate manufacturing processes and equipment.
- Categorize the elements of cost during manufacture of a product and/or apply the methods to estimate the cost.
- Analyze the elements and procedures involved in manufacturing cost estimation.





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- Analyze the machining time of material removal processes in lathe, milling, shaping, planning and grinding.
- Apply methods of estimation in forging and welding processes to determine the cost of the process.

TEXT BOOKS

- Ostwalal P.F. and Munez J., "Manufacturing Processes and systems, John Wiley", Sixth Edition, 2021.
- Dr.V.Jayakumar, "Process Planning and Cost Estimation", Lakshmi publications, Chennai, Second Edition, 2023.
- Panneerselvam R, "Process Planning and Cost Estimation, PHI Learning Pvt Ltd, Second Edition, 2020.

REFERENCES

- Davim, J. Paulo, Jain, Ajai, Phanden, Rakesh Kumar " Integration of process planning and scheduling: approaches and algorithms" CRC Press/Taylor & Francis Group, First Edition, 2021.
- R. Kesavan, C. Elanchezhian, B. Vijaya ramnath "Process Planning and Cost Estimation", New Age International (P) Limited, First Edition, 2023.
- L.Kamaludeen, PR Andiappan," Process, Planning and Cost Estimation", N.V Publications, Second Edition , 2021

E-RESOURCES

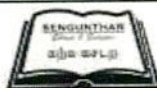
- <https://nptel.ac.in/courses/110/101/110101132/> - (Cost Accounting)
- <https://nptel.ac.in/courses/112/107/112107143> - (Production Planning and Control)

Mapping of COs-POs & PSOs

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

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


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23MEP517

POWER PLANT ENGINEERING

LT P C

3 0 0 3

OBJECTIVES

- To guide students to understand the layout, components, and operation of steam power plants and their subsystems.
- To train students to understand the working principles of diesel and combined cycle power plants.
- To familiarize students with the fundamentals of nuclear power plants, different reactor types, and safety measures.
- To guide students to understand the principles and applications of various renewable energy power generation systems.
- To train students to analyze the economic and environmental aspects of different power plants.

UNIT I STEAM POWER PLANTS

9

Layout of modern coal power plant - Super Critical Boilers - FBC Boilers - Turbines, Condensers, Subsystems of thermal power plants - Fuel and ash handling - Draught system - Feed water treatment - Binary cycles and cogeneration systems.

UNIT II DIESEL AND COMBINED CYCLE POWER PLANTS

9

Components of Diesel - Fuel system - Common Rail Injection - Individual pump injection - Distributor system - Combined cycle power plants - Integrated Gasifier based combined cycle systems.

UNIT III NUCLEAR POWER PLANTS

9

Basics of Nuclear Engineering - Layout and parts - Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium - Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors - Safety measures.

UNIT IV RENEWABLE ENERGY

9

Hydro Electric Power Plants - Classification, Layout and component - Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel cell power systems.

UNIT V ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the principles and components of steam power plants in thermal power generation systems.
- Compare the working principles of diesel and combined cycle power plants for efficient power generation.





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- Analyze the operation and safety features of different nuclear reactors used in nuclear power plants.
- Apply the principles of renewable energy systems such as hydro, wind, solar, tidal, geothermal, and fuel cells for power generation.
- Examine the economic and environmental issues associated with different types of power plants.

TEXT BOOKS

- Nag. P.K., "Power Plant Engineering", Tata McGraw – Hill Publishing Company Ltd., Fifth Edition, 2021.
- R.K. Rajput, "A Textbook of Power Plant Engineering", laxmi publications, Second Edition, 2020.
- Dipak Kumar Mandal, Somnath Chakrabarti, Arup Kumar Das, "Power Plant Engineering: Theory and Practice" Wiley Publications, First Edition, 2023

REFERENCES

- R.K.Jain, "Power Plant Technology", Khanna Publishers, Second Edition, 2020.
- Philip Kiameh, "Power Generation Handbook", Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2022.
- B.Vijaya Ramnath, C. Elanchezhian, L. Saravanakumar, "Power Plant Engineering", Wiley publications, First Edition, 2023.

E-RESOURCES

- https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_me57/ - (Power Plant System Engineering)
- <https://nptel.ac.in/courses/112107291> - (Power Plant Engineering)

Mapping of COs-POs & PSOs

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1	3	1	-	-	-	-	-	-	-	-	2	2	-
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3	3	1	-	-	-	-	-	-	-	-	2	2	-
4	3	1	-	-	-	-	-	-	-	-	2	2	-
5	3	1	-	-	-	-	-	-	-	-	2	2	-
Avg.	3	1	-	-	-	-	-	-	-	-	2	2	-

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


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23MEP518

ADDITIVE MANUFACTURING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts, development, process chain, classification, benefits, applications, and future scope of Additive Manufacturing.
- To teach Design for Additive Manufacturing, including part consolidation, topology optimization, lightweight design, CAD preparation, orientation, supports, slicing, and tool-path generation.
- To train students in the working principles, materials, advantages, limitations, and applications of SLA, DLP, and FDM processes.
- To impart knowledge of SLS, SLM, EBM, and LENS processes, including their materials, parameters, benefits, and applications.
- To equip students with knowledge of Binder Jetting, Material Jetting, and Sheet Lamination processes and their engineering applications.

UNIT I INTRODUCTION

9

Overview – Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Additive Manufacturing. AM Process Chain- Classification – Benefits. Applications: Building Printing-Bio Printing- Food Printing-Printing Electronics. Business Opportunities and Future Directions - Intellectual Property

UNIT II DESIGN FOR ADDITIVE MANUFACTURING

9

Concepts and Objectives- AM Unique Capabilities: Part Consolidation-Topology Optimization- Lightweight Structure - DFAM for Part Quality Improvement. Data Processing - CAD Model Preparation - Part Orientation and Support Structure Generation -Model Slicing - Tool Path Generation- Customized Design and Fabrication for Medical Applications- Case Studies.

UNIT III VAT POLYMERIZATION AND MATERIAL EXTRUSION

9

Photo polymerization: Stereolithography Apparatus (SLA) - Materials - Process - Advantages Limitations Applications. Digital Light Processing (DLP) - Materials – Process - Advantages - Applications. Extrusion Based System: Fused Deposition Modeling (FDM)- Process-Materials - Applications and Limitations

UNIT IV POWDER BED FUSION AND DIRECT ENERGY DEPOSITION

9

Powder Bed Fusions: Selective Laser Sintering (SLS): Process – Powder Fusion Mechanism – Process Parameters – Typical Materials and Application. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications. Beam Deposition Process: Laser Engineered Net Shaping (LENS)- Process -Material Delivery - Process Parameters -Materials -Benefits -Applications.

UNIT V OTHER ADDITIVE MANUFACTURING PROCESSES

9

Binder Jetting: Three-Dimensional Printing - Materials -Process - Benefits and Limitations. Material Jetting: Multijet Modeling- Materials - Process - Benefits. Sheet Lamination Process: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding – Thermal Bonding- Materials-Application and Limitation.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the basic concepts and process chain of additive manufacturing for product development.
- Analyze the design considerations and data preparation methods used in Design for Additive Manufacturing.
- Apply vat polymerization and material extrusion techniques in additive manufacturing applications.
- Compare powder bed fusion and direct energy deposition processes based on materials, process parameters, and applications.
- Examine various additive manufacturing processes such as binder jetting, material jetting, and sheet lamination for different applications.

TEXT BOOKS

1. Andreas Gebhardt and Jan-Steffen Höter "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1- 56990-582-1.
2. Ian Gibson, David W. Rosen and Brent Stucker "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Second edition, Springer., United States, 2015, ISBN-13: 978-1493921126.
3. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press., United States, 2011, ISBN: 9780849334092.

REFERENCES

1. Amit Bandyopadhyay and Susmita Bose, "Additive Manufacturing", 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590.
2. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
3. Milan Brandt, "Laser Additive Manufacturing: Materials, Design, Technologies, and Applications", Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.

E-RESOURCES

1. <https://nptel.ac.in/courses/112103306> (Fundamentals of Additive Manufacturing Technologies)
2. https://onlinecourses.nptel.ac.in/noc24_me130/preview - (Metal Additive Manufacturing)

Mapping of COs-POs & PSOs

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4	3	-	2	1	-	-	-	-	-	-	2	2	2
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Avg.	3	-	2	1	-	-	-	-	-	-	2	2	2

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Professional Elective - IV

23MEP601

CAD/CAM

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of engineering drawings, GD&T, and drawing standards.
- To train students in preparing and interpreting 2D engineering drawings using standard projection and sectioning methods.
- To familiarize students with 3D modeling techniques, including solid, surface, and parametric modeling.
- To impart knowledge of assembly modeling concepts and analysis of clearances, interferences, and motion.
- To expose students to CAM and CNC machining processes, including tool path generation and simulation

UNIT I BASICS OF DESIGNS

9

Understanding of Projections, Scales, units, GD & T; its 14 symbols, Special characteristics & Title Block readings. Revision / ECN status of drawings – Customer Specific requirements – Drawing Grid reading

UNIT II 2D DRAFTING

9

Projection views – Orthographic view, Axillary view, Full & Half Section views, Broken Section view, Offset Section view – Title Block creation – BOM Creation – Notes creation – Ballooning of 2D drawing and its features for Inspection reporting.

UNIT III 3D MODELING

9

Conversion of Views – 2D to 3D & 3D to 2D – Parametric and Non-Parametric Modeling – Tree features of 3D Modeling and its advantages – Surface Modeling – BIW (Body in White) – Solid Modeling, Boolean operations like Unites, Subtraction, Intersect, etc.

UNIT IV ASSEMBLY MODELING

9

Basics of Assembly modeling, Purpose of Assembly modeling & its advantages – Top to Down & Bottom Up modeling approaches – Analysis of Clearances – Undercuts – Interferences – Stack up analysis – Cumulative effect of Tolerances in after assembly conditions. - motion analysis.

UNIT V CAM

9

Basics of CNC Machining – 3, 4 & 5 Axis machines - CNC and Part Programming, CAM programming 2D & 3D. Elements of CAM Orientation, Boundary Creation, Cutter Path Selection, Cutter Compensation – Machining Stocks, Roughing, Re-roughing, Semi Finishing & Finishing - Tool Path Generation, Isl and Milling Programming. Machining program simulation, integration of program with machine; Estimation of CNC Cycle time. – Post Process NC Code conversion and Setup Sheet Preparation.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply basic drawing concepts and GD&T symbols to read and understand engineering drawings.
- Develop neat 2D drawings with views, sections, title blocks, BOM, and balloons.
- Analyze 2D and 3D models to understand features, modeling methods, and conversions.
- Examine assemblies to detect interference, clearance problems, and tolerance issues.
- Analyze CAM tools to develop CNC tool paths and estimate machining cycle time.

TEXT BOOKS

1. K.V.Nageswara Rao, "CAD/CAM: Principles and Applications", Fifth Edition, McGraw Hill Education (India), 2019.
2. M.P.Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Fourth Edition, Pearson Education, 2020.
3. A.K.Chitale&R.C.Gupta, "Product Design and Manufacturing", Prentice Hall of India, 2022.

REFERENCES

1. I.Zeid & A.N.A.Sivasubramanian, "CAD/CAM: Theory and Practice", Fourth Edition, McGraw Hill Education, 2019.
2. Radhakrishnan & Subramanyan, "CAD/CAM/CIM", Wiley India, 2022.
3. T.J.Shah & R.S.Parikh, "Elements of Computer Aided Manufacturing", Charotar Publishing House, 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/112104031> - (Computer Aided Engineering Design)
2. <https://nptel.ac.in/courses/112102102> - (Computer Aided Design and Manufacturing)

Mapping of Cos-Pos &PSOs

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

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


Chairman - BoS





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23MEP602

DESIGN FOR X

L T P C

3 0 0 3

OBJECTIVES

- To build skills in using QFD and experiments to improve product quality.
- To emphasize ways of finding failures and ensuring products stay safe and reliable.
- To promote designs that is easier to manufacture and assemble.
- To highlight design choices that protects the environment and support easy maintenance.
- To support students in analyzing costs and selecting economical design options.

UNIT I DESIGN FOR QUALITY

9

Quality Function Deployment -House of Quality-Objectives and Functions-Targets Stakeholders Measures and Matrices-Design of Experiments -design Process Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments – Conducting the Analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT II DESIGN FOR RELIABILITY AND SAFETY

9

Reliability – Definitions – Constant failure Rate – Weibull Frequency distribution – Reliability with variable failure rate – System reliability - Design strategy – Causes of unreliability – Minimizing Failure – Sources of reliability data – Cost of reliability – Failure Mode Effect Analysis – Defects and Failure Modes – Importance of Failure – Safety – Safe product – Design aspects of safety – Fail safe design – Potential dangers and safety hazards – Guidelines for design for safety – Warning Labels.

UNIT III DESIGN FOR MANUFACTURE AND ASSEMBLY

9

Role of Manufacturing in design – Manufacturing functions - types of manufacturing process, process systems- Manufacturing process selection - Design for Manufacturability (DFM) – Design for Assembly (DFA) - Role of standardization in DFMA – Mistake Proofing.

UNIT IV DESIGN FOR ENVIRONMENT AND SERVICEABILITY

9

Design for Environment – Life cycle design – DFE Approach – DFE scoring methods. Human factors in design, ergonomics, user friendly design- Serviceability – Preventive Maintenance – Breakdown Maintenance – Testability – Role of reliability in maintenance and repair.

UNIT V DESIGN FOR COSTING

9

Categories of costing – Overhead cost – methods of developing cost estimates – Manufacturing cost – Product profit model – refinements to cost analysis methods – Design to cost – Value Analysis in costing – Life cycle costing.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Apply quality function deployment and design of experiments to improve product design performance.
- Examine reliability data, failure modes, and safety aspects to enhance product dependability.
- Determine DFMA principles to streamline manufacturing and assembly operations.
- Examine environmental, ergonomic, and maintenance requirements to improve product sustainability and serviceability.
- Compare cost components and life-cycle costs to support cost-effective design decisions.

TEXT BOOKS

1. Pahl, G., Beitz, W., Feldhusen, J. and Grote, K.-H., "Engineering Design: A Systematic Approach", Springer, 2020.
2. O'Connor, P. D. T., "Practical Reliability Engineering and Analysis for System Design", Wiley, 2023.
3. Smith, R., "Design Cost Analysis and Management", McGraw-Hill Education, 2022.

REFERENCES

1. Crowe, C. and Daley, D., "Design for Reliability: Tools for Managing Predictability", Wiley, 2021.
2. Chen, H. and Goodridge, A., "Human Factors and Ergonomics in Product Design", Academic Press, 2022
3. Kumar, A. and Singh, P., "Advanced Design for Quality and Safety", Springer, 2024.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc25_mm01/preview - (Advanced Manufacturing and Process Modelling)
2. https://onlinecourses.nptel.ac.in/noc25_mm02/preview - (Advances in Additive Manufacturing of Materials)

Mapping of COs-POs & PSOs

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

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


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23MEP603

LEAN MANUFACTURING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the principles of lean manufacturing.
- To acquire knowledge on tools of lean manufacturing..
- To explore various visual management techniques, TPM and lean practices.
- To get knowledge on management and technology drivers of lean manufacturing
- To teach the fundamentals of manufacturing strategy and competitive drivers of lean manufacturing

UNIT I LEAN MANUFACTURING PRINCIPLES

9

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes - tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

UNIT II LEAN MANUFACTURING TOOLS

9

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen - Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

UNIT III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION

9

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

UNIT IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING

9

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver

UNIT V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING

9

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Apply lean manufacturing concepts to identify and reduce wastes using Value Stream Mapping.
- Implement appropriate lean tools such as 5S, Kaizen, SMED and Kanban to improve workflow.
- Analyze production problems using visual management and TPM to determine causes of waste.
- Analyze the influence of management and technology drivers on the effectiveness of lean systems.
- Examine manufacturing strategies and competitive drivers to improve productivity and responsiveness.

TEXT BOOKS

1. Devadasan.S.R, Mohan Sivakumar.V, Muruges.R and Shalij.P.R,"Lean Manufacturing: Theoretical, Practical and Research Futurities", PHI Learning Private Limited, 2020
2. Pascal Dennis, "Lean Production Simplified", Productivity Press, 2020.
3. William M. Feld, "Lean Manufacturing tools and techniques",Third Edition,CRC Press,2021

REFERENCES

1. Bill Carreira, "Lean Manufacturing That Works", PHI Learning Private Limited, 2022.
2. Dennis P. Hobbs, "Lean Manufacturing Implementation", Fifth Edition, Cengage Learning, 2019.
3. Michael, L.G., "Lean Six SIGMA: Combining Six SIGMA Quality with Lean Production Speed", McGraw Hill, 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/104/112104188/> - (Lean Manufacturing System Technology)
2. <https://freevidelectures.com/course/4162/nptel> - (Toyota Production system)

Mapping of COs-POs & PSOs

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

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


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23MEP604

PRODUCTION PLANNING AND CONTROL

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the objectives, functions, types of production, product development, standardization, simplification, specialization, and break-even analysis.
- To introduce the basic concepts and methods of work study, including method study, time study, motion study, work sampling, and predetermined motion time standards.
- To train students in product planning, value analysis, process planning, routing, machine capacity, and production balancing.
- To impart knowledge of production loading, scheduling, Gantt charts, production control systems, MRP, Kanban, dispatching, and progress reporting.
- To equip students with knowledge of inventory control, ABC analysis, JIT, MRP II, ERP, and computer-integrated production planning systems.

UNIT I INTRODUCTION

9

Objectives and benefits of planning and control-Functions of production control-Types of production job batch and continuous-Product development and design-Different aspects. Profit consideration Standardization, Simplification & specialization- Break even analysis.

UNIT II WORK STUDY

9

Method study, basic procedure- Development -Implementation - Micro motion and memo motion study – work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING

9

Product planning-Value analysis-planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing.

UNIT IV PRODUCTION SCHEDULING

9

Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling-Batch production scheduling Production Control systems-Material requirement planning -kanban – Dispatching-Progress reporting and expediting.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC

9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system -ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Apply basic PPC concepts to understand production types, costs, and break-even points.
- Examine work-study methods to find losses and suggest better ways of working.
- Implement process planning to choose routes, set quantities, and match machines.
- Compare scheduling tools (Gantt, MRP, Kanban, dispatching) to solve shop-floor problems.
- Explain inventory control and modern PPC systems (JIT, MRP-II, ERP) to manage materials effectively.

TEXT BOOKS

1. MartandTelsang, "Industrial Engineering and Production Management", S.Chand and Company, 2022.
2. James.B.Dilworth, "Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International, 2020.
3. Norman Gaither, G. Frazier, "Operations Management" 9th Edition, Thomson learning IE, 2019.

REFERENCES

1. Jain. K.C & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 2019.
2. Chary. S.N. "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 2021
3. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", Eighth Edition John Wiley and Sons, 2020

E-RESOURCES

1. <https://nptel.ac.in/courses/112/107/112107143/> -(Production Planning and Control)
2. <https://nptel.ac.in/Courses/112/107/112107217/>-(Product Design and Development)

Mapping of COs-POs & PSOs

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

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


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23MEP605

COMPUTER INTEGRATED MANUFACTURING SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

- To develop knowledge of the basic concepts of Computer Integrated Manufacturing (CIM).
- To discuss on production planning and control, and computer-aided process planning.
- To explore group technology and cellular manufacturing.
- To familiarize flexible manufacturing systems and various AGVS techniques.
- To predict the functions of the basic components of a robot.

UNIT I INTRODUCTION

9

Brief introduction to CAD and CAM - Manufacturing planning and control- Introduction to CAD/CAM - Concurrent Engineering - CIM concepts - Computerised elements of CIM system - Types of production - Basic elements of an automated system - Levels of automation - Lean production and Just-In-Time production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING

9

Process planning - Computer Aided Process Planning (CAPP) - Logical steps in Computer Aided Process Planning - Aggregate Production Planning - Master Production Schedule (MPS) - Material Requirement Planning-I (MRP-I) - Capacity Planning - Control Systems - Shop Floor Control (SFC) - Inventory Control - Manufacturing Resource Planning-II (MRP-II) - Enterprise Resource Planning (ERP).

UNIT III CELLULAR MANUFACTURING

9

Group Technology (GT) - Part Families - Parts classification and coding - Production Flow Analysis (PFA) - Cellular Manufacturing - Composite part concept - Machine cell design and layout - Quantitative analysis in cellular manufacturing - Rank order clustering method - Arranging machines in a GT cell - Hollier Method.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM AND AUTOMATED GUIDED VEHICLE SYSTEM

9

Types of flexibility - FMS - FMS components - FMS application and benefits - FMS planning and control - Quantitative analysis in FMS - Automated Guided Vehicle System (AGVS) - Application - Vehicle guidance technology - Vehicle management and safety.

UNIT V INDUSTRIAL ROBOTICS

9

Robot anatomy and related attributes - Classification of robots - Robot control systems - End effectors - Sensors in robotics - Robot accuracy and repeatability - Industrial robot applications - Robot part programming.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply CAD/CAM and automation principles to analyze modern manufacturing systems.
- Analyze production planning and control methods to compare different planning tools like MRP, MPS, and ERP.





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- Categorize part families and machine cells using Group Technology and evaluate cellular manufacturing layouts.
- Analyze the components and flexibility of Flexible Manufacturing Systems (FMS) and assess AGV operations.
- Classify industrial robots and examine their control systems, sensors, and programming approaches.

TEXTBOOKS

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2020.
2. Radhakrishnan P, Subramanyan S. and Raju V., "CAD/CAM/CIM", New Age International (P) Ltd., New Delhi, 2019.
3. Shivanand H K, Benal M M and Koti V, Flexible Manufacturing System, New Age, 2022

REFERENCES

1. Kant Vajpayee S, Principles of Computer Integrated Manufacturing, Prentice Hall, New Delhi, 2021.
2. Rao.P, N Tewari & T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2020.
3. Alavudeen and Venkateshwaran, Computer Integrated Manufacturing II, PHI Learning Pvt. Ltd., New Delhi, 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/104/112104289/> - (Computer Integrated Manufacturing)
2. https://onlinecourses.nptel.ac.in/noc20_me44/preview - (Computer Integrated Manufacturing)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	3	-	-	-	1	-	2	3	3
2	3	3	2	2	2	-	-	-	1	2	2	3	3
3	3	2	2	2	2	-	-	-	1	2	2	3	3
4	3	3	2	2	3	-	-	-	1	2	2	3	3
5	3	2	2	2	3	-	-	-	1	-	2	3	3
AVG.	3	2.6	2	2	2.6	-	-	-	1	2	2	3	3

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


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23MEP606

SUSTAINABLE MANUFACTURING

L T P C

3 0 0 3

OBJECTIVES

- To teach the principles of sustainability in manufacturing systems.
- To explain sustainable materials, processes and product design aspects.
- To impart knowledge on energy consumption, waste generation and environmental impact.
- To get exposure on tools and techniques for improving sustainability performance.
- To introduce circular economy, smart and future-ready sustainable practices.

UNIT I INTRODUCTION TO SUSTAINABLE MANUFACTURING

9

Sustainability concepts – Triple bottom line – Green vs Sustainable Manufacturing – Drivers and barriers – Environmental regulations and policies – ISO 14001, ISO 50001 – Sustainable product design principles – Case studies.

UNIT II SUSTAINABLE MATERIALS AND PROCESSES

9

Sustainable material selection – recycled, renewable and biodegradable materials – Dematerialization – Sustainable machining, forming, casting, joining – Additive manufacturing and sustainability – Toxic substances, RoHS, REACH – Design for disassembly, reuse and remanufacturing.

UNIT III ENERGY, RESOURCES AND WASTE MANAGEMENT

9

Energy flow in manufacturing systems – Energy audit and benchmarking – Energy-efficient machines and drives – Water conservation and resource optimization – Waste hierarchy (3R/5R) – Cleaner production – Industrial symbiosis – Carbon footprint and emission reduction strategies.

UNIT IV TOOLS AND TECHNIQUES FOR SUSTAINABILITY

9

Life Cycle Assessment (LCA): goal, scope, inventory, impact assessment – Environmental Impact Assessment (EIA) basics – Lean and Green integration – Value Stream Mapping for sustainability – Sustainability indicators and KPIs – Cost-benefit analysis – Digital manufacturing and data analytics.

UNIT V CIRCULAR AND SMART SUSTAINABLE MANUFACTURING

9

Circular economy concepts – Closed-loop supply chains – Product-Service Systems (PSS) – Remanufacturing and refurbishing – Sustainable packaging and logistics – Industry 4.0: IoT, AI, digital twins for sustainability – Industrial best practices and case studies.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Apply the principles of sustainability to different manufacturing systems and operations.
- Analyze alternative materials and processes to determine their environmental and economic impacts.
- Apply energy-efficient and waste-minimizing practices in manufacturing case scenarios.
- Examine manufacturing systems using tools such as LCA, VSM and sustainability indicators to draw conclusions.
- Analyze circular economy strategies and smart manufacturing approaches for industrial applications.

TEXT BOOKS

1. S. Vinodh, "Sustainable Manufacturing: Concepts, Tools, Methods and Case Studies", CRC Press, Boca Raton, 2021..
2. T. E. Graedel and B. R. Allenby, "Industrial Ecology and Sustainable Engineering", Pearson Education, Upper Saddle River, 2020.
3. D. A. Dornfeld, "Green Manufacturing: Fundamentals and Applications", Springer, New York, 2023.

REFERENCES

1. K. Mathiyazhagan et al., Lean and Green Manufacturing: Towards Eco-Efficiency and Business Performance, Springer, Singapore, 2022.
2. G. Seliger (Ed.), Sustainable Manufacturing: Shaping Global Value Creation, Springer, Berlin, 2020.
3. N. K. Jha, Green Design and Manufacturing for Sustainability, CRC Press, New York, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/112104225> - (Sustainability through Green Manufacturing Systems)
2. <https://nptel.ac.in/courses/110104119> - (Advanced Green Manufacturing Systems)

Mapping of COs-POs & PSOs

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

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


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Professional Elective - V

23MEP607

INDUSTRY 4.0

LT P C

3 0 0 3

OBJECTIVES

- To introduce students to the concept, evolution, drivers, and challenges of Industry 4.0.
- To teach the role of IoT, smart systems, and predictive analytics in achieving Industry 4.0.
- To familiarize students with key technologies such as cyber-physical systems, robotics and cybersecurity that enable Industry 4.0.
- To provide an understanding of data, knowledge management, and cloud computing in Industry 4.0 environments.
- To expose students to Industry 4.0 applications, case studies, and future trends including workforce transformation.

UNIT I INTRODUCTION TO INDUSTRY 4.0

9

Introduction to Industry 4.0 The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation

UNIT II ROAD TO INDUSTRY 4.0

9

Road to Industry 4.0 - Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics

UNIT III TECHNOLOGIES ENABLING INDUSTRY 4.0

9

System, Technologies for enabling Industry 4.0—Cyber Physical Systems - Robotic Automation and Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Cyber Security

UNIT IV DATA, KNOWLEDGE AND CLOUD COMPUTING

9

Role of data, information, knowledge and collaboration in future organizations - Resource- based view of a firm - Data as a new resource for organizations - Harnessing and sharing knowledge in organizations - Cloud Computing Basics -Cloud Computing and Industry 4.0.

UNIT V INDUSTRY 4.0 APPLICATIONS AND FUTURE TRENDS

9

Industry 4.0 IIoT case studies - Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world – Society 5.0.

TOTAL : 45 PERIODS

OUTCOMES

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

- Apply basic concepts of Industry 4.0 and industrial revolutions
- Categorize IoT and smart manufacturing concepts
- Develop Industry 4.0 enabling technologies
- Analyze data and cloud computing in Industry 4.0
- Examine Industry 4.0 concepts to real-life industrial applications





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TEXT BOOKS

1. SudipMisra, Chandana Roy, Anandarup Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0", First Edition 2021.
2. Ravi Kant & Hema Gurung (Editors), "Industry 4.0: Concepts, Processes and Systems", First Edition 2024.
3. Vikram Bali, Vishal Bhatnagar, Deepti Aggarwal, Shivani Bali, Mario José Diván (Editors), "Cyber-Physical, IoT, and Autonomous Systems in Industry 4.0", First Edition 2022.

REFERENCES

1. Amy Neustein, Parikshit N. Mahalle, Prachi Joshi, Gitanjali Rahul Shinde (Editors), "AI, IoT, Big Data and Cloud Computing for Industry 4.0", First Edition 2023.
2. G. Rajesh, X. Mercilin Raajini & Hien Dang (Editors), "Industry 4.0 Interoperability, Analytics, Security, and Case Studies", First Edition 2021.
3. Diego Galar, Pasquale Daponte, Uday Kumar, "Handbook of Industry 4.0 and SMART Systems" - First Edition, 2020

E-RESOURCES

1. <https://nptel.ac.in/courses/127101872> - (Industry 4.0: Managing The Digital Transformation)
2. <https://nptel.ac.in/courses/106105195> - (Introduction to industry 4.0 and industrial internet of things)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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
Avg.	3	3	-	-	-	-	-	-	-	-	-	1	1

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



Chairman - BoS





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23MEP608

INSTRUMENTATION AND CONTROL ENGINEERING

L T P C
3 0 0 3

OBJECTIVES

- To teach the fundamentals and characteristics of measuring systems and instruments.
- To introduce the principles, working, and applications of sensors and transducers.
- To train the students in various industrial measurement techniques for mechanical parameters.
- To acquire the basic concepts and analysis methods of control systems.
- To explain learners with the design principles of automated and control systems used in industry.

UNIT I MEASURING SYSTEM

9

Concepts of Mechanical measuring instruments- Elements of a measuring system - Requirements of measuring instruments - Static and dynamic characteristics of measuring instruments - Errors in measurements. - Impedance matching - Least square method- Zero and first order system- step response and impulse response.

UNIT II TRANSDUCER ENGINEERING

9

Classification and types of Transducers and Sensors- Transducer's Mathematical model Electromechanical Piezoelectric, Thermocouples and Optoelectronic transducers - principles of resistive, inductive, and capacitive transducers - Transducer Troubleshooting- special transducers - Smart sensors- Nano sensors.

UNIT III INDUSTRIAL INSTRUMENTATION

9

Measurement of vibrations and speed - Accelerometer - Sensors to measure absolute, gauge, vacuum and atmospheric pressures - Measurement of temperature: pyrometer, Fiber optics sensor - Measurement of flow - hot wire anemometer - magnetic flow meter- ultrasonic meter. Measurement of displacement - Measurement of Force - Strain gauge, Load cells- Measurement, of torque - Case study.

UNIT IV CONTROL SYSTEM

9

Introduction to Control systems - Open and closed loop systems - stepper and servo mechanisms. Transfer function: Block diagram reduction algebra, signal flow graphs - Pollution Control system- Basics of Controllers and response analysis- Problems.

UNIT V DESIGN OF AUTOMATION AND CONTROLS SYSTEM

9

Automated: systems- introduction to systems - design of hydraulic and pneumatic control system controls - Basics of Directional Control Valve (DCV) - sequence operations- Applications of relays/switches- design of electro. Pneumatics - Programmable controllers - Cost considerations - programmable logic controllers - PLC languages (Basics of Ladder Diagram) - case studies.

TOTAL: 45 PERIODS





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OUTCOMES

Up on completion of the course, Students will be able to:

- Categorize the basic components of instrumentation, measurement, and control systems.
- Analyze the parameters and performance of transducers.
- Develop measurement techniques for mechanical systems.
- Apply control engineering methods in automatic control systems used in contemporary manufacturing, processing, and transportation settings.
- Design mechanical control systems for automation purposes.

TEXTBOOKS

1. William C. Dunn "Fundamentals of Industrial Instrumentation and Process Control" Second Edition, Mc Grawhill, 2023.
2. William boltan, "Instrumentation and control Engineering" Third Edition, Newnes, 2021.
3. Katsuhiko Ogata, "Modern Control Engineering", Fifth Edition, Pearson, 2009.

REFERENCES

1. Norman.S.Nise, "Control Engineering systems", John Wiley & sons, 2019.
2. Franklin, Powell, Emami Naeini., "Feedback Control of Dynamic Systems", Eight Edition, Pearson, 2019.
3. Richard C. Drof, Robert H. Bishop., "Modern control system", Pearson, Fourteenth Edition, 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/108105064> - (Industrial Instrumentation)
2. <https://nptel.ac.in/courses/107106081> - (Control systems)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-'-NoCorrelation


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23MEP609

SURFACE ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To introduce surface characteristics and frictional behavior of metals and non-metals under various operating conditions.
- To explain wear mechanisms, wear models, and standard methods used for friction and wear measurement.
- To present corrosion phenomena, influencing factors, testing methods, and common corrosion prevention practices.
- To describe surface properties and surface treatment techniques employed to enhance performance and durability.
- To familiarize students with engineering materials used in friction, wear, and advanced tribological applications.

UNIT I SURFACES AND FRICTION

9

Basics of surfaces features – Roughness parameters – surface measurement - Cause of friction- Laws of friction – Static friction – Rolling Friction – Stick-slip Phenomenon - Friction properties of metal and nonmetals – Friction in extreme conditions – Thermal considerations in sliding contact.

UNIT II WEAR

9

Laws of Wear - Types of Wear mechanism – wear debris analysis - Theoretical wear models - Wear of metals and nonmetals – International standards in friction and wear measurements

UNIT III CORROSION

9

Introduction – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors

UNIT IV SURFACE TREATMENTS

9

Surface properties – Hydrophobic – Super hydrophobic – Hydrophilic - surface metallurgy –Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying - New trends in coating technology – DLC – CNC – Thick coatings – Nano engineered coatings – Other coatings, Corrosion resistant coatings

UNIT V ENGINEERING MATERIALS

9

Introduction – High and low friction materials - Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Bio Tribology - Nano Tribology

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the principles of friction and surface features to engineering materials.
- Analyze different wear mechanisms and evaluate wear measurement methods.
- Classify the different types of corrosion and its preventive measures
- Categorize the surface properties and surface modification techniques
- Analyze the various types of materials used in the friction and wear applications.

TEXTBOOKS

1. Ankit Walia R.S, Murtaza Qasim, "surface engineering" First Edition, 2022
2. P.A Dearnley, "Introduction to surface engineering", Sixth Edition, New York, NY: Cambridge University Press, 2017.
3. G.W. Stachowiak and A.W. Batchelor, "Engineering Tribology", Butterworth-Heinemann, 2005.

REFERENCES

1. Halling, J. (Editor), "Principles of Tribology", MacMillan, 2020.
2. Williams J.A., "Engineering Tribology", Oxford University Press, 2019.
3. Fontana G., "Corrosion Engineering", McGraw Hill, 2017

E-RESOURCES

1. <https://nptel.ac.in/courses/112107248> - (Fundamentals of Surface Engineering: Mechanisms, Processes and Characterizations)
2. <https://nptel.ac.in/courses/113108051> - (Corrosion – introduction, definitions and types)

Mapping of COs-POs & PSOs

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

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

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23MEP610

MAINTENANCE ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To teach the principles and practices of maintenance planning, reliability, and maintenance economics.
- To develop understanding of maintenance policies, preventive maintenance, lubrication, and TPM.
- To introduce condition monitoring techniques and cost comparisons.
- To teach repair methods for basic machine elements, including fault detection and failure analysis.
- To teach repair methods for material handling equipment and manage maintenance records and job orders.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle – Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 9

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 9

Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

TOTAL:45 PERIODS

OUTCOMES

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

- Apply the principles and practices of maintenance planning, reliability, machine availability, and maintenance economics.
- Apply maintenance policies, preventive maintenance strategies, lubrication methods, and Total Productive Maintenance (TPM) concepts.





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- Analyze condition monitoring techniques, including on-load/off-load testing, wear-debris analysis, and cost comparisons.
- Examine repair methods for basic machine elements and perform fault detection and failure analysis.
- Apply repair methods for material handling equipment and manage maintenance records, job orders, and computer-assisted maintenance.

TEXTBOOKS

- Andrew K.S.Jardine & Albert H.C. Tsang, "Maintenance, Replacement and Reliability-Theory and Applications," Taylor and Francis, 2021.
- Mishra R C and Pathak K., "Maintenance Engineering and Management", PHI, 2019
- Mohamed Ben-Daya, Uday Kumar & D. N. Prabhakar Murthy, "Introduction to Maintenance Engineering: Modelling, Optimization and Management", John Wiley & Sons, 2016.

REFERENCES

- Bikas Badhury & S.K.Basu, "Tero Technology: Reliability Engineering and Maintenance Management", Asian Books, 2018.
- Matthew P. Stephens, "Productivity and Reliability-Based Maintenance Management", Purdue University Press, 2019
- Seichi Nakajima, "Total Productive Maintenance", Productivity Press, 2019.

E-RESOURCES

- <https://nptel.ac.in/courses/112105048> - (Machinery fault diagnosis and signal processing
- Maintenance)
- https://onlinecourses.swayam2.ac.in/nou21_me10/preview- (Condition Monitoring and Maintenance Management)

Mapping of COs-POs & PSOs

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

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

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23MEP611

ELECTRONICS MANUFACTURING TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with electronics manufacturing processes and PCB fabrication.
- To outline component types and electronic packaging techniques.
- To describe soldering theory and solder paste application methods.
- To discuss SMT processes and associated standards.
- To introduce PCB inspection, testing, and rework practices.

UNIT I INTRODUCTION TO ELECTRONICS MANUFACTURING

9

History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed Circuit Boards, types- single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection. Electronic packaging – Through Hole Technology (THT) and Surface Mount Technology (SMT)

UNIT II COMPONENTS AND PACKAGING

9

Through-hole components – axial, radial, multi leaded, odd form. Surface mount components active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, Flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends.

UNIT III SOLDERING AND CLEANING

9

Soldering theory, effect of elemental constituents on wetting, microstructure and soldering, solder paste technology – fluxing reactions, flux chemistry, solder powder, solder paste composition and manufacturing, solder paste rheology, Wave soldering. Adhesive and solder paste application.

UNIT IV SURFACE MOUNT TECHNOLOGY

9

SMT Equipment and Material Handling Systems, Handling of Components and Assemblies - Moisture Sensitivity and ESD, Safety and Precautions Needed, IPC and Other Standards, Stencil Printing Process, solder paste storage and handling, stencils and squeegees, process parameters, quality control.

UNIT V INSPECTION, TEST AND REWORK FOR PCB

9

Inspection Techniques, Equipment and Principle – AOI, X-ray. stencil printing process- defects & corrective action, component placement process - defects & corrective action, Reflow Soldering Process- defects & corrective action, under fill and encapsulation Process- defects & corrective action, Testing of assemblies, In-circuit testing (ICT), functional testing, concept of yield, Rework and Repair, tools, rework criteria and process

TOTAL: 45 PERIODS





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OUTCOMES

Up on completion of the course, Students will be able to:

- Apply fundamentals of electronics manufacturing and PCB processes
- Apply component and packaging technologies in electronic assemblies
- Examine soldering processes and defects
- Analyze SMT processes and quality control techniques
- Develop inspection, testing and rework processes for PCB assemblies

TEXTBOOKS

1. Coombs, Jr. C.E., "Printed Circuits Handbook" Mc Graw-Hill Hand books Sixth Edition, 2015
2. Gurnett, K.W., "Surface Mount Handbook", NewnesElsevier, 2018
3. Landers, T.L., "Electronics Manufacturing Processes", Prentice Hall, 2017

REFERENCES

1. Michael Pecht, Rakish Agarwal, F. Patrick McCluskey, "Electronic Packaging Materials and Their Properties", CRC Press / Taylor & Francis, 2020.
2. Clyde F. Coombs Jr., "Printed Circuits Handbook (Latest Edition)", McGraw-Hill, 2019.
3. Christopher Nash & Dr. Ronald C. Lasky, "The Printed Circuit Assembler's Guide to Solder Defects", IPC Publishing, 2016.

E-RESOURCES

1. <https://nptel.ac.in/courses/112107213> - (Joining Technologies for Metals)
2. <https://nptel.ac.in/courses/112105267> - (Electronic Packaging and Manufacturing)

Mapping of COs-POs & PSOs

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

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


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23MEP612

DESIGN FOR ADDITIVE MANUFACTURING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic principles and processes of Additive Manufacturing.
- To teach design concepts, data preparation, and digital workflows used in Additive Manufacturing..
- To explain design considerations specific to Additive Manufacturing and its unique capabilities.
- To outline design rules and considerations for various 3D printing processes.
- To familiarize testing methods and standard organizations related to Additive Manufacturing.

UNIT I BASIC PRINCIPLES OF ADDITIVE MANUFACTURING

9

Introduction to the Basic Principles of Additive Manufacturing, Additive Manufacturing Processes, Extrusion, Beam Deposition.

UNIT II DESIGN CONCEPTS IN ADDITIVE MANUFACTURING

9

Design / Fabrication Processes: Data Sources, Software Tools, File Formats, Model Repair and Validation, Pre- & Post-processing, Designing for Additive Manufacturing, Multiple Materials, Hybrids, and Composite Materials, current and future directions.

UNIT III DESIGN FOR ADDITIVE MANUFACTURING

9

Concepts and Objectives – AM Unique Capabilities – Part Consolidation – Topology Optimization – Lightweight Structures - Design Requirements of Additive Manufacturing: For Part Production, For Mass Production, For Series Production.

UNIT IV DESIGN FOR 3D PRINTING

9

General design considerations for 3D printing, 3D printed features, designing for Material Jetting, Binder Jetting, FFF, SLA/DLP, SLS, DMLS/SLM, design rules.

UNIT V DESIGN STANDARDS FOR ADDITIVE MANUFACTURING

9

Methods of testing and Testing organization – ASTM, ANSI, NBS, NEMA, NFPA, VL, SPI AND SPE.

TOTAL: 45 PERIODS

OUTCOMES

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

- Categorize the importance in the evolution of SFM/AM, proliferation into the various fields and its effects on supply chain.
- Analyze the design for AM and its importance in the quality of fabricated parts.
- Apply knowledge of principles and applications of polymerization and sheet lamination processes with case studies.





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• C

construct the principles of material extrusion and powder bed fusion processes and design guidelines.

- Analyze Perceive jetting and direct energy deposition processes and their applications.

TEXTBOOKS

- Andreas Gephardt and Jan-Steffen Hotter, "Additive Manufacturing: 3D Printing for Proto typing and Manufacturing", Hanser publications Munchen, Germany, 2015.
- Ben Redwood, Brian Garret, Filemon Schöffner, and Tony Fadel, "The 3D Printing Handbook: Technologies, Design and Applications", 3DHubsB.V. Netherland, 2017.
- "Design for Additive Manufacturing", Roland Lachmayer, Tobias Ehlers, and René Bastian Lippert - Springer Berlin/Heidelberg, 2024.

REFERENCES

- Ian Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer – New York, USA, Second Edition, 2019
- Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A tool box for proto type development", CRC Press, First Edition, 2017 FL, USA.
- Milan Brandt., "Laser Additive Manufacturing 1st Edition Materials, Design, Technologies, and Applications", Wood head Publishing, UK, 2016.

E-RESOURCES

- https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr24_ed17 - (3D Printing and Design)
- https://onlinecourses.nptel.ac.in/noc22_me122/preview - (Fundamentals of Additive Manufacturing Technologies)

Mapping of COs-POs & PSOs

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

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



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Professional Elective -VI

23MEP613

MACHINE DRAWING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts and standards of machine drawing required for effective design communication.
- To explain the standard design and drawing procedures of cotter joints, pin joints, and couplings using engineering principles.
- To facilitate student learning of design methodologies for bearings and valves through illustrative examples, calculations, and design exercises.
- To present the design concepts and functional aspects of heat engine components.
- To guide the application of design principles to commonly used machine parts with emphasis on manufacturability and assembly.

UNIT I BASIC CONCEPTS OF MACHINE DRAWING

3+6

Sectioning conventions – Systems of dimensioning and dimensioning of common components – surface finish, symbols and representing surface finish on drawing - Representation of welded joints, riveted joints and screw threads - Fits & Tolerances - calculation of minimum and maximum clearances and allowances - Geometrical tolerance - form and position tolerances - symbols –indicating geometrical tolerances on drawings - Introduction to selective assembly and interchangeable manufacture.

UNIT II COTTER & PIN JOINTS AND COUPLINGS

3+6

Cotter joint with sleeve - Gib and cotter joint - Couplings - Protected and unprotected type flanged coupling - Universal Coupling Using any CAD Software: Laboratory Class: Gib and Cotter joint & protected type flanged coupling

UNIT III BEARINGS AND VALVES

3+6

Plummer block - Swivel Bearing - Foot step journal bearing - Foot step ball bearing - Safety valves Using any CAD Software: Laboratory Class: Plummer block & Swivel Bearing

UNIT IV HEAT ENGINE PARTS

3+6

Petrol Engine Piston & Box type steam engine piston and piston rod- Connecting rod - Gland and Stuffing box Using any CAD Software: Laboratory Class: Petrol Engine Piston & Connecting rod

UNIT V MACHINE PARTS

3+6

Machine vice - Pipe Vice - Screw Jack - Tailstock - Lathe Slide Rest Using any CAD Software: Laboratory Class: Machine vice & Screw Jack

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the basic concepts of machine drawing, types of fits and tolerances, and standard drawing conventions and representations while preparing and interpreting engineering drawings.
- Develop sectional views of various joint and couplings by both manually and computerized drawings using a CAD software
- Develop sectional views of bearings by both manually and computerized drawings using a CAD software
- Develop assembled drawings of heat engine parts and valves by both manually and computerized drawings using a CAD software
- Construct the assembled views of machine parts by manually drafting and by using CAD software, ensuring accuracy, functionality, and adherence to standard drawing conventions.

TEXT BOOKS

1. Gopalakrishna, K.R., "Machine Drawing", Subhas publishing House, Bangalore, 2007.
2. Sidheswar, N., Kanniah, P., and Sastri, V.V.S., "Machine Drawing", TMH New Delhi, 2014.
3. John, K.C., and Verghese, P.L., "Machine Drawing", Jovast Publishers, Trissur, 2004.

REFERENCES

1. Narayanan, K.L., Kanniah, P., and Venkata Reddy, K., "Machine Drawing", New Age International Publications, 2008.
2. Ajeetsingh, "Machine Drawing", TMH, New Delhi, 2012.
3. Bhatt N.D "Machine Drawing", Charotar Publishing House Pvt. Ltd., 2008,

E-RESOURCES

1. <https://nptel.ac.in/courses/112103019> - (Engineering Drawing)
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_me125 - (Engineering Drawing and Computer Graphics)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP614

MATERIAL HANDLING AND SOLID PROCESSING EQUIPMENT

L T P C

3 0 0 3

OBJECTIVES

- To teach students the basics and benefits of material handling and proper equipment use.
- To train students on different industrial vehicles, their types, and applications.
- To familiarize students with conveyor systems and their modern uses.
- To guide students in using auxiliary and hoisting equipment safely and effectively.
- To equip students with knowledge of bulk handling and robotic systems for workplace applications.

UNIT I INTRODUCTION TO MATERIALS HANDLING

9

Basic principles & objectives in material handling and its benefits - Classification of material handling equipment - selection of material handling equipments - guidelines for effective utilisation of material handling equipments - unit load concept

UNIT II INDUSTRIAL VEHICLES

9

Introduction and types - Hand trucks - Two wheel Hand Trucks - Multiple wheel Hand Trucks - Hand Lift Trucks - Power Trucks - Fixed Platform Truck - Platform Lift Truck - Pallet Lift Truck - Walkie Truck - Straddle Carrier - Fork Lift Trucks - Specifications of FLT - FLT Attachments - Tractors - Industrial Tractor-Trailer-Self-propelled trucks and fork trucks - Automated guided vehicles Theory

UNIT III CONVEYORS

9

Classification of conveyors- Definition - Description - General Characteristics - types and uses of belt Conveyors - Roller conveyors - Haulage Conveyors - Screw Conveyors - Bucket Conveyors - Chain Conveyors - Cable Conveyors - Pneumatic and Hydraulic conveyors - Computer controlled conveyor system.

UNIT IV AUXILIARY EQUIPMENT AND HOISTING EQUIPMENT

9

Hoppers - Gates- Feeders- Chutes - positioners- Ball Table- Weighing and Control Equipment- Pallet loaders and unloaders - applications and advancements. - Hoisting Equipment - parts of hoisting equipment - Description and uses of hoists - Description and uses of ropes - description and purpose of crane hooks - Elevators - Cranes - Derricks - and its types

UNIT V BULK HANDLING EQUIPMENT AND SYSTEMS

9

Storage of bulk solids - bulk handling equipment - Robotic handling - Materials handling at the workplace - Robots and their classification - Major components of a robot - classification of Robotic manipulators - Robotic handling applications

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the basic concepts of material handling equipment in selecting and explaining suitable equipment for industrial and manufacturing applications.
- Analyze and explain the basic working principles of various industrial vehicles by examining their operating mechanisms, functional components, and applications in industrial environments.
- Analyze and develop the working principles of various conveyors by examining their operating mechanisms, component interactions, and suitability for different material handling applications.
- Apply the basic working principles of various Auxiliary Equipment and Hoisting Equipment.
- Analyze the working principles of various bulk handling equipment and systems by assessing their operational performance, efficiency, and suitability for different industrial applications.

TEXT BOOKS

1. Allegri (Sr.), T.H., Material Handling - Principles and Practices, CBS Publishers and Distributors, Delhi, 1987.
2. Siddharta Ray, Introduction to Materials Handling, New Age International Publishers, 2007.
3. Theodore H., Allegre Sr., Material Handling Principles and Practice, CBS Publishers and Distributors, First edition, 2019.

REFERENCES

1. Bolz, H. A and Hagemann, G. E (ed.), "Materials Handling Handbook", Ronald Press, 1985.
2. Apple, J.A., "Material Handling System Design", John Wiley & Sons
3. Immer J. R., Material Handling, Tata McGraw Hill Publication.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_mm20/preview - (Bulk Material Transport and Handling Systems)
2. <https://archive.nptel.ac.in/courses/113/105/113105104/> - (Bulk Material Transport and Handling Systems)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP615

DESIGN OF JIGS AND FIXTURES

(Use of Approved Design Data Book is Permitted)

L T P C

3 0 0 3

OBJECTIVES

- To teach students the basics of jigs and fixtures, their elements, advantages, and design principles.
- To train students on the principles of location and the design of locating systems for industrial applications.
- To guide students in understanding clamping principles and designing effective clamping systems.
- To familiarize students with jig bushings, drill jigs, and their design for industrial applications.
- To equip students with the knowledge of fixture design, including turning, milling, grinding, broaching, and welding fixtures, for practical industrial applications.

UNIT I BASICS OF JIGS AND FIXTURE

9

Introduction - Jigs and Fixtures - Difference between Jigs and Fixtures - Advantages of jigs and Fixtures - Economy and cost - Elements of Jigs and Fixtures - Fool Proofing - Materials used in Jigs and Fixtures - Degrees of Freedom - 12 degrees of freedom - 6point location principle - (or) 3-2-1 principle of location - Essential features of Jigs and Fixtures - General Design Principles - Design steps - Common defects in Jigs design.

UNIT II PRINCIPLES OF LOCATION

9

Principles of location - location point - types of locators - pins and studs - V block - cup and cone location points - adjustable locating points - special adjustable stops - location from finished holes in the work - Diamond pin locator - Cam operated 'V' locator - Quick action 'V' locator - Six point location of a three legged object - Location of a cylinder on a v-block- Design of location systems for industrial applications

UNIT III PRINCIPLES OF CLAMPING

9

Principles of clamping - types of clamping - lever clamp - hinged clamp - two way clamp - swinging clamp - wedge clamp - eccentric clamping arrangement - quick action clamp - Cam operated clamp - quarter turn screw - Toggle clamp - Pneumatic and hydraulic clamps - Washers - C washer - spherical and flat washers - Design of clamping system for industrial applications.

UNIT IV JIGS AND BUSHINGS AND DRILL JIGS

9

Jig Bushing: Materials for jig bushing - press fit bushing - Fixed renewable bushing - slip renewable bushing - liner bushing - screw bushing - miscellaneous type of drill bushings - bushing specifications. Drill Jigs: Open drill jig plate drill jig - plate drill jig - template drill jig - channel drill jig - turn over drill jig - angle plate drill jig - closed box drill jig - leaf drill jig - post jig - indexing drill jig - universal drill jig -design of template and leaf jig Design of Jigs for industrial applications.

UNIT V PRINCIPLE OF FIXTURE DESIGN

9

Introduction - principles of fixture design - element of fixtures - design consideration of locators and clamps for fixtures - types of fixtures - design of turning fixtures - mandrels - type of mandrels - boring fixtures - milling fixtures - essentials of milling fixtures - method of locating milling fixtures with respect to cutter position - grinding fixtures - surface grinding and cylindrical grinding fixtures - broaching fixtures - internal and external broaching fixtures- welding fixtures- Design of fixtures system for industrial applications.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Categorize and justify the requirements of Jigs and Fixtures for Manufacturing, Testing and Assembly
- Apply the principles of various indexing mechanisms to describe and implement suitable indexing methods in manufacturing operations.
- Analyze problems related to Jigs and fixtures in Manufacturing, Testing and Assembly.
- Analyze the suitable materials and appropriate manufacturing processes by comparing performance requirements, manufacturability, cost, and application constraints.
- Design and drafting various Jigs and Fixtures using appropriate software package.

TEXT BOOKS

1. Joshi, P.H. "Jigs and Fixtures", Tata McGraw Hill Publishing Co., Ltd., New Delhi, Third Edition, 2019.
2. Joshi P.H "Press tools - Design and Construction", S Chand & Company, Twenty Third Edition, 2020.
3. Springer, Design of Jigs, Fixtures and Press Tools , Springer Nature Switzerland AG Second Edition, 2022

REFERENCES

1. Donaldson, Lecain and Goold "Tool Design", Tata McGraw Hill ", Fifth Edition, 2017.
2. Venkataraman. K., "Design of Jigs Fixtures & Press Tools", John Wiley & Sons, Ltd", Fifth Edition, 2015
3. Philip Gates, "Jigs, Tools and Fixtures, Their Drawing and Design", Legare Street Press, First Edition, 2022

E- RESOURCES

1. <http://www.nptelvideos.in/search?q=Jigs+and+Fixtures> - (Jigs and Fixtures For Machine Shops)
2. <https://nptel.ac.in/courses/112105127> - (Introduction to Manufacturing and Machining)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP616

GAS DYNAMICS AND JET PROPULSIONS

L T P C

(Use of Standard Gas Table is Permitted)

3 0 0 3

OBJECTIVES

- To provide students with a strong foundation in compressible flow theory, including Mach number effects and isentropic flow in nozzles and diffusers.
- To guide students in understanding compressible flows in ducts with friction and heat transfer.
- To develop students' ability to understand shock waves and expansion processes using normal, oblique shock, and Prandtl-Meyer relations.
- To expose students to the operating principles and performance analysis of jet propulsion engines.
- To equip students with knowledge of rocket propulsion systems, propellants, performance parameters, and space flight applications.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS

9

Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone - Effect of Mach number on compressibility - Isentropic flow through variable ducts - Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS

9

Flows through constant area ducts with heat transfer (Rayleigh flow) - Friction (Fanno flow) variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS

9

Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl - Meyer relations - Applications.

UNIT IV JET PROPULSION

9

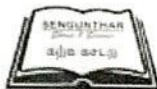
Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operating principle, cycle analysis - Use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION

9

Types of rocket engines - Propellants - feeding systems - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - Space flights.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the concept of compressible flows in variable area ducts.
- Apply the concept of compressible flows in constant area ducts.
- Examine the effect of compression and expansion waves in compressible flow.
- Apply the concept of gas dynamics in Jet Propulsion in turbojet, turbofan and turbo prop engines.
- Analysis the concept of gas dynamics in space propulsion.

TEXT BOOKS

1. Anderson, J.D., "Modern Compressible flow", McGraw Hill, Third Edition, 2012.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 2002.

REFERENCES

1. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd., 1980.
2. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York, 2010.

E-RESOURCES

1. <https://nptel.ac.in/courses/112/106/112106166/> - (Gas Dynamics and Propulsion-Introduction)
2. <https://nptel.ac.in/courses/101/106/101106044/> - (Gas Dynamics)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP617

DESIGN OF TRANSMISSION SYSTEMS

L T P C

(Use of Approved Design Data Book is Permitted)

3 0 0 3

OBJECTIVES

- To teach students the design principles and selection procedures of flexible machine elements such as belts, ropes, chains, and sprockets.
- To train students in the design and analysis of spur and helical gears, including force analysis, stress calculation, and failure considerations.
- To guide students in understanding the design aspects of bevel and worm gears, including geometry, force analysis, and failure modes.
- To familiarize students with the design of single-stage and multi-stage gear boxes using kinematic layouts and standard speed ratios.
- To equip students with the knowledge to design cams, clutches, and brakes considering forces, stresses, and functional requirements.

UNIT I DESIGN OF FLEXIBLE ELEMENT

9

Selection of flat belts and pulleys - Selection of V belts and pulleys - Selection of hoisting wire ropes and pulleys - Selection of transmission chains and sprocket.

UNIT II DESIGN OF SPUR AND HELICAL GEARS

9

Spur and Helical gears - Introduction - Gear design - Force analysis - Tooth stresses - Failure in gears.

UNIT III DESIGN OF BEVEL AND WORM GEARS

9

Bevel gear - Introduction - Types - Geometry - Angle relations - Basic dimensions - Force analysis. Worm Gear - Introduction - Types, Geometry - Basic dimensions - Forces on worm and worm wheel - Modes of failures.

UNIT IV DESIGN OF GEAR BOXES

9

Gear Box - Geometric progression - Standard step ratio - Ray diagram - Kinematics layout - Design of multi stage gear boxes - Calculation of number of teeth and overlapping speed.

UNIT V CAMS, CLUTCHES AND BRAKES

9

Cam Design: Types - pressure angle and under cutting base circle determination - Forces and surface stresses. Design of plate clutches - Axial clutches - Cone clutches - Internal expanding rim clutches - Band and Block brakes - External shoe brakes - Internal expanding shoe brake.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply design procedures to select flat belts, V-belts, wire ropes, chains, and sprockets for power transmission systems.
- Differentiate spur and helical gears by analyzing force transmission, tooth stresses, and failure causes.
- Compare bevel and worm gear designs by analyzing geometry, load distribution, and failure mechanisms.
- Analyze multi-stage gear box designs using kinematic layouts, ray diagrams, and speed ratio calculations.
- Construct cam, clutch, and brake designs based on force and stress considerations.

TEXT BOOKS

1. Bhandari V, "Design of Machine Elements", Tata McGraw-Hill Book Co, New Delhi, Fourth Edition, 2017.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", Tata McGraw-Hill, Tenth Edition, 2014.
3. S.Md.Jalaludeen, "Design of Transmission system", Anuradha Publications, Chennai, Fourth Edition, 2017.

REFERENCES

1. T. J. Prabhu, "Design of Transmission Elements", Mani Offset, Chennai, 2015.
2. B. J. Hamrock, B. Jacobson and S. R. Schmid, "Fundamentals of Machine Elements", Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, Third Edition, 2014.
3. B. R. Patil, "Design of Transmission system", TechKnowledge Publications; Maharashtra, First Edition 2024.

E-RESOURCES

1. <https://nptel.ac.in/courses/112106424> - (Design of Mechanical Transmission Systems)
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_me71 - (Design of Mechanical Transmission Systems)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MEP618

FUEL CELLS

L T P C

3 0 0 3

OBJECTIVES

- To teach students the fundamentals of fuel cell technology, operation, characteristics, and comparison with conventional energy storage systems.
- To train students in the electrochemical principles and reaction kinetics governing fuel cell operation.
- To familiarize students with various types of fuel cells, their construction, working principles, and applications.
- To guide students in understanding hydrogen production, storage, and utilization methods for fuel cell systems.
- To equip students with knowledge of fuel cell power plants, cogeneration systems, electric vehicles, and related safety and cost considerations.

UNIT I INTRODUCTION TO FUEL CELLS

9

Introduction and overview of fuel cell technology- Basics of fuel cell, fuel cell advantages and disadvantages - fuel cell operation - Layout of a Real Fuel Cell - Difference between fuel cell and batteries - Basic Parameters of Fuel Cells

UNIT II FUEL CELL ELECTROCHEMISTRY

9

Electrode kinetics - concepts - Fuel cell reaction kinetics - Conversion of chemical energy to electricity in a fuel cell - Reaction rate of fuel cell - Butler - Volmer equation

UNIT III TYPES OF FUEL CELLS

9

Classification of fuel cells - Polymer electrolyte membrane fuel cell (PEMFC) - Electrodes and Electrode Structure in PEMFC - Water Management in the PEMFC - Direct methanol fuel cells (DMFC) - Alkaline fuel cell (PAFC) - Molten Carbonate fuel cell (MCFC) - Solid oxide fuel cell (SOFC)

UNIT IV HYDROGEN PRODUCTION, STORAGE AND UTILIZATION

9

Hydrogen - Production methods: from fossil fuels, electrolysis, thermal decomposition, photochemical, photocatalytic - Hybrid methods of hydrogen production - Hydrogen storage methods

UNIT V APPLICATION OF FUEL CELLS IN POWER COGENERATION

9

Balance of fuel cell power plant - Fuel cell power plant structure - Cogeneration - Fuel cell electric vehicles - Case study - Safety issues and cost expectation.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the basic working principles and parameters of fuel cells to analyze their operation.
- Examine fuel cell electrochemical reactions to interpret performance behavior.
- Compare various fuel cell types based on construction, materials, and operating conditions.
- Apply suitable hydrogen production and storage methods for fuel cell applications.
- Analyze fuel cell power plant systems and cogeneration applications for performance and safety

TEXTBOOKS

1. Viswanathan, B. Aulice Scibioh, M, "Fuel Cells - Principles and Applications", Universities Press Pvt., Ltd., Third Edition, 2015.
2. Matthew M. Mench, Fuel Cell Engines, John Wiley & Sons, Fourth Edition, 2016.
3. Andrew L. Dicks, David A. J. Rand, "Fuel Cell Systems Explained", Third Edition, Wiley 2018

REFERENCES

1. O'Hayre, R. P., S. Cha, W. Colella, F. B. Prinz, "Fuel Cell Fundamentals", Wiley, Third Edition, 2016
2. Bagotsky .V.S, "Fuel Cells", Wiley, Second Edition, 2012.
3. Frano Barbir, " PEM Fuel Cells : Theory and practice", Elsevier Academic Press, USA, 2005

E-RESOURCES

1. <https://nptel.ac.in/courses/103102015> - (Fuel Cell Technology)
2. <https://archive.nptel.ac.in/courses/103/105/103105110/> - (Fuel Cells)

Mapping of Cos-Pos & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



OPEN ELECTIVE - I

23CEO607

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

LT P C

3 0 0 3

OBJECTIVES

- To explore the Rio principles of environmental impact assessment.
- To enhance the screening and scoping in EIA.
- To develop the environmental monitoring plan and EIA report preparation.
- To inculcate the baseline monitoring of socio economic environment.
- To instruct the EIA case studies pertaining to infrastructure projects.

UNIT I INTRODUCTION

9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT

9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN

9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance.

UNIT IV SOCIO ECONOMIC ASSESSMENT

9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal - Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES

9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems- Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Examine the impacts of development on environment.
- Analyze the scoping and screening of developmental projects for environmental and social assessments.
- Construct the environmental management plans and EIA reports.
- Apply the economic valuation of environmental impacts and cost benefit analysis.
- Identify the EIA case studies pertaining to Infrastructure Projects.

TEXT BOOKS

1. Canter, R.L, "Environmental impact Assessment ", Second Edition, McGraw Hill Inc, New Delhi, 1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank, 1997.
3. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, First Edition, 2009.

REFERENCES

1. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" Conceptual and Methodological Advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.

E-RESOURCES

1. <https://nptel.ac.in/courses/124107160> - (Environmental Impact Assessment)
2. https://onlinecourses.nptel.ac.in/noc25_ch24/preview - (Environmental Quality Monitoring & Analysis)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	-	2	3	-	-	-	-	-	-
2	3	3	2	2	-	2	3	-	-	-	-	-	-
3	3	3	3	2	2	2	3	-	-	-	2	-	-
4	3	3	2	2	-	2	3	-	-	-	3	-	-
5	3	3	3	2	2	3	3	-	-	-	2	-	-
Avg.	3.0	3.0	2.4	2.0	2.0	2.2	3.0	-	-	-	2.3	-	-

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

Chairman - BoS





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23CSO610

INTRODUCTION TO DRONE TECHNOLOGIES

L T P C

3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of drone technology, including its concepts, terminology, historical evolution, and emerging applications.
- To develop students' understanding of UAV architecture, drone components, fabrication techniques, and programming methodologies.
- To train students in drone flight operations, navigation systems, sensors, data acquisition, and UAV management tools.
- To enable students to explore commercial applications of drones in sectors such as agriculture, logistics, inspection, surveillance, and aerial imaging.
- To familiarize students with drone safety regulations, licensing requirements, and emerging technologies including autonomous and swarm-based UAV systems.

UNIT I INTRODUCTION TO DRONE TECHNOLOGY

9

Drone Concept-Vocabulary Terminology-History of drone-Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses-Drone business through entrepreneurship-Opportunities/applications for entrepreneurship and Employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING

9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program – Install program on computer-Running Programs-Multi rotor stabilization-Flight modes-Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION

9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity-Removable storage devices-Linked mobile devices and applications.

UNIT IV DRONE COMMERCIAL APPLICATIONS

9

Choosing a drone based on the application-Drones in the insurance sector-Drones in delivering mail, parcels and other cargo-Drones in agriculture-Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY

9

The safety risks-Guidelines to fly safely –Specific aviation regulation and standardization-Drone License-Miniaturization of drones-Increasing autonomy of drones-The use of drones in swarms.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Explain the fundamental concepts, terminology, classifications, history, and applications of drone technology.
- Design a multirotor drone by selecting appropriate hardware appropriate components and tools.
- Apply flight control principles, navigation methods, onboard sensors, and UAV management tools for drone flight operations.
- Analyze the drone technologies for commercial applications such as aerial imaging, agriculture, logistics, infrastructure inspection, and surveillance
- Analyze drone safety regulations, licensing requirements, and emerging technologies including autonomous drones and swarm intelligence for future UAV applications.

TEXTBOOKS

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, First Edition, 2021.
2. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones, Maker Media, Inc.", Sheroff Publishers and Distributors Pvt Ltd, First Edition, 2015.

REFERENCES

1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, First Edition, 2016.
2. Završnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, First Edition, 2018.

E-RESOURCES

1. <http://www.digimat.in/nptel/courses/video/101108661/L50.html> - (Fundamentals of Drone Technologies)
2. <http://www.digimat.in/nptel/courses/video/101108661/L38.html> - (Drone Technology Commercial Application)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	3	-	-	-	-	-	3	-	-
2	3	3	3	2	3	-	-	-	-	-	3	-	-
3	3	3	2	2	3	-	-	-	-	-	3	-	-
4	2	3	2	2	3	-	-	1	-	-	2	-	-
5	2	3	3	2	3	-	-	2	-	-	2	-	-
Avg.	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-

1-Low, 2-Medium, 3-High, "-" – No Correlation


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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23ECO602

FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS

**L T P C
3 0 0 3**

OBJECTIVES

- To introduce fundamental knowledge of semiconductors and devices and its applications.
- To discuss the operation and characteristics of Bipolar Junction Transistor.
- To expose the various types of oscillators and FET.
- To inculcate the operation of power semiconductor devices.
- To impart knowledge on optoelectronic devices and wave shaping circuits.

UNIT I SEMICONDUCTOR AND DIODES

9

Semiconductor - Definition, classification, intrinsic and extrinsic N type & p type – drift current & diffusion current diodes – PN junction diode – forward and reverse bias characteristics – specification – zener diode construction & working Principle - characteristics - zener break down - avalanche break down.

Rectifier – introduction-classification of rectifiers-half wave rectifier-full wave Rectifier (center tapped, bridge) - (no mathematical equations) – comparison – Applications - filters-C, LC and PI filters.

UNIT II BIPOLAR JUNCTION TRANSISTOR

9

Transistor – NPN and PNP transistor – operation-transistor as an amplifier- transistor as a switch – CB, CE, CC configurations – characteristics - comparison between three configurations in terms of input impedance, output impedance, current gain, voltage gain – negative feedback Concept, effect of negative feedback – types of negative feedback connections.

UNIT III TRANSISTOR OSCILLATORS AND FET

9

Transistor oscillators – Classifications – Condition for oscillations (Barkhausen criterion) – General form of Hartley Oscillator – Colpitts Oscillator – RC Phase shift oscillator.

Field Effect Transistor – construction – working principle of FET – difference Between FET and BJT – classification of FET – characteristics of FET – Applications.

UNIT IV SCR, DIAC, TRIAC

9

SCR – introduction – working – VI-characteristics -comparison between SCR and transistor – SCR as a switch, controlled rectifier. TRIAC working principle, Characteristics –DIAC –characteristics –DIAC as bi- directional switch. Applications of SCR, TRIAC and DIAC.

UNIT V OPTOELECTRONIC DEVICES AND WAVE SHAPING CIRCUITS

9

Classification of optoelectronic devices – symbols, Characteristics, working of LDR, LED, 7 segment LED and LCD– opto coupler - Photo transistor. Clipper, Clamper Circuits and waveforms only – Astable, Monostable Multivibrators and Schmitt trigger using transistors.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Understand the concept of semiconductor, diodes and its applications.
- Discuss the various biasing circuits using BJT.
- Explain the oscillator circuits and Field Effect Transistor.
- Analyze the operation of power semiconductor devices and its applications.
- Explain the operation of optoelectronic devices and wave shaping circuits.

TEXT BOOKS

1. Robert L. Boylestad, Louis Nashelsky "Electronic Devices and Circuits Theory", Prentice Hall Publications, Tenth Edition, 2009.
2. S.Salivahanan, N.Suresh kumar, "Electronic Devices and Circuits", McGraw Hill, Fifth Edition, 2022.

REFERENCES

1. G.S.N. Raju, "Electronic Devices and Circuits", I.K. International Publications, New Delhi, First Edition, 2006
2. A.P Godse, U.A Bakshi, "Electronic Devices and Circuits", Technical Publications, 2010.

E-RESOURCES

1. <https://nptel.ac.in/courses/108108122> - (Fundamentals of Semiconductor Devices).
2. https://onlinecourses.nptel.ac.in/noc21_ee86 - (Microelectronics: Devices To Circuits).

Mapping of COs - POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	2	-	-	-	-	3	-	-
2	3	3	3	3	2	3	-	-	-	-	2	-	-
3	3	3	3	3	3	2	-	-	-	-	3	-	-
4	3	3	3	3	3	2	-	-	-	-	2	-	-
5	3	3	3	3	3	3	-	-	-	-	2	-	-
Avg.	3	3	3	3	2.8	2.4	-	-	-	-	2.4	-	-

1- Low, 2 - Medium, 3 - High, '-' – No correlation


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23EEO603

ELECTRIC VEHICLE TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the basic concepts and working of electric vehicles.
- To familiarize with battery types, parameters, and battery pack design for electric vehicles.
- To instruct on DC and AC electrical machines used in electric vehicle applications.
- To develop understanding of electric vehicle drive train components and regenerative braking.
- To foster awareness of hybrid electric vehicle types, configurations, and component sizing.

UNIT I ELECTRIC VEHICLES

9

Introduction - Components - Vehicle mechanics - Roadway fundamentals - Vehicle kinetics
Dynamics of vehicle motion Propulsion System Design

UNIT II BATTERY

9

Basics - Types - Parameters Capacity, Discharge rate, State of charge, state of discharge,
Depth of discharge - Technical characteristics - Battery pack design Properties of batteries

UNIT III DC & AC ELECTRICAL MACHINES

9

Motor and engine rating - Requirements - DC machines - Three phase AC machines- Induction
machines - Permanent magnet machines - BLDC Motor Switched reluctance machines

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN

9

Transmission configuration - Components - Gears - Differential - Clutch - Brakes
Regenerative braking - Motor sizing

UNIT V HYBRID ELECTRIC VEHICLES

9

Types - Series - Parallel and series - Parallel configuration - Design - Drive train Sizing of
components.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the basic concepts and working of electric vehicles.
- Apply the battery types, parameters in battery pack design.
- Explain the DC and AC electrical machines used in electric vehicles.





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- Identify the electric vehicle drive train components and regenerative braking.
- Examine the hybrid electric vehicle types, configurations, and component sizing.

TEXT BOOKS

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, Second Edition, 2017.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, First Edition, 2015.

REFERENCES

1. Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC press, Second Edition, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, Second Edition, 2020.

E-RESOURCES

1. <https://nptel.ac.in/courses/108103009> - (Hybrids and Electric Vehicle)
2. <http://nptel.ac.in/courses/108103009/> - (Electric Vehicle)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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23EEO604

RENEWABLE ENERGY SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on renewable energy sources and their role in sustainable energy development.
- To familiarize with the working and applications of wind energy systems.
- To develop understanding of solar photovoltaic and solar thermal energy systems.
- To instruct on biomass, geothermal, and hydroelectric energy systems.
- To get knowledge on other renewable energy sources and energy storage systems.

UNIT I RENEWABLE ENERGY SOURCES

9

Environmental consequences of fossil fuel use - Importance of Renewable Sources (RE) of energy - Sustainable design and development - Types of RE sources - Limitations of RE sources - Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY

9

Power in the wind - Types of wind power plants (wpps) - Components of wpps - Working of wpps - Siting of wpps - Grid integration issues of wpps.

UNIT III SOLAR PV AND THERMAL SYSTEMS

9

Solar radiation - Radiation measurement - Solar thermal power plant - Central receiver power plants - Solar ponds - Thermal energy storage system with pcm - Solar photovoltaic systems - Basic principle of spv conversion - Types of pv systems -Maximum power point tracking - Best free solar pv system simulation.

UNIT IV BIOMASS ENERGY

9

Introduction - Bio mass resources - Energy from bio mass - Conversion processes - Biomass cogeneration - Environmental benefits - Geothermal energy - Basics - Direct use - Geothermal electricity - Mini/micro hydro power - Classification of hydropower schemes - Classification of water turbine - Turbine theory - Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES

9

Tidal energy - Energy from the tides - Barrage and non barrage tidal power systems - Wave energy - Energy from waves - Wave power devices - Ocean thermal energy conversion (OTEC) - Hydrogen production and storage - Fuel cell - Principle of working - Various types - Construction and applications - Energy storage system - Hybrid energy systems.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Explain the importance and types of renewable energy sources.
- Analyze the working and components of wind energy systems.
- Discuss how solar photovoltaic and solar thermal systems work.
- Determine biomass, geothermal and hydroelectric energy systems.
- Examine tidal, wave, ocean thermal, fuel cell and hybrid energy systems.

TEXT BOOKS

1. Scott Grinnell, "Renewable Energy & Sustainable Design", Cengage Learning, USA, Second Edition, 2016.
2. Richard A. Dunlap, "Sustainable Energy", Cengage Learning India Private Limited, Second Edition, 2015.

REFERENCES

1. ShobhNath Singh, "Non-conventional Energy resources", Pearson Education India, Second Edition, 2015.
2. Bradley A. Striebig, Adebayo A.Ogundipe and Maria Papadakis, "Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, First Edition, 2016.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/108/108108078/> - (Renewable Energy Systems)
2. <https://nptel.ac.in/courses/108/105/108105058/>-(Non-Conventional Energy resources)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23MEO601

INTRODUCTION TO INDUSTRIAL ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To enable students to grasp the fundamental concepts, scope, and role of Industrial Engineering in manufacturing and service systems.
- To expose students to plant location, facility layout, and production planning concepts relevant to real-world industries.
- To develop analytical ability to apply work study, method study, and ergonomics principles in industrial environments.
- To equip students with foundational knowledge of statistical quality control and its application in process improvement.
- To prepare the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.

UNIT I INTRODUCTION

9

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT II PLANT LOCATION AND LAYOUT

9

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT III WORK SYSTEM DESIGN & ERGONOMICS

9

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Time Study – Work sampling- Ergonomics and its areas of application in the work system - Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing.

UNIT IV STATISTICAL QUALITY CONTROL

9

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Acceptance Sampling- O.C curve – Single sampling plan- Double sampling plan.

UNIT V PRODUCTION PLANNING AND CONTROL

9

Forecasting – Techniques – Types of production – Process planning – Economic Batch Quantity – Loading – Scheduling and control of production.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the concepts of productivity and productivity measurement approaches.
- Examine appropriate location models for various facility types and design various facility layouts.
- Analyze and conduct method study and time study to improve the efficiency of the system.
- Examine the quality of processes using control charts in manufacturing/service industries.
- Apply knowledge and skills for planning strategies and preparing a Material Requirement Plan (MRP).

TEXTBOOKS

1. Martand Telsang, 2016, "Industrial Engineering and Production Management", S. Chand and Company.
2. Khanna O. P., and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2020,
3. George Kanwaty, "Introduction to Work Study", ILO, Geneva, 2016

REFERENCES

1. Ravi Shankar, 2019, "Industrial Engineering and Management", Galgotia Publications & Private Limited.
2. Norberd Lloyd Enrick., "Industrial Engineering Manual for Textile Industry", Wiley Eastern (P) Ltd., New Delhi, 2018,
3. Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd., 2019,

E-RESOURCES

1. <https://nptel.ac.in/courses/112107292> - (Principles of Industrial Engineering)
2. https://onlinecourses.nptel.ac.in/noc25_me181/preview - (Industrial Engineering and Operations Research)

Mapping of COs-POs & PSOs

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

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

 Chairman - BoS





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23MEO605

CNC MACHINING TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of computer graphics, CAD systems, geometric transformations, and viewing techniques used in computer-aided design.
- To provide knowledge on geometric modeling techniques, assembly modeling, graphics standards, and product data exchange standards used in CAD applications.
- To explain the construction, components, control systems, and operational features of CNC machines and advanced machining centres.
- To familiarize students with manual and computer-aided CNC part programming techniques using APT, CAM packages, and canned cycles.
- To develop an understanding of Computer-Aided Manufacturing (CAM), Computer Integrated Manufacturing (CIM), manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) manufacturing concepts.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS

9

Product cycle - Design process - sequential and concurrent engineering - Computer-aided design - CAD system architecture - Computer graphics - coordinate systems - 2D and 3D transformations homogeneous coordinates - Line drawing - Clipping - viewing transformation.

UNIT II GEOMETRIC MODELING

9

Geometric Modeling - types - Wireframe, surface and solid modeling - Boundary Representation, constructive solid geometry - Graphics standards - assembly modeling - use of software packages - Data exchange standards - IGES, STEP, CALS, etc. - communication standards.

UNIT III CNC MACHINES

9

NC, CNC & DNC - types of CNC - constructional features - drives and control systems - feedback devices - Interchangeable tooling system - preset & qualified tools - ISO specification - Machining center - Turning center - CNC EDM - CNC wire cut EDM.

UNIT IV CNC PROGRAMMING

9

Manual part programming - steps involved - sample program in lathe & milling. - Computer-aided part programming - APT - CAM package - canned cycles - Programming.

UNIT V FUNDAMENTALS OF CAM

9

Brief introduction to CAM - Manufacturing Planning, Manufacturing control - Concurrent Engineering - CIM concepts - Computerized elements of CIM system - Types of production Basic Elements of an Automated system - Levels of Automation - Lean Production and Just-In-Time Production.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the principles of computer graphics, CAD system architecture, coordinate systems, geometric transformations, and viewing techniques used in computer-aided design.
- Examine geometric modeling techniques, assembly modeling approaches, graphics standards, and data exchange standards for engineering design applications.
- Compare the constructional features, control systems, tooling arrangements, and operational characteristics of CNC machines and advanced machining centres.
- Classify CNC programming techniques, including manual part programming, computer-aided part programming, APT, CAM packages, and canned cycles for manufacturing applications.
- Differentiate the concepts of CAM, CIM, manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) production in modern manufacturing systems.

TEXTBOOKS

- Mikell.P.Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson Education", Fifth Edition, 2023.
- Ibrahim Zeid, "Mastering CAD/CAM", McGraw-Hill Education, Third Edition, 2021.
- P. N. Rao, "CAD/CAM: Principles and Applications", McGraw-Hill Education (India), Fourth Edition, 2022.

REFERENCES

- M.P.Groover and Emory.W.Zimmers Jr., "CAD/CAM: Computer-Aided Design and Manufacturing", Pearson Education, Second Edition (Reprint), 2020
- M.P.Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley & Sons, Eighth Edition, 2025
- Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM: Theory and Practice", McGraw Hill Education, Second Edition, 2020.

E-RESOURCES

- <https://nptel.ac.in/courses/112102103> - (Overview of CNC machines)
- <http://www.digimat.in/nptel/courses/video/112104289/L20.html> - (CNC Part Programming)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS





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23MDO611

HOSPITAL MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the fundamentals of hospital administration and management.
- To impart knowledge on human resource management practices in healthcare organizations.
- To explore marketing research processes and consumer behavior in healthcare services.
- To introduce hospital information systems and supportive healthcare services.
- To inculcate awareness of quality assurance, accreditation standards, and patient safety practices.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION

9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL

9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS

9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department– Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL

9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Examine the principles and functions of hospital administration in healthcare organizations.
- Analyze human resource management practices and their role in hospital operations.
- Apply marketing research techniques for healthcare service management.
- Utilize hospital information systems and supportive services for decision-making.
- Develop quality assurance and patient safety strategies in healthcare settings.

TEXT BOOKS

1. Gupta Joydeep Das, "Hospital Administration and Management: A Comprehensive Guide", Third Edition, 2023.
2. G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, New Delhi, Fifth Edition, Reprint 2018.

REFERENCES

1. Bruce J. Fried and Myron D. Fottler, "Human Resources in Healthcare Managing for Success", Fourth Edition, 2020.
2. James R. Langabeer, "Handbook on Health Care Operations Management", Jones & Bartlett Publishers, 2020.

E-RESOURCES

1. <https://www.youtube.com/watch?v=2J-F4Fi2VRQ> – (Introduction to Human Resource Management in Healthcare Settings)
2. <https://www.youtube.com/watch?v=dXHJemWm1xl&pp=ygUVI2hvc3BpdGFsX2luZm9ybWF0aW9u> – (Hospital Information Management Software (HIMS))

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	3	1	-	-	2	1	-	-	1	1	-	-
2	1	2	2	1	-	1	2	1	1	2	1	-	-
3	1	2	3	1	1	1	1	-	1	2	1	-	-
4	1	2	2	2	3	1	1	-	1	1	2	-	-
5	1	3	2	2	2	3	2	1	1	2	2	-	-
Avg.	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-

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

Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23RAO609

FUNDAMENTALS OF ROBOTICS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basics of robots, including anatomy, types, specifications, and applications.
- To impart knowledge on robot kinematics, including forward/inverse kinematics and transformation matrices for manipulators.
- To familiarize with robot drive systems and end effectors, including types, features, applications, and design considerations.
- To discuss sensors in robotics, including force, tactile, proximity, and their applications and safety aspects.
- To enhance understanding of robot programming and its applications in industrial and specialized fields.

UNIT I BASICS OF ROBOT

9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT KINEMATICS

9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS

9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT IV SENSORS IN ROBOTICS

9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism

UNIT V PROGRAMMING AND APPLICATIONS OF ROBOT

9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effectors Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Identify robot types, anatomy, specifications, and applications.
- Illustrate forward and inverse kinematics of manipulators using transformation matrices.
- Analyze and select appropriate drive systems and end effectors for robotic applications.
- Apply sensor technologies and safety systems to robotic cells for reliable detection, hazard prevention, and compliant operation.
- Apply robot programming techniques and analyze their applications in industrial and specialized fields.

TEXTBOOKS

1. Ganesh.S.Hedge, "A textbook of Industrial Robotics", Lakshmi Publications, Second Edition, 2015.
2. Mikell.P.Groover, "Industrial Robotics–Technology, Programming and applications", McGraw Hill, Second Edition, 2017.

REFERENCES

1. Fu K.S. Gonalz R.C. and ice C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co., Second Edition, 2007.
2. John. J.Craig, "Introduction to Robotics: Mechanics and Control", Fourth Edition, 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me37/preview - (Fundamentals of Robotics)
2. <https://archive.nptel.ac.in/courses/112/108/112108298> - (Basics of Robotics)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	3	3	-	1	-	2	-	1	-	-
2	3	2	-	3	3	-	-	-	2	-	2	-	-
3	3	2	-	3	3	-	-	2	2	2	2	-	-
4	3	2	-	3	3	2	-	2	2	2	2	-	-
5	3	2	-	2	3	2	-	2	2	3	3	-	-
Avg.	3.0	2	-	2.8	3.0	2.0	1.0	2.0	2.0	2.3	2.0	-	-

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23CSO612

CYBER FORENSICS AND ETHICAL HACKING

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge about the cyber crime and forensics.
- To acquire knowledge about forensic tools used for evidence acquisition and analysis.
- To familiarize with skills to collect, analyse, and present digital evidence following accepted forensic procedures and legal requirements.
- To impart the fundamental concepts, principles, and scope of ethical hacking in cyber security.
- To acquire the ethical hacking principles and security best practices to identify, analyze, and mitigate vulnerabilities in web applications

UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS

9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT II FORENSICS TOOLS

9

Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools - Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chain of Custody- Forensic Tools.

UNIT III VALIDATING FORENSICS DATA

9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India.

UNIT IV ETHICAL HACKING

9

Introduction to Ethical Hacking – Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking.

UNIT V ETHICAL HACKING IN WEB

9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Understand the basics of cyber crime and computer forensics
Apply the forensic tools for acquiring, preserving, and analyzing digital evidence
- Analyze and validate digital evidence by applying standard forensic procedure
- Apply ethical hacking methodologies to perform reconnaissance, scanning, enumeration, and vulnerability
- Analyze the security vulnerabilities in web applications, wireless networks, and mobile platform.

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Christopher Stuart, "Guide to Computer Forensics and Investigations", Cengage Learning, India, Sixth Edition, 2019.
2. CEH official "Certified Ethical Hacking Review Guide", Wiley India Edition, Version 11, 2021.
3. Deje, S. Murugan, "Cyber Forensics", Oxford University Press, India, 2018.

REFERENCES

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005
2. Marjie T.Britz, "Computer Forensics and Cyber Crime:An Introduction", Third Edition, Prentice Hall, 2013.
3. AnkitFadia " Ethical Hacking", Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications, Taylor &Francis Group 2008.

E - RESOURCES

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/cec21_ge10 - (Information Security and Cyber Forensics)
2. <https://nptel.ac.in/courses/106105217> - (Ethical Hacking)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	1	1	1	-	-	-	1	-	-
2	3	2	1	2	3	1	2	1	1	-	2	-	-
3	3	3	1	3	3	2	3	1	2	-	2	-	-
4	3	3	2	2	3	2	2	1	1	-	2	-	-
5	3	3	3	2	3	2	3	1	2	1	3	-	-
Avg.	3	2.6	1.8	1.8	2.6	1.6	2.2	1	1.5	1	2	-	-

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


Chairman - BoS





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23PMO608

PHARMACEUTICAL NANOTECHNOLOGY

L T P C
3 0 0 3

OBJECTIVES

- To introduce the evolution, principles, and applications of nanotechnology in drug delivery.
- To familiarize students with the principles of biopharmaceutics and pharmacokinetics.
- To provide knowledge of the principles, preparation, characterization, evaluation, and pharmaceutical applications of closed bilayered drug delivery systems.
- To develop a comprehensive understanding of programmed drug delivery systems, drug targeting strategies,
- To enhance understanding of the interactions of nanomaterials with biological systems, nanotoxicity.

UNIT I FUNDAMENTALS OF NANOTECHNOLOGY IN DRUG DELIVERY

9

Nanotechnology in Drug Delivery- Past, Present and Future- Conventional delivery of pharmaceuticals and its limitations, Significance of nano-size in Pharmacy, biotechnology and medicine, Physicochemical Principles of nano-sized Drug Delivery Systems, Biopharmaceutical, Physiological, and Clinical Considerations for Nanotechnology in Drug Delivery.

UNIT II PHARMACOKINETICS AND BIO DISTRIBUTION

9

Introduction- Definitions, concepts of Absorption, Distribution, Metabolism and excretion, concentration time profile, Bioavailability, bio pharmaceuticals and pharmacokinetics in drug research. Biotransformation of drugs- Drug metabolizing enzymes, chemical pathways of Drug transformation, Phase-I and Phase-II reactions, Factors affecting drug transformation Prodrugs- Application of produg design.

UNIT III NANO CARRIERS FOR DRUG DELIVERY

9

Closed bilayered system- Introduction, structural aspects, preparation, characterization, evaluation and applications of liposomes, niosomes, erythrosomes. Polymeric Nanoparticles- Introduction, preparation, characterization, evaluation and pharmaceutical applications.

UNIT IV CONTROLLED AND TARGETED DRUG DELIVERY

9

Programmed Drug Delivery Systems- principles of sustained, controlled, pulsatile and triggered release of drug from nanoparticles. Concept of targeting- Targeting Approaches, Transport Across Biological Barriers, mechanisms of drug targeting, Ideal carrier system and approach Disease-Related Approaches by Nanotherapeutics- nanoparticles for Cancer, Skin Diseases, Bacterial, Diseases, Parasites Diseases and Inflammatory Disease.

UNIT V NANO TOXICOLOGY AND REGULATORY ISSUES

9

Human health and safety- Interaction of nanomaterials with biological systems, Toxicology of nanoparticles- in-vitro and in-vivo, Complications with Nanotoxicity studies, environmental impact of nano-materials, Regulatory Toxicology.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the physicochemical principles governing nano-sized drug delivery systems.
- Explain the role of biopharmaceutics and pharmacokinetics in drug discovery, development, and therapeutic optimization.
- Analyze the physicochemical properties and performance of liposomes, niosomes, erythroosomes, and polymeric nanoparticles for pharmaceutical applications.
- Explain the principles of programmed drug delivery systems, including sustained, controlled, pulsatile, and triggered drug release from nanoparticles.
- Apply appropriate approaches to assess the toxicological effects and safety of nanomaterials using in-vitro and in-vivo studies.

TEXT BOOKS

1. Padma Devarajan, Sanyog Jain, "Targeted Drug Delivery: Concepts and Design", Springer publisher, First Edition, 2015.
2. M. A. Mateescu P. Ispas-Szabo E. Assaad, "Controlled Drug Delivery", Woodhead Publishing, Second Edition, 2014.

REFERENCES

1. Michael E. Aulton, "Pharmaceutics", Churchill Livingstone Publisher, Second Edition, 2013.
2. Philippe Houdy, Marcel Lahmani, "Nanoethics and Nanotoxicology", Springer-Verlag Publisher, Second edition, 2011.

E-RESOURCES

1. <https://onlinelibrary.wiley.com/doi/book/10.1002/9783527800681> - (Pharmaceutical Nanotechnology: Innovation and Production: Innovation and Production)
2. <https://www.scribd.com/document/742651789/Nano-Technology-1> - (Nanotechnology in Pharmacy Education)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	2	-	-	-	-	2	-	-
2	2	2	2	3	2	1	2	-	-	-	2	-	-
3	2	2	2	2	2	2	3	-	-	-	2	-	-
4	2	3	3	3	3	2	1	-	-	1	2	-	-
5	3	3	3	3	3	2	2	1	-	-	3	-	-
Avg.	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-

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

[Signature]
Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MAO606

GRAPH THEORY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts of graph theory.
- To explain the properties of trees, spanning trees, and fundamental circuits.
- To explain the concepts of connectivity and planarity.
- To provide knowledge of graph coloring, covering and partitioning.
- To introduce the concepts of directed graphs and Euler digraphs.

UNIT I INTRODUCTION, PATHS AND CIRCUITS

9

Graphs introduction – Finite and Infinite graphs – Incidence and degree – Isolated vertex, Pendant vertex and Null graph – Isomorphism – Sub graphs – Walks, Paths and Circuits – Connected graphs, disconnected graphs and components – Euler graphs – Hamiltonian paths and circuits.

UNIT II TREES AND FUNDAMENTAL CIRCUITS

9

Trees – Properties of trees – Pendant vertices in a tree – Distance and centers in tree – Rooted and binary trees – Spanning trees – Fundamental circuits – Spanning trees in a weighted graph.

UNIT III CONNECTIVITY AND PLANARITY

9

Connectivity and separability – Network flows – 1-isomorphism – 2-isomorphism – Combinational and geometric graphs – Planer graphs – Kuratowski's two graphs – Different representation of a planer graph.

UNIT IV COLORING, COVERING AND PARTITIONING

9

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem.

UNIT V DIRECTED GRAPH

9

Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler digraphs.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Understand the fundamental concepts of graphs, paths, circuits, Euler and Hamiltonian graphs.
- Apply tree properties and fundamental circuits to solve engineering problems.
- Analyze graph connectivity, network flows and planar graphs for modeling real-world systems.
- Apply graph coloring, matching, covering, and partitioning techniques to optimization and scheduling problems.
- Analyze directed graph and Euler digraphs in engineering applications.

TEXT BOOKS

1. Narsingh Deo., "Graph theory with applications to engineering and computer Science ", Prentice-Hall of India Pvt.Ltd, Fifth Edition, 2016.
2. L.R.Foulds , "Graph Theory Applications", Springer LTD, Seventh Edition, 2016

REFERENCES

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill Education (India) Private Ltd., Seventh Edition, 2011.
2. Ralph P Grimaldi and B.V Ramana., "Discrete and Combinatorial Mathematics", Pearson Education limited, Fifth Edition, 2014.

E-RESOURCES

1. <https://nptel.ac.in/courses/111106102> - (Graph theory)
2. <https://nptel.ac.in/courses/128106001> - (Graph theory)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	1	-	-
2	3	3	2	-	-	-	-	-	-	-	1	-	-
3	3	3	2	1	-	-	-	-	-	-	1	-	-
4	3	3	3	1	-	-	-	-	-	-	2	-	-
5	3	3	2	1	-	-	-	-	-	-	2	-	-
Avg.	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-

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

Signature
Chairman - BoS





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23NCCL01

NCC AIRFORCE LEVEL-1

L T P C

(Common to All UG Programme NCC Students)

3 0 0 3

OBJECTIVES

- To familiarize students with the organizational structure of the National Cadet Corps (NCC), the duties and responsibilities of cadets, the incentives offered, and the significance of various NCC camps.
- To impart knowledge on personality development by enhancing communication skills, self-awareness, creative thinking, critical thinking, and leadership qualities.
- To introduce students to the qualities of effective leadership through the study of eminent leaders, their contributions, and the values required for responsible citizenship.
- To inculcate a sense of social responsibility by encouraging active participation in community service activities and promoting awareness of the role of youth in nation-building.
- To provide an understanding of the importance of health, hygiene, yoga, environmental cleanliness, and obstacle training while motivating students to contribute towards the vision of a Clean India.
- To provide practical training in foot drill, rifle drill, ceremonial drill, and social service activities for developing discipline, teamwork, leadership, and a sense of community responsibility.

UNIT I NCC GENERAL

7

Aims, objectives and Organization of NCC - incentives - duties of NCC Cadets - NCC camps - types - conduct.

UNIT II PERSONALITY DEVELOPMENT

7

Personality Development – Factors - Self Awareness - Communication skills –Empathy - Critical and Creative thinking - Decision making.

UNIT III LEADERSHIP

7

Leadership Capsule - Traits - Case studies - Leaders like APJ Abdul Kalam, RatanTata, shivaji, Tipu Sultan, Rabindranath Tagore, N Narayana murthy

UNIT IV SOCIAL SERVICE

7

Social Service Capsule – Basics - Rural development programmes – NGOs -Contribution of Youth - Swatch Bharath Abhiyan, Social evils - Drug Abuse - Digital Awareness - Waste Management - Women Health and Sanitation - Tree Plantation -Traffic Awareness - Pollution.

UNIT V HEALTH AND HYGIENE

7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training – Adventure.

PRACTICAL COMPONENT

10

S.No.	Name of the Experiment	CO Mapping	RBT
1	Foot Drill	CO1	Apply
2	Rifle Drill	CO1	Apply
3	Ceremonial Drill	CO2	Understand
4	Social Service and Community Development	CO4	Understand

TOTAL: 35+10= 45 PERIODS





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OUTCOMES

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

- Explain the organizational structure of the NCC, the roles and responsibilities of cadets, and the significance of various NCC camps.
- Apply communication, self-awareness, and creative and critical thinking skills to demonstrate personality development and confidence.
- Analyze the leadership qualities and contributions of eminent leaders to develop effective leadership skills and responsible citizenship.
- Demonstrate social responsibility by participating in community service activities and promoting awareness of national development initiatives.
- Apply the principles of health, hygiene, yoga, environmental cleanliness, and obstacle training to maintain personal well-being and develop physical fitness.
- Demonstrate proficiency in foot drill, rifle drill, ceremonial drill, and social service activities by applying discipline, teamwork, leadership, and community service skills in practical situations.

TEXT BOOKS

1. Cadet Hand Book (Common Subjects), published by DG NCC.
2. Cadet Hand Book (Specialized Subjects), published by DG NCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG NCC.
2. Youth in Action, published by DGNCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Head quarters on specialized subject available to PI Staff as reference material.

E-RESOURCES

1. <https://www.indiancc.nic.in>
2. <https://www.indiancc.mygov.in>
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	—	—	—	3	3	2	2	—	2	—	—
2	2	3	2	—	—	3	2	3	3	3	2	—	—
3	2	3	2	2	—	3	3	2	2	2	2	—	—
4	3	2	2	2	—	3	3	2	3	2	2	—	—
5	3	2	2	2	2	3	3	2	—	—	2	—	—
6	2	2	3	—	—	3	3	3	3	2	2	—	—
Avg.	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	—	—

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

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23NCCL03

NCC ARMY WING LEVEL-3

L T P C

(Common to All UG Programme NCC Students)

3 0 0 3

COURSE PREREQUISITES: 75% Attendance in First Year of NCC Course

OBJECTIVES

- To learn the basic structure of NCC and its organization, Incentives, duties of Cadets; imbibe the knowledge of various types of Camp.
- To motivate the cadets as confidence leaders by refining their personality and self-awareness, with the help of Communication skills and aware of creative, critical thinking abilities.
- To create an awareness on Military History and great heroes of India and to know about the important military operations
- To inspire the cadets to take part in the Social Service Activities and also to learn about the infantry battalion
- To acquire knowledge about the basics of health and hygiene, yoga, environment cleanliness and motivate young Indians towards the path of clean India and acquaint about obstacle training.
- To develop discipline, confidence, alertness, and coordination through the practice of basic foot drill movements and commands.

Unit I NCC GENERAL

7

Aims, objectives and Organization of NCC-incentives-duties of NCC Cadets-NCC camps- types - conduct.

Unit II PERSONALITY DEVELOPMENT

7

Personality Development -Factors-Self Awareness-Communication skills-Empathy-Critical and Creative thinking-Decision making.

Unit III MILITARY HISTORY

7

Military History-Biographies, Heroes Study of Battles of Indo-Pak War 1965, 1971-Operation Meghdoot and Kargil.

Unit IV SOCIAL SERVICE & INFANTRY BATTALION

7

Social Service Capsule-Basics-Rural development programmes-NGOs-Contribution of Youth - Swatch Bharat hAbhiyan, Social evils-Drug Abuse-Digital Awareness-Waste Management-Women Health and Sanitation-Organisation of Infantry, characteristics

Unit V HEALTH AND HYGIENE

7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training - Adventure

TOTAL: 35 PERIODS





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OUTCOMES

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

- Understand the basic organization of NCC and roles, responsibilities of cadets for the smooth functioning of all camps
- Develop the cadets personality and to think divergently to break functional fixedness
- Identify the Leadership traits of military heroes and learn about their organization
- Understand the concept and important of Social service and evolution of infantry battalion
- Practice healthy practices to improve the personal sanitation and hygiene and get into the adventurous activities
- Execute drill procedures effectively while maintaining military etiquette, discipline, and coordination during parades.

TEXT BOOKS

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.
3. ANO Handbook

REFERENCES

1. Grooming tomorrow's Leaders, published by DG, NCC.
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E - RESOURCES

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2. <https://www.indiancc.mygov.in>
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

LIST OF DRILLS

(Common to All UG Programme NCC Students)

1. Foot Drill
2. Rifle Drill
3. Ceremonial Drill
4. Social Service and Community Development

TOTAL = 10 PERIODS

Mapping of Cos-Pos& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	2	-	3	2	2	1	-	-
2	-	2	-	-	-	2	-	2	3	3	2	-	-
3	2	2	-	-	-	3	-	3	3	2	3	-	-
4	-	2	2	-	-	3	3	3	2	2	2	-	-
5	2	2	-	-	-	3	3	2	2	1	2	-	-
6	2	2	3	-	-	2	-	2	3	2	2	-	-
Avg.	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-

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

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MANDATORY COURSE I

23MDC501

INTRODUCTION TO WOMEN AND GENDER STUDIES

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OBJECTIVES

- To introduce foundational concepts of sex, gender, masculinity, femininity, and socialization.
- To examine structural systems including patriarchy, essentialism, binaryism, power, and hierarchy.
- To study major theoretical frameworks of feminism
- To examine the history and evolution of global, national, and local women's movements.
- To analyze how gender is constructed and represented across language, popular visual media, and social media.

UNIT I CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS:

Global, National and Local Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

OUTCOMES

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

- Identify and articulate concepts of socialization, binaryism, essentialism, and hegemony in social structures.
- Differentiate among various feminist theories and explain their core ideological foundations.
- Illustrate the milestones of women's rights movements in Europe, America, and India.
- Deconstruct linguistic forms and literary narratives to expose implicit gender biases.
- Assess media representations of gender roles in advertising and alternative media critically.


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23MDC502

ELEMENTS OF LITERATURE

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OBJECTIVES

- To explain students aware of the finer sensibilities of human existence through art.
- To develop students' appreciation of different literature forms as modes of human expression.
- To enhance reading, critical thinking, discussion, and writing skills through literary studies.
- To familiarize students with the essential elements, modes, and patterns of fiction and narrative perspective.
- To explore the representational, theatrical, and rhetorical elements of drama and poetry.

UNIT I RELEVANCE OF LITERATURE

Enhances Reading, thinking, discussing and writing skills. Develops finer sensibility for better human relationship. Increases understanding of the problem of humanity without bias. Providing space to reconcile and get a cathartic effect.

UNIT II ELEMENTS OF FICTION

Fiction, fact and literary truth, Fictional modes and patterns. Plot character and perspective.

UNIT III ELEMENTS OF POETRY

Emotions and imaginations. Figurative language. (Simile, metaphor, conceit, symbol, pun and irony). Personification and animation. Rhetoric and trend

UNIT IV ELEMENTS OF DRAMA

Drama as representational art, Content mode and elements, Theatrical performance, Drama as narration, mediation and persuasion, Features of tragedy, comedy and satire.

READINGS:

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Univ Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L. Styan, Literary Licensing, 2011.

OUTCOMES

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

- Demonstrate enhanced reading, thinking, and writing skills by engaging with literary texts.
- Develop finer interpersonal sensibilities and an unbiased understanding of human issues.
- Experience catharsis and emotional reconciliation through literary analysis.
- Identify key figurative devices (metaphor, simile, irony, conceit) and emotional dimensions in poetry.
- Analyze dramatic performance, features of tragedy, comedy, satire, and narrative structures.

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23MDC503

FILM APPRECIATION

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OBJECTIVES

- To introduce the development of film as an art and entertainment form.
- To explore the century-long evolution of film language, movement, and form.
- To instruct students on how to read a film text and appreciate its structural nuances.
- To examine technical components including equipment, screenplays, roles, and the filmmaking process.
- To guide students in studying film theory, criticism, and visual storytelling joyfully.

Theme - A: The Component of Films

- A-1: The material and equipment
- A-2: The story, screenplay and script
- A-3: The actors, crew members, and the director
- A-4: The process of film making... structure of a film

Theme - B: Evolution of Film Language

- B-1: Film language, form, movement etc.
- B-2: Early cinema... silent film (Particularly French)
- B-3: The emergence of feature films: Birth of a Nation
- B-4: Talkies

Theme - C: Film Theories and Criticism/Appreciation

Theme - D: Development of Films

- D-1: Representative Soviet films
- D-2: Representative Japanese films
- D-3: Representative Italian films
- D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

- E-1: The early era
- E-2: The important films made by the directors
- E-3: The regional films
- E-4: The documentaries in India

READING: A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

OUTCOMES

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

- Explain the roles of materials, crew members, screenplays, and directors in film production.
- Trace the historical transition from silent cinema and early French films to talkies and feature films.
- Apply visual and auditory cinematic language to "read" films as complex texts.
- Evaluate film theories and engage in critical film appreciation.
- Demonstrate an understanding of storytelling structure and narrative techniques in modern cinema.

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23MDC504

DISASTER RISK REDUCTION AND MANAGEMENT

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COURSE OBJECTIVE

- To impart knowledge on core concepts of hazards, vulnerability, resilience, and disaster risks.
- To familiarize students with international frameworks (Sendai Framework) and community-based risk reduction strategies.
- To explain the legislative, policy, and institutional frameworks governing disaster management in India.
- To introduce tools, technology, and early warning systems used in preparedness and damage assessment.
- To build practical response skills using case studies, field work, and mock drills.

UNIT I: HAZARDS, VULNERABILITY AND DISASTER RISKS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India

UNIT II DISASTER RISK REDUCTION (DRR)

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)





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UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyze the potential impacts and actions in the contest of disasters-Landslide Hazard: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill

OUTCOMES

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

- Categorize natural, human-induced, and climate-related disasters and assess India's vulnerability profile.
- Formulate disaster risk reduction measures using structural, non-structural, and indigenous methods.
- Understand institutional roles (NDMA, SDMA, DDMA) and legal provisions under the Disaster Management Act (2005).
- Apply GIS, information technology, and standard operating procedures for risk assessment and relief planning.
- Perform damage assessments and participate in mock drills, practical response plans, and field interventions.


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23MDC505

CONSTITUTION OF INDIA

L T P C

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OBJECTIVES

- To understand the meaning of the Constitution law and Constitutionalism.
- To realize the fundamental rights.
- To understand the execution powers of union and states.
- To be aware of the Constitutional powers.
- To acquaint with other Constitutional functionaries.

UNIT I INTRODUCTION

Meaning of the Constitution law and constitutionalism - Historical perspective of the Constitution of India - Preamble - Salient features and characteristics of the Constitution of India - Citizenship.

UNIT II FUNDAMENTAL RIGHTS

Scheme of the fundamental rights - The scheme of the fundamental duties and its legal status - The directive principles of state policy - Its importance and implementation.

UNIT III UNION AND STATE EXECUTIVE

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary form of Government in India - The Constitution powers and status of the President of India - Governor - Appointment, powers and functions.

UNIT IV CONSTITUTIONAL POWERS

Amendment of the Constitutional powers and procedure - The historical perspectives of the Constitutional amendments in India - Emergency provisions: National emergency, President rule, financial emergency.

UNIT V OTHER CONSTITUTIONAL FUNCTIONARIES

Election Commission of India: Organization, powers and functions, Union Public Service Commission, State Public Service Commission - Local Self Government.

OUTCOMES

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

- Understand the salient features and characteristics of the Constitution of India.
- Analyze the scheme of the fundamental rights and duties.
- Evaluate in detail the powers between the Union and the States.
- Know the concept of Constitutional powers.
- Recognize other Constitutional functionaries.


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MANDATORY COURSES II

23MDC601

WELL-BEING WITH TRADITIONAL PRACTICES-YOGA,
AYURVEDA AND SIDDH

L T P C

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OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handbill every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT I HEALTH AND ITS IMPORTANCE

Definition - Importance of maintaining health - More importance on prevention than treatment
Ten types of health one has to maintain - Physical health - Mental health - Social health -
Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health -
Environmental health - Occupational/Professional health

UNIT II DIET

Role of diet in maintaining health - energy one needs to keep active throughout the day -
nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to
prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a
healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis –
hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart
diseases - keeps the teeth and bones strong Balanced Diet and its 7 Components -
Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food
additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI
- different steps to maintain optimal BM

Common cooking mistakes Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as
a soft therapy. Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of
Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) -
basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social
life.





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Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Panchcheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life - Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement. Sleep - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunity.

UNIT V YOGA

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

OUTCOMES

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

- Identify and explain the ten types of health, including physical, mental, emotional, spiritual, and environmental health.
- Analyze the role of a balanced diet and its 7 components in preventing lifestyle disorders like diabetes, hypertension, and arthritis.
- Understand the principles of Siddha and Ayurveda systems, including the Five Element Theory, Tri-Dosha Theory, and daily/seasonal regimens (Dinacharya/Ritucharya).
- Apply stress management techniques, sleep hygiene practices, and emotion-regulation strategies to enhance mental wellness.
- Demonstrate basic yogasanas and understand the Eight Limbs of Yoga for health disorder prevention and cure.


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23MDC602

HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA

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OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health also.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handle every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT I CONCEPTS AND PERSPECTIVES

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

Introduction to the works of D.D. Kosambi, Dharmapal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

UNIT V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

Science and Technology In A Post-Independent India

Science, Technology and Development discourse Shaping of the Science and Technology Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology.

OUTCOMES

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

- Explain the concepts, perspectives, and significance of history, science, and technology in India.
- Examine the contributions of major historians to the historiography of science and technology in India.
- Analyze the development of science and technology in Ancient and Medieval India and their societal contributions.
- Analyze the influence of colonial rule on scientific progress and institutional development in India.
- Evaluate the advancements in science and technology in post-independent India and their impact on development and globalization.

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23MDC603 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY L T P C

3 0 0 0

OBJECTIVES

- Define key historical concepts like determinism, relativism, causation, and historical positivism as applied to science and technology.
- Recognize the historiographical contributions of scholars such as D.D. Kosambi, Dharampal, and Debiprasad Chattopadhyay.
- Explain the technological advancements made during ancient and medieval Indian history, including interactions with Arabic sciences.
- Evaluate the growth of techno-scientific institutions and the Indian response to Western science during the colonial period.
- Assess the social implications of emerging technologies and science policy decisions in post-independent and globalizing India.

COURSE TOPICS:

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. (9 lectures, 1 hour each)

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. (5 lectures)

(Refs: Adam Smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. (2 lectures)

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) (5 lectures)

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. (6 lectures)

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. (3 lectures)

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society.

Future directions. (4 lectures)

(Refs: Nandkishore Acharya, David Dixon, Lewis Mumford)

Conclusion (2 lectures)

OUTCOMES

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

- Understand the core considerations required for a humane society and achieving harmony across self, society, and nature.
- Compare the theoretical foundations and historical implementations of free-market capitalism, imperialism, and communism.
- Analyze the relation between human desires, empowerment, satisfaction, and the mechanisms of a welfare state.
- Apply Gandhian economic and political thought (Swaraj, decentralized polity) to contemporary societal and environmental challenges.
- Evaluate future directions for society by considering technology as a driver and education.

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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MDC604

STATE, NATION BUILDING AND POLITICS IN INDIA

L T P C

3 0 0 0

OBJECTIVES

- To provide an understanding of the state, its main organs (Executive, Legislature, Judiciary), separation of powers, and the concept of sovereignty.
- To acquaint students with the legacies of the national movement and constitutional development in India.
- To explain the reasons for adopting a Parliamentary-federal system and the broad philosophy of the Constitution of India.
- To examine the changing nature of the Indian political system, new social movements, and challenges to nation-building.
- To discuss issues concerning national integration and nation-building with the aim of developing a future vision for better governance.

TOPICS

Understanding the need and role of State and politics. Development of Nation-State, sovereignty, sovereignty in a globalized world. 183 Organs of State – Executive, Legislature, Judiciary. Separation of powers forms of government unitary-federal, Presidential-Parliamentary, and The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies.

Constitution making and the Constitution of India.

Goals, objective and philosophy. Why a federal system? National integration and nation-building

Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?

OUTCOMES

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

- Understand the theoretical aspects of the state, its organs, operationalization, and sovereignty in a globalized world.
- Explain the historical background, philosophy, goals, and objectives behind the founding of the Indian Constitution.
- Analyze the rationale behind adopting a federal-parliamentary system and the broad streams of national integration.
- Identify major challenges to nation-building, social movements, and institutional difficulties within the democratic setup.
- Devise perspectives for active participation in the system to improve governance and delivery for the common citizen.

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23MDC605

INDUSTRIAL SAFETY

L T P C

3 0 0 0

OBJECTIVES

- To understand the introduction and basic terminologies of safety.
- To enable the students to learn about the important statutory regulations and standards.
- To enable students to conduct and participate in various safety activities in the industry.
- To have knowledge about workplace exposures and hazards.
- To assess various hazards and consequences through various risk assessment techniques

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators - Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998 - Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives - Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting posture and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- 217 Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

OUTCOMES

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

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.


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DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION - 2023

(Revision I)

(III - VII SEMESTERS)

MINOR DEGREE / HONOURS

INDUSTRIAL SAFETY ENGINEERING

CURRICULUM AND SYLLABI





MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
Year	Sem	Course Name	1	2	3	4	5	6	7	8	9	10	11	1	2
II	III	23MEIT01- Safety Management	3	1	1	-	-	-	-	-	-	-	1	2	2
II	IV	23MEIT02 - Industrial Safety, Health and Environment (SHE) Acts	3	-	2	-	-	2	-	-	-	-	1	-	2
III	V	23MEIT03 - Fire Engineering and Explosion Control	3	-	2	-	-	2	-	-	-	-	1	1	2
III	VI	23MEIE01 - Safety in Engineering Industry	3	-	2	-	-	2	-	2	-	-	1	-	2
IV	VI	23MEIP01 - Project Work	3	2	2	2	2	-	1	-	1	1	1	3	3



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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
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	60	40	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





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SEMESTER III

23MEIT01

SAFETY MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of safety management and safety regulations in industries.
- To teach students different safety techniques such as inspection, survey, sampling, and safety audit.
- To help students understand accident causes, investigation methods, and reporting procedures.
- To develop knowledge in monitoring safety performance using safety indicators.
- To create awareness about safety education, training, and the importance of a safety culture in workplaces.

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





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OUTCOMES

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

- Classify the modern safety concepts, safety management functions, and statutory safety provisions used in industries.
- Examine the procedures and components of safety audits to identify unsafe acts and unsafe conditions in the workplace.
- Analyze and compare accident causes using accident investigation methods and accident causation theories.
- Analyze safety performance indicators such as accident rate, incident rate, and safety "T" score.
- Categorize safety training methods and safety promotion activities used to develop a positive safety culture.

TEXT BOOKS

1. Philip R. Harris., "Industrial Safety and Health for Small Businesses", Prentice Hall Inc, Third Edition, 2020.
2. National Safety Council, "Accident Prevention Manual for Business & Industry: Engineering & Technology", Fifteenth Edition, 2022.
3. C. Ray Asfahl, David W. Rieske, "Industrial Safety and Health Management", Pearson, Seventh Edition, 2019

REFERENCES

1. Charles D. Reese, "Occupational Health and Safety Management: A Practical Approach", CRC Press, Third Edition, 2021.
2. Frank Crawley, Ian Sutton, "Loss Prevention in the Process Industries: Volume 1 - Fundamental Principles and Methods", Elsevier, Third Edition, 2022.
3. Gupta, R.S., "Handbook of Safety Management: A Practical Approach" CRC Press, Second Edition, 2020.

E-RESOURCES

1. <https://www.youtube.com/watch?v=M0ftV9nPJY> – (Theories of accident causation)
2. [https://www.safetyproresources.com/blog/9-steps-for_accident-investigations-\(OSHA-inspection-process\)](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	PSO1	PSO2
1	3	1	1	-	-	-	-	-	-	-	1	2	2
2	3	1	1	-	-	-	-	-	-	-	1	2	2
3	3	1	1	-	-	-	-	-	-	-	1	2	2
4	3	1	1	-	-	-	-	-	-	-	1	2	2
5	3	1	1	-	-	-	-	-	-	-	1	2	2
Avg.	3	1	1	-	-	-	-	-	-	-	1	2	2

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

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SEMESTER IV

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

OBJECTIVES

- To introduce students to the important provisions of the Factories Act 1948 and Tamil Nadu Factories Rules related to industrial health, safety, and welfare.
- To provide knowledge about environmental protection laws and rules for controlling pollution and ensuring environmental safety.
- To explain the regulations related to the manufacture, storage, and handling of hazardous chemicals in industries.
- To familiarize students with various national industrial safety acts and rules applicable to different sectors.
- To create awareness about international occupational health and safety acts and standards used for improving workplace safety.

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





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OUTCOMES

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

- Classify the important provisions of the Factories Act 1948 and Tamil Nadu Factories Rules related to health, safety, and welfare.
- Examine the main provisions of the Environment Act 1986 and environmental protection rules.
- Categorize the duties and responsibilities under the Manufacture, Storage and Import of Hazardous Chemical Rules 1989.
- Compare different industrial safety acts such as the Boiler Act, Mines Act, and Electricity Act.
- Analyze international safety standards and acts used for occupational health and safety.

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., 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	PSO1	PSO2
1	3	-	2	-	-	2	-	-	-	-	1	-	2
2	3	-	2	-	-	2	-	-	-	-	1	-	2
3	3	-	2	-	-	2	-	-	-	-	1	-	2
4	3	-	2	-	-	2	-	-	-	-	1	-	2
5	3	-	2	-	-	2	-	-	-	-	1	-	2
Avg.	3	-	2	-	-	2	-	-	-	-	1	-	2

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SEMESTER V

23MEIT03

FIRE ENGINEERING AND EXPLOSION CONTROL

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic principles of fire, combustion, and explosion in solids, liquids, and gases.
- To provide knowledge about fire prevention methods, fire protection systems, and different types of fire extinguishing techniques.
- To familiarize students with industrial fire protection systems such as sprinkler systems, hydrants, detection, and suppression systems.
- To introduce the basic principles of fire safety in buildings, including fire-resistant materials and safe evacuation design.
- To develop awareness about explosion hazards and protection systems used in industries handling hazardous materials.

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 - CO₂ 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 (CO₂) and halons - hazards in LPG, ammonia (NH₃), sulphur dioxide (SO₃), chlorine (Cl₂) etc.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Examine the fire properties of solid, liquid and gases and understand the principle of fire and combustion theory.
- Compare the fire prevention and fire protection systems.
- Categorize the sources of ignition, classes of fires and their extinguishing medium
- Apply 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, Ninth 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

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1	3	-	2	-	-	2	-	-	-	-	1	1	2
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3	3	-	2	-	-	2	-	-	-	-	1	1	2
4	3	-	2	-	-	2	-	-	-	-	1	1	2
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Avg.	3	-	2	-	-	2	-	-	-	-	1	1	2

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SEMESTER VI

23MEPS301

SAFETY IN ENGINEERING INDUSTRY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic safety principles and hazards associated with metal working and wood working machines.
- To provide knowledge about machine guarding methods and protective devices used to prevent accidents.
- To familiarize students with safety practices and protective measures in welding and gas cutting operations.
- To present safety procedures involved in cold working and hot working processes in metal industries.
- To develop understanding of safety measures in finishing, inspection, testing operations, and environmental protection in engineering industries.
- To train students to measure, identify, and evaluate workplace and environmental safety hazards using appropriate instruments and safety equipment.

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.





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UNIT V 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 CO₂, CO, SO₂ and O₂ 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 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.





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OUTCOMES

Upon completion of the course, Students will be able to

- Classify the safety rules, hazards, and inspection procedures related to metal working and wood working machines.
- Analyze different machine guarding techniques and point-of-operation protective devices used to control machine hazards.
- Categorize the hazards and safety precautions involved in welding, gas cutting, and handling of industrial gases.
- Examine the safety practices in cold working and hot working processes such as power presses, forging, rolling mills, and foundry operations.
- Compare the safety measures used in finishing, inspection, and testing operations including heat treatment, pressure testing, and radiography.
- Apply safety measurement techniques, use safety instruments, and identify PPE and fire-fighting equipment to evaluate workplace safety conditions in engineering industries.

TEXT BOOKS

1. Frank R Spellman, "Safety Engineering principles and practices", Rowman & Littlefield, Third Edition, 2018.
2. C Ray Ashaff, 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 AI-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-\(Inspection and Quality Control In Manufacturing\)](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	PSO1	PSO2
1	3	-	2	-	-	2	-	-	-	-	1	-	2
2	3	-	2	-	-	2	-	-	-	-	1	-	2
3	3	-	2	-	-	2	-	-	-	-	1	-	2
4	3	-	2	-	-	2	-	-	-	-	1	-	2
5	3	-	2	-	-	2	-	-	-	-	1	-	2
6	3	-	2	-	-	2	-	2	-	-	1	-	2
Avg.	3	-	2	-	-	2	-	2	-	-	1	-	2

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


Chairman - BoS





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23METP01

SEMESTER VII PROJECT WORK

L T P C

0 0 12 6

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work shall be assigned to a single student.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester is 6.
- There shall be three reviews (Zeroth Review, (Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation


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DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION - 2023

(Revision I)

(III - VII SEMESTERS)

MINOR DEGREE/ HONOURS

3D PRINTING

CURRICULUM AND SYLLABI





MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
Year	Sem	Course Name	PO												
			1	2	3	4	5	6	7	8	9	10	11	1	2
II	III	23METT01 - 3D Printing Machines and Systems	3	2	2	-	-	-	-	-	-	-	-	2	2
II	IV	23METT02 - Rapid Tooling and Industrial Applications	2	3	2	-	-	-	-	-	-	-	-	2	2
III	V	23METT03 - Print Operations Management	3	2	-	-	-	-	-	-	-	-	-	2	1
III	VI	23METE01 - 3D Printing Design Process	3	2	-	-	-	2	-	2	-	-	1	2	2
IV	VI	23METP01 - Project Work	3	2	2	2	2	-	1	-	1	1	1	3	3



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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	60	40	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





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SEMESTER III

23METT01

3D PRINTING MACHINES AND SYSTEMS

LT P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals and evolution of 3D printing and rapid prototyping processes.
- To provide knowledge of various rapid prototyping systems and their working principles.
- To familiarize students with the technical capabilities and practical applications of rapid prototyping technology in engineering and manufacturing.
- To explain indirect and direct methods for rapid tool production using different materials and processes.
- To develop understanding of rapid tooling process optimization, error minimization, and part orientation strategies for accurate prototype production.

UNIT I INTRODUCTION TO 3D PRINTING MACHINES & PROCESSES 9

Introduction to 3D Printing Machines: Historical Perspectives, Rapid Prototyping - An Integral Part of TimeCompression 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, Selective Laser 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 Systems Thermo Jet Printer, 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 RapidTool 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





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OUTCOMES

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

- Classify 3D printing machines and rapid prototyping processes based on their working principles and applications.
- Compare different rapid prototyping systems such as SLA, FDM, SLS, and laminated object manufacturing for technical suitability.
- Categorize applications of rapid prototyping technology into functional models, investment patterns, art models, and engineering analysis models.
- Examine indirect and direct rapid tooling methods to select the appropriate technique for tool production.
- Analyze factors influencing rapid tooling accuracy, process errors, and part orientation to optimize prototype and tool quality.

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	PSO1	PSO2
1	3	2	2	-	-	-	-	-	-	-	-	2	2
2	3	2	2	-	-	-	-	-	-	-	-	2	2
3	3	2	2	-	-	-	-	-	-	-	-	2	2
4	3	2	2	-	-	-	-	-	-	-	-	2	2
5	3	2	2	-	-	-	-	-	-	-	-	2	2
Avg.	3	2	2	-	-	-	-	-	-	-	-	2	2

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


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SEMESTER IV

23METT02

RAPID TOOLING AND INDUSTRIAL APPLICATIONS

LT P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of Additive Manufacturing (AM), layer-based technology, and machine classifications.
- To provide knowledge of various layer manufacturing processes including polymerization, sintering, melting, extrusion, and binder-based 3D printing.
- To familiarize students with industrial applications of AM in automotive, aerospace, consumer goods, medical, and mold-making sectors.
- To explain design strategies in AM, including complex geometries, multi-material parts, and customization approaches.
- To develop understanding of materials, engineering design rules, tolerances, and quality management aspects for additive manufacturing.

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 Isotropic 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





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OUTCOMES

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

- Classify additive manufacturing processes and machine types based on their operating principles.
- Compare different layer manufacturing techniques such as polymerization, sintering, melting, and extrusion for various applications.
- Categorize industrial applications of AM across automotive, aerospace, consumer goods, medical, and tooling industries.
- Examine design strategies in AM for complex geometries, multi-material parts, and functional integration.
- Analyze material properties, design rules, and quality factors to optimize additive manufacturing processes.

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 Technologies and Applications of RapidPrototyping & Rapid Tooling, Springer, 2019.
3. Wanlong Wang, Henry W. Stoll and James G. Conley, Rapid Tooling Guidelines for SandCasting, 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	PSO1	PSO2
1	2	3	2	-	-	-	-	-	-	-	-	2	2
2	2	3	2	-	-	-	-	-	-	-	-	2	2
3	2	3	2	-	-	-	-	-	-	-	-	2	2
4	2	3	2	-	-	-	-	-	-	-	-	2	2
5	2	3	2	-	-	-	-	-	-	-	-	2	2
Avg .	2	3	2	-	-	-	-	-	-	-	-	2	2

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

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SEMESTER V

23METT03

PRINT OPERATIONS MANAGEMENT

LT P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of industrial organization, facility layout, human factors, ergonomics, and worker safety.
- To provide knowledge of production sequencing techniques, Gantt charts, and algorithms for job-machine scheduling.
- To familiarize students with inventory management concepts, classification, EOQ, materials handling, and warehousing.
- To explain materials and capacity requirement planning, including MRP, CRP, aggregate planning, master scheduling, and ERP systems.
- To develop understanding of network models, PERT/CPM techniques, resource allocation, and replacement analysis with practical applications.

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





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OUTCOMES

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

- Classify different types of organizational structures, facility layouts, and human factor considerations in industries.
- Analyze sequencing problems and apply algorithms for processing multiple jobs on machines.
- Categorize inventory types, calculate EOQ, and determine appropriate warehousing and materials handling strategies.
- Examine materials and capacity requirement planning using MRP, CRP, aggregate planning, and ERP systems.
- Compare network models like PERT and CPM for resource allocation, scheduling, and replacement analysis in production systems.

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", New Age 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	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	2	1
2	3	2	-	-	-	-	-	-	-	-	-	2	1
3	3	2	-	-	-	-	-	-	-	-	-	2	1
4	3	2	-	-	-	-	-	-	-	-	-	2	1
5	3	2	-	-	-	-	-	-	-	-	-	2	1
Avg.	3	2	-	-	-	-	-	-	-	-	-	2	1

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


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SEMESTER VI

23METE01

3D PRINTING DESIGN PROCESS
(Lab Embedded Theory Course)

L T P C
3 0 2 4

OBJECTIVES

- To introduce students to the fundamentals and development of 3D printing technology, including distinctions from CNC machining and related technologies.
- To provide knowledge of the 3D printing process chain, photo polymerization processes, and material handling considerations.
- To familiarize students with powder bed fusion processes, extrusion-based systems, and their materials, capabilities, and limitations.
- To explain design principles for 3D printing, guidelines for process selection, and software issues related to CAD and STL file preparation.
- To develop understanding of medical applications, multi-material 3D printing, and emerging trends in additive manufacturing.
- To train students to 3D print functional mechanical components using appropriate designs and materials.

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.

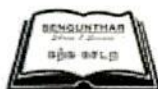
Introduction to Photo polymerization Processes: Photo polymerization Materials, Reaction Rates, Vector Scan SL, SL Resin Curing Process, SL Scan Patterns, Vector Scan Micro stereo lithography, Mask Projection Photo polymerization technologies and processes.

UNIT III POWDER BED FUSION PROCESSES & EXTRUSION-BASED SYSTEMS

9

Powder Bed Fusion Processes: Introduction, SLS Process Description, Powder Handling, Approaches to Metal and Ceramic Part Creation, Variants of Powder Bed Fusion Processes, Process Parameters for 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.





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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

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

- Classify 3D printing technologies, processes, and systems based on principles and applications.
- Analyze the 3D printing process chain and photo polymerization methods for effective material handling and process planning.
- Categorize powder bed fusion and extrusion-based systems, including their materials, capabilities, and limitations.
- Examine design guidelines, process selection criteria, and software requirements for efficient 3D printing.
- Compare medical and multi-material 3D printing applications and evaluate emerging trends in additive manufacturing.
- Classify, fabricate, and assess 3D-printed mechanical components for their functionality and performance.





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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	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	1	2	2
2	3	2	-	-	-	-	-	-	-	-	1	2	2
3	3	2	-	-	-	-	-	-	-	-	1	2	2
4	3	2	-	-	-	-	-	-	-	-	1	2	2
5	3	2	-	-	-	-	-	-	-	-	1	2	2
6	3	2	-	-	-	2	-	2	-	-	1	2	2
Avg.	3	2	-	-	-	2	-	2	-	-	1	2	2

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


Chairman - BoS





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23METP01

SEMESTER VII PROJECT WORK

L T P C
0 0 12 6

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work shall be assigned to a single student.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester is 6.
- There shall be three reviews (Zeroth Review, (Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, “-” - No Correlation


Chairman - BoS





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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

