Sri Krishna College of Engineering and Technology

An Autonomous Institution, Affiliated to Anna University Coimbatore – 641 008



REGULATION 2020 CURRICULUM AND SYLLABI B.E. MECHANICAL ENGINEERING

[BATCH: 2021 – 2025]

DEPARTMENT OF MECHANICAL ENGINEERING

SRI KRISHNA COLLEGE OF ENGNEERING AND TECHNOLOGY

An Autonomous Institution Affiliated to Anna University Kuniamuthur, Coimbatore - 641 008

VISION AND MISSION OF THE DEPARTMENT

Vision

The department aspires to produce experts in Mechanical Engineering with moral values and desires to set up centers of excellence in innovative design and testing, composite materials, automation, automotive technology and green fuels.

Mission

To produce world class mechanical engineering graduates by promoting core technical competency blended with advanced computing skills, creative thinking and desire to upgrade continuously, so as to empower them to the expectation of the industries in our country and abroad and also to impart the interpersonal skills and make them realize the values of life.

Programme Outcomes (POs):-

At the time of their graduation students of Mechanical Engineering Programme should be in possession of the following Programme Outcomes

a.	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b.	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
С.	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d.	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e.	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f.	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g.	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h.	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i.	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j.	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k.	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary
l.	 environments. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Educational Objectives (PEOs):-

The following Programme Educational Objectives are designed based on the department mission

- PEO 1: Provide strong foundation in the science and engineering fundamentals necessary to formulate, solve and analyze real time mechanical engineering problems.
- PEO 2: Develop the ability to synthesize data and technical concepts for making decisions in an ethical manner considering the socio-economic scenario.
- PEO 3: Enable to work as part of teams on multidisciplinary projects with good communication and interpersonal skills in the emerging areas like automation, composite materials, automotive technology, green fuels etc.,
- PEO 4: Prepare for successful careers in industry that meet the needs of Indian and multinational companies and to inculcate the qualities of continuous learning and entrepreneurial skills.

Programme Specific Outcomes (PSO's):-

At the end of the Programme, Graduate shall have

	-
PSO 1	Design, develop and analyse the engineering components using advanced
	design softwares.
PSO 2	Ability to fabricate real time mechanical systems and test its worthiness.
PSO 3	Ability to apply the advancements in mechanical engineering to promote
	automation.

Mapping of PO's and PSO's to PEO's

Program Educatio Objectiv	onal				F	Pro	gramm	e Out	come	s					S	gram pecif tcom	ic
		а	b	С	d	e	e f	g	h	i	i	j	k	Ι	1	2	3
PEO	1	3	3	3	3		1						2		3	3	2
PEO	2	3	3	3	3		3	3	3						3	3	2
PEO	3	2	2	2	1	3	3 3	3		3	3	3	3	1	3	3	3
PEO 4	4	3	3	2	2	2	2	1	2	1	1	3	2	3	3	3	3
	3	Stro	Strongly agreed				Mode	rately	agree	d	1	Re	asona	ably a	greed		

B.E. MECHANICAL ENGINEERING REGULATION 2020 (Batch 2021-2025) CHOICE BASED CREDIT SYSTEM I – VIII SEMESTER CURRICULUM AND SYLLABI

SEM	ESTER I											
SL.	Course	Course	L/T/P	Contact	С	ο	Ext./Int.	Cat.				
No.	Code	Course		hrs./wk.	0	0		Cal.				
THE	THEORY CUM PRACTICAL											
1.	21MA101	Engineering Mathematics	2/1/2	5	4	-	50/50	BSC				
2.	21CH101	Engineering Chemistry	3/0/3	6	4.5	-	50/50	BSC				
3.	21EN101	Technical Communication Skills	2/0/2	4	3	-	50/50	HSMC				
4.	21CS111	Problem Solving using C Programming	3/0/2	5	4	-	50/50	ESC				
5.	21ME101	Engineering Drawing	1/0/3	4	2.5	-	50/50	ESC				
6.	21EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	-	50/50	ESC				
MAN	MANDATORY COURSE											
7.	21MC101	Induction Programme	3 W	/EEKS	0	-	0/100	MC				
		Total	14/1/1	4 29	22	-	700					

SEM	ESTER II							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	ο	Ext./Int.	Cat.
THE	ORY		1				1	I
1.	21ME201	Engineering Mechanics	3/1/0	4	4	-	60/40	ESC
2.	21ME202	Manufacturing Technology I	3/0/0	3	3	-	60/40	ESC
3.	21GE201	Universal Human Values	3/0/0	3	3	-	60/40	HSMC
THE	ORY CUM P	PRACTICAL						
4.	21MA201	Engineering Mathematics II	2/1/2	5	4	-	50/50	BSC
5.	21PH201	Applied Physics	3/0/3	6	4.5	-	50/50	BSC
PRA	CTICAL							
6.	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	-	40/60	ESC
7.	21CS211	Python for Engineers Laboratory	1/0/3	4	2.5	-	40/60	ESC
MAN	DATORY C	OURSE						
8.	21MC102	Environmental Sciences	2/0/0	2	0	-	0/100	MC
		Total	17/2/11	30	22.5	-	800	

SEM	ESTER III							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	0	Ext./Int.	Cat.
THE	ORY			-				
1.	21ME301	Solid Mechanics	3/1/0	4	4	-	60/40	PCC
2.	21ME302	Engineering Thermodynamics	3/0/0	3	3	-	60/40	PCC
3.	21ME303	Fluid Mechanics and Machinery	3/0/0	3	3	-	60/40	PCC
4.	21ME304	Industrial Metallurgy	3/0/0	3	3	-	60/40	ESC
5.	21MA301	Engineering Mathematics	3/1/0	4	4	-	60/40	BSC
THE	ORY CUM P	RACTICAL						
6.	21ME305	Manufacturing Technology- II (with Lab)	3/0/2	5	4	-	50/50	PCC
PRA	CTICAL						·	
7.	21ME306	Fluid Mechanics and Strength of Materials Laboratory	0/0/3	3	1.5	-	40/60	PCC
MAN		OURSE						
8.	21MCZZZ	Mandatory Course-III	2/0/0	2	0	-	0/100	MC
		Total	20/2/5	27	22.5	-	800	

SEM	ESTER IV							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	0	Ext./Int.	Cat.
THE	ORY				1			
1.	21ME401	Automobile Engineering	3/0/0	3	3	-	60/40	PCC
2.	21ME402	Mechanics of Machines	3/1/0	4	4	-	60/40	PCC
3.	21ME403	Metrology and Instrumentation	3/0/0	3	3	-	60/40	PCC
4.	21ME404	Thermal Engineering	3/0/0	3	3	-	60/40	PCC
5.	21MA401	Probability and Numerical Methods	3/1/0	4	4	-	60/40	BSC
6.	21XXZZZ	Open Elective – I	3/0/0	3	3	-	60/40	OEC
PRA	CTICAL			1				
7.	21ME405	Computer Aided Machine Drawing	0/0/3	3	1.5	-	40/60	PCC
8.	21ME406	Metrology and Dynamics Laboratory	0/0/3	3	1.5	-	40/60	PCC
9.	21ME407	Thermal Engineering Laboratory	0/0/2	2	1	-	40/60	PCC
		Total	18/2/8	28	24	-	900	

SEM	ESTER V							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	0	Ext./Int.	Cat.
THE	ORY							
1.	21ME501	Design of Machine Elements	4/0/0	4	4	-	60/40	PCC
2.	21ME502	Applied Hydraulics and Pneumatics	3/0/0	3	3	-	60/40	PCC
3.	21ME013	Industry 4.0	3/0/0	3	3	-	60/40	EC
4.	21ME503	Heat and Mass Transfer	3/0/0	3	3	-	60/40	PCC
5.	21ME9ZZ	Professional Elective-I	3/0/0	3	3	-	60/40	PEC
6.	21XXZZZ	Open Elective – II	3/0/0	3	3	-	60/40	OEC
PRA	CTICAL							
7.	21ME504	CAD/CAM Laboratory	0/0/3	3	1.5	-	40/60	PCC
8.	21ME505	Heat Transfer Laboratory	0/0/2	2	1	-	40/60	PCC
MAN	IDATORY C	OURSE						
9.	21MCZZZ	Mandatory Course-IV	2/0/0	2	0	-	0/100	MC
		Total	21/0/5	26	21.5	-	900	

SEM	ESTER VI							
SL.	Course	Course	L/T/P	Contact	С	ο	Ext./Int.	Cat.
No.	Code	Course		hrs./wk.	C	0		Gal.
THE	ORY							
1.	21ME601	Design of Transmission Systems	3/0/0	3	3	-	60/40	PCC
2.	21ME602	Computational Mechanics	3/0/0	3	3	-	60/40	PCC
3.	21ME9ZZ	Professional Elective-II	3/0/0	3	3	-	60/40	PEC
4.	21ME9ZZ	Professional Elective-III	3/0/0	3	3	-	60/40	PEC
5.	21ME9ZZ	Professional Elective-IV	3/0/0	3	3	-	60/40	PEC
6.	21MEZZZ	Emerging Elective- I	3/0/0	3	3	-	60/40	EEC
PRA	CTICAL							
7.	21ME603	Simulation and Analysis Laboratory	0/0/3	3	1.5	-	40/60	PCC
PRO	JECT WORI	κ						
8.	21ME604	Design Thinking and Mini Project	0/0/3	3	1.5	-	40/60	PROJ
MAN	IDATORY C	OURSE						
9.	21MCZZZ	Mandatory Course-V	2/0/0	2	0	-	0/100	MC
		Total	20/0/6	26	21	-	900	

SEM	ESTER VII							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	ο	Ext./Int.	Cat.
THE	ORY							
1.	21ME701	Industrial Engineering and Operations Management	3/0/0	3	3	-	60/40	HSMC
2.	21ME702	Mechatronics	3/0/0	3	3	-	60/40	ESC
3.	21MEZZZ	Emerging Elective – II	3/0/0	3	3	-	60/40	EEC
4.	21ME9ZZ	Professional Elective-V	3/0/0	3	3	-	60/40	PEC
5.	21ME9ZZ	Professional Elective- VI	3/0/0	3	3	-	60/40	PEC
PRA	CTICAL							
6.	21ME703	Mechatronics Laboratory	0/0/3	3	1.5	-	40/60	ESC
PRO	JECT WOR	K						
7.	21ME704	Phase I – Project Work	0/0/2	2	1	-	40/60	PROJ
		Total	15/0/5	20	17.5	-	700	

SEM	SEMESTER VIII											
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	0	Ext./Int.	Cat.				
PRO	PROJECT WORK											
1.	21ME801	Phase II – Project Work	0/0/24	24	12	-	40/60	PROJ				
		Total	0/0/24	24	12	-	100					

EMP	EMPLOYABILITY ENHANCEMENT SKILLS										
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	С	0	Ext./Int.	Cat.			
1.	21MEE01	Industrial Practice (21 Days) / Publication in Journals (National/International) / IPR	-	-	2	-	-	EES			
		Total	-	-	2	-	-				

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SL.	Stream		1			/Seme				-	С	%
No.	Othealm				IV	V	VI	VII	VIII			
1	Humanities & Social Sciences Including Management (HSMC)	3	3	-	-	-	-	3	-		9	5.45
2	Basic Sciences (BSC)	8.5	8.5	4	4	-	-	-	-		25	15.15
3	Engineering Sciences (ESC)	10.5	11	3	-	-	-	4.5	-		29	17.58
4	Professional Core (PCC)	-	-	15.5	17	12.5	7.5	-	-		52.5	31.82
5	Professional Electives (PEC)	-	-	-	-	3	9	6	-		18	10.91
6	Open Electives (OEC) / Emerging Courses (EC)/ Emerging Elective Courses (EEC)	-	-	-	3	6	3	3	-		15	9.09
7	Project Work (PROJ)	-	-	-	-	-	1.5	1	12		14.5	8.79
8.	Employability Enhancement Skills (EES)	-	-	-	-	-	-	-	-	2	2	1.21
9.	Mandatory Course (MC)	-	-	-	-	-	-	-	-		0	0
	Total	22	22.5	22.5	24	21.5	21	17.5	12	2	165	100

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

S. No.	Course Work - Subject Area	AICTE Suggested Credits	AICTE model curriculum credits	SKCET Credits (165)			
1.	Humanities and Social Sciences (HS), including Management;	12*	6	9			
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	25*	30	25			
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	24*	27	29			
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required ;)	48*	50.5	52.5			
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	18*	18	18			
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	18*	12	15			
7.	Project Work, Seminar and/or Internship in Industry or elsewhere.	15*	15* 15				
8.	Employability Enhancement Skills	Non	2				
9.	Mandatory Courses (MC);	Non-credit					
	Total 160* 158.5 165						
*Min	or Variations is allowed as per need of the res	spective discip	lines				

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (9 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21EN101	Technical Communication Skills	2/0/2	4	3	HSMC
2.	21GE201	Universal Human Values	3/0/0	3	3	HSMC
3.	21ME701	Industrial Engineering and Operations Management	3/0/0	3	3	HSMC

BASIC SCIENCE COURSES (25 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21MA101	Engineering Mathematics I	2/1/2	5	4	BSC
2.	21CH101	Engineering Chemistry	3/0/3	6	4.5	BSC
3.	21MA201	Engineering Mathematics II	2/1/2	5	4	BSC
4.	21PH201	Applied Physics	3/0/3	6	4.5	BSC
5.	21MA301	Engineering Mathematics III	3/1/0	4	4	BSC
6.	21MA401	Probability and Numerical Methods	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (29 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21CS111	Problem Solving using C Programming	3/0/2	5	4	ESC
2.	21ME101	Engineering Drawing	1/0/3	4	2.5	ESC
3.	21EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	ESC
4.	21ME201	Engineering Mechanics	3/1/0	4	4	ESC
5.	21ME202	Manufacturing Technology I	3/0/0	3	3	ESC
6.	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	ESC
7.	21CS211	Python for Engineers Laboratory	1/0/3	4	2.5	ESC
8.	21ME304	Industrial Metallurgy	3/0/0	3	3	ESC
9.	21ME702	Mechatronics	3/0/0	3	3	ESC
10.	21ME703	Mechatronics Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE COURSES (52.5 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21ME301	Solid Mechanics	3/1/0	4	4	PCC
2.	21ME302	Engineering Thermodynamics	3/0/0	3	3	PCC
3.	21ME303	Fluid Mechanics and Machinery	3/0/0	3	3	PCC
4.	21ME305	Manufacturing Technology- II (with Lab)	3/0/2	5	4	PCC
5.	21ME306	Fluid Mechanics and Strength of Materials Laboratory	0/0/3	3	1.5	PCC
6.	21ME401	Automobile Engineering	3/0/0	3	3	PCC

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7.	21ME402	Mechanics of Machines	3/1/0	4	4	PCC
8.	21ME403	Metrology and Instrumentation	3/0/0	3	3	PCC
9.	21ME404	Thermal Engineering	3/0/0	3	3	PCC
10.	21ME405	Computer Aided Machine Drawing	0/0/3	3	1.5	PCC
11	21ME406	Metrology and Dynamics Laboratory	0/0/3	3	1.5	PCC
12.	21ME407	Thermal Engineering Laboratory	0/0/2	2	1	PCC
13.	21ME501	Design of Machine Elements	4/0/0	4	4	PCC
14.	21ME502	Applied Hydraulics and Pneumatics	3/0/0	3	3	PCC
15.	21ME503	Heat and Mass Transfer	3/0/0	3	3	PCC
16.	21ME504	CAD/CAM Laboratory	0/0/3	3	1.5	PCC
17.	21ME505	Heat Transfer Laboratory	0/0/2	2	1	PCC
18.	21ME601	Design of Transmission Systems	3/0/0	3	3	PCC
19.	21ME602	Computational Mechanics	3/0/0	3	3	PCC
20.	21ME603	Simulation and Analysis Laboratory	0/0/3	3	1.5	PCC

PROFESSIONAL ELECTIVE COURSES (18 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
		ELECTIVE STREAM I – ENGINEER	ING DESIG	SN		
1.	21ME901	Product Design and Development	3/0/0	3	3	PEC
2.	21ME902	Tool and Die Design	3/0/0	3	3	PEC
3.	21ME903	Fundamentals of Fracture Mechanics	3/0/0	3	3	PEC
4.	21ME904	Design for Manufacturing and Assembly	3/0/0	3	3	PEC
5.	21ME905	Optimization Techniques in Engineering Design	3/0/0	3	3	PEC
6.	21ME906	Industrial Robotics	3/0/0	3	3	PEC
7.	21ME907	Engineering Failure Analysis	3/0/0	3	3	PEC
8.	21ME908	MEMS/NEMS	3/0/0	3	3	PEC
9.	21ME909	Surface Engineering	3/0/0	3	3	PEC
	1	ELECTIVE STREAM II - THERMAL E		NG		
1.	21ME910	Non-Conventional Energy Sources	3/0/0	3	3	PEC
2.	21ME911	Refrigeration and Air Conditioning	3/0/0	3	3	PEC
3.	21ME912	Alternate Fuels and E-Vehicle Technology	3/0/0	3	3	PEC
4.	21ME913	Turbo Machines	3/0/0	3	3	PEC
5.	21ME914	Gas Dynamics and Jet Propulsion	3/0/0	3	3	PEC
6.	21ME915	Power Plant Engineering	3/0/0	3	3	PEC
7.	21ME916	Energy Conservation and Management	3/0/0	3	3	PEC
8.	21ME917	Internal Combustion Engines	3/0/0	3	3	PEC
9.	21ME918	Cryogenic Engineering	3/0/0	3	3	PEC

	ELECTI\	/E STREAM III - MANUFACTURING /INI	DUSTRIAL	ENGINEER	ING	
1.	21ME919	Composite Materials, Processing and Applications	3/0/0	3	3	PEC
2.	21ME920	Industrial Layout, Ergonomics and Safety Engineering	3/0/0	3	3	PEC
3.	21ME921	Additive Manufacturing	3/0/0	3	3	PEC
4.	21ME922	Lean Six Sigma	3/0/0	3	3	PEC
5.	21ME923	Theory of Metal Cutting	3/0/0	3	3	PEC
6.	21ME924	Entrepreneurship Development and Managerial Skills	3/0/0	3	3	PEC
7.	21ME925	Special Manufacturing Processes	3/0/0	3	3	PEC
8.	21ME926	Engineering Management and Financial Accounting	3/0/0	3	3	PEC
9.	21ME927	Advanced Casting and Welding Processes	3/0/0	3	3	PEC

OPEN ELECTIVE COURSES (Offered to Other Branches)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.			
1.	21ME001	Industrial Safety	3/0/0	3	3	OEC			
2.	21ME002	Fundamentals of MEMS/NEMS	3/0/0	3	3	OEC			
3.	21ME003	Total Quality Management	3/0/0	3	3	OEC			
4.	21ME004	Product Development	3/0/0	3	3	OEC			
5.	21ME005	Fundamentals of Additive Manufacturing	3/0/0	3	3	OEC			
6.	21ME006	Technology Management	3/0/0	3	3	OEC			

EMERGING ELECTIVE COURSES

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21ME007	Applied Soft Computing Techniques	3/0/0	3	3	EEC
2.	21ME008	Internet of Things for Mechanical Engineers	3/0/0	3	3	EEC
3.	21ME009	Data Analytics for Mechanical Engineers	3/0/0	3	3	EEC
4.	21ME010	Expert System and Machine Learning	3/0/0	3	3	EEC
5.	21ME011	Fuel Cells	3/0/0	3	3	EEC
6.	21ME012	Product Life Cycle Management	3/0/0	3	3	EEC

PROJECT WORK (14.5 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21ME604	Design Thinking and Mini Project	0/0/3	3	1.5	PROJ
2.	21ME704	Phase I – Project Work	0/0/2	2	1	PROJ
3.	21ME801	Phase II – Project Work	0/0/24	24	12	PROJ

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	С	Cat.
1.	21MEE01	Industrial Practice (21 Days) and Publication in Journals (National/International) / IPR	-	-	2	EES

MANDATORY COURSES (Non Credits)

SL. No.	Course Code	Course Title L/T/P Contact hrs./Wk.		С	Cat.	
1.	21MC101	Induction Program	3 V	/EEKS	0	MC
2.	21MC102	Environmental Sciences	2/0/0	2	0	MC
3.	21MC103	Soft Skills	2/0/0	2	0	MC
4.	21MC104	Management Organizational Behavior	2/0/0	2	0	МС
5.	21MC105	General Aptitude	2/0/0	2	0	MC
6.	21MC106	Life Skills and Ethics	2/0/0	2	0	MC
7.	21MC107	Stress Management	2/0/0	2	0	MC
8.	21MC108	Constitution of India	2/0/0	2	0	MC
9.	21MC109	Essence of Indian Traditional Knowledge	2/0/0	2	0	МС
10.	21MC110	Biology	2/0/0	2	0	MC

* Courses conducted either by internal faculty or through MOOCs

ONE CREDIT COURSES (Additional Credits) / VALUE ADDED COURSES

S.No	Course Code	Course Title	Credits
1.	21VA500	Certification in Creo, ANSYS, CFD, LabVIEW, CATIA, NDT etc.,	1
2.	21VA501	Any other certification from MNCs/OEMs, Texas Instruments, Bosch, Rexroth, SAE Skill India etc.,	1
3.	21VA502	NSS	1
4.	21VA503	Spoken Hindi / Foreign Language	1
5.	21VA504	Massive Open Online Courses (MOOC) / NPTEL	1
6.	21VA505	Geometric Dimensioning and Tolerancing	1
7.	21VA506	Automotive Interior/Exterior Plastic Parts Design	1
8.	21VA507	Project Management Process	1
9.	21VA508	Heating, Ventilation and Air Conditioning – HVAC	1

SERVICE SUBJECTS

SL. No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	40/60	ES
2	21ME111	Engineering Graphics	1/0/3	4	2.5	40/60	ES

SEMESTER WISE CREDIT DISTRIBUTION: -

Semester	I	II	111	IV	V	VI	VII	VIII	EES	Total
Credits	22	22.5	22.5	24	21.5	21	17.5	12	2	165

Sciences including Management

: Engineering Science Courses

: Professional Core Courses

L: Lecture T: Tutorial P: Practical C: Credit O: Outside Class hours Cat.: Category

- HSMC : Humanities and Social
- **OEC** : Open Elective Courses
- : Emerging Elective Courses EEC
- : Emerging Courses EC
- **PROJ** : Project Work
- : Employability Enhancement Skills EES
- : Professional Elective Courses PEC

: Basic Science Courses

: Mandatory Course MC

Definition of Credit:

BSC

ESC

PCC

L – Lecture	1 Hr. Lecture (L) per week	1 credit
T – Tutorial	1 Hr. Tutorial (T) per week	1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week	0.5 credit

Semester – 01

		ENGINEERING MATHEMATICS I	2/1/2/4				
21MA101 (COM		MMON TO MECH, MCT, CIVIL, ECE, EEE, CSE, IT, AIDS)					
Nature o	of Course	J (Problem analytical)					
Pre-Req	uisites	Concept of Differentiation and Matrices					
Course	Objectives:						
1	To develop practical ap	the skill to use matrix algebra techniques that is needed by enginplications.	neers for				
2		bout system of linear equations and its solution set and how to wr ent matrix and augmented matrix of a linear system	ite down				
3	To familiari engineering	ize with functions of several variables applicable in many brail g.	nches of				
4		e solution of ordinary differential equations as most of the engine rectangle of the engine characterized in this form.	gineering				
Course	Outcomes:						
		the course, students shall have ability to	•				
C101.1	Recall the c	concepts of matrices, ordinary and partial derivatives.	[R]				
C101.2	Express sq	uare matrix in the diagonal form.	[U]				
C101.3	Solve syste	ems of linear equations numerically and to find inverse matrices.	[AP]				
C101.4		erical techniques effectively to analyse and visualize data to solve peering-related problems.	[AP]				
C101.5	Find the extreme values of the given functions to solve the engineering [AP]						
C101.6	01.6 Find the solution of second and higher order differential equations [AP						
Course	Contents						

Course Contents:

MATRICES

Definition – Types of matrices – Characteristic equation – Eigenvalues and eigenvectors of a real matrices and their properties (statement only) – Cayley-Hamilton theorem (statement only) – Verification and application to find inverse and powers of real matrices – Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation. (14)

SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

Newton-Raphson method – Fixed point iteration method– Gauss-Elimination method – Gauss-Jordan method –Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalue of a matrix by Power method and Jacobi method. (16)

CALCULUS

Concepts of limits and continuity –Functions of several variables – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers – Ordinary differential equations –Higher order linear differential equations with constant coefficients –Euler Cauchy's equations – Applications of ODE: Solving electrical circuits and simple harmonic motion. (18)

Lab Component

S.No	List of Experiments						
1	Entering row vector, column vector, accessing blocks of elements in MATLAB.	[U]					
2	Entering matrices, to locate matrix elements and Correcting any entry through indexing in MATLAB.	[U]					
3	Eigenvalues and eigenvectors of a matrix using MATLAB.	[AP]					

4	Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB.	[AP]
5	System of linear equations in MATLAB using Gaussian elimination.	[AP]
6	System of linear equations in MATLAB using matrix inverse method	[AP]
7	System of linear equations in MATLAB using linsolve.	[AP]
8	First and second derivative of single variable functions using MATLAB.	[AP]
9	Maxima and Minima of a function using MATLAB.	[AP]
10	Higher Order Equations of constant coefficients using MATLAB.	[AP]
	Total Hours: (48+12)	60
Text Bo		
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition, Reprint, 2018	
2	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John W Sons (Asia) Limited, Singapore 2018.	iley and
3	Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publi	ications,
	Delhi, 2018.	
Refere	nce Books:	
1	Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing C Ltd., New Delhi, 2018.	ompany
2	Glyn James, Advanced Modern Engineering Mathematics, Pearson Educatio edition, 2012.	n, 4 th
3	N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9 th Laxmi publications ltd, 2014.	edition,
Web Re	eferences:	
1	http://www.nptel.ac.in/courses/111105035	
2	http://www.nptel.ac.in/courses/122104017	
3	http://nptel.ac.in/courses/122102009	
4	http://nptel.ac.in/courses/111107063	
Online	Resources:	
1	https://www.coursera.org/learn/linearalgebra2	
2	https://www.coursera.org/learn/differentiation-calculus	
3	https://www.coursera.org/learn/single-variable-calculus	
4	https://alison.com/courses/Algebra-Functions-Expressions-and-Equations	

Summ	Summative assessment based on Continuous and End Semester Examination											
	Continuous Assessment (50%)											
	CA 1 (10 Marks	s)		CA 2 (10 Marks	s)	Prac Exa (30 M		Theory Examinati				
SA 1	SA 1 FA 1 SA 2 FA 2			2	FA	SA	on					
(6	(6 Compon Compon (6 Compon Compon			(22	(8	(50						
Mark	Mark ent -I ent -II mark ent -III ent -IV				mark	Mark	Marks)					
s)	s) (2 marks) (2 marks) s) (2 marks) (2 marks)						s)					

			Levels (based on			heory		
Formative	asses	sment b	ased on Capstone					
Course Outcome	Bloor Leve		components fro	Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)				
C101.1	Reme	ember	Component - I	Quiz		-	2	
C101.2	Unde	rstand	Component - II	Assign	ment		2	
C101.3	Apply	1	Component - III	Tutoria			2	
C101.4	Apply	,	Component - IV	Group	activity		2	
C101.5	Apply	1						
C101.6	Apply	,						
Summativ	e asse	ssment	based on Continu	ous and End	I Semeste	r Examina	ation	
			Continuous Asse	essment (12%	()	Enc	I Semester	
Bloom's L	.evel		CIA1	CIA	2	Exam	ination (50%)	
			6 Marks] [6 Marks]		[5	0 Marks]		
Remembe	r		20	20	20		20	
Understan	d		30	30)	30		
Apply			50 50		50			
Analyse			-	-	-		-	
Evaluate			-				-	
Create					-			
Summativ Practical	e asse	essment	based on Continu	ous and End	I Semeste	r Examina	ation -	
Bloom's			Contin	uous Asses	sment (30	%)		
Level	5		FA			SA		
Level			(22 Marks)			(8 Mar	ks)	
Remembe	r		20			20		
Understan	d	30				30		
Apply		50				50		
Analyse		_				-		
Evaluate			-			-		
Create			-	-		-		

Mapping Specific					nes ((CO)	with	Pro	gran	nme	Outc	ome	s (PO) Pr	ogramme)	
00	POs PSOs												PSOs	3		
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3	
C101.1	3	3	3	3	1								3			
C101.2	3	3	2	2	3								1			
C101.3	3	3	3	3	3								3			
C101.4	3	3	3	3	3								3			
C101.5	3	3	3	3	3								3			
C101.6	3	3	3	3	3								3			
					1	1				1	1	1		L.	ı	
		3	Stro	ongly	agre	ed	2	Mod	erate	ely ag	greec	1	Reasor	hably agre	ed	

21CH10	1	ENGINEERING CHEMISTRY	3/0/3/4.5
Naturo o	of Course	(COMMON TO ALL I YEAR B.E. / B.TECH) E (Theory skill based)	
Pre-Req		NIL	
	Objectives:		
1		e students conversant with water treatment, boiler feed water te	
2	corrosion.	ne effect of corrosion in materials and the methods for pre-	
3	electroanal	and the principles and applications of electrochemistry and ytical methods.	
4	To understa	and the basic concepts, synthesis, and applications of nanomate	erials.
5	sources and	the synthesis and properties of important engineering plastic d drug molecules.	
6	To underst spectroscop	and the concepts of photophysical and photochemical pro	cesses in
Course	Outcomes:		
Upon co	mpletion of	the course, students shall have ability to	
C101.1	Recall the reformed for industrie	equirements of water treatment procedures and boiler feed water es.	[R]
C101.2	Apply the environment	various corrosion control techniques in real time industria ats.	[AP]
C101.3		I the principle and working of reference electrodes and meters as an analyzer.	[U]
C101.4		I the basic concepts and applications of Nanochemistry.	[U]
C101.5	Use the kr	nowledge of polymers, various energy sources and storage	
C101.6		I the principle and working of certain analytical techniques, and f some common drug molecules.	[U]
Course	Contents:		
and estin requirem (chlorina osmosis.	nation of ha ents-disadva tion, Ozon Corrosion-ty	nd Corrosion: Water treatment-characteristics of water-hardres ardness by EDTA method with numerical problems. Boiler feantages of hard water. Domestic water treatment-disinfection ation, UV treatment)-demineralization process-desalination ypes-mechanism of dry and wet corrosion-galvanic corrosion- otective coatings-electroplating of gold-electroless plating of nic	ed water- methods on-reverse differential
	-	nd Energy sources: Electrochemical cells-electrolytic cell-rever ree energy and emf, cell potentials, Nernst equation and ap	

irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Nanochemistry-Basics-Comparison of molecules, nanomaterials and bulk materials; Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources-Fuel cells (H₂-O₂). Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules: Introduction-monomers and polymers-classification of polymers-Polymerization-types. Mechanism of addition polymerization (free radical mechanism). Plastics-classificationpreparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods- moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow moulding). Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

Field work:

Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

Lab Co	nponents	
S.No	List of Experiments	RBT
1	Estimation of hardness of water by EDTA method	[E]
2	Estimation of alkalinity of water sample	[E]
3	Determination of chloride content in bleaching powder	[E]
4	Estimation of dissolved oxygen in water	[E]
5	Potentiometry- determination of redox potentials and emf's	[E]
6	Conductometric titration-mixture of acids vs NaOH	[E]
7	Determination of strength of strong acid by pH metry	[E]
8	Corrosion rate of mild steel in acid medium	[E]
9	Electroplating of nickel over copper	[E]
10	Spectrophotometry-Estimation of iron in water	[E]
11	Separation of mixture of amino acids by thin layer chromatography	[E]
12	Synthesis of Nylon 66	[E]
	Total Hours:	75
Underst	anding the concepts by simple Demonstrations/Experiments:	
1	To observe the hardness of given water sample by soap solution test	
2	To view the colour of the different medium of given water sample using litmu	is paper
	test	
3	To detect the chlorine content in tap water using simple chemical method	
4	To know the presence of dissolved oxygen in given water sample using gluce	ose by
	redox principle	
5	To illustrate the rate of corrosion in steel nails using acid medium	
Text Bo		
1	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. C Company Ltd., New Delhi 2015.	
2	Jain P. C. & Monica Jain., "Engineering Chemistry", 16 th Edition, Dhan Publishing Company (P) Ltd, New Delhi, 2015.	pat Rai
3	Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Pu McGraw-Hill Book Company (P) Ltd, England, 1994.	ıblishing
4	Physical Chemistry, 11 th Edition by P. W. Atkins Publishing Oxford Universi (P) Ltd, United Kingdom, 2018.	ty Press
5	Nanochemistry, 2 nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2	2013.
6	N.Krishna Murthy, Vallinayagam D.,"Engineering Chemistry" 3 rd Edition Learning Pvt Ltd.,2014.	by PHI

7	Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013.
8	R.V.Gadag, A.Nithyananda Shetty "Engineering Chemistry" 3 rd Edition PHI Learning Pvt Ltd., 2014.
Referen	ce Books:
1	Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016.
2	Liliya.,Bazylak.I.,Gennady.E.,Zaikov.,Haghvi.A.K.,"Polymers and Polymeric Composites" CRC Press,2014.
3	Lefrou.,Christine.,Fabry.,Pierre.,Poignet.,Jean-claude.,"Electrochemistry - The Basics, with examples" 2012 ., Springer.
4	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.
5	Perez, Nestor,"Electrochemistry and Corrosion Science", Springer, 2016.
6	Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015.
7	Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012.
Web Re	ferences:
1	http://www.analyticalinstruments.in/home/index.html
2	www.springer.com > Home > Chemistry > Electrochemistry
3	https://www.kth.se//electrochem/welcome-to-the-division-of-applied-
	electrochemistry
4	https://www.ntnu.edu/studies/courses
5	www.corrosionsource.com/
Online I	Resources:
1	nptel.ac.in/courses/105104102/hardness.htm
2	https://ocw.mit.edu/courses/chemistry
3	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com -
	Spectroscopic technique, Colorimetry
4	https://ocw.mit.edu/courses/chemistry
5	nptel.ac.in/courses/113108051
6	nptel.ac.in/courses/105104102/hardness.htm

Summ	ative assess	sment based	d on Cor	ntinuous an	d End Seme	ster Exa	minatio	on		
		Continu	ious As	sessment (5	0%)			End Semester Examinati on (50%)		
	CA 1 (10 Marks	s)		CA 2 (10 Marks	s)	Prac Ex (30 M		Theory Examinati		
SA 1	FA	A 1	SA 2	FA	2	FA	SA	on		
(6	Compon	Compon	(6	Compon	Compon	(22	(8	(50		
Mark	ent -l	ent -II	mark	ent -III	ent -IV	mark	Mark	Marks)		
s) (2 marks) (2 marks) s) (2 marks) (2 marks) s) s)										

				Blooms'Taxonomy) -	Theory		
Formative	asses	sment b	ased on Capstone		-		
Course Outcome	Blooi Level		components fro	omponent (Choose a m the list – Quiz, Ass ninar, Group Assignn	ignment,	Marks	
C101.1	Reme	ember	Component - I	Quiz		2	
C101.2	Apply		Component - II	Assignment		2	
C101.3	Unde	rstand	Common ant III	Cominen		0	
C101.4	Unde	rstand	Component - III	Seminar		2	
C101.5	Apply		Component IV			2	
C101.6	Unde	rstand	Component - IV	Group activity		Z	
Summativ	e asse	ssment	based on Continu	ous and End Semeste	er Examina	ation	
			Continuous Asse	essment (12%)	Enc	d Semester	
Bloom's L	evel		CIA1 [6 Marks]	CIA2 [6 Marks]		ination (50%) 60 Marks]	
Remember	r		30	30	_	20	
Understand	d		50	40		50	
Apply			20	30		30	
Analyse			-	-		-	
Evaluate			-	-		-	
Create			-	-		-	
Summativ Practical	e asse	ssment		ous and End Semeste		ation -	
Bloom's				uous Assessment (3			
Level	,		FA (22 Marks)		SA (8 Mar	ks)	
Remember	r		10		10		
Understand	d		20		20		
Apply			40		40		
Analyse			30		30		
Evaluate			-		-		
Create			-		-		

C101.2 3 2 3 4 6 6 C101.3 2 2 3 4 6 6 6 C101.4 3 2 3 6 6 6 6 6	3 2 2 3 2 3	0	Pos											PSOs			
C101.2 3 2 3 C101.3 2 2 3 C101.4 3 2 3	2 3 -	Cos	а	b	С	d	е	f	g	h	i	j	κ	Ι	1	2	3
C101.3 2 2 3 4 C101.4 3 2 3 4	2 3	C101.1	3			3			2								
C101.4 3 2 3	2 3	C101.2	3			2			3								
	3	C101.3	2		2				3								
		C101.4	3		2				3								
C101.5 3 3 3	2 3 2	C101.5	3						3								
C101.6 3 2 3 2		C101.6	3		2	3			2								

21EN10)1	TECHNICAL COMMUNICATION SKILLS	2/0/2/3
		(MECH/MCT/IT/CIVIL/CSE)	
Nature o	of Course	E (Theory skill based)	
Pre-Req	uisites	Basics of English Language	
Course	Objectives:		
1	To enhance	e learners' LSRW skills.	
2		effective communication skills.	
3		e learners to acquire effective technical writing skills.	
4		learners for placement and competitive exams.	
5		effective language skills for academic purposes and real-life site	uations
	Outcomes:		
		the course, students shall have ability to	
C101.1		language skills for technical communication.	[U]
C101.2		nunication skills in corporate environment.	[AP]
C101.3	situation.	and communicate effectively in personal and professional	[AP]
C101.4		and analyse a variety of reading strategies to foster sion and to construct meaningful and relevant connections to the	[U]
C101.5	Apply techr documents	nical writing skills to write letters, emails and prepare technical	[AP]
C101.6	Apply langu	age skills with ease in academic and real-life situations.	[AP]
Course	Contents:		
Listenin	g and Speak	king 17	' Hours
Skills - S - Listenin Recognis Preferen Reasons Presenta	elf Introduction ng to Speec se Functions ces-Agree ar and Extra Ir tion using Di	ve Communication- Basics of English Language - Importance on - Introducing Others - Listening to Short Conversations or Mo shes / Talks - Listening and Responding Longer Listening Speaking - Speaking about Giving Directions / Instruction - Ta and Disagree - Giving Opinions - Speaking Practices by Giving E information- Short Talk on Business Topics- Non Verbal Commu gital Tools- Power of Narrative- Leadership, Conflict and Persua	nologue Tasks alk abou xamples inication sion.
Reading			1:
Understa	anding Speci	- Skimming and Scanning - Comparing Facts and Figures - Rea fic Information in a Text - Cloze Reading - Identifying Reas gh Reading Practices - Comprehension - Collocations.	0
Writing a Hours	and Gramma	ar	15
Writing F		s (Accepting and Declining Invitations) - Writing Business Letters int Letter) - Email Writing – Memo - Circular - Agenda and Minut	

Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Placing an Order and Complaint Letter) - Email Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).

Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive

Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms - British and American Words - One Word Substitution- Identifying Common Errors.

Lab Co S.No	List of Experiments	RBT
1	Listening Comprehension	[E]
2	Pronunciation, Intonation, Stress and Rhythm	[E]
3	Common Everyday Situations: Conversations and Dialogues.	[E]
4	Formal Presentation	[E]
5	Group Discussion	[E]
6	Interview Skills	[E]
	Total Hours:	60
Text Bo	oks:	
1	Practical English Usage. Michael Swan. OUP. 1995.	
2	Remedial English Grammar. F.T. Wood. Macmillan.2007	
3	On Writing Well. William Zinsser. Harper Resource Book. 2001	
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2	2015.
Referen	ce Books:	
1	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press	s. 2006.
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Pre	SS.
	2011.	
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford Univers	ity
	Press	•
Web Re	ferences:	
1	http://www.academiccourses.com/Courses/English/Business-English	
2	https://steptest.in	
Online	Resources:	
1	https://www.coursera.org/specializations/business-english	
2	http://www.academiccourses.com/Courses/English/Business-English	
3	https://scoop.eduncle.com/one-word-substitution-list	

Summ	ative assess	sment based	d on Cor	ntinuous an	d End Seme	ster Exa	minatio	n			
		Continuous Assessment (50%) Se Exa on									
	CA 1 (10 Marks	s)		CA 2 (10 Marks	s)	Prac Ex (30 M		Theory Examinati			
SA 1	FA	A 1	SA 2	FA	A 2	FA	SÅ	on			
(6	Compon	Compon	(6	Compon	Compon	(22	(8	(50			
Mark	ent -l	ent -II	mark	ent -III	ent -IV	mark	Mark	Marks)			
s)	s) (2 marks) (2 marks) s) (2 marks) (2 marks) s) s)										

			Levels (based on			neory		
Formative	asses	sment k	based on Capstone					
Course Outcome	Bloon Level		Assessment Co components fro Case study, Sen	m the lis	st – Quiz, Assig	nment,	Marks	
C101.1	Under	stand	Component - I		Quiz		2	
C101.2	Apply		Component - I		Quiz		2	
C101.3	Apply		Component - II		Impromptu spea	kina	2	
C101.4	Under	stand	Component - II			iking	۷	
C101.5	Apply		Component - III		Reading comprehension		2	
C101.6	Apply		Component - IV		Group assignme	ent	2	
Summativ	e asse	ssment	based on Continu	ous and	End Semester	Examina	ation	
			Continuous Asse	essment		End Semester		
Bloom's L	Bloom's Level		CIA1		CIA2		ination (50%)	
			[6 Marks]	[6 Marks]	[5	50 Marks]	
Remember			20		20		20	
Understand			40		40		40	
Apply			40		40		40	
Analyse			-		-		-	
Evaluate			-		-		-	
Create			-		-		-	
Summativ Practical	e asse	ssment	based on Continu				ation -	
Bloom's				nuous As	ssessment (30%	1		
Level	,		FA			SA		
			(22 Marks)			(8 Mar	ks)	
Remember			20			20		
Understand	d		40			40		
Apply			40			40		
Analyse			-			-		
Evaluate			-			-		
Create			-			-		

Mapping Specific (nes ((CO)	with	Pro	gran	nme	Outo	ome	s (PO) Pi	rogramme	9		
00-		Pos												PSOs			
COs	а	b	С	d	е	f	g	h	i	j	κ	Ι	1	2	3		
C101.1									2	3		2					
C101.2									2	3		2					
C101.3									2	3		2					
C101.4										3		2					
C101.5									2	3							
C101.6									2	3		2					
		3	Stro	ongly	agre	ed	2	Mod	erate	ely aç	greed	1	Reaso	nably agre	ed		

2	1CS11	1	PROBLEM SOLVING USING C PROGRAMMING	3/0/2/4								
Ν	ature o	f Course	F (Theory Programming)									
Ρ	re Requ	uisites	Nil									
С	ourse (Objectives:										
	1		and problem solving using structured programming language									
	2	To gain kno	owledge about the control structures in C.									
3 To develop logics and write C programs using arrays												
	4 To gain familiarity in inbuilt functions, structures and unions in C.											
-	5 Apply concept and techniques for implementation in respective domain											
	Course Outcomes: Upon completion of the course, students shall have ability to											
	C111.1 Apply problem solving techniques to solve real world problems [AP]											
	111.3		ncept of pointers and arrays in designing programs	[U]								
				[AP]								
	111.4	•	rograms using the concepts of strings and functions	[C]								
	111.5		ograms using structures and Unions in C	[AP]								
С	111.6	Apply the problem	suitable programming concept for the given computationa	[AP]								
E ru C 	xpression inning a ontrol \$ ontrol S switch – lulti dim	ons –Preced a Complete (Structures, tructures: Br break – con ensional arr	Arrays, Strings 15 Hor ranching: if-else- Looping – while - do while – for - Nested control ntinue – comma - goto. Arrays - Defining an array - Processing rays - Strings: Defining a string - Null character -initialization o	baring and I rs structures an array -								
P F to	 reading and writing a string - processing the string Pointers, Functions, Structures and Unions: 15 Hours Pointers: fundamentals – Pointer Declaration & Usage – Dynamic Memory Allocation. Functions: Defining a Function – Accessing a function – Function Prototype Functions - Pointer to Function - Functions Returning Pointers Pointers and Strings - Passing arguments to a function – Recursion. Structures and Unions: The Type Definition (type def) – Enumerated types Structure - Type Definition – Initialization – Accessing Structures - Unions. 											
_			Lab Components									
_	.ab Cor		List of Experiments									
_		nponents	•	RBT								
_	.ab Cor	nponents Formulate	simple algorithm and flowchart using Raptor Tool for									
_	ab Cor S.No	Formulate simple and Program to	simple algorithm and flowchart using Raptor Tool for d complex problem	RBT								
_	ab Cor.	Formulate simple and Program to evaluate a	simple algorithm and flowchart using Raptor Tool for d complex problem o process data types, format input and output and to in expression	RBT [AP]								
_	ab Cor S.No 1 2	Formulate simple and Program to evaluate a Program u	simple algorithm and flowchart using Raptor Tool for d complex problem o process data types, format input and output and to in expression using decision making statements	[AP]								

	6	Program with Strings	[AP]							
	7	Program using Pointers.	[AP]							
	8	Program using Recursion	[AP]							
	9	Program using structures	[AP]							
	10	10 Branch specific application program								
		Total Hou	rs: 30							
Те	ext Bo									
	1	Sprankle M, "Problem Solving and Programming Concepts", 9 th Edi Education, New Delhi, 2013	tion, Pearson							
	2	Yashavant Kanetkar, "Let Us C", 16 th Edition, BPB Publication, 2017.								
	3	Byron, S. Gottfreid, "Programming with C", McGraw Hill, Schaum's Edition, 2018.	outlines, 4 th							
	4	Reema Thareja Computer Fundamentals and Programming in C, 2 nd ec OXFORD publications, 2016	lition,							
	5	Brian W. Kernighan, Dennis Ritchie, "The C Programming Language", Pearson Publications, 2015	2 nd Edition							
Re	eferen	ce Books:								
	1	Yashavant Kanetkar, "101 Challenges in C Programming" Edition, BPE 2017	B Publication,							
	2	Herbert Schildt, "The Complete Reference C", 4th Edition , McGraw Hill	, 2015							
	3	Venugopal K R and Sudeep R.Prasad, "Mastering C", 2 nd Edition, McG								
	4	Jeri.RHanly, and Elliot B Koffman, "Problem solving and programming D Edition, Pearson 2016	esign in C",8 th							
W	eb Ref	erences:								
	1	http://raptor.martincarlisle.com/								
0	nline F	lesources:								
	1	https://nptel.ac.in/courses/106/104/106104128/								
	2	https://nptel.ac.in/courses/106/105/106105171/								
	3	https://www.coursera.org/specializations/c-programming								

Summa	Summative assessment based on Continuous and End Semester Examination													
		End Semester Examinatio n (50%)												
	CA 1 (10 Marks	.)		CA 2) Marks)	Practica (20 M	al Exam arks)	Theory							
		P/	(10	<u>iviai k5j</u>		<u>ai n 5j</u>	Theory							
SA 1	FA	\ 1	SA 2	FA 2	FA	SA	Examinatio							
(6	Componen	Componen	(6	Componen	(22	(8	n							
Marks	t-l	t-ll	marks	t -III	marks	Marks	(50 Marks)							
)	(2 marks)	(2 marks))	(4 marks)))	-							

			Levels (based on		<mark>10my) - T</mark>	heory		
Formative	asses	sment b	ased on Capstone					
Course Outcome	Bloor Leve		Assessment Co components fro Case study, Sen	m the list – Q	uiz, Assig	gnment,	Marks	
C111.1	Apply	1	Component - I	Quiz			2	
C111.2		rstand	Component - II	Assignm	ent		2	
C111.3	Apply	1						
C111.4	Creat	e	Component - III	Mini proj	ect		4	
C111.5	Apply	1						
C111.6	Apply	1						
Summativ	e asse	essment	based on Continu	ous and End	Semester	Examina	ation	
			Continuous Asse	essment (12%)		Enc	l Semester	
Bloom's L	.evel		CIA1	CIA2		Examination (50%		
			[6 Marks]	[6 Marks]		[50 Marks]		
Remembe			30	20		20		
Understan	d		50	30			40	
Apply			20	50	50		40	
Analyse			-	-			-	
Evaluate			-	-		-		
Create			-		-			
Summativ Practical	e asse	essment	based on Continu	ous and End	Semester	Examina	ation -	
			Contin	uous Assess	ment (30°	%)		
Bloom's	5		FA			SA		
Level			(22 Marks)			(8 Marks)		
Remembe	r		20			20	-	
Understan	d		20		20			
Apply			60		60			
Analyse			-		-			
Evaluate	İ		-		-			
Create	İ		-			-		

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
COs						PSOs									
	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C111.1	3	3	3						2	1		2	2		
C111.2	3	3	3						2	1		2	2		
C111.3	3	3	3						2	1		2	2		
C111.4	3	3	3						2	1		2	2		
C111.5	3	3	3						2	1		2	2		
C111.6	3	3	3						2	1		2	2	1	1
		•												•	•
		3	Stro	ongly	agre	ed	2	Mod	erate	ely ag	greed	1 1	Reaso	nably agre	ed

	01	ENGINEERING DRAWING	1/0/3/2.
Nature	of Course	1. Practical Application	
	quisites	General Drawing skill	
	Objectives:		
1		develop skills for communication of concepts, ideas a	and design o
0	engineering		
2		them to existing national standards related to technical drav	iwings.
-	Outcomes:	eate basic geometries using the modelling software.	
		the course, students shall have ability to	
C101.1		Ind sketch the basic and intermediate geometries.	[Ap]
C101.2		nd sketch the 3D diagram from 2D diagrams.	[Ap]
C101.3		e parametric features of new products.	[C]
C101.4	U	geometries using the drafting software.	[Ap]
C101.5		e isometric to orthographic projection (Vice versa)	[A]
	Contents:		
Genera	I Plane Curve	he following using mini-drafter es: Conic curves: ellipse, parabola and hyperbola by eccer tangents to these curves, Involutes- Circle, Square, Simple	•
Orthog Project Axis inc Sectior Develo Prisms/ Pyramic	raphic project ion of lines ion of solids lined to one of ning of solid pment of lat Pyramids and ds and Compo	 ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane Basic concepts using a simple Prisms/Pyramids in vertic f the principle planes. Is- Basic concepts using a simple prism/pyramid in verticateral surfaces of solids- Development of lateral surface of solids - Sosite solids. Perspective projection – Introduction to Visite 	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms
Orthog Project Project axis inc Sectior Develo Prisms/ Pyramic and var	raphic project ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and	 ction- Conversion of isometric/pictorial in to orthographic view and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface of solids- Development of lateral surface of solids - Sosite solids. Perspective projection – Introduction to Visuanethod. 	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms
Orthog Project Project axis inc Sectior Develo Prisms/ Pyramic and var Lab Co S.No 1	raphic project ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and ds and Compo- hishing point m mponents	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface d Truncated Prisms only. Isometric drawing of solids – Sosite solids. Perspective projection – Introduction to Visuonethod. List of Experiments Mature	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method
Orthog Project Axis inc Section Develo Prisms/ Pyramic and var Lab Co S.No	raphic project ion of lines ion of solids lined to one of ning of solid pment of lat Pyramids and ds and Compo- hishing point m mponents Study the Ba Drafting of tit	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface d Truncated Prisms only. Isometric drawing of solids – Sosite solids. Perspective projection – Introduction to Visumethod. List of Experiments Matrix association of 2D and 3D modeling C te block, Co-ordinate system	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method CO apping C101.4 [R] C101.4 [U]
Orthog Project Project axis inc Sectior Develo Prisms/ Pyramic and var Lab Co S.No 1	ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and ds and Compo- hishing point m mponents Study the Ba Drafting of tit Drafting of si	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface d Truncated Prisms only. Isometric drawing of solids – Sosite solids. Perspective projection – Introduction to Visuonethod. List of Experiments Mathematical Content of the planes of the plane of the plane of the principle plane of the plane	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method CO RBT 2101.4 [R]
Orthog Project Axis inc Section Develo Prisms/ Pyramic and var Lab Co S.No 1 2 3	raphic project ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and ds and Compo- hishing point m mponents Study the Ba Drafting of tit Drafting of si drawings- Th	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface d Truncated Prisms only. Isometric drawing of solids – Sosite solids. Perspective projection – Introduction to Visumethod. List of Experiments Matrix associate system Cases of 2D and 3D modeling the block, Co-ordinate system mple geometrics: Line, planes and simple 2D	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method CO apping CO 101.4 [R] C101.4 [U] C101.4 [A]
Orthog Project axis inc Section Develo Prisms/ Pyramic and var Lab Co S.No 1 2	ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and ds and Componishing point m mponents Study the Ba Drafting of tit Drafting of si drawings- Th	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface d Truncated Prisms only. Isometric drawing of solids – Sosite solids. Perspective projection – Introduction to Visuanethod. List of Experiments Matrix asics of 2D and 3D modeling Convertices: Line, planes and simple 2D Convertices:	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method CO apping C101.4 [R] C101.4 [V] C101.4 [A] urs: 60
Orthog Project axis inc Section Develo Prisms/ Pyramic and var Lab Co S.No 1 2 3 Text Bo	ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and ds and Compo- hishing point m mponents Study the Ba Drafting of tit Drafting of si drawings- Th poks: K. V. Natar 2018.	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surface a Truncated Prisms only. Isometric drawing of solids – Solids. Perspective projection – Introduction to Vision nethod. List of Experiments Material asics of 2D and 3D modeling C the block, Co-ordinate system C mple geometrics: Line, planes and simple 2D C Total Hore Total Hore	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method CO RBT 2101.4 [R] 2101.4 [U] 2101.4 [A] urs: 60 hmi Publishers
Orthog Project axis inc Section Develo Prisms/ Pyramic and var Lab Co S.No 1 2 3 Text Bo 1	ion of lines ion of solids lined to one of hing of solid pment of lat Pyramids and ds and Compo- hishing point m mponents Study the Ba Drafting of tit Drafting of si drawings- Th Doks: K. V. Natar 2018. Varghese P	ction- Conversion of isometric/pictorial in to orthographic vi and planes- Object has inclination to any one plane - Basic concepts using a simple Prisms/Pyramids in vertice f the principle planes. Is- Basic concepts using a simple prism/pyramid in vertice teral surfaces of solids- Development of lateral surfa d Truncated Prisms only. Isometric drawing of solids – Sosite solids. Perspective projection – Introduction to Visuanethod. List of Experiments Matrix asics of 2D and 3D modeling Cle block, Co-ordinate system mple geometrics: Line, planes and simple 2D Corree exercises Total Hor rajan, "A Text Book of Engineering Graphics", Dhanalaksh	iews. es: HP or VP cal position and ertical position aces of Simple Simple Prisms ual ray method CO apping C101.4 [R] C101.4 [R] C101.4 [A] urs: 60 hmi Publishers d., 2015.

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R2020 (Batch:2021-2025)

Referen	ce Bo	oks:									
1		tt N.D	and Pancha	l, "Er	ngineerin	g Drawir	ıg", Ch	arotar Pu	blishir	ng H	louse, 50 th Edition,
2	-		K. and Prab	hu R	aja V, "E	ngineerir	g Grap	phics", Ne	w Age	e Int.	(P) Limited, 2011.
Web Re		•				0	<u> </u>		0		
1			l.ac.in/course	s/11	2103019	/Enginee	rina dra	awing			
2	•		eer.netserv.c				<u> </u>				
Summat			nent based						kamin	natio	n
			Continuo	us A	ssessm	ent (50%)				End Semester Examination (50%)
		CA 1				CA 2		Practica	al Exa	am	x
	(10 Mar	ks)		(1	0 Marks)		(30 M	larks)		Theory
SA 1			FA 1		SA 2	FA	2	FA	SA	4	Theory Examination
(6	Con	nponer	nt Compon	ent	(6	Compo	onent	(22	(8	3	(50 Marks)
Marke) -I			-11		(o marks)	-11	-	marks)	Mar	ks)	(50 Iviai K5)
Assessment Meth			(2 mark	s)	illaiks)	(4 ma	rks)				
Assessr	nent	Metho	ds & Levels	(bas	ed on Bl	ooms'Ta	axonor	ny) - The	ory		
Formativ	ve as	sessm	ent based o	n Ca	pstone I	Model (8 [°]	%)				
				As	ssessme	nt Com	ponen	t (Choo	se		
Course		Bloor	n's Level	an	d map c	ompone	nts fro	om the list	t — 🛛 🗖	/ lark	c
Outcom	е	БІООІ	II S Level	Qı	uiz, As	signmen	t, Ca	ise stuc	ly, ∣"	la n	3
				Se	eminar, C	Group As	signm	nent)			
C101.		Apply		Co	mponen	t - I	Assi	ignment	2	2	
C101.		Apply									
C101.	.3	Creat	е	Co	mponen	t - III	Mod	lel making	4	ŀ	
C101.		Apply									
C101		Analy			mponen			ignment	2		
Summat	tive a	ssessr	nent based								
					s Assess			En	d Sen		er Examination
Bloom's	Leve	el	CIA			CIA				•	50%)
			[6 Mai		s] [6 Marks]		ks]	[50			Marks]
Rememb			10		-						10
Understa	and		20			10					10
Apply			40			40					40
Analyse			30			40					40
Evaluate)		-			10					-
Create	•		-	-		-					-
Summat	ive a	ssessr	nent based	on C						natio	n - Practical
						ntinuous	ASSes	ssment (3	50%)		
Bloom'	s Lev	ei			A				(0	SA	
Domonsk	or				larks)				(8)	Mar	
Rememb					20					20	
Understa Apply	und				30					30	
Apply					50					50	
Analyse					-					-	
Evaluate Create					-					-	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

		POs												PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C101.1	3			1						3			2		
C101.2	3			1						3			3	1	
C101.3	3		1							3			2		
C101.4	3		1		1					3			3	1	
C101.5	3									3			2		
	4		8	8	8		8	8						L	
	3 3	Stron	gly a	greed	d 2	2 Mo	odera	ately a	agree	d	1 R	easo	nably ag	reed	

21EE111		SICS OF ELECTRICAL AND ELECTRONICS ENGINEERING COMMON TO CSE, MECH, CIVIL AND IT)	3/0/2/4
Nature of (G (Theory analytical)	
	e-requisites	Nil	
Course Ob			
1	-	tudents with a basic understanding of Electrical circuit	s
2		ne working principle of transformers	5
		tand the DC and AC Machine working principles and	d to have a
3		on selection of machine for specific types of application	
4	To give a d	comprehensive exposure to electrical installations.	
5	To equip s electronics.	students with an ability to understand basics of analog	g and digital
Course Ou	itcomes:		
Upon com	pletion of the	course, students shall have ability to	
C111.1	Analyze the	e concepts in AC circuit and DC circuits.	[A]
C111.2	Understand	the working principle of single phase and three phase	[U]
0444.0	transforme		
C111.3		the working principle of DC and AC machines.	[U]
C111.4	Utilize the k	pasic components for electrical installations.	[AP]
	Inderstand	the basic concepts of Analog and Digital Electronics.	[U]
C111.5	Understand		
Course Co Course Co Module 1: DC Circui Kirchhoff's Analysis S	ontents: DC Circuits ar ts - Electrical current and volt Superposition,	nd AC Circuits circuit elements (R, L and C), voltage and current tage law, analysis of simple circuits with dc excitation, N Thevenin's Theorem, Maximum power transfer the circuits - Representation of sinusoidal waveforms, pe	lesh, Nodal eorem and
Course Co Module 1: DC Circui Kirchhoff's Analysis S Norton's TI values, Phi	ontents: DC Circuits and ts - Electrical current and volta Superposition, heorem. AC C asor representations single-phase a el). Three	circuit elements (R, L and C), voltage and current tage law, analysis of simple circuits with dc excitation, N	nt sources, lesh, Nodal eorem and ak and rms ower factor. ions (series
Course Co Module 1: DC Circui Kirchhoff's Analysis S Norton's TI values, Phi Analysis of and paralle delta conne Module 2: Magnetic n losses in transforme Constructio Componen and Cables calculations	Dentents: DC Circuits ar ts - Electrical current and volt Superposition, heorem. AC C asor representa single-phase a el). Three ections. Electrical Mac naterials, BH c transformers, r connections (for on and working ts of LT Switcho s, Earthing. Type s for energy con	circuit elements (R, L and C), voltage and current tage law, analysis of simple circuits with dc excitation, M Thevenin's Theorem, Maximum power transfer the circuits - Representation of sinusoidal waveforms, per ation, real power, reactive power, apparent power, por the circuits consisting of R, L, C, RL, RC, RLC combinate phase balanced circuits, voltage and current relations chines and Installations haracteristics, ideal and practical transformer, equival regulation and efficiency. Auto-transformer and t Qualitative only). Construction and working principle of principle of Synchronous motor and three phase Induc gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Typ es of Batteries, Important Characteristics for Batteries. nsumption.	nt sources, lesh, Nodal eorem and ak and rms ower factor. ions (series in star and 15 Hrs lent circuit, hree-phase f DC motor. ction motor.
Course Co Module 1: DC Circui Kirchhoff's Analysis S Norton's Th values, Phi Analysis of and paralle delta conne Module 2: Magnetic n losses in transforme Constructic Componen and Cables calculations Module 3: Semicondu rectifier, Ir	Dentents: DC Circuits ar ts - Electrical current and volta Superposition, heorem. AC C asor representa single-phase a el). Three ections. Electrical Mac naterials, BH c transformers, r connections (to on and working ts of LT Switcho s, Earthing. Type s for energy con Basics of Ana heter, PN junction troduction to s and implement	circuit elements (R, L and C), voltage and current tage law, analysis of simple circuits with dc excitation, M Thevenin's Theorem, Maximum power transfer the circuits - Representation of sinusoidal waveforms, per ation, real power, reactive power, apparent power, por the circuits consisting of R, L, C, RL, RC, RLC combinate phase balanced circuits, voltage and current relations chines and Installations haracteristics, ideal and practical transformer, equival regulation and efficiency. Auto-transformer and te Qualitative only). Construction and working principle of principle of Synchronous motor and three phase Induce gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Type es of Batteries, Important Characteristics for Batteries.	nt sources, Nesh, Nodal eorem and ak and rms ower factor. ions (series in star and 15 Hrs lent circuit, hree-phase DC motor. bes of Wires Elementary 10 Hrs and Bridge

		-								
1	Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law	C111.1	[U]							
2	Estimation of voltage and current by KVL and KCL in Electric Circuits	C111.1	[AP]							
3	Determination of mesh current and node voltage by Mesh and Nodal Analysis	C111.2	[AP]							
4	Application of Superposition theorems, thevenin's and maximum power transfer theorem in electrical circuits	C111. 2	[AP]							
5	Determination of three phase power	C111. 2	[AP]							
6	Demonstration of cut-out sections of machines: dc machine (Commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine									
7	Load test on DC shunt motor.	C111. 3	[AP]							
8	Demonstration of components of LT Switch Gears	C111. 4	[AP]							
9	Construction of bridge rectifier with and without filters	C111. 5	[AP]							
10	Verification of logic gates.	C111. 5	[A]							
	Tota	I Hours	75							
Text Book	(S:									
1	Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, Tata McGraw Hill, 6 th edition 2015.	'Electric	Machinery',							
2	Vincent. Del. Toro, "Electrical Engineering Fundamentals 2 nd edition, 2015.	", Prentice	Hall India,							
3	E. Hughes, "Electrical and Electronics Technology", Pears	on, 10 th ec	lition, 2011							
4	Donald .A. Neamen, Electronic Circuit Analysis and Desig Tata Mc GrawHill, 2013.	n, 2nd Edi	tion reprint,							
5	M. Morris Mano, 'Digital Logic and Computer Design', Pre edition, 2017	entice Hall	of India, 6 th							
Reference	e Books:									
1	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of E CRC press, 2012.	lectrical Er	ngineering",							
2	D. C. Kulshreshtha, "Basic Electrical Engineering", McGrav	v Hill, 5 th e	dition 2012,							
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Ric and Circuits', Pearson Education, 6th edition, 2019.	o, 'Electro	nic Devices							
4	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of E CRC press, 2012.	lectrical Er	ngineering",							
Web Refe	rences:									
1	http://nptel.ac.in/course.php?disciplineId=108									
2	https://ocw.mit.edu/courses/find- bytopic/#cat=engineering&subcat=electricalengineering&s	pec=electi	icpower							
0	https://nptel.ac.in/video.php?subjectId=117103063									
3										
4	https://onionesquereality.wordpress.com//more-video-le	ctures-iit-c	pen							
	https://onionesquereality.wordpress.com//more-video-le https://nptel.iitg.ernet.in/Elec_Comm_Engg//Video-ECE.		pen							
4	https://nptel.iitg.ernet.in/Elec_Comm_Engg//Video-ECE.		pen							

2	https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera
3	https://nptel.ac.in/course.php

Summ	Summative assessment based on Continuous and End Semester Examination													
	End Semester Examinati on (50%)													
	CA 1 (10 Marks	s)		CA 2 (10 Marks	s)	Prac Ex (30 M		Theory Examinati						
SA 1	FA	A 1	SA 2	FA	A 2	FA	SA	on						
(6	Compon	Compon	(6	Compon	Compon	(22	(8	(50						
Mark	ent -l	ent -II	Mark	ent -l	ent -ll	Mark	Mark	Marks)						
s)	(2 Marks)	(2 Marks)	s)	(2 Marks)	(2 Marks)	s)	s)							

			Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory						
	Formative assessment based on Capstone Model (8%								
Cours e Outco	e Bloom's components from the list – Quiz, Assignment, Case								
me									
C111.1	Analyze	Component - I	Assignment	2					
C111.2	Understand	Component - II	Tutorial	2					
C111.3	Understand	Component - III	Quiz	2					
C111.4	Apply	Component - IV	Simulation	2					
C111.5	Understand								

Summative assessment based on Continuous and End Semester Examination								
Bloom's	Continuous Ass	End Semester						
Level	CIA1 [6 Marks]	CIA2 [6 Marks]	Examination (50%) [50 Marks]					
Remember	10	10	10					
Understand	10	30	30					
Apply	40	50	30					
Analyse	40	10	30					
Evaluate	-	-	-					
Create	-	-	-					

Summative assessment based on Continuous and End Semester Examination - Practical								
	Continuous Assessment (30%)							
Bloom's Level	FA	SA						
	(22 Marks)	(8 Marks)						
Remember	10	10						
Understand	30	30						
Apply	20	20						
Analyse	40	40						
Evaluate	-	-						
Create	-	-						

	Form		Summative Assessment										Total				
	Assessment				Continuous Assessment					End Semester Examination					Total		
	30			20				50					100				
	o. of e CO	P 0 1	P O 2	P O 3	P 0 4	P O 5	P O 6	P 0 7	P O 8	P O 9	P 01 0	P O 11	P 01 2	PS O1	PS O2	PSO 3	
C1	11.1	2	1			2							2	3	3		
C1	11.2	3	3	2	2	2							2	3	3		
C1	11.3	3	2	1	1	2							2	3	3		
C1	11.4	3	3	2	2	2							2	3	3		
C1	11.5	2	1			2							2	3	3		
	1	Reasonably Agreed			2	Moderately Agreed				3	Strongly Agreed						

Semester – 02

R2020 (Batch:2021-2025)

21ME201		ENGINEERING MECHANICS							
Nature o	of Course	Concepts and Analytical							
Pre Requisites Fundamentals of basic mathematics and physics									
Course Objectives:									
1	1 To make the students understand the vector and scalar representation of forces and								
	moments a	nd the static equilibrium of particles and rigid bodies.							
2	To understa	and the effect of friction on equilibrium, laws of motion, kinematics	of motion						
	and their in	terrelationship.							
3	To make th	e students understand the properties of surfaces and solids, pre	diction of						
	behaviour of particles and rigid bodies under motion.								
Course Outcomes:									
Upon co	mpletion of	the course, students shall have ability to							
C201.1	Define and	illustrate the basic concepts of force system	[U]						
C201.2	Calculate the resultant force, moment and geometrical properties of 2D, [Ap]								
C201.3	Analyse the resistance force of particles and objects for Impending Motion [A]								
C201.4	Determine the displacement, velocity and acceleration of particles and [Ap]								
C201.5	Determine the Dynamic forces exerted in various mechanisms of planar motion								
Course Contents:									

Equilibrium of Particles and Rigid Bodies: Force Systems – Basic concepts, System of Forces, Coplanar Concurrent Forces, Resolution and addition of forces, resultant of several concurrent forces, Forces in space, Particle equilibrium in 2D and 3D. Moment of Forces and its Application; Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems - Equations of equilibrium of rigid bodies in 2D and 3D. Beams and frames - types of supports, loads and reactions.

Centre of Gravity, Moment of Inertia and Friction: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere.

Friction: Types of friction, Limiting friction, Laws of friction – Static and Dynamic Friction; simple contact friction, ladder friction – wedge friction.

Dynamics of Particles and rigid bodies: Kinematics of Particles: Basic terms, general principles in dynamics; Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates); Relative motion.

Kinetics of Particles: Newton's 2nd law (rectangular, path, and polar coordinates). D'Alembert's principle and its applications; Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

Kinetics of rigid bodies: rigid body translation, rotation and general plane motion.

Total Hours: 60

Text Bo	oks:										
1		r F P and	l.lohr	nston FR	Vector M	echanic	s for En	aineers -	Statics	s and Dynamics,	
•		Graw Hill E					0.01 211	gineere	olaliot	o ana Dynamico,	
2							. Enaii	neerina I	Vechar	nics-Statics and	
-		amics, Mo					, <u> .</u>				
Referen											
1			N. I	Engineerir	na Mech	anics -	Statio	s and	Dvnam	nics, Sri Balaji	
		lications-		•	5						
2		asekaran			rasubram	anian (G, F	undamen	tals of	Engineering	
	-	chanics, V								0 0	
3										cs", John Willey	
	and	Son's pul	blicat	ion, 8th ed	dition.201	1			-	-	
4		nar DS, "E									
5	Irvin	ng H. Shar	nes, l	Engineerir	ng Mecha	nics - St	atics ar	id Dynam	ics, Pe	arson Education	
		a Pvt. Ltd.									
6	Tim	oshenko.S	S, "Er	ngineering) Mechani	cs", Mc	Graw H	ill Educat	ion, 20	08.	
Web Re	feren	ces:									
1	http	://nptel.ac	c.in/c	ourses/12	2104015/						
2		://nptel.ac									
Online I		•									
1		os://ocw.m	nit.edu	I/courses							
Summa	•	ssessme				is and l	End So	mostor F	ivamin	ation	
Summa		1336331116			ontinuot	is and i		IIIESIEI L		End Semester	
		C	ontin	uous As	sossmon	+ (10%)				Examination	
			onun		5635111611	L (40 /0)				(60 %)	
	CA	1 (20 Mar	'ks)			CA 2	(20 Mai	'ks)			
		FA						2		Theory	
SA 1	Con	nponent		nponent	SA 2	Comp		Compo			
(12		-1		-II	(12	-		-IV		(60 Marks)	
Marks)	(4	marks)	(4	marks)	marks)	(4 ma	arks)	(4 mar	ks)	. ,	
Assess	ment	Methods	& Le	evels (bas	sed on Bl	ooms'T	axono	my)			
Formati	ve as	sessmen	it bas	sed on Ca	apstone M	Nodel (1	6%)				
Course	D	loom's		Assessr	nent Co	mpone	nt (Ch	oose ar	nd ma	р	
Outcom		evel		compon	ents from	n the li	st – Qı	liz, Assig	gnmen	t, Marks	
Outcom		evei		Case st	udy, Sem	inar, G					
C201.1	U	Inderstand	b	Compon	ent - I	Objective type			Quiz	4	
C201.2	2 A	pply		Compon	ent - II	Assignment				4	
C201.3	3 A	nalyze		Compon	ent - III		Assigr	ment		4	
C201.4		pply		Compon			Tutoria			4	
C201.5		1-1-1									
		issessme	nt ba	ased on C	ontinuo	is and I	End Se	mester E	xamin	ation	
				Continuo						d Semester	
				CIA1			CIA2			nination (60%)	
Bloom's	s Lev	el						sl		60 Marks]	
Bloom's	s Lev	el	[1	2 Marks]		[1	[12 Marks]			00 marks	
Bloom's		el	[1			[1	<u>2 імагк</u> 10	0]		10	
	ber	el	[1	2 Marks]		[1		<u>.</u>			
Remem Understa	ber		[1	2 Marks] 10		[1	10			10	
Rememl Understa Apply	ber and		[1	2 Marks] 10 10		[1	10 20			10 20	
Remem Understa	ber and		[1	2 Marks] 10 10 40		[1	10 20 40	<u></u>		10 20 40	

COs						P	Ds						PSOs			
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C201.1	3		1										2			
C201.2	3	2	2										3	1		
C201.3	3	3	3										3			
C201.4	3	2	3										3	1		
C201.5	3	2	2										3	1		

21ME202	MANUFACTURING TECHNOLOGY – I	3/0/0/3
Nature of Course	Theory concepts	
Pre Requisites	Fundamentals of Physics and Chemistry	
Course Objectives:		
1 3. To	describe the various manufacturing processes used to produce the	edesired
component	ts.	
	the methodologies to be followed in casting, metal joining and fo	rming of
•	g materials.	
3 To enable	the students to select a suitable manufacturing process for the	required
product ba	sed on its process characteristics.	
Course Outcomes:		
Upon completion o	f the course, students shall have ability to	
	ne concepts of basic manufacturing processes like casting, plastic welding and forming processes	[U]
C202.2 Develop a component	appropriate casting techniques for various materials and ts	[Ap]
C202.3 Select the	suitable welding process for an application	[Ap]
	itable metal forming processes and other manufacturing process an industrial usable component	[Ap]
C202.5 Explore th processes.	e possible defects and its causes in various manufacturing	[U]
Course Contents:		

METAL CASTING AND PLASTIC MOULDING PROCESSES: Metal casting: Sand casting – Sand moulding - Pattern – materials, types and allowances - Types of Molding sand – Properties and testing - Cores and its types – CO₂ process for core hardening –Classification and methods of moulding-Moulding Machines – Induction furnace for melting – Fettling and cleaning of castings - Casting defects - Special casting techniques - shell moulding, Investment casting, pressure die casting processes, centrifugal casting, continuous casting, ceramic mould casting, stir casting and squeeze casting – Plastic moulding: Plastic types and properties – plastic moulding techniques – injection moulding, blow moulding, rotational moulding, extrusion process, thermoforming and film blowing, compression moulding, transfer moulding.

METAL JOINING PROCESSES: Welding – classification- Gas welding processes – equipments and flame characteristics – Arc welding processes – use of bare and coated electrode – shielded metal arc welding, TIG welding, MIG welding - Submerged arc welding, plasma arc welding, atomic hydrogen welding, electro slag welding, thermit welding, Resistance welding – working principle of spot, seam and projection welding –diffusion and explosive welding - friction welding and friction stir welding-Electron beam welding , Laser beam welding – common welding defects and inspection of weldments- Soldering and brazing – other joining processes – mechanical joining and adhesive bonding.

METAL FORMING PROCESSES: Hot and cold working processes – Open and closed die forging– Types of forging hammers – forging operations – forging defects – Rolling – types of rolling mills – flat and shape rolling - Thread and ring rolling – Defects in rolled parts - Extrusion types – Wire, rod and tube drawing. **SHEET METAL WORKING:** Sheet metal characteristics – Shearing, drawing, bending and metal spinning operations – Stretch forming operations – Formability of sheet metal, Formability limit diagram –special forming processes- hydro forming, Electro hydraulic forming, Rubber pad forming, Explosive forming, Electromagnetic forming, Peen forming. **SPECIAL MANUFACURING TECHNIQUES:** Introduction to powder metallurgy and additive manufacturing- FDM.

Total Hours:

45

Text Bo	oks:
1	Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology,
	Pearson Education, Seventh edition, 2018.
2	P. N. Rao, "Manufacturing Technology", Vol.1, McGraw-Hill Education, 2013.
Referen	ce Books:
1	Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors
	Pvt Ltd., 2014
2	P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, Eighth
	Revised edition, 2014.
3	Radhakrishnan, "Manufacturing Technology I", Scitech Publications Pvt Ltd, 2010
Web Ref	ferences:
1	www.nptel.ac.in
2	www.sme.org
3	https://www.coursera.org/learn/3d-printing-revolution
Online F	Resources:
1	https://ocw.mit.edu/courses

Summa	tive	assessme	ent based	on C	ontinuou	is and	End Se	mester E	xamin	ation		
			ontinuous							End Semester Examination		
							(00.14			(60 %)		
	CA	<u>1 (20 Mar</u>				CA 2	(20 Ma		-			
SA 1	0.0	FA		1	SA 2	FA 2				Theory Examination		
(12	CO	mponent	Compon –II	^{1ent} (12		Component -III		Component -IV		(60 Marks)		
Marks)	(4	-i marks)	(4 mark	c)	marks)	-III (4 marks)		-iv (4 marks)				
Assess			& Levels		ed on Bl				(3)			
			t based o					,				
		Bloom's						oose an	d ma	p		
Course	tcome Level				nmen							
				e sti	udy, Sem	inar, G	roup A	ssignmer	nt)			
C202.1 Understand		d Com	npon	ent - I		Quiz			4			
C202.5												
C202.2	2 A	Apply	Component - II				Assignment			4		
					Presentation							
C202.3	3 A	Apply	Com	npon	ent - III Group Assignme					4		
C202.4	ŀ	Apply	Corr	npon	ent - IV		Semin	ar		4		
Summa	tive	assessme	ent based	on C	ontinuou	is and	End Se	mester E	xamin	ation		
					us Asses	ssment	(24%)		Er	nd Semester		
Bloom's	s Lev	/el	CIA	-			CIA2			mination (60%)		
			[12 Ma	rks]		[1	2 Mark	s]		[60 Marks]		
Rememb			20				20			20		
Understa	and		50				50			50		
Apply			30				30			30		
Analyse			-				-			-		
Evaluate)		-				-			-		
Create			-				-			-		

<u> </u>						P	Os						PSOs		
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C202.1	3	3	2											3	
C202.2	3	3	2											3	
C202.3	3	3	2											3	
C202.4	3	3	2											3	
C202.5	3	3	2											3	

21GE20)1	UNIVERSAL HUMAN VALUES (All Branches)	3/0/0/3
Nature of	of Course	C (Theory Concept)	
Pre-Req	uisites	Interpersonal Communication and Value Sciences	
Course	Objectives:		
1	Developme	nt of a holistic perspective based on self-exploration about thems	elves
	(human bei	ng), family, society and nature/existence.	
2		ling (or developing clarity) of the harmony in the human being, far	nily,
		nature/existence.	
3		ng of self-reflection.	
4		nt of commitment and courage to act.	
5		students to appreciate the essential complementarily between 'V	
		S' to ensure sustained happiness and prosperity, which are the co	ore
		of all human beings	
6		plausible implications of such a Holistic understanding in terms of	
		an conduct, trustful and mutually fulfilling human behavior and m	utually
0	-	teraction with Nature	
	Outcomes:	the source students shall have shilling to	
		the course, students shall have ability to about themselves and their surroundings (family, society,	
C201.1	nature).		[U]
		and take responsibilities in life and handle problems to attain	
C201.2		solutions while keeping human relationships and human nature	[U]
	in mind.		
C201.3		onsibilities towards their commitments (human values, human and human society).	[AP]
C201.4		they have learnt to their own self in different day-to-day settings at least a beginning would be made in this direction.	[AP]
C201.5	Analyse et	hical and unethical practices, and formulate strategies to harmonious environment wherever they work.	[A]
		the harmony in nature and existence, and work out mutually on	
C201.6		ticipation in the nature.	[U]
Course	Contents:		
		d, Basic Guidelines, Content and Process for Value Ed	ucation.
		mony in the Human Being - Harmony in Myself! - Purp	-
	•	urse. Self-Exploration–Its content and process; 'Natural Accepta	
•		on- as the process for self-exploration. Continuous Happing	
•	•	basic Human Aspirations. Right understanding, Relationship and	•
•		quirements for fulfilment of aspirations of every human being v	
correct p	priority. Unde	rstanding Happiness and Prosperity correctly- A critical apprais	al of the
current s	scenario. Me	thod to fulfil the above human aspirations: understanding and	living in
harmony	at various le	vels. Understanding human being as a co-existence of the sentie	nt 'l' and
the 'Mate	erial Body'. L	Inderstanding the needs of Self ('I') and 'Body' - happiness and	physical
	•	ng the Body as an instrument of 'l' (I being the doer, seer and e	
•		haracteristics and activities of 'I' and harmony in 'I'. Understan	,
	•	Body: Sanyam and Health; correct appraisal of Physical needs,	•
•			meaning
or Prosp	enty in detail	-Programs to ensure Sanyam and Health.	
l lus al a ma t		many in the Family and Society Harmony in Human	

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence - Whole existence as Coexistence - Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.

Implications of the above Holistic Understanding of Harmony on Professional Ethics -Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and ecofriendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems. Case studies of typical holistic technologies, management models and eco-friendly production systems. Strategy for transition from the present state to Universal Human Order: a. Individual level: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.

	Total Hours: 45
Text Bo	oks:
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel
	Books,New Delhi, 2010
2	Rajni Setia, Priyanka Sharma, "Human Values", Genius Publication", Jaipur,2019.
Referen	ce Books:
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3	India Wins Freedom - Maulana Abdul Kalam Azad.
Web Re	ferences:
1	https://examupdates.in/professional-ethics-and-human-values/
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf
Online F	Resources:
1	https://nptel.ac.in/courses/109/104/109104068/
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-
	school-f4593b49445b
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222

Summat	ive	asses					continu sessm				Seme	ster E	xami	En	on Id Sem xamina (60 %	tion	
	С	A 1 (20) Mar	'ks)					CA 2	(20 N	larks				(00 //	/	
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(12	Сс	ompon	ent	Con	npone	ent	(12			ponen	t Co	ompo			xamina		
Marks)	_	-1			-11		mark			·III		-IV		(60 Mar	ks)	
,		4 mark	- /		marks	-		<u> </u>	<u> </u>	narks)		4 mar	'ks)				
Assessn											lomy)						
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Course Outcom		Bloon Level	n's		com	pon	nent (ents fi udy, Se	rom	the	ist – (Quiz,	Assi	gnmei		Marks		
C201.1		Under	stanc	ł	Com	pon	ent - I			Gro	up Dis	scussi	on	4			
C201.2		Under	stanc	ł	Com	pon	ent - II			Boo	k Rev	iew			4		
C201.3, C201.4		Apply			Com	pon	ent - III			Role	e Play			4			
C201.5, C201.6		Apply			Com	pon	ent - IV	/		Forr	nal Pr	esent	ation		4		
Summat		asses	ssme	nt ba	ised c	on C	ontinu	Ious	s and	End S	Seme	ster E	xami	natio	on		
							us As								Semest	er	
Bloom's	Le	vel			CIA1					CIA	2		Exa	min	ination (60%)		
				[1	2 Mar	ˈks]			[12 Marks]					[60	Marks		
Rememb	-				20				<u>20</u> 40						20		
Understa	Ind													<u>40</u> 40			
Apply					40			_		40							
Analyse					-					-					-		
Evaluate Create					-					-					-		
Mapping		Cours		itcor	nos ((201	with P	roa	ramn		come	s (P()) Pro	ara	mme		
Specific					1165 ((50)	WILIII	log	ranni		come	55 (1 (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	grai	iiiie		
			\				P	os							PSOs	5	
COs		а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3	
C201.1	1						3	3		2				1			
C201.2	2						3	3	3	2				1			
C201.3	3						3	3	3	2				1			
C201.4	1						2	1	3	1				1			
C201.5							3	3						1	_	<u> </u>	
C201.6	6						3	3	3	2				1			
	3	3 Stro	ongly	agre	ed 2	2	Modera	itely	agre	ed ´	I Re	asona	ably a	gree	d		

21MA20)1 (COI	ENGINEERING MATHEMATICS II MMON TO MECH, MCT, CIVIL, ECE, EEE, CSE, IT, AIDS)	2/1/2/4
Nature of	of Course	J (Problem analytical)	
Pre Req	uisites	Concepts of Differentiation and Integration	
Course	Objectives:		
1	To gain kno	owledge in integrals, which are needed in engineering application	าร.
2	To develop	logical thinking and analytical skills in evaluating multiple integra	als.
3		nt with the concepts of vector calculus needed for proble g disciplines.	ms in all
4	•	the knowledge of Laplace transform, to find solutions of ini or linear ordinary differential equations.	tial value
	Outcomes: ompletion of	the course, students shall have ability to	
C201.1	Determine t triple integra	the area and volume by applying the techniques of double and als.	[R]
C201.2	Finding the	values of integrals through different numerical methods.	[U]
C201.3	Differentiate applications	e and integrate a vector-valued functions to solve real world	[AP]
C201.4		rad, div, curl and use Gauss, Stokes and Greens theorem to calculations of integrals.	[AP]
C201.5		ace transform techniques in system modelling, digital signal , process control, solving boundary value problems.	[AP]
C201.6	Apply Lapla	ace transform methods for solving linear differential equations.	[AP]
Course	Contents:		

Integral Calculus

Definite integrals: Evaluation of definite integrals using Bernoulli's formula –Multiple Integrals: Double integration in Cartesian coordinates –Area as double integral –Change of order of Integration – Triple integration in Cartesian co-ordinates –Volume as triple integral –Beta and Gamma functions – Relation between Beta and Gamma Functions – Evaluation of Integrals using Beta and Gamma Functions –Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals. (18)

Vector Calculus

Vector differential operator – Gradient of a scalar point function - Directional derivatives – Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields –Simple problems – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (theorems statements only)– Simple applications involving cubes and rectangular parallelepipeds. (14)

Laplace Transform

Convergence of Laplace transform – Transform of some standard functions –Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second order ordinary differential equation. (16)

Lab Cor	nponents	
S.No	List of Experiments	RBT
1	Double integrals evaluation in cartesian coordinates using MATLAB.	[AP]

2	Triple integral calculations using MATLAB in cartesian and cylindrical	
2	coordinates.	[AP]
3	Double integral evaluation in MATLAB by Trapezoidal rule.	[AP]
4	Evaluation of gradient, curl and divergence in MATLAB.	[AP]
5	Line integral over a vector field using MATLAB	[AP]
6	Applying Green's theorem to solve integrals in MATLAB.	[AP]
7	Relation between Laplace transform of function and its derivative using MATLAB.	[AP]
8	Laplace transform of Dirac delta and Heaviside functions in MATLAB.	[AP]
9	Solving Differential Equations in MATLAB using Laplace Transform.	[AP]
10	Inverse Laplace Transform of symbolic expressions using MATLAB.	[AP]
	Total Hours:	60
Text Bo		
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition, P	earson.
	Reprint, 2018.	,
2	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wi	ley and
	Sons (Asia) Limited, Singapore, 2018.	-
3	Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publi	cations,
	Delhi, 2014.	
Referer	ce Books:	
1	Veerarajan. T, "Engineering Mathematics II", Tata McGraw-Hill Publishing Co Ltd., New Delhi, 2018.	ompany
2	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Educat edition, 2012.	ion, 4 th
3	N.P.Bali and Dr.ManishGoyal, "A Text book of Engineering Mathematics", 9th	edition,
	Laxmi publications ltd, 2014.	
Web Re	eferences:	
1	http://nptel.ac.in/video.php?subjectId=122107037	
2	http://nptel.ac.in/courses/122107036/	
3	http://nptel.ac.in/video.php?subjectId=117102060	
Online	Resources:	
1	https://www.coursera.org/learn/pre-calculus	
2	https://www.coursera.org/learn/linearalgebra1	
3	https://alison.com/courses/Advanced-Mathematics-1	
4		
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x.	

Summ	ative assess	sment based	d on Cor	ntinuous an	d End Seme	ster Exa	minatio	on
		Continu	ious As:	sessment (5	0%)			End Semester Examinati on (50%)
	CA 1 (10 Marks	s)		CA 2 (10 Marks	s)	Prac Exa (30 M		Theory Examinati
SA 1	FA	A 1	SA 2	FA	2	FA	SÅ	on
(6	(6 Compon Compon (6 Compon Compon (22 (8 (50							(50
Mark	ent -l	ent -II	mark	ent -III	ent -IV	mark	Mark	Marks)
s)	(2 marks)	(2 marks)	s)	(2 marks)	(2 marks)	s)	s)	

			Levels (based on l			Theory	
Formative Course Outcome	Blooi Leve	m's	ased on Capstone Assessment Co components fro Case study, Sen	omponent (0 m the list – 0	Choose a Quiz, Assi	gnment,	Marks
C201.1	Reme	ember	Component - I	Quiz			2
C201.2	Unde	rstand	Component - II	Assigni	ment		2
C201.3	Apply	1	Component - III	Tutoria			2
C201.4	Apply	1	Component - IV	Group	activity		2
C201.5	Apply	1					
C201.6	Apply	1	7				
Summativ	e asse	essment	based on Continu	ous and End	I Semeste	r Examina	ation
			Continuous Asse	essment (12%	%)	Enc	Semester
Bloom's Level		CIA1 [6 Marks]	CIA [6 Ma			ination (50%) 0 Marks]	
Remembe	ſ		20	20)	•	20
Understan	d		30	30)		30
Apply			50	50)		50
Analyse			-	-			-
Evaluate			-	-			-
Create			-	-		-	
Summativ Practical	e asse	essment	based on Continu	ous and End	I Semeste	r Examina	ation -
Bloom's			Contin	uous Asses	sment (30		
Level			FA			SA	
Levei			(22 Marks)			(8 Mar	ks)
Remembe	r		20			20	
Understan	d		30			30	
Apply			50			50	
Analyse			-			-	
Evaluate			-			-	
Create			-			-	

<u> </u>		Pos PSOs													
COs	а	b	С	d	е	f	g	н	i	j	k	I	1	2	3
C201.1	2	2	2	1	2	1							1		
C201.2	2	2	2	2	2	2							2		
C201.3	3	3	3	3	3	3							3		
C201.4	3	3	3	3	3	3							3		
C201.5	3	3	3	3	3	3							3		
C201.6	3	3	3	3	3	3							3		

21PH20	01	APPLIED PHYSICS (COMMON TO MECH, MCT AND CIVIL)	3/0/3/4.5
Nature	of Course	E (Theory skill based)	
Prerequ		Nil	
Course	Objectives:		
1	To learn the ba	asic concepts of physics needed for all branches of enginee	ring.
2		students to understand the basics of properties of mattentum mechanics and crystallography.	r, harmonic
3	To familiarize t	the principles of various instruments and laser.	
Course	Outcomes:	he course, students shall have the ability to	
C201.1		e bending behavior beams, analyze the expression for lulus and working of torsional pendulum.	[U]
C201.2	Identify the instruments.	various parameters that are measurable in different	[U]
C201.3	Discuss the p of laser.	physical characteristics of oscillation and the basic principle	[U]
C201.4		the central concepts and principles in quantum mechanics, Schrödinger equation, the wave function and its statistical n.	[U]
C201.5		Atomic packing and acquire the basic knowledge about ce, Unit cell, Crystal defects and classify the solids based bry.	[Ap]
C201.6	Apply the ga of study.	ined knowledge to solve the problems related to their field	[Ap]

Course Contents:

Properties of matter and Instrumentations:

Properties of matter: elasticity - Plasticity - Types of stress and strain - Hooke's law, stressstrain diagram - Poisson's ratio - Types of moduli of elasticity, relation between three moduli of elasticity -Factors affecting elasticity - Bending moment of a body: neutral surface and neutral plane, derivation of expression for bending moment of a beam with circular and rectangular cross section, cantilever, I- beam – Derivation of expression for Young's modulus -Torsion of cylinder: expression for couple per unit twist of a solid cylinder (derivation), torsional pendulum, expression for period of oscillation. Instrumentations: dial gauge - Piezo

electric strain gauge - Load cell: pneumatic load cell and hydraulic load cell - Pirani gauge -Optical microscope: Scanning electron microscope (SEM), transmission electron microscope (TEM) – Types of errors: gross error, systematic error and random error.

Harmonic oscillations and Laser

15 hours Harmonic oscillations: periodic motion- Simple harmonic motion: characteristics of simple harmonic motion -Simple spring-mass system - Resonance - Damped harmonic oscillator, energy decay in a damped harmonic oscillator. Laser: characteristics of laser - Principle of spontaneous emission and stimulated emission - Einstein's theory of matter radiation interaction and A and B coefficients (derivation) – Population inversion – Pumping –Different types of lasers: Neodymium laser, CO₂ and semiconductor laser (heterojunction) – Thermal effect –Qualitative industrial applications of lasers: welding, drilling and cutting.

Quantum mechanics and Crystallography:

Quantum mechanics: Planck's quantum theory (derivation)- Matter waves, de-Broglie wavelength -Heisenberg's uncertainty principle - Schrödinger's wave equation: time independent and time dependent- Physical significances of wave function - Particle in a one dimensional potential box. Crystallography: crystal system - lattice -Bravais lattice, calculation of atomic packing factor for simple cubic, body centered cubic, face centered cubic

15 hours

15 hours

and hexagonal close packed lattice–Miller indices – Crystal imperfections: point, line burger vector – Basic concepts of band theory and classification of materials into conductor, semiconductor and insulator.

Lab C	omponents	
S.No	List of Experiments	RBT
1	Young's modulus of the material - Non-Uniform bending method.	[U]
2	Moment of Inertia of disc and rigidity modulus of a wire – Torsional pendulum.	[U]
3	Projectile motion – Simulation lab.	[U]
4	Frequency of transverse and longitudinal wave modes –Melde's experiment.	[U]
5	Simple harmonic motion- Simulation lab.	[U]
6	Determination of laser and optical fiber parameters.	[U]
7	Determination of Planck's Constant.	[U]
8	Determination of Stefan's Constant.	[U]
9	Determination of lattice constant of cubic crystal structure.	[U]
10	Determination of band gap of semiconductor.	[U]
	Life Skills Experiments	
1	How does a fuel (gas/liquid) pump nozzle shut off?	
2	How does a circuit breaker work?	
3	How to Check Earthing at Home?	
	Total Hours:	75
Text B	ooks:	
1	David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 2018	Wileyplus,
2	Rajendran. V, "Engineering Physics", Mc Graw Hill Publications ltd, New D	elhi, 2016.
Refere	ence Books:	
1	Avadhanulu M. N., Kshirshagar P. G., Arun Murthy TVS, "A Text Book of E Physics", S. Chand & Co Ltd, 2018.	Engineering
2	Sawhney A. K., Puneet Sawhney "A Course In Mechanical Measure Instrumentation & Control", Dhanpat Rai & Co, 2013.	ments And
3	Richard P. Feynman. Robert B. Leighton, Matthew Sands, "The Feynman I Physics Vol. I": The New Millennium Edition, 2015.	_ectures on
Web F	eferences/ Online Resources:	
1	https://faraday.physics.utoronto.ca/IYearLab/Elastic-properties-of-solids-m	
2	https://www.physik.uzh.ch/~matthias/espace-assistant/manuals/en/anleitur tb_e.pdf	ng_102-
3	https://ir.nctu.edu.tw/bitstream/11536/1680/1/A1995TF11100052.pdf	
4	http://www2.optics.rochester.edu/workgroups/cml/whole-enchilada-SPR05	.pdf
5	https://nptel.ac.in/courses/122/103/122103010/	
6	https://nptel.ac.in/courses/115/106/115106119/	
7	https://www.eatm.in/upload/sritunit_i_laser.pdf	
8	https://nptel.ac.in/courses/115/101/115101107/	
9	https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/le	ecture-
10	http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf	

Summ	ative	e assess	ment l	based	on Cor	ntinuous	and	I End Seme	ster Exa	mina	atio	n
						sessmer						End Semester Examinat ion (50%)
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	1	assessr	nent ba									
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C201.1					ponent -		Qu					2
C201.2					ponent -			signment				2
					Component - III			Seminar				2
	C201.4 Understand											
C201.5		Apply		Com	ponent -	١V	Tut	torial				2
C201.6		Apply										
Summ	ative	e assess	ment l					End Semes	ster Exa			
		_				Assessn	nent					mester
Bloom	's Le	evel	-	CIA			-	CIA2	E			ion (50%)
Davasava				<u>6 Mar</u>	KS		[6 Marks]		[:		arks]
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	ative	e assess	ment l	based	on Cor	ntinuous	and	I End Seme	ster Exa	mina	atio	n -
					Co	ntinuou	s As	ssessment (30%)			
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Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme S	becific
Outcomes (PSO)	

<u> </u>						Р	Os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
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C201.2	3	1		1					1				1		
C201.3	3	1		1					1				1		
C201.4	3	1		1					1				1		
C201.5	3	2		2					2				2		
C201.6	3	2		2					3				2		
		•	•	•	•	•	•	•	•		•	•			
		3	Stro	ongly	agre	ed	2	Mod	erate	ely ag	greed	1 1	Reasor	hably agre	ed

	03	ENGINEERING PRACTICES LABORATORY	0/	0/3/1.5
Nature (of Course	Practical application		
Pre Req	uisites	Nil		
1	To learn the	e use of basic hand tools and to know the need for safe	ty in work	<pre>k place</pre>
	and to gain	hands on experience in Carpentry, Sheet metal, Plumbir	ng, Weldi	ng and
	Foundry.			U
2	To learn ab	out basic electrical devices, meters and electronics devi	ices and	to gai
	knowledge a	about the fundamentals of various electrical and electron	nic gadge	ts thei
	working and	d trouble shooting.		
Course		-		
Upon co	ompletion of t	the course, students shall have ability to		
	Identify and	d solve the basic engineering problems at home a	and in	[Ap]
	workplace.			
C103.2	Develop the	e surfaces and make simple components like tray and fun	nnel.	[Ap]
-		, , , , ,	Ŭ	
C103.4				[Ap]
				<u>[' ']</u>
•		• • • • • • •		
•		List of Experiments	CO Japping	RBT
List of E	Experiments:	List of Experiments	lapping	
List of E S.No	Experiments: Preparation o	List of Experiments M of butt joints and lap joints using arc welding (lapping C103.3	[Ap]
List of E S.No 1	Experiments: Preparation o	List of Experiments M of butt joints and lap joints using arc welding (lapping C103.3	
List of E S.No 1	Experiments: Preparation o Sheet metal F funnels.	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0	Iapping C103.3 C103.2	[Ap]
List of E S.No 1 2 3	Experiments: Preparation o Sheet metal F funnels. Preparation o	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0	Iapping C103.3 C103.2	[Ap] [Ap]
List of E S.No 1 2 3	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 pipe connections involving the fittings like valves, 0	Iapping C103.3 C103.2 C103.3	[Ap] [Ap]
List of E S.No 1 2 3 4	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic taps, coupling used in house	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of unions, reducers, elbows and other components ehold fittings. 0	Iapping C103.3 C103.2 C103.3	[Ap] [Ap] [Ap]
List of E S.No 1 2 3 4	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic taps, coupling used in house Demonstratio	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of of oundry, reducers, elbows and other components ehold fittings. 0 on of foundry operations like mould preparation for 0	Iapping C103.3 C103.2 C103.3 C103.3 C103.4	[Ap] [Ap] [Ap] [Ap]
List of E S.No 1 2 3 4 5	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic taps, coupling used in house Demonstratio solid and split	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of of onnections involving the fittings like valves, 0 of unions, reducers, elbows and other components 0 ehold fittings. 0 on of foundry operations like mould preparation for 0 t piece pattern. 0	Iapping C103.3 C103.2 C103.3 C103.4 C103.4	[Ap] [Ap] [Ap] [Ap] [U]
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List of E S.No 1 2 3 4 5 6 7	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic taps, coupling used in house Demonstratio Solid and split Demonstratio moulding	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints involving the fittings like valves, 0 g, unions, reducers, elbows and other components 0 ehold fittings. 0 on of foundry operations like mould preparation for 0 t piece pattern. 0 on of Smithy operations 0 on of assembly of pump / Demonstration of Injection 0	Iapping C103.3 C103.2 C103.3 C103.4 C103.4 C103.5 C103.1	[Ap] [Ap] [Ap] [Ap] [U]
List of E S.No 1 2 3 4 5 6 7	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic taps, coupling used in house Demonstratio Solid and split Demonstratio moulding	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints by sawing, planning and cutting. 0 of wooden joints involving the fittings like valves, 0 g, unions, reducers, elbows and other components 0 ehold fittings. 0 on of foundry operations like mould preparation for 0 t piece pattern. 0 on of Smithy operations 0 on of assembly of pump / Demonstration of Injection 0	Iapping C103.3 C103.2 C103.3 C103.4 C103.4 C103.5 C103.1	[Ap] [Ap] [Ap] [Ap] [U] [Ap]
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Nature of Course Practical application Pre Requisites Nil Course Objectives: Nil 1 To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry. 2 To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting. Course Outcomes: Upon completion of the course, students shall have ability to C103.1 Identify and solve the basic engineering problems at home and in [Ap] workplace. C103.2 Develop the surfaces and make simple components like tray and funnel. [Ap] C103.3 Make simple metal joints using welding equipment and wooden joints using [Ap] carpentry tools. [Ap] C103.4 Prepare pipe connections and sand moulds. [Ap] C103.5 Describe the fundamentals of hot forging and nijection moulding [U] C103.6 Examine and troubleshoot electrical and electronic circuits [A] Course Contents: [AP] Carpentry work using power tools - Plumbing components and pipelines List of Experiments Coonstantion of boundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tool				
List of E S.No 1 2 3 4 5 6 7 List of E Basic C Moving i circuits,	Experiments: Preparation o Sheet metal F funnels. Preparation o Making basic taps, coupling used in house Demonstratio solid and split Demonstratio Demonstratio moulding GROUF Experiments: ircuit Element ircunt Element pCB design, f	List of Experiments M of butt joints and lap joints using arc welding 0 Forming and Bending, Model making – Trays and 0 of wooden joints by sawing, planning and cutting. 0 pipe connections involving the fittings like valves, 0 g, unions, reducers, elbows and other components 0 ehold fittings. 0 on of foundry operations like mould preparation for 0 t piece pattern. 0 on of Smithy operations 0 on of assembly of pump / Demonstration of Injection 0 P B (ELECTRICAL AND ELECTRONICS ENGINEERING 0 ts: Resistor, inductor, capacitor. Introduction to measuri 0 oving coil meter, Wattmeter, Energy meter, CRO, Multi-meter 0 fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent 0	Iapping C103.3 C103.2 C103.3 C103.4 C103.4 C103.5 C103.1 G) ing equip eter. Digit	[Ap] [Ap] [Ap] [Ap] [U] [Ap] [Ap] ments al logi
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3 purpose PCB. C103.6 [AP] 6 Demonstration of meters and electrical components. C103.6 [AP] 7 Safety precautions with electrical components. C103.6 [AP] 8 Residential house wiring. C103.6 [A] 9 Measurement of power and energy. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] 11 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New		4	Familiarisation of digital basic gate IC's.	C103.6	[AP]
7 Safety precautions with electrical components. C103.6 [AP] 8 Residential house wiring. C103.6 [A] 9 Measurement of power and energy. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] Total Hours: 45 Reference Books: 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 1 www.nptel.ac.in 2 www.sme.org		5		C103.6	[AP]
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Reference Books: 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 1 www.nptel.ac.in 2 www.sme.org		10	Trouble shooting of electrical equipments.	C103.6	[A]
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2 www.sme.org	V	Neb Re	ferences:		
		1	www.nptel.ac.in		
3 http://www.allaboutcircuits.com/education/			www.sme.org		
	1	3	http://www.allaboutcircuits.com/education/		

Summative asse	essment based or	Continuous and	End Semester Examination
	Continuous As	sessment (60%)	End Semester Examination (40%)
Bloom's Level	FA (45 Marks)	SA (15 Marks)	Practical Examination (40 Marks)
Remember	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

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COs						P	Os							PSOs		
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C103.1	3															
C103.2	3	1														
C103.3	3													3		
C103.4	3	1												3		
C103.5	3	1												3		
C103.6	3															
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		3 3	Stron	gly a	greed	1 2	2 Mo	odera	tely a	agree	ed	1	Reasona	bly agre	ed	

	1	PYTHON FOR ENGINEERS LABORATORY	1/0/3/2.5
Nature of	of Course	F (Theory Programming)	
Pre Req	uisites	NIL	
Course	Objectives:		
1		e use of procedural statements like assignments, conditional sta	tements,
		unction calls.	
2		ipported data structures like lists, dictionaries and tuples in Pytho	n.
3		oblem solving skills using strings, and functions	
4		ne need for Object-oriented programming concepts in Python.	
	Outcomes:	f the course, students shall have ability to	
C211.1		imple Python programs for solving problems.	[U]
02		ne Python language syntax including control statements, loops	[0]
C211.2		ons to write programs for a wide variety problem in mathematics,	[U]
-	science, an		L - J
0011.0		ne core data structures like lists, dictionaries, tuples and sets in	
C211.3	Python to s	store, process and sort the data.	[AP]
C211.4	Interpret th	e concepts of Object-oriented programming as used in Python	
6211.4	using enca	psulation, polymorphism and inheritance.	[AP]
C211.5		external modules for creating and writing data to excel files and	[AP]
0211.5	inspect the	file operations to navigate the file systems.	
	Contents:		
Expressi Condition	ions, Stater nal (If), Alter	hon: Interpreter and Interactive Mode; Values and Data Types, V ments, Operators. Conditionals: Boolean Values and O rnative (If-Else), Chained Conditional (If-Elif-Else). Iteration: WI	perators, hile, For,
Expressi Condition Break, C Strings: Methods Argumer	ions, Stater nal (If), Alter continue, Pas String Slice s, List Loop. s, Set in Py nts.	ments, Operators. Conditionals: Boolean Values and O	perators, hile, For, ecursion. ices, List ions and
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R2020 (Batch:2021-2025)

14	Program	ns using Files			[AP]								
15	Program	ns using Command	l line arguments		[AP]								
	•			Total Hours:	60								
Text Bo													
1		0	•	and programming using pythor	n: with								
	applicat	tions to understand	ling data, PHI Publi	sher, 2016									
2	Beginni	ng Python: From N	lovice to Professior	nal, Magnus Lie Hetland. Editio	on, 2005								
3	Allen B.	Downey, "Think P	ython: How to Thin	k Like a Computer Scientist",									
	2 nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016												
4	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and												
	updated for Python 3.2, Network Theory Ltd., 2011.												
Referer	nce Book												
1			Wayne, Robert Dor	ndero, "Introduction to Program	nming in								
	Python:	An Inter-disciplina	ry Approach", Pear	son India Education Services	Pvt. Ltd.,								
	2016.												
2	Timothy	/ A. Budd, "Explorir	ng Pythonll", Mc-Gr	aw Hill Education (India) Priva	te Ltd.,								
	2015.	•											
3	John V	Guttag, "Introduction	on to Computation	and Programming Using Pytho	n",								
		•	lition, MIT Press, 20										
Web Re	ferences):											
1	https://	www.wileyindia.cor	n/introduction-to-co	mputer-science-using-python.	html								
2	https://	www.programiz.co	m/python-programn	ning									
3	https://	www.fullstackpythc	n.com/best-python	-resources									
4	https://	www.tutorialspoint.	com/python/										
5	-	•	s.org/python-progra	amming-language/									
	Resource	<u> </u>											
1		ptel.ac.in/courses/	106106145/										
2			com/learn/learn-py	thon									
	•												
Summa	live asse			End Semester Examination End Semester Examinatio	n (40%)								
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Remem	ber	20	20	20									
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Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
00-							PSOs								
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C211.1	3	3	3	2	1								2	1	1
C211.2	3	3	3	2	1								2		
C211.3	3	3	3	2	1								2		
C211.4	3	3	3	2	1								2		
C211.5	3	3	3	2	1								2	1	1
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21MC10	2	ENVIRONMENTAL SCIENCES	2/0/0/0						
Nature of	of Course	C (Theory Concept)							
Pre Req	uisites	Basics in Environmental Studies							
Course	Objectives:								
1	To learn the	e integrated themes on various natural resources.							
2	To gain kno	wledge on the type of pollution and its control methods.							
3	To have a	n awareness about the current environmental issues and the	ne social						
	problems.								
	Outcomes:								
Upon co	mpletion of	the course, students shall have ability to							
C102.1	Recall and future gene	play an important role in transferring a healthy environment for ration.	[R]						
C102.2	Understand biodiversity	the importance of natural resources and conservation of	[U]						
C102.3	Understand and societa	I and analyze the impact of engineering solutions in a global I context.	[U]						
C102.4	Apply the g	ained knowledge to overcome pollution problems.	[AP]						
C102.5	C102.5 Apply the gained knowledge in various environmental issues and [AP]								
Course	Contents:								

Natural Resources:

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification – Role of an individual in conservation of natural resources.

Environmental Pollutions:

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Greenhouse effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

Social issues and the Environment:

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.

	Total Hours: 3	0
Text Bo	oks:	
1	Anubha Kaushik and C P Kaushik "Perspectives in Environmental Studies"	, 4 th
	Edition, New age International (P) Limited, Publisher Reprint 2014. New Delhi.	
2	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford Unive	rsity
	Press 2015.	

Reference	e B	ooks:															
1	Tyle	er Mille	er, Jr.,	"Env	ironm	ental	Scie	nce",	Broo	ks/Cc	ole a l	part o	f Ceng	age Lea	arning,		
	201								"					" 40th F			
2		iam C Graw F			and	Mary	Cunn	lingha	am, "I	nviro	onme	ntal S	cience	", 13 th E	dition,		
3			,		ntrod	uction	to E	nviror	mon	tal Er	ainor	vring c	and So	ience", ⁻	Third		
3		tion, P							IIIIEII	lai Li	iyinee	anny a	anu Sc	ience,	miu		
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4		o://npte															
5		o://nptel.ac.in/courses/122102006/20 urces:															
Online R		esources: https://www.edx.org/course/subject/environmental-studies															
1		https://www.edx.org/course/subject/environmental-studies www.environmentalscience.org															
2																	
Tentative							•						my)				
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C102.2		Unde							menta reser		10						
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Mapping Specific					s (CC) wit	h Pro	ogran	nme (Dutco	omes	(PO)	Progra	amme			
		come		,		P	Os							PSOs			
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C102.1	3		2			3	2	1				1	1	1			
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C102.3	2	2	2			3	3	1				1	1				
C102.4	3	2	2			3	3	1				1	1				
C102.5	3	2	2			3	3	1				1	1				
	3		ngly ag		2								ly agre				

Semester – 03

21ME301		SOLID MECHANICS	3/1/0/4							
Nature of C	Course	Theory Analytical								
Pre Requis	ites	Engineering Mechanics								
Course Ob	jectives:									
1	To learn t	he fundamental concepts of strength of materials								
	To under	stand and analyze the stress induced in various structural memb	ers							
		ate the stability of columns and beams.								
		stand the two dimensional stresses.								
	pletion of	the course, students shall have ability to								
	Discuss t loading.	he strength of various structural elements subjected to axial	[U]							
		the principle stress and strain energy	[U]							
	Compute graphically the shear force and bending moment for different [Ap] types of beams and interpret the effect of transverse loading on beams									
C301.4	Inspect th	ne slope and deflection of beams.	[Ap]							
C301.5	Examine	the stresses in shafts and columns	[A]							
C301.6	Analyze t	he stresses involved in thin & thick cylinders.	[A]							
Course Co	ntents:									
section mo sections. Do Torsion - s modulus, F Rankine's o	dulus, fle eflection stresses a Power trai equations	subjected various kinds of loads. Stresses in Beams - bending xural rigidity. Analysis of bending stress in the circular, recta of Beams - Double Integration method and Macaulay's method.								
ucronnation	n of thin ai	and deformation in circular and hollow shafts, torsional rigidity nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal and thick cylinders subjected to internal pressure	and polar iler's and							
Taxt Deale	n of thin ai	nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal nd thick cylinders subjected to internal pressure.	and polar iler's and							
Text Books		nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal	and polar ıler's and pressure,							
1	s: Ferdinand Sanjeev S	nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal nd thick cylinders subjected to internal pressure.	and polar uler's and pressure, 60 Mazurek,							
1	s: Ferdinand Sanjeev S New Delh	nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal nd thick cylinders subjected to internal pressure. Total Hours: d P. Beer, E. Russell Johnston Jr, John T. DeWolf, David F. Sanghi, ""Mechanics of Materials", Tata McGraw Hill Publishing ni, 8 th Edition, 2020 an "Strength of Materials", McGraw Hill Education (India) Pvt.	and polar iler's and pressure, 60 Mazurek, 'co. Ltd.,							
1 2 Reference	S: Ferdinand Sanjeev S New Delh S.S. Ratt Edition, 2 Books:	nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal nd thick cylinders subjected to internal pressure. Total Hours: d P. Beer, E. Russell Johnston Jr, John T. DeWolf, David F. Sanghi, ""Mechanics of Materials", Tata McGraw Hill Publishing ni, 8 th Edition, 2020 an "Strength of Materials", McGraw Hill Education (India) Pvt. 017.	and polar uler's and pressure, 60 Mazurek, 'co. Ltd., Ltd., 3rd							
1 2 Reference	S: Ferdinand Sanjeev S New Delh S.S. Ratt Edition, 2 Books:	nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal nd thick cylinders subjected to internal pressure. Total Hours: d P. Beer, E. Russell Johnston Jr, John T. DeWolf, David F. Sanghi, ""Mechanics of Materials", Tata McGraw Hill Publishing ni, 8 th Edition, 2020 an "Strength of Materials", McGraw Hill Education (India) Pvt.	and polar uler's and pressure, 60 Mazurek, 'co. Ltd., Ltd., 3rd							
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1 2 Reference 1 2 3 Web Refer	S: Ferdinand Sanjeev S New Dell S.S. Ratt Edition, 2 Books: Egor.Pop S. H. Cra Tata McC Bansal, F ences:	nsmitted by a uniform shaft, Columns – Buckling load by Eu Axial and hoop stresses in cylinders subjected to internal and thick cylinders subjected to internal pressure. Total Hours: d P. Beer, E. Russell Johnston Jr, John T. DeWolf, David F. Sanghi, ""Mechanics of Materials", Tata McGraw Hill Publishing hi, 8 th Edition, 2020 an "Strength of Materials", McGraw Hill Education (India) Pvt. 017. ov, "Mechanics of Materials" 2 nd Edition, Pearson Education India and all and N. C. Dahl, "Introduction to Mechanics of Solids", 3 Graw Hill, India, 2013. R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2018.	and polar uler's and pressure, 60 Mazurek, 'co. Ltd., Ltd., 3rd a, 2015							
1 2 Reference 1 2 3 Web Refer 1	s: Ferdinand Sanjeev S New Delh S.S. Ratt Edition, 2 Books: Egor.Pop S. H. Cra Tata McG Bansal, R ences: https://lec	nsmitted by a uniform shaft, Columns – Buckling load by Eu . Axial and hoop stresses in cylinders subjected to internal Ind thick cylinders subjected to internal pressure. Total Hours: d P. Beer, E. Russell Johnston Jr, John T. DeWolf, David F. Sanghi, ""Mechanics of Materials", Tata McGraw Hill Publishing i, 8 th Edition, 2020 an "Strength of Materials", McGraw Hill Education (India) Pvt. 017. ov, "Mechanics of Materials" 2 nd Edition, Pearson Education India andall and N. C. Dahl, "Introduction to Mechanics of Solids", 3 Graw Hill, India, 2013.	and polar uler's and pressure, 60 Mazurek, 'co. Ltd., Ltd., 3rd a, 2015							
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Course Outcom			oon _eve	-			con	npor	nents , Cas	s fro se St	m th	ie lis , Ser	ose a t - Qu ninar	Jiz,	map oup			6%) arks]
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C301.3 C301.4		Арр	ly					Assi signn	gnme nent	ent							20 20	
C301.5 C301.6		Ana	alyze Tutorial														20)
Assessm	ent	bas	ed c	on S	umn	nativ	ve ar	nd Ei	nd Se	eme	ster	Exa	mina	tion				
Bloom's	Assessment based on Summative Summative Bloom's Level								men s]	t (24	%)		End	Ser	nester (60°		min	ation
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Apply					40				40					40				
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21ME30	2	ENGINEERING THERMODYNAMICS	3/0/0/3
Nature o	f Course	Concepts and Analytical	•
Pre Requ	uisites	Fundamentals of basic mathematics and physics	
Course 0	Objectives:		
1	To underst	and the thermodynamic laws and their applications.	
2	To study th	ne properties of steam and the use of steam tables and Mollier	Chart.
3	To develop	o a clear understanding about thermodynamic relations.	
Course (Dutcomes:		
Upon co	mpletion of	the course, students shall have ability to	
C302.1	Discuss ab	bout the thermodynamic properties, work, heat and entropy.	[U]
C302.2	Apply laws	of thermodynamics to open and closed systems.	[Ap]
C302.3	Examine th	ne properties of pure substances	[A]
C302.4	Analyze ar plants.	nd understand the vapor power cycle used in steam power	[A]
C302.5	Derive sim	ple thermodynamic relations of ideal and real gases	[A]
C302.6	Illustrate th allied com	ne working principles of various refrigeration systems and ponents	[Ap]
Course (Contents:		•
		d First Law: Review of basic concepts of thermodynamics y, State and Equilibrium, Process and Cycle, Work, Tempera	

Surrounding, Property, State and Equilibrium, Process and Cycle, Work, Temperature, Heat and Other forms of energy, Internal energy, Specific heat capacities, Macroscopic approach and Microscopic approach - Quasi static process, Zeroth law of thermodynamics, First law of thermodynamics, Application of First law to non- flow system, Steady flow energy equation and its application to various thermal equipments, Unsteady flow process-Tank filling and emptying (Descriptive). **Second Law:** Second law of Thermodynamics – Kelvin's and Clausius statements of Second law, Reversibility and Irreversibility, Heat reservoirs - Refrigerator and heat pump, Carnot theorem, Carnot cycle, Reversed Carnot cycle, Efficiency, COP, Thermodynamic temperature scale, Clausius inequality, Concept of entropy, Entropy of ideal gas, and Principle of increase of entropy.

Properties of Pure Substance and Vapour Power Cycle: Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, Phase rule, P-V, P-T, T-V, T-S, H-S (Mollier chart) diagrams, PVT surfaces, Specific properties of steam - Use of Steam Tables & Mollier chart, Calculations of work done and heat transfer in non-flow and flow processes, Standard Rankine cycle (Analytical), Reheat (Descriptive) and Regenerative cycle (Descriptive).

Gas Mixtures and Thermodynamic Relations: Gas mixtures – Properties of ideal and real gases, Equation state, Vander waal's equation of state, Compressibility factor, Compressibility chart, Dalton's law of partial pressure, Exact differentials, TdS relations, Maxwell's relations, Clausius clapeyron equations, Joule–Thomson coefficient. **Refrigeration:** Refrigeration – definition - terminology used, desirable properties of refrigerant, classification of refrigerants, introduction to eco-friendly refrigerants, selection of refrigerant, types of refrigeration systems, Ideal vapour compression refrigeration cycle (Descriptive), Vapour absorption refrigeration cycle (Descriptive).

	I otal Hours: 45
Text B	ooks:
1	Nag. P.K, "Engineering Thermodynamics", 5th Edition, McGraw Hill Education, New Delhi, 2017.
2	Yunus. N.J, Cengel. A and Michael Boles. A, "Thermodynamics- An Engineering Approach" 8 th Edition, McGraw Hill Education, New Delhi, 2016.

Referenc	e Book	s:									
1			1. Rathore, "Th	nermal Eng	ginee	ering", Mo	c Gra	aw Hill Edu	ucatio	on private	
			eprint 2016.								
2			loran.J, and								
			namics", 4th E	dition, Joh	n wi	ley &	; Soi	ns, New Yo	ork, 2	.017.	
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	ative sment		Summative Assessment	Total Continue Assessm			ous	Semest Examinat	-	Total	
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Assessm	ent Me	thods a	& Levels (bas	ed on Blo	oms	' Taxono	omy)				
Formativ	e Asse	ssmen	t based on Ca	pstone M	odel						
Course Outcom	· · · · · · · · · · · · · · · · · · ·									A (16%)) Marks]	
C302.1	Un	derstan	d Quiz		- 5					20	
C302.2	Ap	oly	Tutorial							20	
C302.3		-									
C302.4		alyze	Assignme	ent						40	
C302.5										10	
C302.6											
Assessm	ent bas	sed on	Summative a	nd End Se	emes	ster Exan	ninat	tion			
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Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
605						PSOs									
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C302.1	3	2	2												
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21ME303	5	FLUID MECHANICS AND MACHINERY	3/0/0/3					
Nature of	Course:	G (Theory and Practical)						
Pre Requ	isites:	Basic Mathematics and Engineering Physics						
Course O	bjectives:							
1		tand the properties of the fluid						
2	problems.	e and appreciate the complexities involved in solving the						
3	flow Proble		f practical					
4	Learn to a	pply conservation laws flow through pipes.						
Course O	outcomes:							
Upon cor	npletion of	f the course, students shall have ability to						
C303.1	•	e the basic concepts of fluid properties.	[U]					
C303.2	Examine t	Examine the fluid flow and its behaviour. [A]						
C303.3		behaviour of boundary layer flows.	[U]					
C303.4		he dependent and independent dimensionless parameters.	[A]					
C303.5		ne performance of hydraulic machines.	[A]					
Course C	ontents:							
submerge of fluid sta Fluid Dyr Hagan Po	ed bodies, M atic pressur namics - E biseuille equ	ompressibility, capillary, surface tension and buoyancy - f leasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami uation - Turbulent flow – Darcy Weisbach formula - Major and min	- concept nar flow – nor losses					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles	ed bodies, M atic pressur namics - E biseuille equ circular pi boundary nless numb , Velocity tion of wate	leasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami	- concept nar flow – nor losses dary layer militude – working n pumps. s, working					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles, Classifica	ed bodies, M atic pressur namics - E biseuille equ circular pi boundary nless numb , Velocity tion of wate	Aleasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami uation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation rsis - Dimension and Units – Buckingham π theorem – sin pers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation i er turbines - Pelton wheel, Francis turbine and Kaplan turbines	- concept nar flow – nor losses dary layer militude – working n pumps. s, working					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed.	ed bodies, Matic pressur namics - E biseuille equ circular pi , boundary onal Analy nless numb , Velocity tion of wate - Construct	Aleasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami lation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation rsis - Dimension and Units – Buckingham π theorem – sin pers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation is er turbines - Pelton wheel, Francis turbine and Kaplan turbines ional details, Velocity triangles, Power and efficiency calculations	- concept nar flow – nor losses dary layer – working n pumps. s, working					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed.	ed bodies, Matic pressur namics - En biseuille equination of the circular pinal , boundary onal Analy nless numbiness numbiness numbiness numbiness numbiness numbines , Velocity tion of wateiness - Constructions of the circular of the circular pination of the	Aleasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami lation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation rsis - Dimension and Units – Buckingham π theorem – sin pers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation is er turbines - Pelton wheel, Francis turbine and Kaplan turbines ional details, Velocity triangles, Power and efficiency calculations	- concept nar flow – nor losses dary layer – working n pumps. s, working - Specific 45					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed. Text Boo	ed bodies, Matic pressur hamics - E biseuille equ circular pi boundary onal Analy nless numb , Velocity tion of wate - Construct ks: Streeter, V	Aleasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami lation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation rsis - Dimension and Units – Buckingham π theorem – sin pers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation i er turbines - Pelton wheel, Francis turbine and Kaplan turbines tional details, Velocity triangles, Power and efficiency calculations	- concept nar flow – nor losses dary layer militude – working n pumps. s, working - Specific 45 2017.					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed. Text Boo	ed bodies, Matic pressur hamics - E biseuille equ circular pi boundary hless numb Velocity tion of wate - Construct ks: Streeter, M Rajput, R. YunusCer	Aleasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami lation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation rsis - Dimension and Units – Buckingham π theorem – sin bers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation is er turbines - Pelton wheel, Francis turbine and Kaplan turbines cional details, Velocity triangles, Power and efficiency calculations Total Hours:	- concept nar flow – nor losses dary layer militude – – working n pumps. s, working - Specific 45 2017. ers, 2016.					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed. Text Boo 1 2 3	ed bodies, Matic pressur namics - E biseuille equ circular pi boundary onal Analy nless numb , Velocity tion of wate - Construct ks: Streeter, M Rajput, R.I YunusCer Tata McG	Aleasurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami uation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation sis - Dimension and Units – Buckingham π theorem – sin pers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation i er turbines - Pelton wheel, Francis turbine and Kaplan turbines cional details, Velocity triangles, Power and efficiency calculations Total Hours: /.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill Education, K., "Fluid Mechanics and Hydraulic Machines", S.Chand Publish ngel and John Cimbala, Fluid Mechanics Fundamentals and A	- concept nar flow – nor losses dary layer militude – – working n pumps. s, working - Specific 45 2017. ers, 2016.					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed. Text Boo 1 2	ed bodies, M atic pressur hamics - E biseuille equ circular pi boundary onal Analy nless numb , Velocity tion of wate - Construct ks: Streeter, V Rajput, R. YunusCen Tata McG e Books: Kumar K. Delhi 2016	Measurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami lation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation sis - Dimension and Units – Buckingham π theorem – sin bers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation i er turbines - Pelton wheel, Francis turbine and Kaplan turbines ional details, Velocity triangles, Power and efficiency calculations Total Hours: /.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill Education, K., "Fluid Mechanics and Hydraulic Machines", S.Chand Publish ngel and John Cimbala, Fluid Mechanics Fundamentals and Ap raw Hill Publishing Company Pvt Ltd., New Delhi 2010.	- concept nar flow – nor losses dary layer – working n pumps. s, working - Specific 2017. 2017. ers, 2016. oplication, Ltd., New					
submerge of fluid sta Fluid Dyr Hagan Po of flow in thickness, Dimension principles Classifica principles speed. Text Boo 1 2 3 Referenc	ed bodies, Matic pressur namics - E biseuille equ circular pi boundary onal Analy nless numb , Velocity tion of wate - Construct ks: Streeter, M Rajput, R. YunusCen Tata McG e Books: Kumar K. Delhi 2016 Bansal, R. New Delhi	Measurement of Pressure: Pascal's law and Hydrostatic equation e, Measurement of Pressure using Manometers. uler's equation - Bernoulli's equation and its applications. Lami lation - Turbulent flow – Darcy Weisbach formula - Major and min pes. Pipes in series and in parallel. Boundary Layer - Bound layer separation sis - Dimension and Units – Buckingham π theorem – sin bers - Model analysis. Centrifugal pumps, reciprocating pump triangles, Work done by impellor, Efficiencies, Cavitation i er turbines - Pelton wheel, Francis turbine and Kaplan turbines ional details, Velocity triangles, Power and efficiency calculations Total Hours: A.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill Education, K., "Fluid Mechanics and Hydraulic Machines", S.Chand Publish ngel and John Cimbala, Fluid Mechanics Fundamentals and A raw Hill Publishing Company Pvt Ltd., New Delhi 2010.	- concept har flow – hor losses dary layer militude – working h pumps. s, working - Specific 2017. ers, 2016. pplication, Ltd., New s (P) Ltd.,					

Web Refe	erence	S:								
1	http://	www.nptel.a	ac.in							
2	http://	www.creativ	veworld9.co	m						
Online R	esouro	es:								
1			it.com/r/fluid	l_mechan	ics_	online_an	dor_	textbook_r	esou	rces
2	WWW.	efluids.com						1		
		Continu	lous Asses	sment				Final		
Form Asses			ummative sessment	Tot	Total Continu Assess		ous	End Semest Examinat	-	Total
8	0		120	20	0	40		60		100
Assessm	nent M	ethods & L	evels (base	ed on Blo	oms	s' Taxono	omy)		•	
Formativ	e Asse	essment ba	sed on Ca	pstone M	ode					
Course Outcom								A (16%) 0 Marks]		
C303.1		nderstand	erstand Quiz						20	
C303.3		nderstand		Accierces						
C303.2 C303.4	Δr	nalyse	Individual Group Ass		ent					20 20
C303.5		nalyse	Tutorial							20
Assessm			mmative ar	nd End So	eme	ster Exar	nina	tion		
		Sum	mative As		t (2 4	l%)	End	Semester	Exa	mination
Bloom's	Level	CIA1: [[120 Marks] 60 Marks] CIA2: [60 Marks]				– (60%) [100 Marks]			5]
Remembe	er		10		10		10			
Understar	nd		20		20		30			
Apply			20	20			40			
Analyse Evaluate			<u>50</u>		50 2			2(20	
Create			-		-			-		
Assessm	nent ba	ised on Co	ntinuous a	nd End S	eme	ester Exa	mina	tion		
		Conti	nuous Asso [200 M		(40°	%)				End
	CA 1:	100 Marks			CA	2: 100 Ma	arks		-	emester amination
SA 1	I	FA 1 (40 Ma	arks)	SA 2		FA 2 (4	0 Ma	arks)		(60%)
(60 Marks)		onent - I Iarks)	mponent - II 0 Marks)	(60 Marks)	I	omponent - 0 Marks)		mponent - II) Marks)	[10	0 Marks]

<u> </u>						P	Os						PSOs		
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C303.1	3	1	1												
C303.2	3	3	2												
C303.3	3	1	1												
C303.4	3	3	2												
C303.5	3	3	2										3		

21ME304		INDUSTRIAL METALLURGY	3/0/0/3					
Nature of (Course	Theory concepts						
Pre Requis	sites	Engineering Physics						
Course Ob	jectives							
1	To impa	art knowledge on phase diagrams and use of phase diagrams						
2	To und	lerstand the heat treatments processes and apply the same to mod	ify the					
	materia	al properties.						
3	To impa	art knowledge on various metals and non-metals and its application	าร					
4	To dem	nonstrate the various material testing methods.						
Course Ou	tcomes	<u> </u>						
		of the course, students shall have ability to						
C304.1	Recall propert	the different types of materials, bonding of materials and their ties.	[R]					
C304.2	Discuss	Discuss the crystallization mechanisms [U]						
C304.3	Interpre	et the phase diagrams and the use of phase diagrams.	[U]					
C304.4	Identify and apply the heat treatment processes and coatings to modify [Ap							
the properties of materials.								
C304.5	materia	nent the various testing procedures to study the properties of als.	[Ap]					
Course Co								
Nucleation- -Classificat structure of of phase ru	Homoge tion of so solid sol le and le	comic bonding and phase diagrams: Mechanism of Crysta eneous and Heterogeneous Nucleation- Growth of crystals- dendriti olids – characteristics of covalent solids, ionic solids and metallic s lutions - Phase diagrams- cooling curves- phase rule- lever rule – ap ever rule in Cu-Ni phase diagram - Iron and carbon phase diagram - n-carbon diagram.	c growth solids — plication					
tempering interpretation case harde beam hard properties a steel) - spen different ca aluminium	of steel on of fina ning - ca ening - c and appl ecificatior st iron - alloys -	steel: Definition – purposes – types - annealing, normalizing, harde I – TTT diagram for eutectoid steel – continuous cooling cu al microstructure – austempering and mar tempering - surface modi arburising, nitriding, carbonitriding, flame, induction, electron beam a coating - PVD process using plasma - Metals and non-metals: lications of carbon steel, alloy steel (stainless steel, HSLA steel, N n of steels - SAE standard - microstructure, properties and applic – properties and applications of nickel, magnesium, copper, titan precipitation hardening – Non-metals: Polymers - Thermoplas erties and applications (Acrylonitrile butadiene styrene, po	rve and fication and lase Metals Maraging cation o ium and tics and					

Mechanical properties and testing of materials: Mechanical properties of materials - testing methods- metallography – specimen preparation – optical microscope - jominy end quench test – Deformation – slip and twinning - tensile test - stress-strain curve (Engineering and True) – compression test – shear test – torsion test – hardness tests – impact test – fatigue test- S-N curve – creep test- creep curve - fractures – types of fractures – corrosion test- wear test – ASTM for above testing methods – Non destructive testing – liquid penetrant test, ultrasonic test and magnetic particle inspection.

Text Boo	ks:
1	William D. Callister Jr., David G. Rethwisch , 'Material Science and Engineering – An introduction' 10th edition, Wiley India, 2018.

composites and smart materials (SMA).

80		120	200	40	60	100		
Formative Assessment		Summative Assessment	Total	Total Continuous Assessment	End Semester Examination	Total		
	C	Continuous Assessm	ent		End			
2	WWW.SC	encedaily.com/articles	s/m/metallu	urgy.html				
1	nptel.iitm.ac.in./courses/113105028/							
Neb Refere	nces:							
0	V. Raghavan "Materials Science and Engineering", PHI Learning Pvt. Ltd., 6 th edition, 2015.							
3						Itd 6 th		
2		eter, Mechanical Meta	lluray McC	Fraw Hill 3 rd ed	lition 2017			
1	Sidney.H Avner , "Introduction to Physical Metallurgy", McGraw Hill Education, 2 nd edition, 2017.							
Reference B	ooks:							
L	and selection", PHI learning private limited, 9 th edition, 2016.							
2								

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C304.1	Remember	Quiz	20
C304.2	Understand	Assignment	20
C304.3	Understand	Assignment	20
C304.4	Apply	Presentation / seminar	20
C304.5	Apply		20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Ass [120 N	. ,	End Semester Examination (60%)		
	CIA1: [60 Marks]	CIA2: [60 Marks]	[100 Marks]		
Remember	20	20	20		
Understand	30	30	40		
Apply	50	50	40		
Analyse	-	-	-		
Evaluate	-	-	-		
Create	-	-	-		

Assessment based on Continuous and End Semester Examination

	Co	ontinuous Ass [200 M	•	40%)		End Semester	
(CA 1: 100 Marks CA 2: 100 Marks						
	FA 1 (4	FA 1 (40 Marks) SA 2 FA 2 (40 Marks)				Examination (60%)	
SA 1 (60 Marks)	Component - I (20 Marks)	Component - Component (60 I - II Marks)	Component - I (20 Marks)	Component - II (20 Marks)	[100 Marks]		

••• •	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
CO 2							P	Os							PSOs	
COs	Γ	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C304.1		3	1	1												
C304.2		3	1	1												
C304.3		3	1	2										2		
C304.4		3	2	3										2		
C304.5		3	2	3										3		
	3	Stre	ongly	agre	ed	2	Mode	rately	/ agre	ed	1	Reas	onabl	y agree	ed	

21MA30	01	ENGINEERING MATHEMATICS III MECH/MCT/CIVIL	3/1/0/4						
-	of Course	B (100% analytical)							
Pre requ		-							
1	Objectives:	and the different possible forms of Fourier series and the	froquantly						
I		and the different possible forms of Fourier series and the actical harmonic analysis that an engineer may have to n							
	discrete dat								
2		t the student with transform techniques which are used in	varietv of						
	engineering fields.								
3	To study the	e concept of mathematical formulation of certain practical pr	oblems in						
		rtial differential equations and solving for physical interpretat	ion.						
4		numerical solution for partial differential equations.							
	Outcomes:								
		the course, students shall have ability to	[[]]						
C301.1		pasic integration concepts and partial derivatives	[R]						
C301.2		urier series solutions to the engineering problems	[U]						
C301.3 C301.4		nuous transforms techniques to evaluate definite integrals	[AP]						
C301.4 C301.5		transform techniques in discrete sequences tical methods to solve the partial differential equations	[AP] [AP]						
C301.6		erical methods to solve the partial differential equations							
0001.0	boundary co		[AP]						
Course	Contents:								
	E I - FOURIE	R SERIES	(20 Hrs)						
Dirichlet	's conditions -	General Fourier Series - Odd and Even Functions - Half rar							
series ar	nd cosine seri	es - Parseval's Identity - Harmonic analysis.	-						
MODUL	E II - FOURIE	R TRANSFORM AND Z TRANSFORM	(20 Hrs)						
		Complex form of Fourier Transforms – Fourier sine a							
		es – Transforms of simple functions – Self reciprocal - C							
		I's Identity (Statement only) – Evaluation of integrals using							
		n: Convergence of Z transform - Z-transform of Standard							
•		d Final value Theorem - Inverse Z- transform - Convolutio							
•	• •	rtial fraction method - Formation of difference equations -	Solution of						
differenc	e equations u	using Z-transform Techniques.							
MODU			(20 11=-)						
		AL DIFFERENTIAL EQUATIONS Formation of PDE by eliminating arbitrary constants and	(20 Hrs)						
		PDE by Lagrange's linear equations - Linear homogened							
		of second and higher order with constant coefficients-Class							
		Partial differential Equation - Elliptic equations - Laplace							
		Process -Poisson equation - Parabolic Equation (one dimension							
		chmidt's Difference Scheme – Crank-Nicholson's Difference							
		one dimensional wave equation).							
		Total hours:	60						
Text Bo									
	win E Kreyszi nited, Hoboke	ig., "Advanced Engineering Mathematics",John Wiley and S en,2020.	ons (Asia)						
2 Gr		ligher Engineering Mathematics", 44th edition, Khanna Pu	blications,						
		jar, K & Jain R.K., Numerical Methods for Scientific and E	ngineering						
·ł	, .								

	Computation, New Age International (P) Ltd, Publishers,6th edition, 2016.
Refe	rence Books:
1	Veerarajan. T, "Transforms and Partial differential equations", 3rd edition, Tata
	McGraw-Hill Publishing Company Ltd., reprint, 2016.
2	N.P.Bali ,"A Text book of Engineering Mathematics Sem-III/IV" 13th edition, Laxmi
	Publications Ltd, 2017.
3	Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th
	edition, 2016.
4	P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S. Chand Co.
	Ltd., New Delhi, 2015.
5	Holly Moore, "MATLAB for Engineers" Fifth Edition – Pearson Publications, 2018.
Web	References:
1	https://www.youtube.com/watch?v=jNC0jxb0OxE
2	https://www.youtube.com/watch?v=iRXXmtcocAQ
3	https://www.youtube.com/watch?v=OGT59INHz3Y
Onlii	ne Resources:
1	https://nptel.ac.in/courses/111/106/111106111/
2	https://nptel.ac.in/courses/111/107/111107111/
3	https://nptel.ac.in/courses/111/107/111107107/

Continuous Assessment										
Formative Assessment			Summativ Assessme		Total	Total End Continuous Semes Assessment Examin		ester	Total	
80			120		200	40	6	60		
Assessment Methods & Levels (based on Blooms' Taxonomy)										
Formative Assessment based on Capstone Model										
Course Outcome	Bloom's Level			Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)				FA (16%) [80 Marks]		
C301.1		nem		Quiz				20		
C301.2	Und	lerst	and	Seminar				20		
C301.3– C301.6	Арр	ly		Tutorial				20		
C301.3– C301.6	Арр	ly		Assignment				20		
Assessme	nt ba	sed	on Sun	nmative a	and End	Semester Exa	mination			
Bloom's Level		[tive Assessment (24%) [120 Marks]			End Semester Examination (60%)		
		CI	A1 : [60	Marks]	CIA2	: [60 Marks]	[1	[100 Marks]		
Remember		20				20		20		
Understand		30			30		30			
Apply		50				50	50			
Analyse		-				-		-		
Evaluate		-				-		-		
Create			-		-			-		

Assessi	ment based or	Continuous a	and End S	Semester Exa	mination	
	C	ontinuous As	sessment	t (40%)		
		[200 N	larks]			End
	CA 1: 100 Ma	irks		CA 2: 100 Ma	arks	Semester
SA 1	FA 1 (40) Marks)	SA 2	FA 2 (40) Marks)	Examination
(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60%) [100 Marks]

Course			Pro	ogra	amr	ne	Out	cor	nes	5 (PC))		Programme Specific Outcomes (PSO)		
Outcomes (CO)	а	b	с	d	е	f	g	h	i	j	k	Ι	1	2	3
C301.1	2	2	1										1		
C301.2	2	2	2										2		
C301.3	3	3	3										3		
C301.4	2	2	2										1		
C301.5	2	2	2										2		
C301.6	2	2	2										1		

21ME30	5	MANUFACTURING TECHNOLOGY – II (WITH LAB)		3/0/2/4
Nature o	f Course	Theory concepts and laboratory		
Pre Requ	uisites	Manufacturing Technology I		
Course C	Objectives:			
1		erstand the concepts of metal cutting and measuremer		
2		erstand the working of standard machine tools, specia ed machining processes.	al purpose m	achines
3		y the advancements in manufacturing operations.		
Course C	Dutcomes :			
Upon con	npletion of t	the course, students shall have ability to		
C305.1	Illustrate operatio	e the basics of metal cutting processes and various ons.	machining	[U]
C305.2	Discuss	the working principle of special purpose machines a nisms involved.	ind various	[U]
C305.3		rize the various finishing operations and advanced mar	nufacturing	[Ap]
C305.4	Interpre	t the working of CNC machine tools and differer cturing techniques.	nt additive	[U]
C305.5	Make c	omponents using various manufacturing processes ar achining time.	nd analyze	[A]
Course C	Contents:			
cutting: I Construct estimation	Merchant's tional featu n. Capstan Purpose N	 Introduction, cutting tool: Types, materials and line circle, cutting force measurements - Chip formations, various operations, work holding devices ar and turret lathes – Automats: Single and Multi spindle. Iachines and Abrasive processes: Shaper, Planer pes, cutters and various operations. Drilling machines: 	nd machinin r, Slotter ma	ng time achines.
cutting: I Construct estimation Special I Milling ma Broaching of grindir buffing. Advance (USM), E beam ma processe Beam Me machine	Merchant's tional featu n. Capstan Purpose M achines: Ty g - Gear cun g processe ed Manufac Electro cher achining (E es: Direct M elting (EBM structure a	circle, cutting force measurements - Chip formation ures, various operations, work holding devices are and turret lathes – Automats: Single and Multi spindle. Machines and Abrasive processes: Shaper, Planer pes, cutters and various operations. Drilling machines: tting: forming, generation, shaping, Grinding Process es - Finishing processes: Honing, lapping, super finis cturing Methods: Abrasive Jet machining (AJM), U mical machining (ECM), Electrical discharge machini EBM) and Laser beam machining (LBM). Additi letal Laser Sintering (DMLS) - Direct Metal Laser Meltin) - Stereolithography (SLA) – Applications. CNC mac nd drives, feedback devices, Automatic tool changers	nd machinin r, Slotter ma : Types, Ope : Introduction shing, polish JItrasonic ma ing (EDM), ive Manufa ing (DMLM) - : hines: Intro- s and multip	ng time achines. erations. n, types ing and achining Electron acturing Electron duction, le pallet
cutting: I Construct estimation Special I Milling ma Broaching of grindin buffing. Advance (USM), E beam ma processe Beam Me machine systems,	Merchant's tional featu n. Capstan Purpose M achines: Ty g - Gear cun g processe ed Manufac Electro cher achining (E es: Direct M elting (EBM structure a	circle, cutting force measurements - Chip formation ures, various operations, work holding devices are and turret lathes – Automats: Single and Multi spindle. Machines and Abrasive processes: Shaper, Planer pes, cutters and various operations. Drilling machines: tting: forming, generation, shaping, Grinding Process es - Finishing processes: Honing, lapping, super finis cturing Methods: Abrasive Jet machining (AJM), U mical machining (ECM), Electrical discharge machini EBM) and Laser beam machining (LBM). Additi letal Laser Sintering (DMLS) - Direct Metal Laser Meltin) - Stereolithography (SLA) – Applications. CNC mac nd drives, feedback devices, Automatic tool changers ect, Industrial Internet of CNC Machines, DIY H	nd machinin r, Slotter ma : Types, Ope : Introduction shing, polish JItrasonic ma ing (EDM), ive Manufa ing (DMLM) - : hines: Intro- s and multip	ng time achines. erations. n, types ing and achining Electron acturing Electron duction, le pallet
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7	Make a spur gear / helical gear using hobbing machine.	C305.5	[Ap]						
8	Improve the surface finish of the given component using	C305.5	[Ap]						
	grinding process								
9 Perform a machining operation using CNC turning centre. C305.4 [L									
10	Estimate the cycle timing of the machining operation	C305.5	[A]						
11	Every student must undergo minimum of 3 industrial visits during the activity day.	C305.1	[U]						
Text Bo	oks:	•							
1	SeropeKalpakjian, "Manufacturing Engineering and Techno India, 7th edition. 2018	logy", Pears	on						
2	Rao, P.N. "Manufacturing Technology - Metal Cutting and M McGraw – Hill Education, New Delhi, 2013.	Achine Tool	s,"						
Referer	ce Books:								
1	Hajra Choudhury, "Elements of Workshop Technology", Vo Promotors Pvt Ltd., 2014.	I. I & II, Medi	а						
2	HMT - "Production Technology", McGraw-Hill Education, 20)17.							
Web Re	Web References:								
1	https://nptel.ac.in/courses/112105127/								
2	www.sme.org								

			Con	tinuous Asse	essment					
	Theory			P	ractical		Total	Total	End Semester	Total
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)	(A+B)	Continuous Assessment	Examination	
80	120	200	100	75	25	100	200	50	50	100

Formative A	sses	sment ba	ased on Caps	tone Model - Theory								
Course Outcome	Outcome Level components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)											
C305.1	Und	erstand										
C305.2	Und	erstand	Assignment			20						
C305.3	Арр	ly	Assignment			20						
C305.4	Und	erstand	erstand Presentation / seminar									
C305.5	Ana	lyse	Fresentation	/ Seminar		20						
Assessment	t base	ed on Su	immative and	End Semester Examination	on - Theory							
Bloom's Lev	/el			Assessment (15%) 0 Marks]		r Examination 5%)						
		CIA1:	(60 Marks)	CIA2: (60 Marks)	[10Ò N							
Remember			10	10	1	0						
Understand			40	50	4	0						
Apply			40	30	0							
Analyse			10	10	1	0						
Evaluate												
Create			-	-	-							

Bloon	n's Level		C	ont		us As [100			t (25°	%)		Er	nd So	emes (ter E> 15%)	amin	ation
		FÆ	A: (7	75 Marks) SA: (25 Marks)											Mark	s]	
Remem	nber			20	20										20		
Unders	tand			20					20						20		
Apply				40					40						40		
Analyse				20					20						20		
Evaluat	е			-					-						-		
Create				-					-						-		
Assess	sment base	ed on	Con	tinu	ous a	and E	End S	Seme	ster	Exa	amina	tion					
		Co	ntin	uou	s Ass	sessr	nent	(50%	b)							meste ion (5	-
	CA 1 CA 2 (100 Marks) (100 Marks)											ctical xam Marks		Theo	ory Examination		
	FÆ	\ 1					F	A 2							(35%) Practical		
SA 1 (60M)	Compone nt-l (20 Marks)	n	npone t-II ⁄Iarks) (SA 2 60M)	n (2	pone t-l 20 rks)		mpone nt-II Marks		FA (75M)	S/ (25	-				
	g of Cours nes (PSO)	e Out	tcon	nes ((CO)	with	Prog	ramr	ne O	utc	omes	(PO)	Pro	gram	me Sj	oecifi	C
								P	Os							PSOs	5
	COs		а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
	C305.1		3	2												1	
	C305.2		3	2												1	
C305.3 3				2												3	
C305.4 3			2												3		
C305.5 3					1							1	1	1		2	

21ME306	FLUID MECHANICS AND STRENGTH OF MATERIALS	⁵ 0	/0/3/1.5
Nature of	Course: Practical		
Pre Requi	sites: Fluid Mechanics & Solid Mechanics		
Course Ob	ojectives:		
1	Ability to apply knowledge of fluid & solid mechanics in calculati fluids & solids.	ng the prope	erties of
2	Ability to function on multi-disciplinary teams in the area of flu testing.	d & solid m	aterials
3	Ability to use the techniques, skills and modern engineering engineering.	ools neces	sary for
4	Ability to communicate effectively the properties of fluids & solic	materials	
Course Ou	utcomes:		
Upon com	pletion of the course, students shall have ability to		
C306.1	Calculate the coefficient of discharge for Orifice meter and Vent	urimeter	[Ap]
C306.2	Calibrate the Rotameter		[A]
C306.3	Estimate the friction factor for flow through pipes		[E]
C306.4	Conduct the performance test on pump		[Ap]
C306.5	Evaluate the values of yield stress, breaking stress and ultimat of the given specimen under tension test & examine the strain calibration		[A]
C306.6	Evaluate the compression strength of brick/wood and the shear of a given specimen.	strength	[A]
C306.7	Evaluate the Rockwell, Brinell hardness values and examine the	e shear	[A]
C306.8	modulus using torsional test for the given specimen. Evaluate the impact strength of specimen by using charpy and iz and examine the modulus of elasticity using deflection test	od tests	[A]
Course Co	ontents:		
S.No	List of Experiments	CO Mapping	RBT
1	Determination of the Coefficient of discharge of given Orifice meter	C306.1	[U]
2	Determination of the Coefficient of discharge of given Venturimeter.	C306.1	[A]
3	Determination of the rate of flow using Rotameter	C306.2	[A]
4	Determination of friction factor for a given set of pipes	C306.3	[Ap]
5	Performance test on characteristics of centrifugal pump / Gear pump / Submersible pimp/ Reciprocating pump	C306.4	[A]
6	Tensile test on metals to determine tensile strength and ductility	C306.5	[A]
7		C306.6	
	Study of strain gauge calibration		[U]
8	Compression test on wood / bricks to determine compressive strength	C306.6	[A]
9	Hardness test on ferrous and nonferrous metals to Determine hardness value	C306.7	[A]
10	Torsion test on mild steel rod to find shear modulus	C306.7	[A]
11	Impact test on metal specimen to determine the impact strength and toughness using Izod test Charpy test	C306.8	[A]
12	Deflection test on steel and aluminium beam to find modulus of elasticity	C306.8	[A]

Reference B	Books:
1	Ferdinand P. Beer, E. Russell Johnston Jr, John T. DeWolf, David F. Mazurek,
	Sanjeev Sanghi , ""Mechanics of Materials", Tata McGraw Hill Publishing 'co.
	Ltd., New Delhi, 8 th Edition , 2020
2	Bansal, R.K. "Fluid Mechanics and hydraulic Machines", Laxmi Publications (P)
	Ltd., New Delhi, 2018
3	Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill Education, 2017.
Web Refere	nces:
1	https://sm-nitk.vlabs.ac.in/
2	https://fm-nitk.vlabs.ac.in/

	Continuous Ass	sessment			
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment	End Semester Examination	Total
75	25	100	60	40	100

Assessmen	t base	ed on	Cor	ntinu	ious	anc	l End	d Se	mes	ter E	xam	ninat	ion		
Bloom's			С	ontii			sses Mar		ent ((60%))			nd Seme	
Level				FA Mark	(s)					SA Marl	ks)		(40%) [100 Marks]		
Remember				10						10				10	
Understand				10						10				10	
Apply				30						30				30	
Analyse				40						40				40	
Evaluate				10			_			10				10	
Create				-						-				-	
Mapping of Specific Out				mes	(CO)) wit	h Pr	ogra	amm	e Oı	utco	mes	(PO) Pro	ogramme	
COs						Ро	S							PSOs	
COS	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C306.1	3												1		
C306.2	3												1		
C306.3	3												1		
C306.4	3												1		
C306.5	3												1		
C306.6	3												1		
C306.7	3	2											1		
C306.8	3	2											3		
		3 S	trong	gly ag	gree	d	2 N	lode	ratel	y ag	reed	1	Reaso	nably agre	eed

Semester – 04

21ME401		AUTOMOBILE ENGINEERING	3/0/0/3
Nature of 0	Course	Theory Technology	
Pre Requis	sites	Thermodynamics	
Course Ob	jectives	;;	
1	To ena	ble the students to understand the working of various automobi	le
	system		
2		pare the students to update their knowledge in upcoming techno	ology
		to automobiles.	
3	To ena	ble the students to modify various automobile systems.	
Course Ou	tcomes	:	
Upon com	pletion	of the course, students shall have ability to	
C401.1	Recall	the fundamental concepts of automobile engineering	[R]
C401.2	Discus	s the various mechanisms involved in automobile systems.	[U]
C401.3	Explore	e the advanced mechanisms in current vehicles.	[Ap]
C401.4	Survey	the various systems of the vehicle.	[A]
C401.5	Design	the components of automotive systems.	[C]
0			

Course Contents:

AUTOMOBILE AND ENGINE ARCHITECTURE: Automobile - types, components, subsystems and their positions - Power required for automobile - resistance and force - Chassis, frame and body–Engine- classification, components - An overview of Cooling and Lubrication systems–Petrol and Diesel fuel feed system- drawbacks- Petrol engine fuel injection (MPFI) and diesel engine fuel injection (CRDI) – VVTi engine, GDI technology, BS - VI Engine technology, Turbo engine -supercharging and turbo charging. **AUTOTRONICS:** An overview of basic electrical components and circuits in an automobile - overview of various sensors and other vehicle electronic systems.

EMISSION CONTROL AND ALTERNALE ENERGY SOURCE: An overview of SI and CI Engine emission and its control, Emission norms BS-VI, Non-exhaust and exhaust emission types (description only) – Alternative energy source - Overview - Electricity vehicle, hybrid vehicle, hydrogen fuel cell. **TRANSMISSION LINES AND AXLES: Power train:** Clutch, single plate, diaphragm, multi plate clutch, centrifugal- Gear box, sliding mesh, synchromesh, automatic gearbox, CVT, torque converter, overdrive gear changing mechanism types **Drive Line:** Universal joints and Propeller shaft types, **Rear axle:** types of rear axle, **Final Drive:** Differential unit, Differential Lock, Limited Slip Differential.

VEHICLE CONTROL SYSTEMS: Front axle: Types of front axle Steering System: Ackermann principle, manual steering, wheel geometry, rack and pinion, recirculating ball screw steering gear box, Power steering types- **Suspension system**: Types of suspension systems – coil spring, leaf spring, shock absorber, air suspension, hydro assisted suspension. **Brake system**: braking system types – hydraulic drum brake, disc brake, air brake, power assisted brake, ABS - **Wheels and Tyres**: Types of wheels, tyres and tubes. **Self-study**: Introduce to additive manufacturing and its applications in the automobile industry.

	Total Hours 45
Text Books	
1	Anil chhikara, "Automobile engineering", Vol. 1&2 Tech India Publications, New Delhi,3 th edition, 2018.
2	Kirpal Singh, "Automobile Engineering", Vol. 1&2, Standard Publishers, Delhi, 13 th edition, 2017.
Reference	Books:
1	Crouse and Anglin, "Automotive Mechanics", McGraw Hill Education, 10 th edition, 2017.
2	Julian Happian-Smith "Introduction to Modern Vehicle Design", Publisher: Society of Automotive Engineers Inc, 2016.

R2020 (Batch:2021-2025)

			Со	ontin	uous	Ass	essn	nent						F in al			
Form Asses		-				ative smen		Т	otal		Tota ontini sess		Fxa	End emeste aminat	-	т	otal
8	-				12				00		40			60			100
Assessm						•					axon	omy)					
Formativ	e A	sses	sme	nt ba											1		
Course Outcom			loom Leve	-		C	ompo	onen nt, Ca	ts fr ase S	om ti	he lis /, Sei	oose a st - Qi minar	uiz,	-	FA (16%) [80 Marks]		
C401.1			nemt							lustri	al Ca	se St	udy v	with		4(h
C401.2			nderstand Poster Presentation												1	,	
C401.3		App															
C401.4			llyze fabrication												4()	
C401.5	1		eate														
Assessm	ent	bas	ased on Summative and End Semester Examination												Eve	malia	otion
Bloom's			Summative Assessment (24%) End Semeste													min	ation
DIOOIII S	Lev	ei											(00) 100 M	-	-1		
Remembe	r			<u> </u>	30	ains	-		<u>. [00</u> 30		noj			30		2	
Understar					40				30					40			
Apply					20				30					20	-		
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Create					-				-					-			
Assessm	ent	bas	ed o	n Co	ntin	uous	and	End	Sem	este	r Exa	amina	ition				
			C	Conti		us As			nt (40	%)						_	-
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Mapping Specific (of (Cour	se O)utco	mes										gran	nme	
•		com	<u>es (i</u>	30)			РС	Ds							PS	Os	
COs	-	а	b	С	d	е	f	g	h	i	j	k	I	1		2	3
C401.1		3									-						
C401.2		3	3														
C401.3		3	3														
C401.4		3	3											1			
C401.5		3	3			3						2	3				
3	S	Stron	gly a	gree	d :	2	Node	rately	/ agr	eed	1	Rea	ason	ably aç	gree	d	

		MECHANICS OF MACHINES	3/1/0/4
Nature of	Course	Theory Analytical	
Pre Requi	sites	Engineering Mechanics	
Course Ol			
1		t knowledge about forces acting on machine parts.	
2		e students to understand the fundamental concepts of machin	nes
3		ate students to understand the functions of cams and gears.	
4		e students to get an insight into balancing of rotating and	reciprocating
	masses a	and the concepts of vibration.	
Course Ou	utcomes:		
Upon com		f the course, students shall have ability to	
C402.1	Relate di	ifferent mechanisms for designing machines	[Ap]
C402.2	Compute	e velocity and acceleration of various mechanisms	[A]
C402.3	Relate th	ne principles for analyzing cams, gears and gear trains.	[Ap]
C402.4	Measure	and analyze free vibrations of mechanical systems	[A]
C402.5	Examine	the balancing of rotating and reciprocating masses.	[A]
C402.6		gyroscopic effects on aero planes & ships	[A]
Course Co		5,	
dearee of	freedom ·	 Analysis by tabular method. Basic features of vibratory syst Free vibration – Equations of motion – Natural frequency 	
Damping – Balancing multi-cyling	- Damped - Static a der engine	– Free vibration– Equations of motion – Natural frequency vibration– Torsional vibration of shaft – Critical speeds of sha and dynamic balancing of revolving & reciprocating masses i es. Gyroscopes - Basic concepts - gyroscopic law, effect of	Types of afts.in single and
Damping – Balancing	- Damped - Static a der engine	 Free vibration- Equations of motion - Natural frequency vibration- Torsional vibration of shaft - Critical speeds of shaft and dynamic balancing of revolving & reciprocating masses is as. Gyroscopes - Basic concepts - gyroscopic law, effect of aircrafts. 	 Types of afts. in single and of gyroscopic
Damping – Balancing multi-cyling couple on s	- Damped - Static a der engine ships and	– Free vibration– Equations of motion – Natural frequency vibration– Torsional vibration of shaft – Critical speeds of sha and dynamic balancing of revolving & reciprocating masses i es. Gyroscopes - Basic concepts - gyroscopic law, effect of	 Types of afts. in single and of gyroscopic
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Damping – Balancing multi-cylind couple on s Text Book 1 2 3 4	- Damped der engine ships and ss: F.B. Say Educatio Rattan, S Uicker, Mechanis Cleghorn	 Free vibration – Equations of motion – Natural frequency vibration – Torsional vibration of shaft – Critical speeds of shaft and dynamic balancing of revolving & reciprocating masses is es. Gyroscopes - Basic concepts - gyroscopic law, effect of aircrafts. Total Hour yad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltonal resources, 2020. S.S. "Theory of Machines", 5th Edition, Tata McGraw-Hill, 201 J.J., Pennock G.R and Shigley, J.E., "Theory of Masses", 4th Edition, Oxford University Press, 2014. W. L, "Mechanisms of Machines", Oxford University Press, 2014. 	 / – Types of afts. in single and of gyroscopic urs: 60 d., Tech-max 9. achines and 2014
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Assess 80	ment	_	ummative			Tota		End				
	Formative S Assessment As 80			Tota	al	Continu Assessr	ious	t Examination		Total		
-			120	200	0	40		60		100		
Assessme	ent Meth	ods & L	_evels (base	d on Blo	oms	s' Taxono	omy)					
Formative	Asses	sment b	ased on Cap									
Course	BI	oom's	Assessm			ent (Cho m the lis			F	A (16%)		
Outcome		evel	Assignm	-				•		0 Marks]		
Outcome		evei	Assignin			nment)	mai	, Group	10	u mai koj		
C402.1					- 3					00		
C402.3	- Appl	У	Quiz							20		
C402.2			Individual A	Assignme	ent					20		
C402.4	Anal	170	Group Ass	Group Assignment								
C402.5	Anai	yze	Tutorial	Tutorial								
C402.6			Tutonai							20		
Assessme	ent base	ed on Su	ummative and	d End Se	eme	ster Exai	minat	tion				
		Sur	nmative Ass		: (24	%)	End	Semester		mination		
Bloom's L	.evel		[120 M				(60%)					
		CIA1:	[60 Marks]	CIA2: [Marks]	[100 Marks]					
Remember			30		30		10					
Understand	d		30		30			20	-			
Apply			30		30			50				
Analyse			10		10			20)			
Evaluate			-		-			-				
Create			-		-			-				
ASSessme	ent base		ontinuous an				mina	tion				
		Cont	inuous Asse [200 Ma		(40%	/o)				End		
(CA 1: 10	0 Marks	<u>-</u>	-	2: 100 M	arks		-	emester			
SA 1	FA	1 (40 M		SA 2 FA 2 (40			(40 Marks)			amination		
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(00 Marks)	ا (20 Mar	ks) (:	- II 20 Marks)	Marks)	(20	- I 0 Marks)	(20	ll) Marks)	[10	0 Marks]		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Specific Ou	LCOIL	ies (r	-30)												
CO 2					PSOs										
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C402.1	3	3	2										2		
C402.2	3	3	2										2		
C402.3	3	3	2										2		
C402.4	3	3	2										2		
C402.5	3	3	2										2		
C402.6	3	3	2										2		
		3 St	rong	ly ag	reed	2	Мо	derat	ely aç	greec	1 1	Re	asonat	ly agre	ed

21ME403		METROLOGY AND INSTRUMENTATION	3/0/0/3
Nature of	Course	Theory applications	
Pre Requis	sites	Manufacturing Technology- II (with Lab)	
Course Ob	ojectives	S:	
1	roughn	pose the students in the measurement of linear, angular ess, threads and gears	
2	dimens	vide knowledge on the correct procedure to be adopted to me ion of the components.	
3	compor		
4		iliarize the students with basic and advanced metrology concept	ts
Course Ou			
		of the course, students shall have ability to	
C403.1		be the concepts of measurements to apply in various ogical instruments	[U]
C403.2		the principles of linear and angular measurement tools used ustrial applications	[U]
C403.3	Demon compor	strate the techniques of form measurement used for industrial nents	[Ap]
C403.4		e the force, torque and power calculations based on the al standards.	[A]
C403.5	Examin	e the temperature through appropriate electrical instruments.	[A]
Course Co	ontents:		
accuracy. I selection of MEASURE gauges, Ar operation of	Limits, fit of instrui EMENTS ngular me of mechai	ROLOGY: Introduction to Metrology, Distinction between prec is and tolerances, Tolerance grades, Types of fits, Factors consi ments, Errors in Measurements – Types. LINEAR AND A : Linear Measuring Instruments – Evolution – Types – Classificate easuring instruments – Types, Comparators - Constructional feat nical, optical, electrical / electronics and pneumatic comparators, lichelson interferometer, NPL flatness interferometer.	sidered in NGULAR tion, Limit tures and
Surface Te measurem	exture Mo ent, Rou	MENT: Principles and Methods of straightness – Flatness meas easurement – Thread measurement, gear measurement, surfa indness measurement – Applications. ADVANCES IN METR sers Advantages of lasers – laser Interferometers – types – D	ace finish

measurement, Roundness measurement – Applications. **ADVANCES IN METROLOGY:** Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications. Special Measuring Equipment - Principles of measurement using Tool Maker's microscope profile projector & 3D coordinate measuring machine. Nano-measurements: Scanning Electron Microscope-Atomic Force Microscopy-Transmission Electron Microscopy.

INDUSTRIAL MEASUREMENTS: Force, torque, power - Mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

	Total Hours: 45
Text Book	(S:
1	R.K Jain, 'Engineering Metrology', 21st edition, Khanna Publishers, 2018.
2	Gupta I C, "A text book of Engineering Metrology", Dhanpat Rai Publications, New Delhi, 2018.
3	Ernest O. Doebelin, "Measurement Systems", McGraw Hill Education; 6th edition, 2017.

Reference	Books:										
				Langari,		eme	nt and I	nstru	mentation	: Th	eory and
				Press, 20							
				chanical N							
	avendr s, 2013		shnai	murthy "Er	ngineering	Met	trology &	Meas	surements	", Ox ⁻	ford Univ.
4 Eckm	nan Dor	nald P	Eckn	nan, "Indu	strial Instr	ume	ntation",	Wiley	Eastern L	imite	ed, 2019.
Web Refere											
1 http://	/www.n	plindia	a.in/r	esearch-a	reas						
Online Res	ources	:									
1 https	://nptel.	ac.in/o	cours	ses/11210	6179/						
2 http://	/www.n	i.com/	/en-ir	n/shop/lab	view/labvi	ew-c	details.htr	nl			
		Cont	inuo	ous Asses	sment						
Forma Assess				Immative sessment	Tot	al	Tota Continu Assessr	ous	End Semest Examina	-	Total
80				120	20	0	40		60		100
Assessmer	nt Meth	s sho		els (haso	d on Blog	ome	' Taxono	mv)			
				•				y /			
Formative <i>I</i>	Assess	ment	bas	ed on Cap	ostone Mo	odel					
Course Outcome		's I	map	ssment Co compone nent, Cas As	nts i se St	from the	list -	Quiz,		A (16%)) Marks]	
C403.1	Un	dersta	and	Quiz							20
C403.2	— Ар	nlv		Assignm	ent		40				
C403.3		.,			_						
C403.4 C403.5	— An	alysis		l utorial/C	Group ass	Ignn	nent			20	
Assessmer	nt haso	d on (Sum	mativo an	d End Se	mos	stor Evan	ninat	ion		
Assessmen	ii base	1		mative an				iiiiai			
	_		Sum		Marks]	it (24	+ 70)		End Se		
Bloom's Le	vel					500			Examinat		
		CIA	A1: [6	60 Marks]	CIA2:	[60	Marks]		[100 N	arks	5]
Remember				10		10			1		
Understand				40		40			4	-	
Apply				30		30			4		
Analyse		ļ		20		20			1	υ	
Evaluate				-		-			-		
Create				-		-			-		
Assessmer	nt base							nina	tion		
		Coi	ntinu	IOUS ASSE	essment (arks]	40%	b)				E. d
										End Semester	
C	A 1: 10	0 Mai	rks			CA	2: 100 M	arks		Se	
	r	00 Mai A 1 (4		-	SA 2	CA	2: 100 M FA 2 (4		ırks)	Exa	emester mination
SA 1	F. Comp	A 1 (4 onent	0 Ma	arks) mponent	SA 2 (60		FA 2 (4	0 Ma	nponent	Exa	emester mination (60%)
	F	A 1 (4 onent	0 Ma Co	arks)		Co	FA 2 (4	0 Ma Coi	-	Exa	emester mination

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)																
<u> </u>		POs PSOs															
COs	а	b	С	d	е	f	g	h	I	j	k	I	1	2	3		
C403.1	3												2				
C403.2	3	2											2				
C403.3	3	1											2				
C403.4	3	1											2				
C403.5	3	1											3				
3	Stro	ongly	agre	ed	2	Mode	erate	ly ag	reed	1	Rea	asona	ably agr	eed			

21ME40	4	THERMAL ENGINEERING	3/0/0/3
Nature of	f Course	Theory analytical.	
Pre Requ	uisites	Engineering thermodynamics and Mathematics	
Course C	Objectives:		
1	To study th	ne fuel properties and performance of I.C Engines.	
2	To underst	and the performance of air compressors.	
3	To impart k	knowledge of the psychrometric processes and air conditioning sy	ystems.
Course C	Dutcomes:		
		the course, students shall have ability to	I
C404.1		d describe air standard cycles for air standard efficiencies	[U]
C404.2		asic components of Engines, differentiate and describe the different types of Engines.	[A]
C404.3	Analyze the	e performance of Internal combustion Engines.	[A]
C404.4		ne performance of reciprocating and rotary equipment.	[A]
C404.5		e psychrometry processes and calculate the air conditioning erformance.	[A]
Course C	Contents:		
reciproca compress Psychro	ting compressor, Screw compressor, Screw co	Single stage reciprocating compressor- Working principle, M essors: Working principle. Rotary compressor (Descriptive ompressor and lobe compressor. Air Conditioning: Psychrometry and Psychrometric charts, Psych meat exchange processes. Latent heat exchange processes.): Vane
mixing, E	vaporative c Self-cleaning	cooling, Introduction to HVAC (Descriptive) - Air handling and dis / Electro static precipitation in Air conditioning, Layout of Air co	stribution
		Total Hours:	
Text Boo	oks:		45
1			45
2	Rai & Co. p	man C.P, Domkundwar S, "A course in Thermal Engineering", vt ltd, 2017.	
Reference	Mahesh M, Reprint 201	vt ltd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private	Dhanpat
1	Mahesh M, Reprint 201 e Books:	vt ltd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6.	Dhanpat e limited,
	Mahesh M, Reprint 201 e Books:	vt ltd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L	Dhanpat e limited,
2	Mahesh M, Reprint 201 e Books: Rudramoort Delhi, 2016. Ganesan V,	vt ltd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L	Dhanpat e limited, td., New
2 3	Mahesh M, Reprint 2010 e Books: Rudramoort Delhi, 2016. Ganesan V, Delhi, 2016. Arora C.P, "	vt ltd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L	Dhanpat e limited, td., New td., New
3	Mahesh M, Reprint 2010 e Books: Rudramoort Delhi, 2016. Ganesan V, Delhi, 2016. Arora C.P, " 2017.	vt ltd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L	Dhanpat e limited, td., New td., New
3 Web Ref	Mahesh M, Reprint 2010 Rudramoort Delhi, 2016. Ganesan V, Delhi, 2016. Arora C.P, " 2017. erences:	vt Itd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L 'Refrigeration and Air Conditioning", Tata McGraw Hill publishers	Dhanpat e limited, td., New td., New
3 Web Ref	Mahesh M, Reprint 2010 Rudramoort Delhi, 2016. Ganesan V, Delhi, 2016. Arora C.P, " 2017. erences: http://nptel.	vt Itd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L Refrigeration and Air Conditioning", Tata McGraw Hill publishers ac.in/courses/112104033/	Dhanpat e limited, td., New td., New
3 Web Ref 1 2	Mahesh M, Reprint 2010 Rudramoort Delhi, 2016. Ganesan V, Delhi, 2016. Arora C.P, " 2017. erences: http://nptel.	vt Itd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L 'Refrigeration and Air Conditioning", Tata McGraw Hill publishers	Dhanpat e limited, td., New td., New
3 Web Ref 1 2	Mahesh M, Reprint 2010 Redramoort Delhi, 2016. Ganesan V, Delhi, 2016. Arora C.P, " 2017. erences: http://nptel. http://nptel. esources:	vt Itd, 2017. Rathore, "Thermal Engineering", Mc Draw Hill Education private 6. thy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. L , Internal Combustion Engine; Tata McGraw Hill Publishers Co. L Refrigeration and Air Conditioning", Tata McGraw Hill publishers ac.in/courses/112104033/	Dhanpat e limited, td., New td., New

	2017/pages/lecture-notes/													
		Continu	ous Asses	sment										
Forma Assess	tive	S	Summative Assessment			Total Continuous Assessment		End Semest Examinat		I				
80			120	20	0	40		60	100					
Assessmen	t Method	ls & Lev	els (based	on Bloom	ıs' T	axonom	y)							
Formative A	ssessm	ent base												
Course Outcome		oom's .evel	co	nent Com mponents nent, Cas As	fro Se St	m the lis	t - Qı	ıiz, ·	FA (16%) [80 Marks	,				
C404.1	Unde	erstand	Quiz		- 5				20					
C404.2	Anal	yse	Assignme	ent					20					
C404.3	Anal	yse	Assignme	ent			20							
C404.4	Anal	yse	Tutorial						20					
C404.5	Anal	yse	Tutorial						20					
Assessmen	t based o	on Sum	mative and	End Sem	este	er Examii	natior	า	•					
		Sur	nmative As	sessment	t (24	%)	End	Semester	Examinatio	on				
Bloom's Lev	vel			Marks]				(60	%)					
		CIA1:	[60 Marks]	CIA2:	[60 I	Marks]		[100 Marks]						
Remember			20		20			20	-					
Understand			30		30			30						
Apply			30		30			30	-					
Analyse			20		20			20	0					
Evaluate			-		-			-						
Create			-		-			-						
Assessmen	t based of						natio	n						
		Contir	uous Asse [200 Ma	•	10%))			End					
C	A 1: 100	Marks			CA	2: 100 M	arks		Semester	r				
		1 (40 M	arks)	04.0		FA 2 (4		rks)	Examinatio	on				
SA 1	Compone		omponent	SA 2 (60	Co	mponent		nponent -	(60%)					
(60 Marks)	l (20 Mar	·ks) (2	- II 20 Marks)	(60 Marks)	(2	- I 0 Marks)	(20	Îl Marks)	[100 Marks	s]				

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														•
C O2		POs PSOs													
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C404.1	3	2	2	1			1								
C404.2	3	2	2												
C404.3	3	2	2												
C404.4	3	2	2												
C404.5	3	2	2												
		3	Stro	ongly	agre	ed	2	Mod	erate	ely aç	greed	1	Reaso	nably agre	ed

21 M	A401	PROBABILITY AND NUMERICAL METHODS 3/	1/0/4
	A401	MECH/MCT/CIVIL	1/0/4
Natur	e of (Course B (100% Analytical)	
Pre re			
		jectives:	
1.		lefine the concept of probability and its features	
0	To ł	nave a well - founded knowledge of standard distributions which can be u	used to
2.	des	cribe real life phenomena	
3.	To l	earn the concept of testing hypothesis using statistical analysis	
4.	To s	study the concept of fitting a curve of best fit to the given numerical data	and to
4.	calc	ulate the deviation of the expected value from the observed value	
		tcomes:	
		pletion of the course, students shall have ability to	
C40 ⁻	1.1	Recall the concept of probability	[R]
C40 ⁻	1.2	Understand to handle situations involving random variables and Standard distributions.	[U]
C40 ⁻	1.3	Apply measures of central tendency to Analyze statistical data	[AP]
C40 ⁻	1.4	Develop the inferences for engineering problems using testing of hypothesis.	[AP]
C40 ⁻	1.5	Apply curve fitting to Fit a polynomial or special function curve for the given data.	[AP]
C40 ⁻	1.6	Apply numerical methods to fit the polynomial.	[AP]
Cours	se Co	ntents	
MOD	ULE I	- PROBABILITY (20	Hrs)
		ace, Axioms of Probability-Events-independent events-Conditional prob	
		ability- Baye's Theorem (Statement only) - Simple Problems. One dime	
		ariable-Probability mass function-Probability density function-Discrete r	
		ntinuous Random Variable-Simple problems. Mathematical Expect	
			Discrete
		s: Binomial – Poisson - Geometric – Continuous distribution: Uniform - No	ormai –
			0.11==)
			0 Hrs)
		f Statistics - Applications - Data - Collection of Data: Internal and externation of united and externation of united and the statistics of the statistics of united and the statistics of uni	
		ures of central tendency: Mean Median and Mode. Measures of dispe	
		iance and Standard deviation – Scatter diagram - Correlation (Karl Pears	
•		ation (Spearman's) - Linear regression. Testing of Hypothesis - Small Sa	,
		-Test for single mean, difference of mean -F test - Chi square test for go	
		dependence of attributes.	24.1000
		•	20 Hrs)
		g-Empirical laws - Linear law - Laws reducible to Linear law- Method of	-
avera parab	ges - ola ai	straight line and parabola - Principle of Least squares - Fitting straig ad exponential curve - Interpolation - Interpolation with equal intervals –Ne ad Backward difference formula - Interpolation with unequal intervals –Ne	ht line, ewton's

parabola and exponential curve - Interpolation - Interpolation with equal intervals –Newton's Forward and Backward difference formula - Interpolation with unequal intervals –Newton's Divided difference formula – Lagrange's interpolation formula. Numerical differentiation -Newton's Forward and Backward differentiation formulas. Total Hrs 60 Hrs

Text	Books:
1	Peebles Jr. P.Z., —Probability Random Variables and Random Signal Principles, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2016
1.	McGraw-Hill Publishers, Fourth Edition, New Delhi, 2016
2	Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand
Ζ.	& sons, 12th edition, 2020

3. Grewal B.S., Numerical methods in Engineering and Science. 12th edition, Stylus Publishing, 2018.

Reference Books: 1. Ross, S, "A First Course in Probability, Ninth edition", Pearson Education, Delhi, 2018. 2. Richard A. Johnson, Irwin Miller, John Freund, Miller & Freund's, "Probability and Statistics for Engineers", Ninth edition, 2016. 3. Steven Chapra, "Applied Numerical Methods with MATLAB for engineers and scientists", 4th edition, 2017. 4. Holly Moore, "MATLAB for Engineers" Fifth Edition – Pearson Publications, 2018.

Web References:

1. http://nptel.ac.in/courses/111104079/

- 2. http://www.nptelvideos.in/2012/12/probability-random-variables.html
- 3. http://freevideolectures.com/Course/2311/Digital-Communication/4

Online Resources:

- 1. https://www.coursera.org/learn/probability-intro
- 2. https://www.coursera.org/lecture/wharton-introduction-spreadsheets-models/3-1-
- ² random-variables-and-probability-distributions-Y3bCF
- 3. https://www.codewithc.com/newtons-interpolation-in-matlab/

		Contin	uous A	ssess	ment							
Formati Assessm			nmative essmer	-	Total	Con	lotal tinuous essment	En Seme Examir	ester	Total		
80			120		200		40	60)	100		
Assessme	nt Met	hods & L	.evels (b	based	on Bloor	ns' Ta	xonomy)					
Formative	Asses	sment b	ased on	Caps	tone Mo	del						
Course Outcome		oom's evel	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)							(16%) Marks]		
C401.1	Reme	ember	Quiz			20						
C401.2	Unde	rstand	Semina	ar		20						
C401.3– C401.6	Apply	/	Tutoria	l				20				
C401.3– C401.6	Apply	/	Assign	ment						20		
Assessme	nt bas	ed on Su	ımmativ	e and	End Sen	nester	Examinat	ion				
Bloom's Level			ative Assessment (24%) E [120 Marks]					End Semester Examination (60%)				
	CI	A1 : [60 I	Marks]	CIA	2 : [60 Ma	arks]	[100 Marks]					
Remember		20			20		20	-				
Understand		30			30			30				
Apply		50			50			50	J			
Analyse		-			-			-				
Evaluate		-			-			-				
Create		-			-			-				

Assess	ment based or	n Continuous	and End 🗄	Semester Exa	mination	
	С	ontinuous As	sessmen	t (40%)		
		[200 N	/larks]			End
	CA 1: 100 Ma	arks		CA 2: 100 Ma	arks	Semester
SA 1	FA 1 (40) Marks)	SA 2	FA 2 (40) Marks)	Examination
(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60%) [100 Marks]

Course	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)			
Outcomes (CO)	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
C401.1	2	1	1	1									1			
C401.2	1	2	2	1									2			
C401.3	2	2	2	3									2			
C401.4	1	1	2	2									2			
C401.5	2	3	2	3									3			
C401.6	2	3	2	3									3			

21ME40	5	COMPUTER AIDED MACHINE DRAWING	G	0/0/3/1.
Nature o	of Course:	Practical Application		
Pre Requ	uisites:	Engineering Drawing		
Course (Objectives			
1		impart the knowledge of drawing practices for co	ommon machine	
	componer			
2	To enable	the students to understand blue prints and asser	mbly drawings.	
3	To impart	the fundamental knowledge about geometric dim	ensioning and to	olerance
Course (Outcomes:			
Upon co	mpletion of	of the course, students shall have ability to		
C405.1	Recall the	conventional representation of mechanical comp	onents and	[U]
		d the concept of joints		
C405.2	Applying to	olerance to mechanical components.		[Ap]
C405.3		various components/products elements using mo	delling	[Ap]
	software.			
C405.4		nd draw the assembled views of machine parts u	sing modelling	[C]
_	software.			
		the detailed drawing of the given component		[C]
	Contents:			
		onventions - Conventional representation of mac		
		Geometric Tolerances. Geometric tolerance-use		
		symbols, method of indicating geometric tolerand	ces on part draw	ings.
		uction drawing.	-	ings.
	ion to Prod	uction drawing. List of Exercises	СО	ings.
ntroduct S.No	ion to Prod	uction drawing. List of Exercises [Using Recent Modelling Software]	CO Mapping	RBT
Introduct	ion to Prod	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed	CO Mapping C405. 1	
Introduct S.No 1	ion to Prod Draw hexa bolt, squar	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer.	CO Mapping C405. 1 C405. 3	RBT [Ap]
Introduct S.No	ion to Prod Draw hexa bolt, squai Draw sing	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap	CO Mapping C405. 1 C405. 3 C405. 1	RBT
S.No 1 2	ion to Prod Draw hexa bolt, squai Draw sing joint, doub	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ole riveted (zigzag) lap joint.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3	RBT [Ap] [Ap]
ntroduct S.No 1	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1	RBT [Ap]
ntroduct S.No 1 2 3	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double st	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3	RBT [Ap] [Ap] [Ap]
S.No	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double st	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2	RBT [Ap] [Ap]
IntroductS.No1234	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [C]
IntroductS.No123	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 2	RBT [Ap] [Ap] [Ap]
IntroductS.No12345	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [Ap] [Ap] [C] [C]
Introduct S.No 1 2 3 4	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2	RBT [Ap] [Ap] [Ap] [C]
IntroductS.No123456	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [Ap] [C] [C]
IntroductS.No12345	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2	RBT [Ap] [Ap] [Ap] [Ap] [Ap] [C] [C]
Improduct S.No 1 2 3 4 5 6 7	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint. assembly of Foot step bearing/ Plummer block.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [Ap] [C] [C] [C]
ntroduct S.No 1 2 3 4 5 6	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2	RBT [Ap] [Ap] [Ap] [Ap] [C] [C]
Introduct S.No 1 2 3 4 5 6 7 8	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint. assembly of Foot step bearing/ Plummer block. assembly of Flange coupling.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [Ap] [C] [C] [C] [C]
Introduct S.No 1 2 3 4 5 6 7	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint. assembly of Foot step bearing/ Plummer block.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2	RBT [Ap] [Ap] [Ap] [Ap] [C] [C] [C]
ntroduct S.No 1 2 3 4 5 6 7 8	ion to Prod Draw hexa bolt, squar Draw sing joint, doub Draw sing (double str Draw the a Draw the a Draw the a Draw the a	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint. assembly of Foot step bearing/ Plummer block. assembly of Flange coupling.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [Ap] [C] [C] [C] [C]
ntroduct S.No 1 2 3 4 5 6 7 8	ion to Prode	List of Exercises [Using Recent Modelling Software] agonal nut and square nut, hexagonal headed re headed bolt and washer. le riveted lap joint, double riveted (chain) lap ble riveted (zigzag) lap joint. le riveted (single strap) butt joint, single riveted raps) butt joint. assembly of Sleeve & Cotter Joint assembly of Sleeve & Cotter Joint assembly of Socket and Spigot joint assembly of Knuckle joint. assembly of Foot step bearing/ Plummer block. assembly of Flange coupling.	CO Mapping C405. 1 C405. 3 C405. 1 C405. 3 C405. 1 C405. 3 C405. 2 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4 C405. 2 C405. 4	RBT [Ap] [Ap] [Ap] [Ap] [C] [C] [C] [C] [C]
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Reference	e Books:
1	K.L. Narayana, P.Kannaiah, & K.Venkata Reddy, "Machine Drawing-Multi Color Edition", New Age International Publishers, 2019.
2	Laxminarayan and Mathur, "A Textbook Of Machine Drawing", "Machine Drawing", Jain Brothers Publications, 2016.
Web Refe	erences:
1	http://www.nptel.ac.in
2	http://www.sigmetrix.com
Online Re	esources:
1	1 https://www.universalclass.com/i/crn/8683.htm
2	2 https://www.machinedesignonline.com

	Continuous Ass	sessment			
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment	End Semester Examination	Total
75	25	100	60	40	100
Assessment bas	sed on Continuous	and End Ser	nester Examinat	lion	
	Continuo	us Assessmo [100 Marks]	End Sem Practical Exa		
Bloom's Level	FA (75 Marks)		(40%) (40%) (100 Ma)	
Remember	-		-	-	
Understand	40		40	40	
Apply	30		30	30	
Analyse	-		-	-	
Evaluate	-		-	-	
Create	30		30	30	

Mapping Specific C					es ((CO)	with	Prog	gram	me C	Outco	ome	s (PO) Pro	ogramme	
00-					PSOs										
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C405.1	3				3								3		
C405.2	3		2		3								3		
C405.3	3		3		3								3		
C405.4	3		3		3								3		
C405.5	3		3		3								3		
3	3 8	Stron	gly a	greec	1 2	2	Mode	erate	ly ag	reed	1	R	easonabl	y agreed]

21ME40	06	METROLOGY AND DYNAMICS LABORATORY		0/0/3/1.5
Nature	of Course	Practical application		
Pre Rec	quisites	Manufacturing Technology II Engineering mechanics Kinematics of Machines		
Course	Objectives			
1	instrum		•	easuring
2		elop programs for applications using Lab View software		
3		ble the students to understand the principles of static for	orce analysis	sand
4		c force analysis of mechanisms.		tene en el
4		vide an insight regarding the undesirable effects of unb	balance in ro	otors and
5	engines To intro	s. Induce the concept of vibratory systems and damping m	ethods	
	Outcomes		cinous.	
		of the course, students shall have ability to		
C406.		the experiments to check linear and angular measure	ments.	[Ap]
C406.2		p programs for various applications using Lab View sof		[A]
C406.3	3 Determ	ine the forces acting on machines and mechanisms		[Ap]
C406.4	4 Determ	ine the gyroscopic couple on motorized gyroscopentally and analytically.	ope both	[A]
C406.8	5 Evaluat	te the various types of vibrations and to impart know		[E]
	masses			
C406.6		n static and dynamic balancing calculations for rotatin	g parts of	[A]
Course	Contents:	ory.		
	••••••••			
S.No		List of Experiments	CO	RBT
	()	Jsing analysis and simulation softwares)	Mapping	
1	Measure th	ne various physical parameters of the given workpiece r measuring instruments	C406.1	[Ap]
2		the unknown angle by using angle measuring	C406.1	[Ap]
3	Non-conta		C406.1	[Ap]
		irtual instrumentation for simple applications.		
4	-	ne basic arithmetic and logic operations using VI.	C406.2	[A]
5		ne Real time temperature Using DAQ	C406.2	[A]
6		tion the moment of inertia of turn table apparatus.	C406.4	[Ap]
7		tion the moment of inertia using bifilar suspension.	C406.4	[Ap]
8		tion of gyroscopic couple using motorized gyroscope.	C406.4	[A]
9		tion of transmissibility ratio using vibrating table.	C406.5	[F]
10		tion of transverse frequency of beam.	C406.5	[E]
10		of rotating masses and reciprocating masses.	C406.6	[A]
12		tion of Natural frequency of Free longitudinal Vibration	C406.5	[A]
12		tion of Critical speed of Shaft	C406.5	[A]
	20.011111U	Tot		L' 'I

Reference Bo	oks:				
1	R.K Jain, 'Engineering	g Metrology', 2	1st edition, Khan	na Publishers, 20	18.
2	Sanjay Gupta and Jos	seph john, "Virl	ual Instrumentati	on using Labview"	, Mcgraw
	Hill Education; 2nd ed	ition, 2017.		-	_
3	Rattan S.S., "Theory	of Machines'	', 5th edition, Ta	ta McGraw-Hill P	ublishing
	Company Ltd., New I	Delhi, 2019.			_
4	Thomas Bevan, "The	ory of Machine	s", CBS Publishe	ers and Distributor	s, 2013.
Web Referen	ces:	-			
1	https://nptel.ac.in/cou	rses/112/106/2	12106180/		
2	https://nptel.ac.in/cou				
	Continuous As	sessment			
Formative Assessmen	Summative Assessment	Total	Total Continuous Assessment	End Semester Examination	Total
75	25	100	60	40	100
Assessment	based on Continuou	is and End Se	mester Examina	ation	
Bloom's	Continue	ous Assessm [100 Marks]	ent (60%)	End Sem Practical Exa	
Level	FA (75 Marks)		SA (25 Marks)	(40%) (40%) (100 Ma	6)
Remember	30		30	30	
Understand	30	1	30	30	
Apply	20		20	20	
Analyse	20		20	20	
Evaluate	-		-	-	

<u> </u>					PSOs										
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C406.1	3	3	2											2	
C406.2	3	3	2		3								3	2	
C406.3	3	3	3										1		
C406.4	3	3	3										1		
C406.5	3	3	3										2		
C406.6	3	3	3										2		

-

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Create

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21ME	407	THERMAL ENGINEERING LABORATORY		0/0/2/1
Nature	of Course	Practical application		
Pre Re	quisites	Nil		
Course	Objectives:			
1		the fuel properties and performance of I.C Eng	gines and u	Inderstar
		ce of Air compressors.		
2		knowledge on the air conditioning system and refrig	gerator.	
	Outcomes:	the course students chall have chility to		
C407.		f the course, students shall have ability to asic components of Engines, differentiate and o	locaribo tha	[A]
0407.		f different types of Engines.		[^]
C407.		conduct performance test in Engines and c	alculate the	[E]
0107.		ice of Engines.		[-]
C407.		and calculate the performance of reciprocating	and rotary	[A]
	equipmen		,, ,	
C407.		he properties of lubricants.		[E]
C407.	5 Evaluate t	he performance of air conditioner and refrigerator.		[E]
	Contents:	<u> </u>		
S.No		List of Experiments	CO	RBT
3.NO		List of Experiments	Mapping	KDI
1		al study on valve timing diagram in 4-stroke engine	C407.1	[A]
		and port timing diagram in 2-stroke engine cut		
	model.			
2		e and Heat balance test on a twin cylinder diesel	C407.2	[E]
3	-	electrical dynamometer (Alternator).		
3		e test on a single cylinder diesel engine with dynamometer.	C407.2	[E]
4		e performance of Two stage Air compressor using	C407.3	[E]
-	test rig.	performance of two stage the compressor using	0407.0	[-]
5	<u> </u>	e and combustion test on computerized Kirloskar	C407.2	[E]
-		with eddy current dynamometer. (In diesel mode).		[_]
6		Analysis of a centrifugal blower test rig.	C407.3	[A]
7		al analysis of performance of air-conditioning	C407.5	[A]
	system.			
8	Determination	on of flash and fire point by open cup apparatus.	C407.4	[E]
9.		on of viscosity using Redwood viscometer.	C407.4	[E]
10.	Experimenta	al analysis of performance of Refrigeration system.	C407.5	[A]
		Тс	otal Hours:	45
	nce Books:			· ·
1		idaraman C.P, Domkundwar S, "A course in ⁻	inermai Eng	gineering
2	Dhanp	at Rai & Co. pvt ltd, 2017. h M, Rathore, "Thermal Engineering", Mc Draw		on privat
2	limited	, Reprint 2016.		on priva
3		C.P, "Refrigeration and Air Conditioning", Tata McG	raw Hill publ	ishers Co
0	Ltd, 20			51013 0
Web Re	eferences:			
1		labs.iitkgp.ernet.in/rtvlas/#		
2		ptel.ac.in/courses/112105128/		
3.		ocw.mit.edu/courses/2-61-internal-combustion-eng	ines-spring-	
		ages/labs/	1 3	

	Continuous Ass	sessment						
Formative Assessment	Summative Assessment	End Semester Examination	Total					
75	25	100	60	40	100			
Assessment ba	sed on Continuous	and End Ser	nester Examinat	tion				
Bloom's	Continuou	End Semester Practical Examination						
Level	FA	[100 Marks]	SA	(40%)				
	(75 Marks)		(25 Marks)	[100 Marks]				
Remember	10		10	10				
Understand	10		10	10				
Apply	10	10		10		10		
Analyse	35		35	35				
Evaluate	35		35	35				
Create	-		-	-				

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
CO 2						PSOs									
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C407.1	3	2	2	2										2	
C407.2	3	3	3	3										3	
C407.3	3	3	3	2										2	
C407.4	3	2	2	2										3	
C407.5	3	3	2	3										3	
		3 S	trong	jly ag	greed	2	Mo	odera	tely a	agree	ed	1	Reasona	ably agre	eed

Semester – 05

Nature of Pre Requis		DESIGN OF MACHINE ELEMENTS	4/0/0/4
	Course	Concept and Analytical	
	sites	Engineering Mechanics, Strength of Materials, Kinematics of Ma	achinery
Course Ob	ojectives:		
1	To famil	iarize the various steps involved in the design process.	
2	To unde	erstand the principles involved in evaluating the shape and dime	nsions of
		onent in order to satisfy functional and strength requirements.	
3		purage the usage of standard practices and standard data.	
Course Ou			
Upon com	pletion o	of the course, students shall have ability to	
C501.1		r various processes involved in machine design.	[U]
C501.2		e the variety of stresses induced in machine components to	[Ap]
		the design of machine components.	r. 17.1
C501.3		ize with standard design data and select the appropriate	[A]
000110		ical components.	6.7
C501.4		rize the results of a design assignment by means of drawing and	[E]
000111	design r		[-]
C501.5		and make a model of the learnt concepts.	[C]
Course Co	· · · ·		[0]
		le Stresses in Machine Elements: Introduction to the Design	Dragona
		Couplings and Springs: Design of Solid and Hollow Shafts – ign of Keys and Couplings – Design of Helical and Leaf springs.	Design o
Knuckle Jo Design of Welded Joi	int – Desi Fastene ints – Des	ign of Keys and Couplings – Design of Helical and Leaf springs. ers, Bearings, Seal and Gaskets: – Threaded Fasteners – sign of riveted joints (Various types of failures alone) – Adhesive	Design of ly Bondec
Knuckle Jo Design of Welded Joi Joints in Ai	Fastene Fastene ints – Des rcraft Stru	ign of Keys and Couplings – Design of Helical and Leaf springs. ers, Bearings, Seal and Gaskets: – Threaded Fasteners – sign of riveted joints (Various types of failures alone) – Adhesive actures - Selection of Bearings, Sliding Contact and Rolling Contact	Design of ly Bonded
Knuckle Jo Design of Welded Joi Joints in Ai	Fastene Fastene ints – Des rcraft Stru	ign of Keys and Couplings – Design of Helical and Leaf springs. Frs, Bearings, Seal and Gaskets: – Threaded Fasteners – sign of riveted joints (Various types of failures alone) – Adhesive actures - Selection of Bearings, Sliding Contact and Rolling Contact Gaskets.	Design of ly Bonded ct bearing,
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Knuckle Jo Design of Welded Joi Joints in Ai Design of S Text Book	Fastene ints – Des rcraft Stru Seal and (s: Shigley J. McGraw-H	ign of Keys and Couplings – Design of Helical and Leaf springs. ers, Bearings, Seal and Gaskets: – Threaded Fasteners – sign of riveted joints (Various types of failures alone) – Adhesive actures - Selection of Bearings, Sliding Contact and Rolling Contac Gaskets. Total Hours: .E and Mischke C. R., "Mechanical Engineering Design", 10t Hill, 2017.	Design of ly Bondec ct bearing 60 h Edition
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Knuckle Jo Design of Welded Joi Joints in Ai Design of S Text Book 1 S 2 E Reference	Fastene ints – Des rcraft Stru Seal and G s: Shigley J McGraw-H Bhandari M Books:	ign of Keys and Couplings – Design of Helical and Leaf springs. ers, Bearings, Seal and Gaskets: – Threaded Fasteners – sign of riveted joints (Various types of failures alone) – Adhesive actures - Selection of Bearings, Sliding Contact and Rolling Contact Gaskets. Total Hours: .E and Mischke C. R., "Mechanical Engineering Design", 10t Hill, 2017. V.B, "Design of Machine Elements", McGraw-Hill Book Co, 2017.	Design o ly Bondec ct bearing 60 h Edition
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	native ssment		ntinuous Asse Summative Assessment	T	otal	Tota Continu Assessn	ous	End Semeste Examinat	-	Total		
-	30		120		00	40		60		100		
			& Levels (bas				omy)					
Formativ	e Asse	ssmen	nt based on Ca					un al una aux				
Course		Bloom'				ent (Cho			E	A (16%)		
Outcom		Level										
Outcon		Level	Assign		, oroup	10.	0 Marks]					
C501.1	Un	dersta	nd Tutorials	Assignment) Tutorials/Assignments								
C501.2				Poster presentation and Case study								
C501.3	3 An	alyze	Poster pr	esentatio	on and	a Case stu	iay					
C501.4	l Eva	aluate	Mini Proi	oct						40		
C501.5	5 Cre	eate										
Assessn	nent ba		Summative a									
			Summative As		nt (24	%)	End	Semester		mination		
Bloom's	Level			Marks]	500				(60%) 100 Markel			
Daveaara		CIA	1: [60 Marks]	CIA2	_	Marks]	[100 Marks]					
Rememb Understa			<u>10</u> 20		<u>10</u> 20		10					
Apply	nu		30		30		20					
Analyse			20		20		20					
Evaluate			20		20							
Create			-		-			- 20	-			
	nent ba	sed on	Continuous	and End	Seme	ester Exa	mina	tion				
		C	ontinuous As		t (40°	%)						
				/larks]					-	End		
	CA 1: 1				CA	2: 100 Ma				emester		
SA 1			0 Marks)	SA 2		FA 2 (4		/		mination (60%)		
(60	Compo	onent -	Component - II	(60		omponent - I	Con	nponent -		(00%) 0 Marks]		
Marks)	(20 M	arks)	(20 Marks)	Marks)	(2	0 Marks)	(20	Marks)	1.0	•		
looping	of Cours	aa 0		uith Dress			mee			20		
happing Specific C			tcomes (CO) v	vith Prog	framn		nes	(PO) Progi	ami	ne		
		cs (F3		DO								

Specific Ou	tcom	es (P	SO)													
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COs	а	b	С	d	е	f	g	h	i	j	k	-	1	2	3	
C501.1	3	2	2	2												
C501.2	3	3	3	3									3			
C501.3	3	3	3	3									3			
C501.4	3	3	3	3									3			
C501.5	3	3	3	3							2		3		1	
													•			
3	Stro	rongly agreed 2 Moderately agreed 1 Reasonably agreed														

21ME502		APPLIED HYDRAULICS AND PNEUMATICS	3/0/0/3
Nature of C	ourse	Theory application	
Pre Requis	ites	Fluid Mechanics and Machinery	
Course Ob	jectives	:	
1	To intro	oduce the working of the fluid power components and their needs	
2	To ena	able the students to understand the operation of various fluid powe	er circuits.
3	To ena	able the students to understand the concepts like synchron	izing and
	sequer	ncing for automation.	
4	To pre	pare the students to design electro-pneumatic circuit and ladder of	diagrams.
5	To allo	w students to design and simulate the circuits.	
Course Out	tcomes:	: Upon completion of the course, students shall have ability to	
C502.1	Recall	the fundamentals of hydraulic and pneumatic systems	[U]
C502.2		the components and control elements for hydraulic and	[Ap]
	pneum	natic systems as per the application.	
C502.3	Analyz	e the scenario and provide suitable solution to the problems in	[A]
	hydrau	Ilic and pneumatic systems.	
C502.4	Design	n customized circuits in hydraulics systems for various industrial	[C]
	needs.		
C502.5	Design	n customized circuits in pneumatics and servo systems for	[C]
	various	s industrial needs.	
Course Co	ntents.		

Course Contents:

Fluid power systems and Fundamentals: Introduction to fluid power, advantages of fluid power, application of fluid power system. Types of fluid power systems, properties of hydraulic fluids, general types of fluids, fluid power symbols. Basics of hydraulics, applications of Pascal's Law, laminar and turbulent flow, Reynolds's number, Darcy's equation, losses in pipe, valves and fittings. Properties of Air - Perfect Gas laws. Fluid power - ANSI symbol. Hydraulic System and Components: Sources of Hydraulic Power- Pumping theory pump classification, gear pump, vane pump, piston pump. Construction and working of pumps, pump performance, variable displacement pumps. Fluid Power Actuators, Linear hydraulic actuators, types of hydraulic cylinders, single acting, double acting special cylinders like tandem, rod less, telescopic, cushioning mechanism. Construction of double acting cylinder, rotary actuators, fluid motors, gear, vane and piston motors.

Design of Hydraulic Circuits: Construction of Control Components, Directional control valve, 3/2 way valve, 4/2 way valve, shuttle valve, check valve, pressure control valve, pressure reducing valve, sequence valve, flow control valve, fixed and adjustable, electrical control solenoid valves, relays, ladder diagram. Accumulators and Intensifiers, types of accumulators, accumulator's circuits, sizing of accumulators, intensifier, applications of intensifier, intensifier circuit, control of single, double hydraulic, regenerative, sequencing, synchronizing, continuous reciprocation, speed control, fail-safe circuit, control of hydraulic motor.

Pneumatic System and Components: Pneumatic Components, Properties of air, compressors, filter, regulator, lubricator unit, air control valves, quick exhaust valves, and pneumatic actuators. Control of single, double pneumatic, sequencing, semi-automatic, automatic, speed control, synchronizing circuit, pneumatic motor, pneumo-hydraulic circuit, sequential circuit design for simple applications using cascade method. **Design of Fluid Power Circuits:** Servo systems, Hydro mechanical servo systems, electro hydraulic servo systems and proportional valves, Introduction to electro hydraulic pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits, failure and troubleshooting. **Case studies:** A simple sequence, synchronizing circuits using hydraulic and pneumatic components.

Total Hours: 45

Text Books:

1	Ilango Sivaraman, "Introduction to Hydraulics and Pneumatics", PHI Learning,
	2017.
2	Jagadeesha T, "Hydraulics and Pneumatics systems", Wiley Publications, 2019.
Reference B	ooks:
1	Anthony Esposito, "Fluid Power with Applications", Pearson Education, 2019.
2	James R. Daines, Martha J. Daines, "Fluid Power: Hydraulics and Pneumatics",
	Goodheart-Willcox; Third Edition, Revised, 2018.
Web Refere	nces:
1	http://www.nfpa.com
2	http://www.fluidpowerjournal.com

Forma Assess		-	Summative Assessment			Tota Continu Assessr	ious	End Semest Examinat	-	Total	
80			120	2	200	60		100			
Assessmen	t Metho	ds & Lev	els (based	on Bloc	oms' 1	axonom	y)				
Formative A	ssessn	nent base	ed on Caps	tone Mo	odel						
Course Outcome		loom's Level	CO	mponer ment, C	nts fro ase S	ent (Cho m the lis tudy, Ser nment)	uiz,		A (16%)) Marks]		
C502.1	Unc	lerstand	Assignme							20	
C502.2	Арр	ly	Assignme							20	
C502.3	Ana	lyze									
C502.4 C502.5	Cre	ate	Mini proje	ect/simul	ation o	of circuits				40	
Assessmen	t based	on Sum	mative and	End Se	meste	er Examir	natio	า			
Bloom's Lev		Sur	nmative As [120	sessme Marks]	ent (24	!%)	End	Semester		mination	
DIOOIII S Lev	vei	CIA1:	[60 Marks]	CIA2	2: [60	Marks]		(60%) [100 Marks]			
Remember			20		10		10				
Understand			40		30			30			
Apply			40		30		30				
Analyse			-		20		20				
Evaluate			-		10						
Create			-		-			-			
Assessmen	t based	on Cont	inuous and	End Se	emest	er Exami	natio	n			
		Contir	nuous Asse [200 Ma		: (40%)				End	
C	A 1: 10	0 Marks			CA	2: 100 M	arks			mester mination	
	arks)	SA 2	EA 2 (FA 2 (40 Marks)					
SA 1 (60 Marks)	omponent - II	(60 Marks)) Co	omponent - I		nponent - II	[10	0 Marks]			
	(20 Ma	rks) (2	20 Marks)		(2	0 Marks)	(20) Marks)			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
00-				PSOs											
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C502.1	3	3	2	2									1		3
C502.2	3	3	3	2									2		3
C502.3	3	3	3	2									2		3
C502.4	3	2	3	3							1		2		3
C502.5	3	2	3	3							1		2		3
3 Strongly agreed 2 Moderately agreed 1 Reasonably agreed															

21ME013		INDUSTRY 4.0	3/0/0/3
Nature of C	ourse	Theory Application	
Pre Requis		Manufacturing Technology-I (with lab), Manufacturing Technolog lab) and Electrical Drives and Microprocessor Laboratory	gy-II (with
Course Ob	iectives		
1		oduce the concepts of Industry 4.0	
2	To und industr	derstand the various systems and technologies used for imply 4.0.	· ·
3	To lear	n about the fundamentals of IoT, cloud computing and big data a	nalytics.
Course Out			
Upon comp	oletion c	of the course, students shall have ability to	
C013.1	Descril	be the drivers and enablers of Industry 4.0.	[U]
C013.2		et the smartness in smart factories, smart cities, smart products nart services.	[U]
C013.3	Study t	the applications of Industry 4.0	[U]
C013.4	-	nent the various systems and technologies used in Industry 4.0.	[Ap]
C013.5	Design	the components for Industry 4.0 using learned concepts such cloud computing and data analytics.	[C]
Course Co			
Comparison	of Indu	e Networked Economy, Compelling Forces and Challenges for Ind stry 4.0 Factory and Today's Factory, Fundamentals of Machine Big Data and Productive Apolytics for Smart Rusiness Transforma	
Comparison Trends of In Technologi Predictive A Support Sys Cloud Comp Application manufacturi	of Indu dustrial es enab analytics stem for buting ar of Ind ng, Indu	stry 4.0 Factory and Today's Factory, Fundamentals of Machine Big Data and Predictive Analytics for Smart Business Transforma bling Industry 4.0: Industrial Internet of Things (IIoT) & Internet of , Cyber physical Systems; Robotic Automation and Collaborative Industry 4.0, Mobile Computing, Cyber Security, Cloud Computin and Industry 4.0. Ilustry 4.0: Smart Manufacturing, Virtual Power Plants, e-comm Istrial 3D printing, e-mobility, The Road towards Industry 5.0 -, In	ation. Services, e Robots; ng Basics, merce for
Comparison Trends of In Technologi Predictive A Support Sys Cloud Comp Application manufacturi	of Indu dustrial es enab analytics stem for buting ar of Ind ng, Indu	stry 4.0 Factory and Today's Factory, Fundamentals of Machine Big Data and Predictive Analytics for Smart Business Transforma Ding Industry 4.0: Industrial Internet of Things (IIoT) & Internet of , Cyber physical Systems; Robotic Automation and Collaborative Industry 4.0, Mobile Computing, Cyber Security, Cloud Computin and Industry 4.0. Iustry 4.0: Smart Manufacturing, Virtual Power Plants, e-comr Istrial 3D printing, e-mobility, The Road towards Industry 5.0 -, In stem, Connected factory.	ation. Services, e Robots; ng Basics, merce for mpacts of
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80)				120	0		20	00		40			60		1	00	
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Course Outcome	9		loom Leve	-		CC	ompo	onent t, Ca	om th tudy,	ind m liz, , Gro	FA (16%)			-				
C013.1		Unc	Assignment)												20			
C013.2		Unc	dersta	ind	Cro		ooian	mont								20		
C013.3		Unc	derstand Group Assignment															
C013.4		Арр																
C013.5		Cre	Create 40															
Assessm	ent	based on Summative and End Semester Examination																
Bloom's I	Bloom's Level [12 CIA1: [60 Marks								•	l%) Mark	el	End		(60	%)		ation	
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SA 1 (60	Со	mpor	nent -	Со	mpor	nent		A 2 (60	Co	ompor	nent	Com	pone	nt -		(60%	•	
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Mapping Specific C					come	es (C	0) w	lith I	Prog	ramn	ne (Jutco	mes	(PO)) Pro	ogra	mme	
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Nature of Course Theory analytical. Pre Requisites Thermal Engineering, Engineering Thermodynamics. Course Objectives: To enable the students to apply various laws of heat transfer in engineering applications. 3 To enable the students to analyze heat exchangers using LMTD and NTU methods. 4 To interpret the concepts underlying the types of mass transfer. Course Outcomes: Upon completion of the course, students shall have ability to C503.1 Summarize the basics of different modes and laws of heat transfer. [U] C503.3 Interpret and analyse forced and free convection heat transfer. [A] C503.4 Appraise the heat exchangers performance using LMTD and NTU [A] methods. C503.5 Classify and appraise the different modes of mass transfer. [A] C503.6 Evaluate the radiative properties of a surface. [E] Conduction Heat Transfer: Fourier Law of Conduction, General Differential equation of Heat Conduction Classify and appraise theoded Surfaces (Circular, Rectangular). Completed Surfaces (Circular, Rectangular). Conduction Heat Transfer and Heat Exchangers: Heat Transfer Coefficients – Boundary Layer Concept, External Flow – Flow over Plates, Cylinders, Internal Flow, Phase Change Heat Transfer (descriptive) – Nusselt's theory of condensation and Regimes of boiling, Heat Exchangers: Analysis – LMTD &		3	HEAT AND MASS TRANSFER	3/0/0/3
Pre Requisites Thermal Engineering, Engineering Thermodynamics. Course Objectives: 1 To impart knowledge on the theoretical and analytical concepts to analyze the modes of heat transfer. 2 To enable the students to apply various laws of heat transfer in engineering applications. 3 To enable the students to analyze heat exchangers using LMTD and NTU methods. 4 To interpret the concepts underlying the types of mass transfer. Course Outcomes: Upon completion of the course, students shall have ability to C503.1 Summarize the basics of different modes and laws of heat transfer. [U] C503.2 Compute heat transfer and temperature distribution in composite systems [AP] [A] C503.3 Interpret and analyse forced and free convection heat transfer. [A] C503.4 Appraise the heat exchangers performance using LMTD and NTU [A] [A] C503.5 Classify and appraise the different modes of mass transfer. [A] Conduction Heat Transfer: Fourier Law of Conduction, General Differential equation of Heat Conduction Cartesian Coordinates, 1-D Steady State Heat Conduction (Plane Wall, Cylinders) Composite Systems, Extended Surfaces (Circular, Rectangular). Convection Heat Transfer and Heat Exchangers: Heat Transfer Coefficients – Boundary Layer Concept, External Flow – Flow over Plates, Cylinders, Internal Flow, Phase	Nature o	f Course	Theory analytical.	
Course Objectives: 1 To impart knowledge on the theoretical and analytical concepts to analyze the modes of heat transfer. 2 To enable the students to apply various laws of heat transfer in engineering applications. 3 To enable the students to analyze heat exchangers using LMTD and NTU methods. 4 To interpret the concepts underlying the types of mass transfer. Course Outcomes: Upon completion of the course, students shall have ability to C503.1 Summarize the basics of different modes and laws of heat transfer. [U] C503.2 Compute heat transfer and temperature distribution in composite systems in and extended surfaces. [A] C503.3 Linterpret and analyse forced and free convection heat transfer. [A] C503.4 Appraise the heat exchangers performance using LMTD and NTU interpret and analyse forced and free convection heat transfer. [A] C503.5 Classify and appraise the different modes of mass transfer. [A] C503.6 Evaluate the radiative properties of a surface. [E] Conduction Heat Transfer: Fourier Law of Conduction, General Differential equation of Heat Conduction - Cartesian Coordinates, 1-D Stady State Heat Conduction (Plane Wall, Cylinders, Internal Flow - Flow over Plates, Cylinders, Internal Flow, Phase Change Heat Transfer (descriptive) - Nusselt's theory of condensatin and Regimes of boling, Heat Exchangers: Analysis – LMTD & NTU me	Pre Requ	uisites	Thermal Engineering, Engineering Thermodynamics.	
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21ME504		CAD/CAM LABORATORY		0/0/3/1.5
Nature of (Course:	Practical application		
Pre Requis	sites:	Engineering Drawing		
Course Ob	jectives:			
1	To unde	erstand and interpret drawings of machine compor	nents	
2	To prep	are the assembly drawings using standard CAD p	ackages.	
3	To gain	practical experience in handling 3D modeling soft	ware system.	
4		erstand and interpret program codes for manufactune to the manufactune to the manufacture of the manufacture	uring different	machine
Course Ou	itcomes:			
Upon com	pletion o	f the course, students shall have ability to		
C504.1		the fundamentals of computer applications in	design and	[R]
	manufa	0		
C504.2		the features of computer packages.	the sime setural	[U]
C504.3	fabricat		e their actual	[Ap]
C504.4		e part programming for a CAD model.		[Ap]
C504.5		te the machining codes automatically using the C/	AM system.	[A]
C504.6		te the components using RPT machine.		[A]
Recent trer		D/CAM, features of solid modeling packages, CN IRP I, MRP II, 3D Printing, Group technology, PLN	I Softwares.	codes for
Recent trer	nds in CA mming, N	•. •	A Softwares.	codes for RBT
Recent trer part progra S.No 1	nds in CA mming, M List o Introduc	IRP I, MRP II, 3D Printing, Group technology, PLM f Experiments (Using appropriate softwares) tion to CAD & CAM software packages.	A Softwares.	RBT U
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Recent trer part progra S.No 1	nds in CA mming, M List o Introduc 3D Mode bracket	IRP I, MRP II, 3D Printing, Group technology, PLM f Experiments (Using appropriate softwares) tion to CAD & CAM software packages. elling of simple components like V Block, corner	A Softwares. CO Mapping C504.2 C504.3 C504.3	RBT U
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Recent trer part progra 1 2 3 4 5	List o Introduc 3D Mode 3D Mode 3D Mode 3D Mode 3D Mode 3D Mode 3D Mode Manual turning, facing, n on cyline	IRP I, MRP II, 3D Printing, Group technology, PLM f Experiments (Using appropriate softwares) tion to CAD & CAM software packages. elling of simple components like V Block, corner and Safety valves etc. elling and assembly of Connecting rod. elling and assembly of Pedestal bearing. elling and assembly of Tail stock. part programming using G and M codes for step turning, taper turning, multiple turning, nultiple facing, thread cutting and radius turning drical components. ling program involving linear motion and circular	A Softwares. CO Mapping C504.2 C504.3 C504.3 C504.3 C504.3 C504.3	RBT U [Ap] [Ap] [Ap] [Ap]
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Reference Bool	ks:
1	Ibrahim Zeid, "CAD-CAM Theory and Practice", McGraw-Hill Publishing Co.
	Ltd., 2015.
2	N.D. Bhatt, "Machine Drawing", Charotar Publishing House Pvt. Limited., 2016.
3	Gopalakrishnan, K.R, "Machine drawing", Subash publishers, 2017.
Web Reference	s:
1	http://www.mastercam.com/en-us/Support/Training/Certification
2	www.nptel.ac.in/video.php?subjectId=112102101

Formative Assessme		Su	ntinu Imma sessr	tive	Asse	ssme Tot				tal nuous smen	5	End Semester Examination			Total	
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Bloom's Le	evel			FA FA		ıs As [100		5]	: (60% SA 5 Mar	-		End Semester Practical Examination (40%) [100 Marks]				
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Understand				30				30 30								
Apply				30					30							
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Evaluate				-			-							-		
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C504.4	3	3	3		3								1			
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C504.6	3	3	3		3				2			3	2	3	3	
3	Str	ongly	agre	ed	2 N	/loder	ately	agre	ed	1 R	easc	nably	agree	d		

21ME50	5	HEAT AND MASS TRANSFER LABORATORY		0/0/2/1					
Nature of	Course	Practical application							
Pre Requi	sites	Nil							
	bjectives								
1		t knowledge on applying the analytical concepts to ana s of heat transfer.	lyze the perf	ormano					
2		e the students to analyze heat exchangers using LMT	D and NTU	method					
Course O	utcomes:								
		f the course, students shall have ability to							
C505.1		e heat transfer and temperature distribution in st	eady-state,	[Ap]					
	unsteady	y-state heat conduction and extended surfaces.							
C505.2	Appraise application	the forced and free convection heat transfer i	n practical	[E]					
C505.3		he heat exchangers performance using LMTD and NT	nance using LMTD and NTU methods.						
C505.4		the radiative properties of a surface.		[E] [E]					
Course Co									
	ententa.								
			CO						
S.No		List of Experiments	Mapping	RBT					
1		e the thermal conductivity of insulation by using be apparatus.	C505.1	[Ap]					
	Experime	ntal determination of Heat Transfer from pin-fin onvection mode).	C505.1	[Ap]					
З	Determina	C505.2	[Ap]						
4	heat transfer from a vertical cylinder.Determination of heat transfer coefficient of Forced convectionC505.2inside tube.C505.2								
5		ntal determination of Effectiveness of parallel flow	C505.3	[E]					
6		ntal determination of Effectiveness of counter flow	C505.3	[E]					
		ation of Stefan- Boltzmann constant.	C505.4	[E]					
8	Determina	ation of Emissivity of a grey surface.	C505.4	[E]					
9	Determina	ation of thermal conductivity measurements by plate method	C505.1	[Ap]					
10	Determina	ation of thermal conductivity of pipe insulation by ged pipe apparatus	C505.1	[Ap]					
<u> </u>			I Hours:	45					
Reference	Books:								
1	Kotha	andaraman C.P "Fundamentals of Heat and Mass Tra	nsfer", New	Age					
		national, New Delhi, 2018.							
2		pera, F. P. and De Witt, D. P., "Fundamentals of Heat							
		sfer", 5th Edition, John Wiley and Sons, New York, 20							
3		an J.P "Heat and Mass Transfer", McGraw-Hill, 2019.							
4	Nag	P.K, "Heat and Mass Transfer", McGraw-Hill, 2019.							
Veb Refe									
1		://virtuallabs.hkust.edu.hk/TubularHeatExchanger/Virt	ualExperime	ent					
2		/vmt-iitg.vlabs.ac.in/							
3		://vlab.amrita.edu/index.php?sub=1&brch=194∼=8	01&cnt=4						
4	http://	/mfts-iitg.vlabs.ac.in/							

	Continuous Ass	sessment			
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment	End Semester Examination	Total
75	25	100	60	40	100
Assessment bas	ed on Continuous	and End Se	tion		
	Continu	ous Assessn [100 Marks]	· · ·	End Sem Practic	
Bloom's Level	FA (75 Marks))	SA (25 Marks)	Examina (40% [100 Ma)
Remember	10		10	10	
Understand	10		10	10	
Apply	10		10	10	
Analyse	35		35	35	
Evaluate	35		35	35	
Create	-		-	-	

<u> </u>				PSOs											
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C505.1	3	2	2	3										1	
C505.2	2	2	2	3										3	
C505.3	3	1	2	2										2	
C505.4	3	2	3	2										3	

Semester – 06

21ME601		DESIGN OF TRANSMISSION SYSTEMS	3/0/0/3
Nature of	Course	Theory analytical	
Pre Requ	isites	Design of Machine Elements	
Course O			
1	To und	derstand the different types of flexible transmission systems.	
2		derstand the terminology, geometry and basic kinematic concep	ts of
	gears.		
3	To lea	rn the design of brakes, clutches and gear box.	
4	To ena	able the students to design real time transmission system eleme	ents.
Course O	utcomes		
Upon con	npletion of	of the course, students shall have ability to	
C601.1	Recall	the basic design concepts of transmission systems.	[R]
C601.2		n and develop the flexible transmission elements for	[A]
	engine	ering applications by selecting the standard data from design	
	data b	ook and manufacturers catalog.	
C601.3	Desigr	n and analyze the stresses in gear drives for power	[A]
		nission.	
C601.4	Apply	the standard procedure to design gear box, clutch and brake	[Ap]
		ns for engineering applications.	
C601.5		n, fabricate and evaluate a model of the transmission system.	[C]
Course C	ontents:		
pulleys, In Spur Gea considera of helical of tooth force	troduction rs and He tions. Par gear. Bev e analysis	Elements: Belt Drives, Selection of V belts and pulleys, flat in to toothed belts, design of chain drives and sprockets. Elical Gears: Spur gear – Design of spur gear based on strength allel axis helical gears - force, beam strength, wear strength ar el and Worm Gears: Straight bevel gear – Beam strength, wear s, design of bevel gears. Worm Gear – force, stresses, thermal of the worm gear pair.	and weand design
pulleys, In Spur Gea consideral of helical g tooth force estimating Design of gearbox, o Introductio Clutches	troduction rs and He tions. Par gear. Beve analysis the size f Gear Bo constant n on to fluid and Bral	h to toothed belts, design of chain drives and sprockets. elical Gears: Spur gear – Design of spur gear based on strength allel axis helical gears - force, beam strength, wear strength ar el and Worm Gears: Straight bevel gear – Beam strength, wear s, design of bevel gears. Worm Gear – force, stresses, thermal of the worm gear pair. bxes: Step ratio, ray diagram, kinematics layout. Design of slid nesh gear box, multi speed gear box, Theory of variable speed couplings and Torque converters for automotive applications. E kes: Clutches, Design of clutches – Plate clutches–Axial clutch	and weand design strength capacity ing mesl gear box Design o nes-Cond
pulleys, In Spur Gea considera of helical of tooth force estimating Design of gearbox, of Introductio Clutches clutches,	troduction rs and He tions. Par gear. Beve analysis the size f Gear Bo constant n on to fluid and Bral Centrifuga	h to toothed belts, design of chain drives and sprockets. elical Gears: Spur gear – Design of spur gear based on strength allel axis helical gears - force, beam strength, wear strength ar el and Worm Gears: Straight bevel gear – Beam strength, wear s, design of bevel gears. Worm Gear – force, stresses, thermal of the worm gear pair. bxes: Step ratio, ray diagram, kinematics layout. Design of slid nesh gear box, multi speed gear box, Theory of variable speed couplings and Torque converters for automotive applications. E kes: Clutches, Design of clutches – Plate clutches–Axial clutch al Clutches, Electromagnetic clutches. Brakes – Design of blo	and weand design strength capacity ing mesl gear box Design o nes-Conte ck brake
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Online R	esourc	es:									
1	htt	os://ww	/w.co	ursera.org	/learn/m	nachin	e-design1				
2				edu/cours 1/index.ht		nanica	al-enginee	ering/2	2-75-precis	ion-n	nachine-
		Cor	ntinuo	ous Asse	ssment						
Form Asses			Su	mmative sessment		otal	Tota Continu Assessi	ious	End Semeste Examinat	-	Total
8	0			120	2	200	40		60		100
Assessm	ent Me	thods	& Le	vels (bas	ed on B	loom	s' Taxono	omy)			
Formativ	e Asse	ssmen	nt bas	sed on Ca	pstone	Mode	el				
Course Outcom		Bloom' Level	-	со	mponer ment, C	nts fro ase S	nent (Cho om the lis tudy, Ser nment)	t - Qı	ıiz,		A (16%)) Marks]
C601.1	Re	membe	er	Quiz							20
C601.2		alyze									
C601.3		alyze		Group As	signmer	nt					20
C601.4											
C601.5		eate		Mini Proje							40
Assessm	ent ba	-									
Bloom's	Level				sessme Marks]	ent (24	4%)	End	Semester (60 ⁴	%)	
		CIA	1: [6	0 Marks]	CIA2	2: [60	Marks]	[100 Marks]
Remembe	ər		1	0		10		10			
Understar	nd		2	0		20			20)	
Apply				0		50			4(
Analyse			2	0		20			30)	
Evaluate				-		-			-		
Create			-	-		-			-		
Assessm	ent ba							mina	tion		
		Co	ontin	uous Ass [200 N		nt (40 [°]	%)				End
	CA 1: 1	100 Ma	rks		•	CA	2: 100 M	arks		Se	mester
		A 1 (40		ˈks)	64.0		FA 2 (4		ırks)		mination
SA 1 (60	Compo			nponent	SA 2 (60	C	omponent	Con	nponent -		(60%)
(60 Marks)	l (20 M	arks)	(20	- II Marks)	(60 Marks)) (2	- I 20 Marks)	(20	ll Marks)	[10	0 Marks]
Mapping	of Co	urse (Outco	omes (CC	D) with	Prog	ramme (Dutco	mes (PO)	Pro	gramme

· · · –	outcor	tcomes (PSO)											. ,	J		
<u> </u>						P	Os							PSOs		
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3	
C601.1	3	2	2	2									1	1		
C601.2	3	3	3	3									3	1		
C601.3	3	3	3	3									3	1		
C601.4	3	3	3	3									3	1		
C601.5	3	3	3	3									3	3		
3	Stro	ngly a	gree	d	2	Mode	rately	/ agre	eed	1	Rea	asona	ably agr	eed		

	2	COMPUTATIONAL MECHANICS	3/0/0/3
Nature of	Course	Theory	
Pre Requ	lisites	Engineering Mathematics I & II, Solid Mechanics, Fluid mecha machinery	nics and
<u>Course O</u>	bjectives:		
1		the students to understand the principle involved in discretiza stiffness matrices and force vectors.	tion, the
2		the students to apply the concepts of finite element analysis for g problems.	r solving
3		confidence among students to solve complex problems in the field	d of fluid
Course O	outcomes:		
		the course, students shall have ability to	
C602.1	Summarize	e the governing equations for continuum and implementation FEA and CFD.	[U]
C602.2		appropriate element for the given structural problems.	[Ap]
C602.3	Solve for s	tresses, strains and deformation of a structural component due d, transverse load and bending.	[A]
C602.4	Examine tl	he time-dependent non-linear problems by applying various on methods and technologies in finite element methods.	[E]
C602.5		ble structural, thermal and fluid flow problems using simulation	[A]
Course C			
packages FDM.	- advantage	eam subjected to point load, uniformly distributed load (UD point load and UDL), weighted residual method, finite element ses and limitations, Introduction to FDM and difference between F	oftware EM and
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (i	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta	point load and UDL), weighted residual method, finite element s	nctions, vector, ts. Two endipity
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (i (Gauss qu Introduct flow -Gove (for an inf	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat	ements: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effectents: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical intertected) - one dimensional problem.	nctions, vector, ts. Two r node endipity egration Is of the quations e exam
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (a (Gauss que Introduct flow -Gove (for an inf purpose.	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally	boint load and UDL), weighted residual method, finite element sees and limitations, Introduction to FDM and difference between F ements: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effect ents: Triangular Element (CST), Isoparametric elements-four , shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical inter ethod) - one dimensional problem.	nctions, vector, ts. Two r node endipity egration
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (a (Gauss quadrilate) (Gauss quadrilate) flow -Gove (for an inf purpose.	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally ks:	boint load and UDL), weighted residual method, finite element sees and limitations, Introduction to FDM and difference between F ements: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effect ents: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical interested ethod) - one dimensional problem. Purpose – Applications - Fundamental physical principles, Mode tions of fluid dynamics – the continuity, momentum and energy ec- small fluid element moving with the flow) - only derivation for the Total Hours:	nctions, vector, ts. Two r node endipity egration ls of the juations e exam
packages FDM. One Dime quadratic finite elem Dimensic quadrilate element (i (Gauss qu Introduct flow -Gove (for an inf purpose. Text Boo	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally <u>ks:</u> Logan D.L, Edition, Cen	Depoint load and UDL), weighted residual method, finite element sets and limitations, Introduction to FDM and difference between Ferenents: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effected ons: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical interested of fluid dynamics – the continuity, momentum and energy endstand fluid element moving with the flow) - only derivation for the trust fluid element moving with the flow) - only derivation for the moving with the flow) - only derivation for the moving problem.	eoftware EM and nctions, vector, ts. Two r node endipity egration ls of the quations e exam 45
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (a (Gauss quadrilate element (a (Gauss quadrilate flow -Gove (for an inf purpose. Text Boo 1	- advantage ensional Ele shape func- nent equatio onal Eleme eral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally ks: Logan D.L, Edition, Cen Muralidhar.k edition, Nare	ements: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effectents: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical interested of fluid dynamics – the continuity, momentum and energy exists and fluid element moving with the flow) - only derivation for the Total Hours:	anctions, vector, ts. Two r node endipity egration ls of the quations e exam 45
packages FDM. One Dime quadratic finite elem Dimensic quadrilate element (i (Gauss que Introduct flow -Gove (for an inf purpose. Text Boo 1 2 Referenc	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally ks: Logan D.L, Edition, Cen Muralidhar.k edition, Naro e Books:	boint load and UDL), weighted residual method, finite element is as and limitations, Introduction to FDM and difference between Ferenents: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effecters: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical interethod) - one dimensional problem. Purpose – Applications - Fundamental physical principles, Mode tions of fluid dynamics – the continuity, momentum and energy existent fluid element moving with the flow) - only derivation for the tions of fluid approximation of the fluid element moving with the flow of the transfer for the transfer in the Finite Element Method", Thomson Learning age learning India pvt Itd, 2016.	Anctions, Vector, ts. Two r node endipity egration ls of the uations e exam 45 ng, Sixth Second
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (a (Gauss que Introduct flow -Gove (for an inf purpose. Text Boo 1 2 Reference	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally <u>ks:</u> Logan D.L, Edition, Cen Muralidhar.k edition, Naro e Books: Tirupathi R. in Engineeri	boint load and UDL), weighted residual method, finite element is as and limitations, Introduction to FDM and difference between Ferenets: General procedure of FEM, coordinates and shapes functions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effecters: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical interethod) - one dimensional problem. Purpose – Applications - Fundamental physical principles, Mode tions of fluid dynamics – the continuity, momentum and energy existent fluid element moving with the flow) - only derivation for the tions of fluid appet interest. "A First Course in the Finite Element Method", Thomson Learning age learning India pvt Itd, 2016. K, Sundararajan.T, "Computational fluid flow and heat transfer", osa publishers, 2014. Chandrupatla and Ashok D. Belugundu, "Introduction to Finite Eign", Fifth Edition by Cambridge University, 2022.	Actions, vector, vector, ts. Two r node endipity egration Is of the quations e exam 45 ng, Sixth Second
packages FDM. One Dime quadratic finite elem Dimensio quadrilate element (i (Gauss qu Introduct flow -Gove (for an inf purpose. Text Boo 1 2 Reference 1	- advantage ensional Ele shape func- nent equatio onal Eleme ral element, 8 node recta uadrature me ion to CFD: erning equat finitesimally <u>ks:</u> Logan D.L, Edition, Cen Muralidhar.k edition, Naro e Books: Tirupathi R. in Engineeri	boint load and UDL), weighted residual method, finite element sees and limitations, Introduction to FDM and difference between Ferenents: General procedure of FEM, coordinates and shapes fuctions, Galerkin's approach-Element stiffness matrices and load ons: 1D-bar, beam and plane truss elements, Temperature effecters: Triangular Element (CST), Isoparametric elements-four, shape functions, element stiffness matrix and force vector, Ser angular element) – only shape function derivation, numerical interethod) - one dimensional problem. Purpose – Applications - Fundamental physical principles, Mode tions of fluid dynamics – the continuity, momentum and energy existent for the first Course in the Finite Element Method", Thomson Learning age learning India pvt Itd, 2016. K, Sundararajan.T, "Computational fluid flow and heat transfer", osa publishers, 2014. Chandrupatla and Ashok D. Belugundu, "Introduction to Finite Element, 2022.	software EM and nctions, vector, ts. Two ir node endipity egration ls of the guations ie exam 45 ng, Sixth Second

Web Re	ferences:
1	http://www.nptel.ac.in/courses/105105041/1
2	http://nptel.ac.in/courses/112105045/
Online I	Resources:
1	https://www.edx.org/course/hands-introduction-engineering-cornellx-engr2000

		С	ontinu	ous Asses	ssme	ent				F is al			
Forma Assess				ummative sessment		Tota		Tota Continu Assessr	ous	End Semest Examinat	-	Total	
80)			120		200		40		60		100	
Assessme	ent Me	ethod	s & Lev	vels (base	d on	Bloom	ıs' '	Taxonor	ny)				
Formative	Asse	essme	ent bas	ed on Cap	stor	ne Mod	el						
Course Outcome	,	Bloc Lev	-	со	mpo	nents f t, Case	fror Sti	ent (Cho n the lis udy, Sen ment)	t - Qı			A (16%) 0 Marks]	
C602.1	ι	Unders	stand	Quiz		7100	- gri	monty				20	
C602.2	A	Apply		Assignme	ent							20	
C602.3		Analyz	e	Assignme							20		
C602.4	E	Evalua	ite	Tutorial								20	
C602.5	A	Analyz	e	Tutonai	Tutorial							20	
Assessme	ent ba	ased o	on Sum	mative an	d En	d Sem	est	er Exam	inatio	on			
Bloom's L	مريما		Sum	mative As [120			(249	%)	End	Semester (60		mination	
Bloom 5 E	CVCI	(CIA1: [(60 Marks]	C	- (00					Marks]		
Remember	•			10			10			1()		
Understand	k			10			10			1()		
Apply				20			20			20)		
Analyse				40 40				4(
Evaluate				20			20			20)		
Create				-			-			-			
Assessme	ent ba	ased c	on Cont	tinuous ar	nd Er	nd Sem	nest	er Exam	ninati	on			
			Contin	uous Ass [200 M		•	0%))				End	
(CA 1:	: 100 I	Marks			C		2: 100 M	arks			emester mination	
SA 1		FA 1	(40 Ma	ırks)	S	A 2		FA 2 (4	l0 Ma	ırks)		(60%)	
(60 Marks)		nponen I Marks		mponent - II 0 Marks)	(60 irks)		nponent - I Marks)		nponent - II) Marks)	[10	0 Marks]	

COs	POs PSOs														
COS	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C602.1	3	2	2	2									3		3
C602.2	3	2	2		3								3		1
C602.3	3	2	3	3	3								3		1
C602.4	3	3	1	2									3		3
C602.5	3	3	3	3	3										

21ME60	3	SIMULATION AND ANALYSIS LABORATORY		0/0/3/1.5
Nature of	of Course	Problem experimental		
Pre Req	uisites	Problem solving using C programming, Solid Mechani	cs, CAD/C	AM
•		laboratory	,	
Course	Objectives:			
1		le students create model for a given component using s	software.	
2	To impa	rt knowledge to perform stress analysis for any given	compone	nt under
	various	mechanical loading conditions.	•	
3		ble the students to simulate and analyze engineering thermal loading conditions.	componer	its under
4		le the students to verify the simple 2D flow using nume	rical codin	g.
Course	Outcomes:			•
Upon co	mpletion o	f the course, students shall have the ability to		
C603.1		of 3D machine components using analysis software.		[Ap]
C603.2		e simple structural problems using analysis software.		[A]
C603.3		and evaluate the given component under thermal co	ondition	[E]
		alysis software.		=
C603.4	Validate	simple flow problem through CFD analysis.		[E]
C603.5		programs to simulate mechanical system.		[C]
Laborat	ory Compo			
S.No	,	List of Experiments	CO	RBT
		Using analysis and simulation softwares)	Mapping	
1		lysis of L bracket/ Plate with Hole.	C603.1	[Ap]
2		lysis of axisymmetric component.	C603.2	
3		lysis using link elements in Trusses	C603.2	
4		lysis in Beam under different loading conditions (Point	C603.2	[A]
	load and U	,	0000.0	[4]
5		ysis of Beam.	C603.2	
6		Analysis of Spring-Mass System	C603.2	
7		ress analysis in 2D components.	C603.2	
8		and convective heat transfer analysis.	C603.3	[E]
9	flow over fl	sis for velocity and pressure distribution in simple 2D at plate.	C603.3	[E]
10		eat transfer analysis of fluid flowing in a circular pipe.	C603.4	[E]
11		of hydraulic / pneumatic cylinder.	C603.5	
12		of cam and follower mechanism.	C603.5	[C]
	ce Books:		0000.0	
<u>reieleli</u> 1		Chen, Y. Yujin Liu, "Finite Element Modelling and Simula	ation using	
· ·		nch", CRC Press, 2015.		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
2		ickoo "ANSYS Workbench 14.0 for Engineers & Des	sianers [.] A	Tutorial
-		sh", Dreamtech Press, 2012.		
3		dhar, T.Sundarajan, "Computational Fluid Flow and Hea	at Transfei	. Narosa
-		ng House, 2014.		,
4	Soumitra	a Kumar Mandal, "Basic Electronics", McGraw Hill Educ	cation Indi	a Private
_	Ltd., 202			
5		o,J.P.Danier. "An Introduction to Programming and Nur	merical Me	ethods in
<u> </u>		3", Springer, 2005.		
	ferences:			
1		ww.nafems.org/e-learning/		
2		vw.mece.ualberta.ca/tutorials/ansys/		
3	nttp://su	2.stanford.edu/training.html		

Online Resources:							
1	http://nptel.ac.in/courses/105103140/40						
2	http://nptel.ac.in/courses/112105045/						
3	https://www.coursera.org/learn/matlab						
4	https://www.edx.org/course/hands-introduction-engineering-cornellx-engr2000x						

	Continuous Ass	sessment							
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment	End Semester Examination	Total				
75	25	100	60	40	100				
Assessment bas	ed on Continuous	and End Se	mester Examina	tion					
	Continu	ous Assessr [100 <u>Marks</u>	End Semester Practical						
Bloom's Level	FA (75 Marks))	SA (25 Marks)	Examination (40%) [100 Marks]					
Remember	10		10	10					
Understand	10		10	10					
Apply	20		20	20					
Analyse	20		20	20					
Evaluate	20	20 20 20							
Create	20		20	20					

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme	• Specific
Outcomes (PSO)	

<u> </u>						P	Ds							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C603.1	3	3	3	2	3				2		3		3	2	
C603.2	3	3	3	3	3				2		2		3	2	
C603.3	3	3	3	3	3				2		3		3	1	
C603.4	3	3	3	3	3				2		3		3	1	
C603.5	3	3	2	3	3				2		2		3	1	
3	Str	ongly	y agr	eed	2	Mode	erate	ly ag	reed		1	Rea	sonably a	agreed	

			Design Thinking and Mini Project	0/0/3/1.5					
Nature of Co	urse	Practic	al						
Pre Requisit			acturing Technology I and Manufacturing Technology						
Course Obje									
1	To de	monstra	ate the interpersonal skills and technical abilities.						
2	To ap	ply suita	able tools and techniques to solve the practical proble	ms.					
Course Outc									
Upon comple	etion o	of the co	ourse, students shall have ability to						
C604.1			evelop a working model.	[C]					
C604.2		Develop technical skill, presentation skill and interpersonal [Ap] behavior.							
C604.3			interdisciplinary skill, ethical values and team work.	[Ap]					
C604.4 Course Guid			ket trends in terms of economics and finance.	[Ap]					
2. Every Identification sixth semeste 3. The st conducting lite	team of facu er. udent	shall ha Ilty guid has to io	ected to do a project and form a team of 3 members. ave a guide who is the member of the faculty of th e has to be completed within a week from the day of dentify and fabricate his/her idea into the project work	beginning of					
complete des 5. Five n work have to their faculty g 6. During	ect rep ign pro nid sen be cor uide as g the e	ort (of the pject rep nester re nducted s a men and ser	The phase-I) to this effect has to be submitted by the tea port has to be submitted by team. eviews and one end semester review of the progress by a team of faculty (minimum 3 and a maximum of the faculty team. nester exam, one internal examiner and one extern examine the project phase I done by the students.	am. Also, the of the project 5) along with					
complete des 5. Five n work have to their faculty g 6. During appointed by	ect rep ign pro nid sem be cor uide as the cC	ort (of the pject rep nester rep nducted s a men end sen DE will e	the phase-I) to this effect has to be submitted by the tead out has to be submitted by team. eviews and one end semester review of the progress of by a team of faculty (minimum 3 and a maximum of suber of the faculty team. nester exam, one internal examiner and one extern	am. Also, the of the project 5) along with al examiner,					
complete des 5. Five n work have to their faculty g 6. During appointed by	ect rep ign pro nid sem be con uide as the co the CC	ort (of the pject rep nester rep nducted s a men end sen DE will e	he phase-I) to this effect has to be submitted by the teaport has to be submitted by team.eviews and one end semester review of the progress ofby a team of faculty (minimum 3 and a maximum of some of the faculty team.nester exam, one internal examiner and one externexamine the project phase I done by the students.ased on Continuous and End Semester ExaminationMonthMonth	am. Also, the of the project 5) along with al examiner,					
complete des 5. Five m work have to their faculty g 6. During appointed by Summative a Activ	ect rep ign pro nid sen be cor uide as the co the CC Issess	ort (of the pject rep nester rep nducted s a men end sen DE will e	he phase-I) to this effect has to be submitted by the teaport has to be submitted by team.eviews and one end semester review of the progress ofby a team of faculty (minimum 3 and a maximum of some of the faculty team.nester exam, one internal examiner and one externexamine the project phase I done by the students.ased on Continuous and End Semester ExaminationMonthMonth	am. Also, the of the project 5) along with al examiner, on Semester amination					
complete des 5. Five m work have to their faculty g 6. During appointed by Summative a	ect rep ign pro nid sem be con uide as the co the CC assess vity	ort (of the pject rep nester rep nducted s a men end sen DE will e	he phase-I) to this effect has to be submitted by team.eviews and one end semester review of the progress of by a team of faculty (minimum 3 and a maximum of the pher of the faculty team.hester exam, one internal examiner and one extern examine the project phase I done by the students.ased on Continuous and End Semester Examination Assessment [60 marks]Month	am. Also, the of the project 5) along with al examiner, on Semester amination					

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
605						PSOs									
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C604.1	3	3	2	2									3	3	
C604.2	3	3	3	3					2	3	2			3	
C604.3	3	3	3	3					3	2				3	
C604.4	3	3	3	3					2		3			3	
	3 S	Strongly agreed 2 Moderately agreed 1 Reasonably agreed													

Semester – 07

21ME701			
Nature of C	Course	Concept and Analytical	
Pre Requis	sites	Manufacturing Technology I & II	
Course Ob	jectives	S:	
1	To cre	ate awareness about the basic industrial engineering concepts.	
2	To unc	derstand and apply management principles, basics of quality and	ł
	statisti	cal quality control.	
3	Ability	to apply the suitable mathematical technique to solve the practic	cal
	proble	ms.	
Course Ou	tcomes		
Upon com	pletion	of the course, students shall have ability to	
C701.1	Demor	nstrate knowledge on fundamental concepts of Industrial	[U]
	Engine	eering.	
C701.2	Apply	the quality concepts for continuous improvement.	[Ap]
C701.3	Solve	quality related problems in manufacturing using control charts	[A]
C701.4		important business decisions using statistical and analytical	[Ap]
	metho	ds.	
C701.5	Solve	the real world problems using suitable operation research	[A]
	technic	que.	
concepts a Therbligs, neasureme QUALITY I service qu	and Tec and app Standar ent techr MANAG ality -	EMENT: Introduction - Definition of quality - Dimensions of pro Contributions of Deming, Juran and Crosby. Continuous	oductivit rocedure of wor oduct an proces
concepts a Therbligs, measureme QUALITY I service qu mproveme Function De benefits and of control c using softw OPERATIC simplex alg	and Tec ind app Standar ent techr MANAG ality - nt - PD evelopm d limitati hart –Co are pack ONS RE gorithm.	 hniques. Industrial Engineering application in service sectors. Prolications. Work study -concept and need, Method study productions. Work study -concept and need, Method study production - Definition of quality - Dimensions of proceed of the study. Comparison in the sector - Definition of quality - Dimensions of proceed contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality is the seven traditional tools of quality on -Variation in process causes of variation –Theory of control charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). SEARCH: Introduction, LPP models: Formation-graphical sectors. The seven traditions (NW method- Letons). 	oductivit rocedure of wor oduct an proces - Qualit of SQC part- use problem
concepts a Therbligs, measureme QUALITY I service qu improveme Function De benefits and of control c using softw OPERATIC simplex alo method- Vo	and Tec and app Standar ent techr MANAG ality - nt - PD evelopm d limitation hart –Co are pack ONS RE gorithm. ogels' ap	 hniques. Industrial Engineering application in service sectors. Prolications. Work study -concept and need, Method study productions. Work study -concept and need, Method study production - Stop-watch time study. Comparison indues. EMENT: Introduction - Definition of quality - Dimensions of productions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality thent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). ESEARCH: Introduction, LPP models: Formation-graphical sectors (NW method). Project networks - Introduction and problematical problemati	oductivit rocedure of wor oduct and proces - Qualit n of SQC part- use problem olution
concepts a Therbligs, measureme QUALITY I service qu improveme Function De benefits and of control c using softw OPERATIC simplex alo method- Vo	and Tec and app Standar ent techr MANAG ality - nt - PD evelopm d limitation hart –Co are pack ONS RE gorithm. ogels' ap	 hniques. Industrial Engineering application in service sectors. Prolications. Work study -concept and need, Method study productions. Work study -concept and need, Method study production - Stop-watch time study. Comparison indues. EMENT: Introduction - Definition of quality - Dimensions of productions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality thent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). ESEARCH: Introduction, LPP models: Formation-graphical sectors (NW method). Project networks - Introduction and problematical problemati	oductivit rocedure of wor oduct an proces - Qualit of SQC part- use problem
concepts a Therbligs, measureme QUALITY I service qu improveme Function De benefits and of control c using softw OPERATIC simplex alg	and Tec and app Standar ent techr MANAG ality - nt - PD evelopm d limitation hart –Co are pack ponst RE gorithm. ogels' ap construc	hniques. Industrial Engineering application in service sectors. Pro- lications. Work study -concept and need, Method study pro- rd Time calculation: Stop-watch time study. Comparison iniques. EMENT: Introduction - Definition of quality - Dimensions of pro- Contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality inent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control ch ontrol Charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). SEARCH: Introduction, LPP models: Formation-graphical sec Transportation models: Feasible solutions (NW method- Le opproximation method). Project networks - Introduction and probletion. Total Hours	oductivit rocedure of wor oduct and proces - Qualit of SQC part- use problem olution east cos ems onl
concepts a Therbligs, measureme QUALITY I service qu improveme Function De benefits and of control c using softw OPERATIC simplex alg method- Vo in network of	and Tec and app Standar ent techr MANAG ality - nt - PD evelopm d limitativ hart –Co are pack DS RE gorithm. ogels' ap construct s: Dale H Asia, F	hniques. Industrial Engineering application in service sectors. Pro- lications. Work study -concept and need, Method study pro- rd Time calculation: Stop-watch time study. Comparison iniques. EMENT: Introduction - Definition of quality - Dimensions of pro- Contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality nent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control ch ontrol Charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). SEARCH: Introduction, LPP models: Formation-graphical sectors Transportation models: Feasible solutions (NW method- Leoproximation method). Project networks - Introduction and probletion. Total Hours A. Besterfiled, et al., "Total quality Management", Pearson Education Fourth Edition, 2018.	oductivit rocedure of wor oduct an proces - Qualit n of SQC nart- use problem olution east cos ems onl 45
concepts a Therbligs, measureme QUALITY I service qui improveme Function De benefits and of control c using softw OPERATIC simplex alg method- Vo in network of Text Books	and Tec and app Standar ent techr MANAG ality - nt - PD evelopm d limitativ hart –Co are pack DS RE gorithm. ogels' ap construct s: Dale H Asia, F	hniques. Industrial Engineering application in service sectors. Pro- lications. Work study -concept and need, Method study pro- rd Time calculation: Stop-watch time study. Comparison iniques. EMENT: Introduction - Definition of quality - Dimensions of pro- Contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality nent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control ch ontrol Charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). SEARCH: Introduction, LPP models: Formation-graphical sec proximation method). Project networks - Introduction and problection. Total Hours A. Besterfiled, et al., "Total quality Management", Pearson Education	oductivit rocedure of wor oduct an proces - Qualit n of SQC nart- use problem olution east cos ems onl 45
Concepts a Therbligs, measureme QUALITY I service qui mproveme Function De benefits and of control c using softw OPERATIC simplex alo method- Vo n network of Text Books	and Tec ind app Standar ent techr MANAG ality - nt - PD evelopm d limitati- hart –Co are pack DS RE porithm. ogels' ap construct s: Dale H Asia, F Taha H 2019. Eugen	hniques. Industrial Engineering application in service sectors. Pro- lications. Work study -concept and need, Method study pro- rd Time calculation: Stop-watch time study. Comparison iniques. EMENT: Introduction - Definition of quality - Dimensions of pro- Contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality nent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control ch ontrol Charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). SEARCH: Introduction, LPP models: Formation-graphical sectors Transportation models: Feasible solutions (NW method- Leoproximation method). Project networks - Introduction and probletion. Total Hours A. Besterfiled, et al., "Total quality Management", Pearson Education Fourth Edition, 2018.	oductivit rocedure of wor oduct an proces - Qualit of SQC nart- use problem olution east cos ems onl 45 ation
Concepts a Therbligs, measureme QUALITY I service qui improveme Function De benefits and of control c using softw OPERATIC simplex alo method- Vo in network o Text Books 1 2 3	and Tec and app Standar ent techr MANAG ality - nt - PD evelopm d limitati hart –Co are pack onst RE gorithm. ogels' ap construct S: Dale H Asia, F Taha H 2019. Eugen McGra	hniques. Industrial Engineering application in service sectors. Pro- lications. Work study -concept and need, Method study pure rd Time calculation: Stop-watch time study. Comparison inques. EMENT: Introduction - Definition of quality - Dimensions of pro- Contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality nent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control ch ontrol Charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). ESEARCH: Introduction, LPP models: Formation-graphical sec Transportation models: Feasible solutions (NW method- Leoproximation method). Project networks - Introduction and probletion. Total Hours 4. Besterfiled, et al., "Total quality Management", Pearson Education Fourth Edition, 2018. H.A, "Operation Research", Pearson Education sixth edition, 10 the Grant and Richard Leavenworth, Statistical Quality Control, 7t aw Hill Education, 2017.	oductivit rocedure of wor oduct an proces - Qualit of SQC nart- use problem olution east cos ems onl 45 ation
concepts a Therbligs, measureme QUALITY I service qui improveme Function De benefits and of control c using softw OPERATIC simplex alg method- Vo in network of Text Books 1	and Tec ind app Standar ent techr MANAG ality - nt - PD evelopm d limitati hart –Co are pack ONS RE gorithm. ogels' ap construct S: Dale H Asia, F Taha H 2019. Eugen McGra Books: Freder	hniques. Industrial Engineering application in service sectors. Pro- lications. Work study -concept and need, Method study pure rd Time calculation: Stop-watch time study. Comparison inques. EMENT: Introduction - Definition of quality - Dimensions of pro- Contributions of Deming, Juran and Crosby. Continuous CA cycle, 5S, Kaizen. The seven traditional tools of quality nent (QFD) – Failure mode and effect analysis (FMEA). Definition on -Variation in process causes of variation –Theory of control ch ontrol Charts for X bar, R, np, p,c charts. Solving control chart kages (Not for examination). ESEARCH: Introduction, LPP models: Formation-graphical sec Transportation models: Feasible solutions (NW method- Leoproximation method). Project networks - Introduction and probletion. Total Hours 4. Besterfiled, et al., "Total quality Management", Pearson Education Fourth Edition, 2018. H.A, "Operation Research", Pearson Education sixth edition, 10 the Grant and Richard Leavenworth, Statistical Quality Control, 7t aw Hill Education, 2017.	oductivit rocedure of wor oduct an proces - Qualit of SQC nart- use problem olution east cos ems onl 45 ation th Edition

Web Refe	erences	:										
1							ry.com/subje		ustrial_enç	ginee	ering	
2	con	trol/ov		earn-abou w/tutorial.l		ty/sta	atistical-proc	ess-				
Online Re												
1							anical > IIT I			ons	Research	
2	nttp						nce-samplin	g-cou	rse			
		Con	tinu	ious Asse	ssmer	nt			End			
Form Asses				Immative sessment		Tota	al Continu Assess	uous	Semest Examinat	-	Total	
8	0			120		200	40		60		100	
Assessm	ent Me	thods	& Le	evels (bas	ed on	Bloc	oms' Taxon	omy)				
Formativ	e Asse	ssmen	t ba	sed on Ca	pston	e Mo	odel					
Course Bloom's Outcome Level				со	mpone	ents Case	oonent (Cho from the lis e Study, Se signment)	st - Qı	ıiz,		A (16%) 0 Marks]	
C701.1	Un	derstand Group			signm	ent				20		
C701.2, C701.4	Anr	bly		Assignme	Assignment 40							
C701.3	Ana	alyze		Occasional and	alı a			00				
C701.5	Ana	alyze		Case stud	ay			20				
Assessm	ent bas	sed on	Sur	nmative a	nd En	d Se	mester Exa	mina	tion			
Bloom's	Level	S	Sum	mative As [120	sessn Marks		(24%)	End Semester Exar (60%)			mination	
		CIA	1: [6	60 Marks]	CIA	CIA2: [60 Marks]			[100 Marks]			
Remembe	ər			30			20		20			
Understar	nd		Ę	50			30	30				
Apply			2	20			30		30)		
Analyse				-			20		20)		
Evaluate				-			-		-			
Create				-			-		-			
Assessm	ent bas	sed on	Сог	ntinuous a	and En	nd Se	emester Exa	mina	tion			
		Co	ontir	nuous Ass [200 N		ent (40%)				End	
	CA 1: 1	00 Ma	rks			(CA 2: 100 N	larks		Se	emester	
		A 1 (40		rks)	64		FA 2 (irks)	Exa	mination	
SA 1 (60	Compo	<u> </u>		mponent	SA (60		Component				(60%) [100 Marks]	
Marks)	ا (20 Ma	arks)	(20	- II) Marks)	Mark		- I (20 Marks)	(20	ll) Marks)	[10	v marksj	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
60-					PSOs										
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C701.1	3														
C701.2	3											1	2		
C701.3	3	3	3										3		
C701.4	3	3	1	2								1	2		
C701.5	3	3	3	2									3		
3 Strongly agreed 2 Moderately agreed 1 Reasonably agreed															

21ME70)2	MECHATRONICS	3/0/0/3					
Nature of	of Course	Theory & Practical Application						
Pre Req	uisites	Measurements and instrumentation laboratory, Fluid Mechanics and Machinery (with lab), CAD/CAM laboratory						
Course	Objectives:							
1	To learn inc	dustrial automation using hydraulics and pneumatics circuits.						
2								
3	3 To train the students in the different aspects of Sensors, PLC programming language and robot languages.							
Course	Outcomes:							
Upon co	mpletion of	the course, students shall have ability to						
C702.1	Describe th	e hydraulic and pneumatic circuits for industrial applications.	[U]					
C702.2	Create and	simulate hydraulic and pneumatic circuits.	[C]					
C702.3	Study the c	oncepts of sensors, PLC and robotics.	[U]					
C702.4	Select suita	ble Sensors, PLC & robot for specific application.	[Ap]					
C702.5	Prepare Programs to automate the six axes articulated robot. [A]							
Course	Contents:							
INTRODUCTION: Definition, Key elements, Mechatronics approach for Design process, Concept of Siemens Totally Integrated Architecture. Industrial Networking, HMI systems and								

Concept of Siemens Totally Integrated Architecture. Industrial Networking, HMI systems and Wireless controls. **SENSORS AND APPLICATIONS:** Mechatronic control in automated manufacturing, Traditional Vs Mechatronics approach, Integrated product design, General principle- Sensor for motion and position measurement- Force sensor- Pressure sensor- Torque sensor – Tactile sensor - Temperature sensor- Ultrasonic sensor- Piezoelectric sensor. Application of sensors in modern industry.

ACTUATORS FOR MECHATRONICS SYSTEM: Types of actuators and their working principles, control valves, direction, pressure and flow, comparison of hydraulic, pneumatic and electrical actuators - Pneumatic elements, electro pneumatic system, circuit design, examples, hydraulic elements, electro hydraulic system, cascade method. Introduction to PLC-Ladder Logic.

REAL TIME INTERFACING: Introduction of data acquisition and control system, Overview of I/O process, Interfacing of various sensors, Architecture of a Virtual instrument and its relation to the operating system. Introduction of Arduino boards & IDE Software– Programming Basics. **INDUSTRIAL ROBOTICS:** Robot Sensors, Robotic Vision Systems, Introduction to RAPID Programming; Case study – Pick and Place robot, automatic car parking system and other applications.

	Total Hours: 45
Text B	ooks:
1	Larry T. Ross, Stephen W. Fardo, Michael F. Walach, Larry T. Ross, Stephen W.Fardo, Michael F. Walach, "Industrial Robotics Fundamentals - Theory and Applications", 2 nd edition, 2021.
2	Dr. Deepali A. Godse, Atul P. Godse, Dr. Deepali A. Godse, Atul P. Godse, "Microprocessors & Introduction to Microcontroller", 1st edition,2020
3	Andrea Vacca, GermanoFranzoni, Andrea Vacca, GermanoFranzoni, "Hydraulic Fluid PowerFundamentals, Applications, and Circuit Design", 1st edition,2021
4	William Bolton, "Electronic Control Systems in Mechanical and Electrical Engineering", 7th edition, 2018.
Refere	nce Books:
1	R.K.Mittal, I.J. Nagrath, "Robotics and Control", McGraw Hill Education, 2017.

2	Zeev Bahir, "Electrical Drive Control: Textbook with Applicative Aspects", CreateSpace]
2	Independent Publishing Platform, 2015.	

Web Re	eferences:										
1	http://www.electrical4u.com/electrical-drives/										
2	http://www.tutorialspoint.com/microprocessor/microprocessor_8085_architecture.htm										
Online	Online Resources:										
1	http://nptel.ac.in/courses/108104011/										
2	http://nptel.ac.in/courses/108107029/										

	C	ontinuc	ous Asses	sment				F ield			
Forma Assess			Immative sessment	:	Tota	Tota Continu Assess	uous	End Semest Examinat	-	Total	
80			120		200	40		60		100	
Assessmen	t Methods	s & Leve	els (based	on Blo	ooms	' Taxonom	y)				
Formative A	ssessme	nt base	d on Caps	tone N	lode						
Course Outcome										A (16%)) Marks]	
C702.1	Unde	erstand Quiz								20	
C702.2	Creat								1	20	
C702.3		lerstand Assignment							1	20	
C702.4	Apply	/ Tutorial								20	
C702.5 Analyse										20	
Assessmen	t based o	n Sumn	native and	End S	eme	ster Exami	natio	n			
Bloom's Lev	/el	Sum	mative Assessment (24%) [120 Marks] End					Semester (60		mination	
		CIA1: [0	60 Marks]	CIA	CIA2: [60 Marks]			[100 N]	
Remember			30 30				30				
Understand			20			20		20	0		
Apply			50		3	30		30	0		
Analyse			-			20		20	0		
Evaluate			-			-		-			
Create			-			-		-			
Assessmen	t based o	n Conti	nuous and	End S	Seme	ster Exami	inatio	n			
	Continuous Assessment (40%) [200 Marks] End										
C	A 1: 100	Marks			C	CA 2: 100 N	larks			mester mination	
	FA	1 (40 Ma	irks)	SA	2	FA 2 (40 Ma	arks)	(60%)	
SA 1 (60 Marks)	Compone I (20 Mark		mponent - II 0 Marks)	(60 Mark)	Component - I (20 Marks)	Î I		[100	[100 Marks]	

COs						Ρ	Os						PSOs						
	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3				
C702.1	3	2											3						
C702.2	3	3	3										3						
C702.3	3	3																	
C702.4	3	3	3																
C702.5	3	3	3												3				
		3	Stro	ongly	agre	eed	2												

21ME70	3	MECHATRONICS LABORATORY	0/0	0/3/1.5						
Nature o Course	of	Practical application								
Pre Req	uisites	Measurements and instrumentation laboratory, Fluid Machinery (with lab), CAD/CAM laboratory	l Mechanic	s and						
Course	Objective									
1	To learn	industrial automation using hydraulics and pneumatic	s circuits.							
2	To under and Robe	stand and classify the advantages in automation usi ptics.	ng of Sens	sors, PL						
3		the students in the different aspects of Sensors, and robot languages.	PLC prog	grammin						
Course	Outcomes	S:								
Upon co	ompletion	of the course, students shall have ability to								
C703.1		and simulate various hydraulic and pneumatic circ applications.	cuits for	[Ap]						
C703.2	Identify various sensors to calculate appropriate parameters like [Ap pressure, temperature and torque.									
C703.3	Identify the logics of a Programmable Logic Controller to actuate the robotic sensors in ABB Robot.									
C703.4	Study the	TCP to actuate the six axes articulated robot.		[U]						
C703.5	Prepare	programs to automate the six axes articulated robot to perations.	perform	[Ap]						
Course	Contents:		·							
S.No		List of Experiments	CO Mapping	RBT						
		d Simulation of pneumatic circuit for actuating single acting cylinder.	C703.1	[C]						
	•	d Simulation of Logical functions (AND, OR) for double acting cylinder.	C703.2	[C]						
		d Simulation of metering-in and metering-out circuits.	C703.2	[C]						
4	Simulation	and Actuation of Sequencing Circuit A+B+B-A	C703.2	[C]						
5		circuit for single cycle automation of multi cylinder ce of A+B+B-A- using cascade method.	C703.2	[C]						
		ent of displacement using LVDT	C703.3,4	[Ap]						
		ent of torque using Torque Measurement device	C703.3,4	[Ap]						
		ent of pressure using bourdon gauge	C703.3,4	[Ap]						
		ing to Robot	C703.3,4	[Ap]						
10	Teach the	ABB six robot to identify the given component is on-metal using teach pendant	C703.3,4	[Ap]						
11	Perform a	matrix palletizing operation of ABB six axis robot h pendant with single suction cup	C703.3,4	[Ap]						
		eumatic circuit using PLC	C703.3,4	[Ap]						
	Liceno pri			45						
				40						
12	oo Booko	Total Hou	10.							
12 Referen	ce Books:			2047						
12	R.K.Mi	ttal, I.J. Nagrath, "Robotics and Control", McGraw Hill	Education							
12 Referen 1 2	R.K.Mi Zeev Create		Education							
12 Referen 1 2 Web Re	R.K.Mi Zeev Create	ttal, I.J. Nagrath, "Robotics and Control", McGraw Hill Bahir, "Electrical Drive Control: Textbook with Ap Space Independent Publishing Platform, 2015.	Education							
12 Referen 1 2	R.K.Mi Zeev Create	ttal, I.J. Nagrath, "Robotics and Control", McGraw Hill Bahir, "Electrical Drive Control: Textbook with Ap	Education							

2	http://www.tutorialspoint.com/microprocessor/microprocessor_8085_architectur e.htm									
Online Resources:										
1	http://nptel.ac.in/courses/108104011/									
2	http://nptel.ac.in/courses/108107029/									

	Continuous Ass	sessment					
Formative Assessment	Summative Assessment	End Semester Examination	Total				
75	25	100	60	40	100		
Assessment ba	ised on Continuou	is and End S	emester Exami	nation			
Bloom's -	Continuo	End Semester Practical					
Level	FA (75 Marks)		SA (25 Marks)	Examination (40%) [100 Marks]			
Remember	10		10	10			
Understand	10		10	10			
Apply	30		30	30			
Analyse	40		40	40			
Evaluate	10		10	10			
Create	-		-	-			

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
00-					PSOs										
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C703.1	3	3													
C703.2	3	3													
C703.3	3	3	3												3
C703.4	3	3													
C703.5 3 3 3			3												3
3	Stro	ongly	y agre	ed	2	Mod	erate	ly ag	reed	1	Re	ason	ably ag	reed	

21ME704

Nature	of Course	Practical
1		

Pre Requisit	tes	-	
Course Obje	ectives:		
1	To der	nonstrate the technical and literature survey abilities.	
2	To ide	ntify suitable tools and techniques to solve the practical problems	3.
Course Out	comes:		
Upon comp	letion o	f the course, students shall have ability to	
C704.1	Study	the problem and identify the solution space.	[A]
C704.2	Condu	ict literature survey.	[A]
C704.3	Develo	pp technical skill, presentation skill and interpersonal behavior.	[Ap]
C704.4	Demo	nstrate interdisciplinary skill, ethical values and team work.	[Ap]
C704.5	Exami	ne business/market trend in terms of economics and finance.	[Ap]
Course Guid	delines		
1. Each	student	t is expected to do a project and form a team of 3 members.	
2. Every	/ team	shall have a guide who is the member of the faculty of the in	stitution.
Identification	of facu	Ity guide has to be completed within a week from the day of beg	inning of
seventh sem	ester.		
3. The s	student	has to identify and select the problem to be addressed as his/he	er project
work by cond	ducting :	a complete literature survey and finalize a comprehensive aim ar	nd scope

work by conducting a complete literature survey and finalize a comprehensive aim and scope of his/her work to be done.

4. 25% of the total project work (up to design phase) has to be completed by the end of seventh semester.

A project report (of the phase-I) to this effect has to be submitted by the team. Also, the 5. complete design project report has to be submitted by team.

Two mid semester reviews and one end semester review of the progress of the project 6. work have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of the faculty team.

During the end semester exam, one internal examiner and one external examiner, 7. appointed by the COE will examine the project phase I done by the students.

Summative assessment based on Continuous and End Semester Examination											
Activity	Month	Continuous Assessment [60 marks]	End Semester Examination [40 marks]								
Problem Statement	August	30									
Project Evaluation	September	30	100								
(Up to design phase)	October	40]								

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs						PC	Ds						PSOs			
COS	а	b	С	d	е	f	g	h	i	j	k		1	2	3	
C704.1	3											2	2			
C704.2	3								3			1				
C704.3	2								3			3				
C704.4	3								2			2				
C704.5	2								3			2				
	3 S	trong	ly ag	reed	2	Mo	dera	tely a	agree	ed	1 F	Reaso	onably aç	greed		

Semester – 08

21ME801		Phase II – Pro	ject Work	0/0/24/12
Nature of	Course	Practical		I
Pre Requis		-		
Course Ob				
1	To demor	nstrate technical, interdiscip	linary and interpersonal abi	ilities.
2	To apply a	suitable tools and technique	es to solve the practical pro	blems.
Course Ou				
		the course, students sha		101
C801.1	U :	nalyse and develop a worki	0	[C]
C801.2	U ·	ptimize and automate a tec		[C]
C801.3		echnical skill, presentation		
C801.4		ate interdisciplinary skill, et		
C801.5		business/market trend in te	ms of economics and finar	nce. [Ap]
Course Gu		mester shall be utilized b	<u> </u>	
work, comp seminars a 2. The in Phase II. Any chang circumstan department 3. The minimum of Department 4. Eac background conclusion by the COE 5. The the COE, B	outer analy bout the pro- same team . The team e in the team ces shall b t. progress of three re- t. ch batch of d informat . This final e project wo based on of	ns from the guide. The time sis or field work as assigne rogress made in the project m formulated in Phase I sha shall be guided by the facu am members or problem st be initiated after the approva- of the project is to be evalu- views. The review committed of students shall finally pro- ion, literature survey, pro- report shall be in typewritted ork is evaluated jointly by ex- oral presentation and the p- ork in peer reviewed journal	d by the guide and also to p all proceed with the same p lity guide deputed during Pl atement or faculty guide du al of the project coordinator lated on a continuous basis see may be constituted by produce a comprehensive blem statement, project w en form as specified in the sternal and internal examin- project report. The candida	present periodical problem statement hase I. ue to unavoidable r and Head of the s by conducting a the Head of the e report covering work details and guidelines issued ers constituted by
Summativ	e assessn	nent based on Continuous	and End Semester Exam	nination
Act	ivity	Month	Continuous Assessment [60 marks]	End Semester Examination [40 marks]
Project Eva	aluation	February	30	
Project Eva	aluation	March	30	
Project Eva Presenting Internation Conference	in al	April	40	100

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

			•			Р	Os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C801.1	3	3		2					2		2		3	3	
C801.2	3	3		3	3				2		2		3	3	
C801.3	2			2				3	3		1		2	3	
C801.4	2			2	3			3	3		3			3	
C801.5	3			3	3			2	2		3			3	
		•	•	•			•	•	•		•				
	3 S	trong	gly ag	greed	2	Mo	odera	ately	agree	əd	1 F	Reas	onably a	greed	

Elective Stream I – Engineering Design

21ME901		PRODUCT DESIGN AND DEVELOPMENT	
Nature of C	ourse	Theory	
Pre requisi	tes	Design of Machine Elements, Manufacturing Technology	
Course Ob			
1	develop	ble the students to gain knowledge on the process of product pment based on customer needs.	
2		ble the students to understand the standard procedure available of development.	for
3	To facil issues.	litate the students to use design process and identify system leve	el design
4	To mak	the students familiarize with the intellectual property rights.	
Course Out			
		of the course, students shall have ability to	
C901.1		the basic product development process.	[R]
C901.2		he design thinking process for product development.	[Ap]
C901.3		ate the use of computers in decision making	[U]
C901.4		er the IPR related issues and patent registration.	[U]
C901.5 Course Co		e the feasibility of the proposed project.	[A]
		DEVELOPMENT: Product and Target specification, various	
screening a DESIGN PR Architecture PLANNING Project plar analysis/eng INTELLECT Rights, Writ	neration, nd conce COCESS , Syster FOR MA nning an gineering FUAL PF te the de	Brainstorming, Selection of concepts, Pugh selection method ept scoring Concept Testing, Concept Implementation. Product specification in level design issues. Embodiment design, Robust design ANUFACTURE AND MANAGEMENT Detail Design, Design Mar id control, Production design specification (PDS), Design revie g. ROPERTY RIGHTS AND PROJECT ECONOMICS Intellectual escription of the invention, Refine Claims, Pursue application. E ccelerating Projects, Project Execution.	, Concept n, Product and DFx. nagement, ew, Value I Property conomics
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		Continu	ous Asse	ssment			E. J				
Forma Assess	_		ummative sessment	Tot		Total ontinuous ssessment	End Semest Examinat				
80			120	20	0	40	60	100			
Assessme						Taxonomy)				
Formative	Assess	sment ba									
Course Outcome		oom's ₋evel	map o	componer nent, Cas	nts fro e Stud						
0004.4				As	signm	ent)					
C901.1		nember	Quiz	1				20			
C901.2	Арр	ly	Assignm	ent			20				
C901.3 & C901.4	Unc	erstand	Technica	I Presenta	ation		20				
C901.5	Ana	lyze	Group As	ssignment				20			
Assessme	nt base	d on Su	mmative a	nd End S	emeste	er Examina	ation				
Bloom's L	evel	Sum	mative As [120	sessmen Marks]	t (24%) En		er Examination 0%)			
	ſ	CIA1: [60 Marks]	CIA2:	[60 Ma	rks]	[10Ò	Marks]			
Remember			40					40			
Understand	lerstand 3					30			30		
Apply			20	0 20					20		
Analyse			10		10			10			
Evaluate			-					-			
Create			-		-			-			
Assessme	nt base					er Examin	ation				
		Contin	uous Ass		(40%)						
			[200 M					End Semester			
			CA 1: 100 Marks CA 2: 100 Marks								
C	-				-			Examination			
C SA 1	FA	1 (40 Ma		SA 2	F	A 2 (40 Ma	/	Examination (60%)			
SA 1 (60	-	1 (40 Ma	mponent	SA 2 (60	F Comp	A 2 (40 Ma onent Co	mponent				
SA 1	FA Compo	1 (40 Ma nent Co		SA 2	F Comp	A 2 (40 Ma onent Co I	/	(60%)			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

<u> </u>							P	Os							PSOs	
COs		а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C901.1		2	3	2	2										3	
C901.2		2	3	3										3	2	
C901.3		3	3	3	2									3	2	
C901.4		3	3	3										2		
C901.5		3	3	2	2										3	
	3	Stro	ngly	agree	d 2	Μ	odera	tely a	gree	d 1	Re	eason	ably a	agreed		

	Engineering Mechanics, Strength of Materials, Manufacturing Technology II ctives: To enable the students to design locating devices and clamps To design the jigs and fixtures for simplifying manufacturing process	
Course Obje	Technology II ctives: To enable the students to design locating devices and clamps To design the jigs and fixtures for simplifying manufacturing process	
1	To enable the students to design locating devices and clamps To design the jigs and fixtures for simplifying manufacturing process	
	To design the jigs and fixtures for simplifying manufacturing process	
0		
2		
3	To design the tools for Bending, Forming and Drawing operations	
4	To study the design process of press tools	
Course Outc	omes:	
Upon comple	etion of the course, students shall have ability to	
C902.1	Interpret various terminologies of Jigs and Fixtures	[U]
C902.2	Design Jigs and Fixtures for Manufacturing, Testing and Assembly applications	[A]
C902.3	Interpret Various Terminologies of Press Tools and Dies	[U]
C902.4	Design Press Tools and Dies Using Various Design Rules	[A]
C902.5	Design Forming Tools and Moulds Using Various Design Rules	[A]
Course Cont	ents:	·

INTRODUCTION AND BASIC PRINCIPLES OF JIGS AND FIXTURES

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices — Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures

TERMINOLOGIES AND ELEMENTS OF PRESS TOOLS AND DIES

Press Working Terminologies – operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies. Bending and Drawing Dies- Blank development -Types of bending dies – Design and development of bending and drawing dies.

DESIGN OF MOULDS AND FORMING TECHNIQUES

Basic construction of mould – Types of moulds – Mould parts –Mould clamping methods, Mould lifting arrangements. Design of different circuits in mould design (cooling, pouring and flow circuits). Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction – tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

	Total Hours: 45
Text Books:	
1	Donaldson C., Lecain G.H. and Goold V.C. "Tool Design" McGraw Hill
	Education; 4 edition, 20 April 2012.
2	Joshi, P.H. "Jigs and Fixtures", Thirs Edition, Tata McGraw Hill Publishing Co.,
	Ltd., New Delhi, 2017
Reference B	ooks:
1	Joshi P.H "Press tools: Design and Construction", S.Chand Publishing, 2012.
2	Donaldson, Lecain, Gooldand Joyeet "Tool Design", Fourth Edition, Tata McGraw
	Hill, 2012.

R2020 (Batch:2021-2025)

3	Desi	gn Da	ata ⊦	land E	Book,	PSG	Colle	ge of	f Tech	nolog	y, Co	imbat	ore		
Web Referen	ices:														
1	http:/ draw			nensio	nalac	aden	ny.cor	n/coi	urses/ı	necha	anica	l/macl	nine-t	tool-	
Online Reso	urces	:													
1	http:/	/www	v.too	lingu.	com/il	t/915	101/E	Desig	n-for-	FOOL	-DFT	7			
		Со	ntinu	ious /	Asses	ssme	nt					F in al			
Format Assessn	-		-	Summ ssess			Tot		To Contii Asses	nuous	FY	End emes amina		Tot	al
80				12	0		20	0	4	0		60		10	0
Assessment	Meth	ods	& L(evels	(base	d on	Bloo	ms'	Taxor	nomy)					
Formative A															
Course Outcome	E	Blooi Lev	-		map	com	ooner , Cas	nts fr e Sti	onent om th udy, S ment)	e list	- Qu	ıiz,		FA (16º 80 Mar	
C902.1 & C902.3	Ur	nders	tand	Tut	torials	/Assi	gnme	ents						20	
C902.2,				Gro	oup A	ssign	ment							20	
C902.4 & C902.5	An	alyz	e	Ind	lividua	al Ass	signm	ent /	Mini P	roject	40				
Assessment	base	ed or	n Sur	nmati	ive an	nd En	d Se	mest	er Exa	amina	tion				
			Sur	nmati	ive As	ssess	smen	t (24	%)	En	d Se	emeste	er Ex	amina	tion
Bloom's Lev	/el				[120	Marl	ks]	•	-			(6	60%)		
		С	IA1:	[60 M	larks]	С	IA2:	[60 N	larks]			[100	Mark	(s]	
Remember				30				30					30		
Understand				20				20					20		
Apply				50				30					30		
Analyse				-				20					20		
Evaluate				-				-					-		
Create				-				-					-		
Assessment	base									amina	atior)	1		
		C	ontir	າuous [2	s Asse 200 Ma		•	40%)						End	
CA	1: 10							CA 2	2: 100					Semest	
				larks		S	A 2			(40 N			Ex	amina	
SA 1	Comp		t C	ompo			60	Cor	nponen - I	nt Co		onent	Г4	(60%) 00 Mar	
(60 Marks)	- (20 M			- II 20 Ma		Ma	rks)	(20	Marks		- II 20 Ma				vəl
Mapping of C Outcomes (F	Cours					ith P	rogra	•		<i>,</i>			Iram	me Spe	ecific
						P	Os							PSOs	
COs	а	b	C	d	е	f	g	h	i	j	k	I	1	2	3
C902.1	3	2	2	<u> </u>			ļ						3	1	
C902.2	3	3	3										3	1	
C902.3	3	3	3										3	1	
C902.4	3	3	3	-							2		3	1	
C902.5	3	3	3	3							2		3	1	
3	Stro	ngly	agre	ed 2	2 Mo	odera	itely a	gree	d 1	Rea	isona	ably aç	greed		

21ME90	3	FUNDAMENTALS OF FRACTURE MECHANICS	3/0/0/3
Nature of	Course	Theory application	·
Pre Requ		Strength of materials	
Course O			
1		roduce the stress calculation at crack tip and their needs.	
2		able the students to understand the critical failure for different cra etries.	ack
3	To en	able the students to understand the different modes of fracture.	
Course O			
		of the course, students shall have ability to	
C903.1		ibe the fundamentals of failures and fracture mechanics	[U]
C903.2	Formu	ulate governing equation for elastic problems	[Ap]
C903.3		late stresses/displacements around the crack tip for different s of fracture	[A]
C903.4	Analy: fractu	ze failed engineering components under different modes of re.	[A]
C903.5		ibe the finite element implementation in fracture mechanics.	[U]
Course C		•	
balance, t cracks, re plasticity, Elastic PI contour in resistance	he energy ationship mixed mo astic Frac ategral an curves, J	ure Mechanics (LFEM): Stress concentration effect of flaws, Grif release rate, instability and resistance curve (R-curve), stress between stress intensity factor and energy release rate (K and G de crack initiation and propagation. cture Mechanics (EPFM) : Crack-Tip-Opening Displacement (CT and its determination, relationships between J and CTOD, cra l-controlled fracture. Fracture mechanism in metals and non-meta the ductile-brittle transition, intergranular fracture, fracture in	analysis of), crack tip OD), the J ack-growth als: Ductile
Application determination of fatigue fracture m matching	tion of frac crack grov echanics and energi	ure in ceramic and ceramic composites. oduction to fracture toughness testing of metals and non-re- cture parameters, Application of fracture mechanics concepts in the wth. Computational fracture mechanics: Overview of numerical methods problems, traditional methods in computational fracture mechanics gy methods, the energy domain integral, finite element imple- ment mesh, linear elastic convergence study, analysis of growing	ne analysis nethods for ics – point mentation,
Text Boo	KS:	Total Hours:	45
1		Total Hours:	45
		Total Hours: T. L. – 'Fracture Mechanics: Fundamentals and Applications' – (4th Edition	
2	<u>– 2017 – -</u> Surjya Kur	T. L. – 'Fracture Mechanics: Fundamentals and Applications' – (CRC Press
	– 2017 – - Surjya Kui University	T. L. – 'Fracture Mechanics: Fundamentals and Applications' – (4th Edition mar Maiti- 'Fracture Mechanics: Fundamentals and Applications' (CRC Press
Reference	– 2017 – Surjya Kur University Books:	a T. L. – 'Fracture Mechanics: Fundamentals and Applications' – (4th Edition mar Maiti- 'Fracture Mechanics: Fundamentals and Applications' (7 Press 2016. itchie, Dong Liu – 'Introduction to Fracture Mechanics -Elsevier 1	CRC Press Cambridge

Web Referen	ces:										
1	https://	nptel.ac.	in/courses	/112/10	6/112	106065/					
2	https://	www.you	utube.com	/watch?	v=G5i	mcTw-PL	EI.				
	С	ontinuo	us Asses	sment				End			
Format Assessn	-		ummative sessment	t T	otal	Continu			er ion	Total	
80			120		200	40		60		100	
Assessment	Method	ls & Lev	els (based	d on Ble	ooms	' Taxono	my)				
Formative A	ssessm	ent base	ed on Cap	stone M	lodel						
Course Outcome	_	oom's .evel	map o	compor nent, C	nents ase S	oonent (C from the tudy, Se <u>nment)</u>	list -	Quiz,		⁼ A (16%) 30 Marks]	
C903.1 & C903.5	Und	erstand	Assignm	ent				20			
C903.2	Арр	ly	Quiz					20			
C903.3 & C903.4	Anal	lyze	Group A	ssignme	ent / C	ase Stud	У			40	
Assessment	based of	on Sumi	native and	d End S	Semes	ster Exan	ninat	ion			
Bloom's Lev	el	Sum	mative As [120	ssessm Marks]	ent (2	4%)	Enc		r Ex 0%)	amination	
		CIA1: [60 Marks]	CIA2	2: [60	Marks]		[100 I	Marl	(s]	
Remember			20		20				20		
Understand			40		30		30				
Apply			40		30			30			
Analyse			-	20			20				
Evaluate			-	-					-		
Create Assessment	basada	on Cont		d End 9	- Some	stor Ever	ninc	ion	-		
ASSESSIIIGHT			inuous an ious Asse				mind				
		Continu	[200 Ma		. (40%	27				End	
CA	1: 100	Marks		1 10]	CA	2: 100 M	arks		S	Semester	
0.		1 (40 M	arks)			FA 2 (4		rks)	Ex	amination	
SA 1 (60 Marks)	Compor - I	nent Co	mponent - II	SA 2 (60 Marks	、 Co	omponent - I	Cor	nponent - II	[1	(60%) 00 Marks]	
	(20 Mar	'KS) (2	0 Marks)		· (2	0 Marks)	(20	Marks)			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Specific Out	comes	<u>יט ון כי</u>	<i>.</i> ,											
<u> </u>						POs							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	1	2	3
C903.1	2	2	3	2								1	1	
C903.2	3	2	2	2								1	1	1
C903.3	2	2	2	3								2	1	1
C903.4	2	2	3	3								1	1	1
C903.5	2	2	3	2										
3	Stron	gly ag	reed	2	Мос	lerate	ly agre	eed	1	Reas	onabl	y agre	ed	

Nature of C		DESIGN FOR MANUFACTURING AND ASSEMBLY	3/0/0/3
	Course	Theory Application	
Pre Requis	sites	Manufacturing Technology II	
Course Ob	jectives	8:	
1	To ena	able the students to understand the general design guidelines of design and the students to understand the general design guidelines of design and the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students are straight as the students as the students are straight a	sign for
		acture and assembly.	
2		vide the knowledge on minimizing the cost/time, maximizing the qua	ality
		ase of manufacture and assembly.	
3		able the students to understand the principles and design rules perta	aining
4		gn for casting, welding and machining. line the features of DFMA software.	
Course Ou			
		of the course, students shall have ability to	
C904.1		arize the design procedure of engineering products in order to ze the cost/time.	[U]
C904.2	Analys	e the importance of tolerance and process capability in promoting	[A]
	interch	angeability and selective assembly.	
C904.3		e the design process of engineering products for ease of	[A]
		bly and machining.	
C904.4		the design concepts for engineering products for casting, welding	[Ap]
00045		achining operations.	F1 13
C904.5 Course Co		the design parameters of a product using DFMA software	[U]
	Feature	Control frame – Virtual Tolerance.	
Design for Design for f – Design fo Assembled disassembl	casting orgings r plastic parts - y.	Control frame – Virtual Tolerance. g, welding and machining: Design for castings – Design for weld – Design for sheet metal formed parts – Design for powder metallur parts. Design for machining – Design for economy – Economic An • Design for clampability – Design for ease of assembly – De	ments - gy part: alysis c sign fo
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21ME905		TIMIZATION TECHNIQUES IN ENGINEERING DESIGN	3/0/0/3
Nature of C	ourse	Theory analytical	
Pre Requis		Industrial Engineering and Operations Management	
Course Ob			
1		le the students to have an in-depth knowledge about the op	timizatior
		es applied to industrial operations.	<u> </u>
2		the students understand and apply optimization techniques to	real world
3		s. le the students to develop the mathematical techniques and alg	<u></u>
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Course Out		problems.	
		the course, students shall have ability to	
C905.1		e basics of optimization techniques applied to engineering	[U]
	problems		r - 1
C905.2	Formulat	te and solve non-linear programming problems.	[Ap]
C905.3	Solve rea	al time integer programming problems	[Ap]
C905.4		ynamic programming problems as applied to real time	[Ap]
	scenario		
C905.5	Impleme	nt non-traditional optimization techniques to solve complex	[E]
	manager	rial problems.	
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C905.2 &															20		
C905.3	Ap	oply		Tu	torial										20		
C905.4	Ap	oply		Ca	se St	udy									20		
C905.5		/alua	te		oup A		nmen	t	-	-		-		-	20		
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			Sum	mati	ve A	sses	smer	nt (24	4%)		End	Seme	ester	Exan	nina	tion	
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		INDUSTRIAL ROBOTICS	3/0/0/3
Nature of	course	Concept and Theory	
Pre requis	ites	Engineering Mechanics, Kinematics of Machinery	
Course Ob	ojectives	S:	
1	To fami	liarize the students in industrial automation, robots and its applica	tion.
2		ble the students to familiarize with the kinematics of robots.	
3		art knowledge on robot end effectors, arm and their design.	
4		ble the students to write programs for Robot.	
5		art knowledge on various sensors and their applications in robots.	
Course Ou	utcomes	::	
Upon com	-	of the course, students shall have ability to	
C906.1	sensors		[U]
C906.2	based c	te the types of robotic manipulators and gripper configuration on kinematics and dynamics of robot.	[U]
C906.3	robots.	e the drive mechanism and power transmission methods used in	[A]
C906.4	concept	the various components of a robot by applying the learnt ts such as kinematics, transmission and control mechanism, and programming language.	[C]
C906.5		e the industrial applications of robots.	[U]
Course Co			L - J
in automate industrial re Rotations	ed manu obots - W and Tr	bot, Kinematics and dynamics: Robot definition: Robotic system facturing; robot anatomy; robot classifications and specifications /ork envelope - Flexible automation versus Robotic technology. Tra ansformations - Forward and reverse transformation, hom	- Types o Inslations ogeneou
in automati industrial ro Rotations transforma Arm. Robo and workin Robot driv pneumatic manipulato Integral, Di	ed manu obots - W and Tra- tions - F it Arm dy g. ves, cor and el ors - Co ifferential	facturing; robot anatomy; robot classifications and specifications /ork envelope - Flexible automation versus Robotic technology. Tra	- Types of anslations ogeneou om Robo s - Basic ydraulic Pneumati oportiona
in automati industrial ro Rotations transforma Arm. Robo and workin Robot driv pneumatic manipulato Integral, Di Mechanica Robot se different ty techniques categorizat Assembly,	ed manu obots - W and Tr tions - F t Arm dy g. ves, cor and el ors - Co fferential l-adhesiv nsors, p (pes of 5. Robo tion, Rol inspecti	facturing; robot anatomy; robot classifications and specifications - /ork envelope - Flexible automation versus Robotic technology. Tra- ansformations - Forward and reverse transformation, hom orward and inverse Kinematics Of three & four Degree of Freed /namics. ABB – SCARA robot anatomy and it's working. Cobotic /ntrols and power transmission: Robot drive mechanisms – h lectric, Mechanical transmission methods. Electronic and F instruction of Manipulators. Different Types of Controllers-Pro- I, PID controllers. Classification of End effectors - Drive system for /ve-vacuum-magnetic-grippers. Active and passive grippers.	- Types of inslations ogeneou om Robo s - Basic ydraulic Pneumati pportiona r grippers sensors grammin ition an e loading
in automati industrial ro Rotations transforma Arm. Robo and workin Robot driv pneumatic manipulato Integral, Di Mechanica Robot se different ty techniques categorizat Assembly,	ed manu obots - W and Tr tions - F t Arm dy g. ves, cor and el ors - Co fferential l-adhesiv nsors, p (pes of 5. Robo tion, Rol inspecti	facturing; robot anatomy; robot classifications and specifications - /ork envelope - Flexible automation versus Robotic technology. Tra- ansformations - Forward and reverse transformation, hom orward and inverse Kinematics Of three & four Degree of Freed /namics. ABB – SCARA robot anatomy and it's working. Cobotic /ntrols and power transmission: Robot drive mechanisms – h lectric, Mechanical transmission methods. Electronic and F instruction of Manipulators. Different Types of Controllers-Pro- I, PID controllers. Classification of End effectors - Drive system for /ve-vacuum-magnetic-grippers. Active and passive grippers.	- Types of inslations ogeneou om Robo s - Basic ydraulic Pneumati pportiona r grippers sensors grammin ition an e loading
in automati industrial ro Rotations transforma Arm. Robo and workin Robot driv pneumatic manipulato Integral, Di Mechanica Robot se different ty techniques categorizat	ed manu obots - W and Tra- tions - F it Arm dy g. ves, cor and el ors - Co fferential l-adhesiv nsors, p /pes of s. Robo tion, Rol inspectio obot cell.	facturing; robot anatomy; robot classifications and specifications /ork envelope - Flexible automation versus Robotic technology. Tra- ansformations - Forward and reverse transformation, hom orward and inverse Kinematics Of three & four Degree of Freed /namics. ABB – SCARA robot anatomy and it's working. Cobotic htrols and power transmission: Robot drive mechanisms – hilectric, Mechanical transmission methods. Electronic and Forstruction of Manipulators. Different Types of Controllers-Pro- I, PID controllers. Classification of End effectors - Drive system for /ve-vacuum-magnetic-grippers. Active and passive grippers. brogramming language and Industrial Applications Robot contact and non-contact sensors. Robot languages and pro- tic vision systems, image representation, object recogni e of artificial intelligence in robotics. Material transfer, Machine on, processing operations and service robots, Robots in contir	- Types of inslations ogeneou om Robo s - Basic ydraulic Pneumati portiona grammin ition an e loading nuous ar
in automati industrial ro Rotations transforma Arm. Robo and workin Robot driv pneumatic manipulato Integral, Di Mechanica Robot se different ty techniques categorizat Assembly, welding, Ro	ed manu obots - W and Tr tions - F t Arm dy g. ves, cor and el ors - Co ifferential l-adhesiv nsors, p /pes of c. Robo tion, Rol inspectio obot cell.	facturing; robot anatomy; robot classifications and specifications /ork envelope - Flexible automation versus Robotic technology. Tra- ansformations - Forward and reverse transformation, hom orward and inverse Kinematics Of three & four Degree of Freed /namics. ABB – SCARA robot anatomy and it's working. Cobotic htrols and power transmission: Robot drive mechanisms – hilectric, Mechanical transmission methods. Electronic and Forstruction of Manipulators. Different Types of Controllers-Pro- I, PID controllers. Classification of End effectors - Drive system for /ve-vacuum-magnetic-grippers. Active and passive grippers. brogramming language and Industrial Applications Robot contact and non-contact sensors. Robot languages and pro- tic vision systems, image representation, object recogni e of artificial intelligence in robotics. Material transfer, Machine on, processing operations and service robots, Robots in contir	- Types of anslations ogeneou om Robo s - Basic ydraulic Pneumati portiona grammin ition an e loading nuous ar 45

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2	M.P C McGr	Groover aw - Hi	, M Weiss, R II, New Delhi,	M Gnag 2019	el an	d N G Or	drey,	"Industrial	Rob	otics", Tata
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1	http://	www.rc	botics.org/							
2	http://	www.rc	botbooks.co	m/genera	l-rob	otics-links	.htm			
Online Res	ources:									
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3			edx.org/cours							
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Formative A	ssessr	nent ba	ased on Cap						6	
Course Outcome		loom's Level	s co	mponen ment, Ca	ts fro ase S	om the lis tudy, Sei nment)	st - Q			FA (16%) 30 Marks]
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C906.2 &	Uno	derstan	d Class Pr	esentatio	n/Δs	signment				20
C906.5		-		ooomana	/1// / (C	orgrinnerin	•		20	
C906.3		alyze		ent / Min	i Proi	ect			40	
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Assessmen	t basec		Immative an							a malur atlana
Bloom's Lev		5	ummative As	ssessme Marks]	nt (2	4%)	Enc		r ⊨x)%)	amination
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Assessmen	t based		ontinuous an				ninati	on		
		Cont	tinuous Asso [200 Ma		(40%	0)				End
C	A 1: 10	0 Mark			CA	2: 100 M				Semester
			Marks)	SA 2		FA 2 (4			Ex	amination
SA 1 (60 Marks)	Compo - I		Component - II	(60 Marks)		omponent - I		nponent - II	[1	(60%) 00 Marks]
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· · · –	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)																
<u> </u>																PSOs	
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C906.2		3	3	2											1		3
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		ENGINEERING FAILURE ANALYSIS	3/0/0/3
Nature of Co	ourse	Theory Analytical	
Pre Requisi	tes	Engineering Mechanics, Kinematics of Machinery, Dynamics of Machinery	
Course Obje	ectives		
1	To im it.	part knowledge on failure of mechanical components and the theo	ory behind
2	To en	able the students to understand the various modes of failure.	
3	To ec analys	quip students with knowledge on skills required to carry out t sis.	he failure
4	To en	able the students to understand the various tools used for failure	analysis.
Course Out	comes:		
		of the course, students shall have ability to	
C907.1	and th	fy and explain different types of failure of engineering materials neir characteristic features.	[U]
C907.2	multid	various theories of failure to the components subjected to lirectional loading.	[Ap]
C907.3		the principles of fracture mechanics and design for failure st fracture.	[Ap]
C907.4		n for failure against wear failure and creep loading	[E]
C907.5		op expertise on the experimental techniques and simulations d for failure analysis	[E]
Course Con	tents:		
		nder high cycle fatigue conditions, Test methods, S-N-P curves, e	
diagrams, in stress; cumu wear at elev creep, Cree temperature	fluence lative d vated te p test, propert	factors - Low cycle fatigue, fretting fatigue; Fatigue design for lamage and life prediction. Wear : Types of wear, analysis of wea emperatures. Creep: Mechanics of creep, inter-granular, trans Creep strain rate-time curves, Deformation mechanism m ties of materials.	endurance combined ar failures s-granula nap; Higł
diagrams, in stress; cumu wear at elev creep, Cree temperature Failure Ana reliability, ba FMEA, analy	fluence lative d vated to p test, propert lysis & th tub o sis of ca	factors - Low cycle fatigue, fretting fatigue; Fatigue design for lamage and life prediction. Wear : Types of wear, analysis of wear emperatures. Creep: Mechanics of creep, inter-granular, trans Creep strain rate-time curves, Deformation mechanism m ties of materials. Tools: Application of Poisson, exponential and Weibull distribut curve, parallel and series systems, MTBF, MTTR, FMEA-design auses of failure modes, ranks of failure modes; Fault tree analysis; EA.	endurance combined ar failures s-granula nap; High putions for process ; Industria
diagrams, in stress; cumu wear at elev creep, Cree temperature Failure Ana reliability, ba FMEA, analy case studies	fluence lative d vated to p test, propert lysis & th tub o sis of ca on FMI	factors - Low cycle fatigue, fretting fatigue; Fatigue design for lamage and life prediction. Wear : Types of wear, analysis of wear emperatures. Creep: Mechanics of creep, inter-granular, trans Creep strain rate-time curves, Deformation mechanism m ties of materials. Tools: Application of Poisson, exponential and Weibull distribut curve, parallel and series systems, MTBF, MTTR, FMEA-design auses of failure modes, ranks of failure modes; Fault tree analysis;	endurance combined ar failures s-granula nap; High putions for n process
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Assessm										Taxo	nomy	')						
Formativ	e As	sses	smen															
Course Outcome			Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) lerstand Quiz													6%) rks]		
C907.1		Unde	derstand Quiz															
C907.2		Appl	oly Assignment												20			
C907.3		Appl													20			
C907.4		Eval		Т	utoria	als									20			
C907.5		Eval																
Assessm	ent	base																
Disamia		_	S	umma			sessm		24%))	End	Sem	lester	-	imina	ation		
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Understar				10					0				1					
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Specific C	Dutc	come	s (PS	0)														
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COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1		2	3		
C907.1	3	2	2	2									2					
C907.2	3	3	2	2									2					
C907.3	3	3	3										2					
C907.4	3	3	2	3									2					
C907.5	3	3	2	3			2					2						
	3 5	Stron	gly ag	reed	2	Мо	derate	ly ag	reed	1	Reas	sonat	oly ag	reed				

21ME908		MEMS/NEMS	3/0/0/3
Nature of C	ourse	Theory	
Pre requisi	tes	Basics of Physics and Chemistry	
Course Ob	jectives	:	
1		ke the students learn various techniques available to make min various materials.	cro shapes
2	To imp	part the methodologies to be followed in micro fabrication and for	ming.
3	To enl applica	hance the students knowledge about MEMS / NEMS devices ations.	and their
Course Out	tcomes		
Upon comp	oletion o	of the course, students shall have ability to	
C908.1	Recall	the basic concepts related to MEMS / NEMS.	[R]
C908.2		ate the various fabrication techniques and micro machining sees for MEMS / NEMS.	[U]
C908.3	Use va Systen	arious fabrication techniques to develop a MEMS / NEMS n.	[Ap]
C908.4	Analyz	e the characteristics of MEMS and NEMS devices.	[A]
C908.5	Interpr	et the principles and applications of MEOMS	[U]
Course Co	ntents:		

INTRODUCTION TO MEMS/NEMS: Introduction – MEMS vs NEMS - Evolution of Microsensors and MEMS Mechanical, Inertial, Biological, Chemical, Acoustic, Microsystems Technology, Integrated Smart Sensors and MEMS, Interface Electronics for MEMS, MEMS Simulators, MEMS for RF Applications, Bonding & Packaging of MEMS, Introduction to NEMS - a journey from MEMS to NEMS, MEMS based nanotechnology – fabrication, film formation and micromachining, Nano-mechanical Resonators, Nano-mechanical Sensors. NEMS architecture, Surface Plasmon effects, energy conversion in NEMS and MEMS LITHOGRAPHY: Introduction to Photolithography - Photolithography Resolution - Enhancement Technology Beyond Moore's Law - Next Generation Lithographies– Emerging Lithography Technologies.

ADDITIVE TECHNOLOGY: Introduction –Silicon Growth -Doping of Si - Oxidation of Silicon-Physical Vapor Deposition - Chemical Vapor Deposition- Silk-Screening or Screen-Printing -Sol-Gel Deposition Technique. Plasma Spraying - Deposition and Arraying Methods of Organic Layers in BIOMEMS and BIONEMS - Thin versus Thick Film Deposition - Selection Criteria for Deposition Method. Nanofabrication with EBL & IBL.

MINIATURIZATION TECHNIQUES Introduction - Absolute and Relative Tolerance in Manufacturing - Historical Note: Human Manufacturing - Top-Down Manufacturing Methods-Surface Micromachining, Silicon on Insulator Technology (SOI), Bottom-Up Approaches - modelling, brains, packaging, sample preparation and new MEMS materials Introduction-Modelling, Brains in Miniaturization- Packaging, Substrate Choice. **MINIATURIZATION APPLICATIONS**: Introduction to Scaling - Scaling effects - Scaling laws in miniaturization - Actuators, Fluidics - Other Actuators - Integrated Power miniaturization applications-Introduction - Definitions and Classification Method – MOEMS – Principles and Applications to Automotive, Telecom and Biomedical.

Text Books	:											
1		-Ran-l [•] Repri			Mic	rosyst	ems	: Design	and N	lanufacture	∋", N	lcGraw Hill,
2		ang Li tion, 2			ns c	of MEI	MS"	, Pearso	n edu	ucation Inc	lia li	mited, 2nd
Reference E	Books:											
1	V.K	. Jain	, "Mie	cromanufa	actur	ing Pr	oce	sses", CF	RC Pr	ess, 2016.		
2		rc J M ss, 20		ı, "Fundan	nent	als of	Micı	rofabricat	ion ar	nd Nanoteo	chno	logy", CRC
Web Refere		, -										
1		os://yo I NEM		e/ZcCXFr	HQ7	7Ao/In	trod	luction to	Mate	erials Scie	nce	for MEMS
Online Rese	ources:											
1	ME	MS ar	nd M	icrosysten	ns -	https:/	//npt	el.ac.in/c	ourse	s/1171050	82/	
2	http	os://wv	vw.c	oursera.or	g/lea	arn/MI	EMS	S/NEMS				
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Formative A	ssessr	nent k	base	d on Cap	ston	e Mo	del					
Course Outcome		loom' Level	-	CO	mpo	nents t, Cas	s fro se Si	ent (Cho m the lis tudy, Se nment)	st - Qı	•		FA (16%) 80 Marks]
C908.1	Rer	nemb	er	Quiz		710	-oig	linenty				20
C908.2 & C908.5	Und	dersta	nd	Assignme	ent							20
C908.3	Арр	oly		Technica	l Pre	esenta	tion					20
C908.4	Ana	alyse		Assignme	ent							20
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C908.4	2	3	3											2	
C908.5	2	1	1		3									1	

21ME909		SURFACE ENGINEERING	3/0/0/3
Nature of Co	ourse	Concepts and Analytical	
Pre requisite	es	Engineering Mechanics and Fluid Mechanics and Machinery	
Course Obje	ectives		
1	-	ovide greater insight into the science and technology of interacting	g surface
		tive motion.	
2		dy in detail about surfaces, friction, wear, lubrication and their eff	
3		ply the concepts to the design of hydro dynamic, hydro static a nt bearings.	and rolling
Course Outo		of the course, students shall have ability to	
C909.1		ibe the fundamentals of friction, wear and lubrication.	[U]
C909.2	Illustra	ate the concept of wear and lubrication to solve inter-disciplinary pering problems.	[Ap]
C909.3		the concepts of lubrication to design of rolling element bearings.	[Ap]
C909.4		ze the different types of surface coating techniques	[A]
C909.5	•	ate the surface coating techniques with nano tribology	[A]
Course Con	tents:		
of Ceramic r motion - Mea sliding wear Corrosive we Polymers - W	naterial sureme of meta ar - Sui /ear Me		Stick sli hanism o ituations amics an
of Ceramic r motion - Mea sliding wear Corrosive we Polymers - W Lubrication regimes-Test Boundary Lu Viscous flow film Lubrication Surface Eng surface fusio coatings DLC Plating and	naterial sureme of meta ar - Sur /ear Me and Fil ting me bricatio betwee on – Hig pineerir on – Th C, CNC anodiz	s and polymers - Rolling Friction - Source of Rolling Friction - ent of Friction. Types of wear - Simple theory of Sliding Wear Med Is - Abrasive wear - Materials for Adhesive and Abrasive wear s face Fatigue wear situations - Brittle Fracture wear - Wear of Cera easurements. Im Lubrication Theory - Types and properties of Lubricants –L ethods - Hydrodynamic Lubrication - Elasto hydrodynamic lu- en - Solid Lubrication Hydrostatic Lubrication. Fluid film in simple on very close parallel plates – Shear stress variation Reynolds Ec- gh speed loaded/unloaded journal bearings-The Somerfield diago ag &Nano tribology - Surface modifications – Transformation H- hermo chemical processes – Surface coatings Recent develo- thick coatings– Coating of polymers and plastics- Measuring te ing – Fusion Processes – Vapour Phase processes. Nano udies- AFM/FFM studies.	Stick sli hanism o ituations amics an ubrication bricatior e shear quation for ram. lardening opment i chniques tribology
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Online Res	sources:
1	https://n

https://nptel.ac.in/courses/113/105/113105086/

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C909.2 8 C909.3	A	pply			Gro	up Ass	ignn	nent							40		
C909.4 8 C909.5	Å	nalyz	ze		Cas	e study	y								20		
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Elective Stream II – Thermal Engineering

21ME910		NON-CONVENTIONAL ENERGY SOURCES	3/0/0/3
Nature of	Course	Theory	1
Pre Requis	sites	Engineering Thermodynamics, Fluid Mechanics and Machinery and Mass Transfer	and Heat
Course Ob	ojectives	:	
1		erstand and analyze the various non-conventional energy resourd vironmental merits.	ces and
2	To disc	uss technologies for utilization of non-conventional energy source	es.
3	To enab	ble the students to understand the various economics involved in on of non-conventional energy sources.	
Course Ou			
Upon com	pletion of	of the course, students shall have ability to	
C910.1	List the	various sources of non-conventional energy	[R]
C910.2	Interpre source	t the ways in optimizing and selecting an alternate energy	[U]
C910.3	Explain resourc	the various means to utilize the non-conventional energy es	[U]
C910.4	Identify	the impact of alternate energy resources on the environment	[Ap]
C910.5	Analyze	the scope of newer sources of energy and their application	[A]
Course Co	ontents:		
PV System Application solar Radia	ns, Solai s – funda ation and	I of new and renewable source: The solar energy option – So Thermal Collectors – Flat Plate and Concentrating Collector amentals of photo Voltaic Conversion, Solar Radiation – Measur sunshine – PV Applications and state of the art applications like s Floatovoltaic cell.	rs – Solar rements of
PV System Application solar Radia solar refrige Energy ava Angle of a Application operation. Producer of conversion – Biogas p Photosynth involved in	ns, Solar s – funda ation and eration, F ailable fr attack, W s – Hybr Biomas gas, Trai process plant – E bio gas p bio gas p	r Thermal Collectors – Flat Plate and Concentrating Collector amentals of photo Voltaic Conversion, Solar Radiation – Measur sunshine – PV Applications and state of the art applications like s Floatovoltaic cell. rom wind: Basis of Wind energy conversion, Lift and drag, Effect /ind Energy generators and its performance – Wind Energy rid systems – State of the art technology trends for offshore wi s: Biogas, Source, Composition, Raw materials, Properties of nsportation of bio gas, Bio gas production Aerobic and anae , Technology for utilization – Biomass direct combustion – Bioma Digesters – Ethanol production – Bio diesel production and e o gas plant technology & status, Community biogas plants, production - Government Policy and Status of Bio fuel technologie urces: Principle of Ocean Thermal Energy Conversion (OTEC),	rs – Solar rements of colar walls, of density, Storage – nd energy f bio gas, probic bio- ss gasifier conomics. Problems es in India.
PV System Application solar Radia solar refrige Energy ava Angle of a Application operation. Producer of conversion – Biogas p Photosynth involved in Other pote closed OTH Small hydr potential in Sonofusion	ns, Solar s – funda ation and eration, F ailable fr attack, W s – Hybr Biomas gas, Trai process plant – E bio gas p ential so EC Cycle o turbine n India, n – energ	r Thermal Collectors – Flat Plate and Concentrating Collector amentals of photo Voltaic Conversion, Solar Radiation – Measur sunshine – PV Applications and state of the art applications like s Floatovoltaic cell. rom wind: Basis of Wind energy conversion, Lift and drag, Effect /ind Energy generators and its performance – Wind Energy rid systems – State of the art technology trends for offshore wi s: Biogas, Source, Composition, Raw materials, Properties o insportation of bio gas, Bio gas production Aerobic and anae , Technology for utilization – Biomass direct combustion – Bioma Digesters – Ethanol production – Bio diesel production and e o gas plant technology & status, Community biogas plants, production - Government Policy and Status of Bio fuel technologie	rs – Solar rements of colar walls, of density, Storage – nd energy f bio gas, probic bio- ss gasifier conomics. Problems es in India. Open and systems – al issues – ieneration,
PV System Application solar Radia solar refrige Energy ava Angle of a Application operation. Producer of conversion – Biogas p Photosynth involved in Other pote closed OTE Small hydr potential in Sonofusion from sea –	ns, Solar s – funda ation and eration, F ailable fr attack, W s – Hybr Biomas gas, Trai process plant – I bio gas p ential so EC Cycle o turbine n India, n – energ concept,	 Thermal Collectors – Flat Plate and Concentrating Collector amentals of photo Voltaic Conversion, Solar Radiation – Measur sunshine – PV Applications and state of the art applications like s Floatovoltaic cell. rom wind: Basis of Wind energy conversion, Lift and drag, Effect /ind Energy generators and its performance – Wind Energy rid systems – State of the art technology trends for offshore wi s: Biogas, Source, Composition, Raw materials, Properties of msportation of bio gas, Bio gas production Aerobic and anae , Technology for utilization – Biomass direct combustion – Bioma Digesters – Ethanol production – Bio diesel production and e o gas plant technology & status, Community biogas plants, production - Government Policy and Status of Bio fuel technologies urces: Principle of Ocean Thermal Energy Conversion (OTEC), es, Problems associated with ocean thermal energy conversion Fuel cells – technologies, types – economics and power g gy from bubbles, Magneto-hydro-dynamic (MHD) energy conver- , Green islands- Canary Island. 	rs – Solar rements of colar walls, of density, Storage – nd energy f bio gas, probic bio- ss gasifier conomics. Problems es in India. Open and systems – al issues – ieneration, rsion, Fuel
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Reference B	ooks:
1	C. Godfrey Boyle, "Renewable Energy - Power for a Sustainable Future", Oxford
	University Press, U.K., 2017
2	D. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK,
	2015
3	David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, "Renewable Energy
	Systems", Pearson Education, 2017.
Web Referer	nces:
1	https://www.udemy.com/climate-change-and-renewable-energy
2	https://nptel.ac.in/courses/121/106/121106014/
3	https://nptel.ac.in/courses/103/103/103103206/

		Continuo	ous Asses	sment				F is al					
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Formative A	rmative Assessment based on Capstone Model Assessment Component (Choose and												
Course	B	loom's				from the				FA (16%)			
Outcome		Level	Assignr	•		tudy, Ser	mina	r, Group	8]	30 Marks]			
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C910.2 &	Un	derstand	Presenta	ition						20			
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C910.4	Ар		Individua	-	nment					20			
C910.5		alyze	Case Stu	-						20			
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Analyse			10		10			1	0				
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SA 1	Compo		mponent	SA 2	Co	omponent		nponent		(60%)			
(60 Marks)	- 1		- 11	(60 Marks		-1		- 11	[100 Marks]				
	(20 Ma	rks) (2	0 Marks)	iviai Ka	" (2	0 Marks)	(20	Marks)					

•••	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
605				PSOs											
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C910.1	3					1	1							1	
C910.2	2		1			3	3							2	
C910.3	3					3	3							2	
C910.4	3					3	3							3	
C910.5	3		1			3	3							2	
3	Stro	ngly	agree	d	2 N	lodera	ately	agree	ed	1 R	leaso	nably	agreed	k	

21ME911		REFRIGERATION AND AIR CONDITIONING	3/0/0/3
Nature of Co	ourse	Theory analytical	
Pre Requisi		Engineering Thermodynamics and Thermal Engineering.	
Course Obje	ectives:		
1	To uno	derstand the vapour compression and vapour absorption system	operation
2	To ana	alyse the refrigeration cycles and methods for improving their pe	rformance
3	To fan	niliarize the components of refrigeration system.	
4	To des	sign air conditioning systems using cooling load calculations.	
5	To kno	ow the application of refrigeration and air conditioning systems.	
Course Out	comes:		
Upon compl	letion o	of the course, students shall have ability to	
C911.1		ibe the principles and applications of refrigeration and air ioning systems.	[R]
C911.2	Differe systen	entiate the various types of refrigeration and air conditioning ns.	[U]
C911.3	Calcul systen	ate the performance of refrigeration and air conditioning ns.	[Ap]
C911.4	Analys	se the methods to improve the performance of refrigeration and nditioning systems.	[A]
C911.5	Analys	se various transport air conditioning systems.	[A]
Course Con	tents:	· · · · ·	
cycle analys system (deso	is, Air R criptive)	Afrigeration – Basic Definition, Air Refrigeration Cycles-, Be Refrigeration systems-simple air cooling system and boot strap , merits and demerits.	air cooling
Systems – V cooling and (descriptive) Systems, Wa	Vapour I super Vapo ater-Lith	sion Refrigeration system and Vapour Absorption Ref Compression system - Working and analysis, Limitations, Effe r heating, Compound Vapour Compression Refrigeration ur Absorption Refrigeration Systems (Descriptive)-Water ium Bromide System, Contrast between the two systems, Modifi nalyzer Assembly, Absorbent – Refrigerant combinations.	ects of sub Systems r-Ammonia
Refrigeratio	n Syste	em Equipments and Air Conditioning Systems - Classification	, Selectior

Refrigeration System Equipments and Air Conditioning Systems - Classification, Selection and Nomenclature of refrigerants. Refrigeration systems Equipment - Compressors, Condensers, Expansion Devices and Evaporators, Testing and charging of refrigeration units. **Air Conditioning Systems-** Different Air-Conditioning Systems – Central Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems, Mathematical Analysis of Air-Conditioning Loads, Introduction to HVAC systems (descriptive), air conditioning in automobiles and Trains – Automotive A/C manual control system case study.

	Total Hours:	45
Text Books:		
1	Arora, C.P. "Refrigeration and Air Conditioning", Third edition, Tata Me New Delhi, 2017.	cGraw Hill,
2	Ananthanarayanan.P.N, "Basic Refrigeration and Air Conditioning", Ta Hill, 5th edition, New Delhi, 2019.	ta McGraw

Reference B	Books:								
1	1 Manohar Prasad, "Refrigeration and Air conditioning", New Age International (P)								
	Ltd, New Delhi, 2020.								
2	Arora.S.C and Domkundwar.S, "A course in Refrigeration and Air conditioning",								
	DhanpatRai (P) Ltd., New Delhi, 2019.								
Online Reso	ources:								
1	http://nptel.ac.in/courses/112105128/								

		Conti	nuous Asse	essment			F in al	
Form Asses	ative sment		Summative Assessment	Tota	Tota al Continu Assessi	End Semeste Examinati		
8	0		120	200	40		60	100
Assessm	nent M	ethods &	Levels (bas	ed on Bloc	oms' Taxon	omy)		·
Formativ	e Ass	essment	based on Ca	apstone Mo	odel			
Course Outcom	and map uiz, , Group	FA (16%) [80 Marks]						
C911.1	R	emember	Quiz		signment)			20
C911.2	U	nderstand	Presenta	tion				20
C911.3		oply		signment				20
C911.4		nalyze		•				
C911.5		nalyze	Case Stu					20
Assessm	ent ba	ased on S	Summative a	nd End Se	mester Exa	minat	tion	
Bloom's		Su	mmative As [120]	sessment Marks]	(24%)	Enc	l Semester (60	Examination
Bioomis	Levei	CIA1	[60 Marks]	CIA2: [60 Marks]		(00 [100 N	•
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	er							
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Understa Apply Analyse Evaluate Create	nd nent ba		30 30 20 - - Continuous as tinuous Ass [200 M	and End Se sessment (Marks]	30 30 20 - - - emester Exa		30 30 20 -	End Semester
Understa Apply Analyse Evaluate Create Assessm	nd nent ba	Cor 100 Mari FA 1 (40	30 30 20 - - Continuous a tinuous Ass [200 N (ss Marks)	and End Se sessment (Marks]	30 30 20 - - - emester Exa 40%) CA 2: 100 M FA 2 (4	arks 40 Ma	3(3(2(- - tion	End Semester Examination (60%)
Understa Apply Analyse Evaluate Create Assessm SA 1 (60	nd nent ba	Cor 100 Mari FA 1 (40	30 30 20 - - Continuous a tinuous Ass [200 N (s Marks) Component	and End Se sessment (Marks]	30 30 20 - - - - - - - - - - - - -	arks 40 Ma	30 30 20 - - tion	End Semester Examination
Understa Apply Analyse Evaluate Create Assessm	nd nent ba	Cor 100 Mari FA 1 (40	30 30 20 - - Continuous a tinuous Ass [200 N (ss Marks)	and End Se sessment (Marks]	30 30 20 - - - emester Exa 40%) CA 2: 100 M FA 2 (4	arks 40 Ma Con	3(3(2(- - tion	End Semester Examination (60%)

· · · –	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
600							PSOs									
COs	á	a	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C911.1		3													2	
C911.2		3													2	
C911.3		3	2	3											3	
C911.4		3	3	3											3	
C911.5		3	3	3											3	
	3 3	Stro	ongly	agre	ed	2 N	loder	ately	agree	ed	1 R	easo	nably	agreed	b	

21ME912	A	LTERNATE FUELS AND E-VEHICLE TECHNOLOGY	3/0/0/3
Nature of C	ourse	Theory technology	
Pre Requisi	tes	Thermal engineering and Automobile engineering	
Course Obj	ectives:		
1	To fami	liarize the importance of alternate fuels.	
2		erstand the combustion and emission characteristics of various	liquid and
		s alternate fuels.	
3	To impa	art knowledge on e-vehicles.	
Course Out	comes:		
Upon comp	letion of	the course, students shall have ability to	
C912.1		e the limitations of fossil fuels and need for alternate fuels.	[U]
C912.2	Identify fuels.	the sources and properties of various liquid and gaseous	[Ap]
C912.3	-	the criteria for storage, distribution and safety aspects of ive fuels.	[Ap]
C912.4		e the engine requirements and categorize the combustion eristics of alternate fuels.	[A]
C912.5	Analyze	e the technology behind developing of e-vehicles.	[A]
Course Cor			
Merits and d Properties – and CI engi Esterificatior Storage – Ec Gaseous F Performance	emerits of Blends of nes – Pr n – Biod conomics uels: Pr e and er	oduction and properties of CNG, LPG, biogas and produc nission in SI/CI engines – Storage - Distribution and safety	oduction istics in S operties teristics cer gas y aspects
Merits and d Properties – and CI engi Esterificatior Storage – Ed Gaseous F Performance Hydrogen – – Performan E-Vehicle T components methods - A Case studie	emerits of Blends of nes – Pr n – Biod conomics uels: Pr e and er Sources ce and e Fechnolo dvantage	of various alternate fuels. Liquid fuels: Alcohol – Methods of proof gasoline and alcohol – Combustion and emission characteric operties of alcohol esters, Vegetable oils – Feed stock – Proviesel preparation and its performance and emission characters.	oduction - istics in S operties - teristics - cer gas - y aspects ty aspects - Systen - Charging
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Web Referen	Web References:									
1	1 https://nptel.ac.in/courses/112104033/39									
2	https://fueleconomy.gov/feg/current.shtml									
Online Reso	urces:									
1	https://afdc.energy.gov/fuels/									

		C	onti	nu	ous	Ass	ess	sment							F ield			
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Assessme						•					Гахоі	non	ıy)					
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C912.2 & C912.3	A	pply			As	signr	ner	nt									20)
C912.4	A	nalyz	e		Gr	oup	Ass	ignme	ent								20)
C912.5		nalyz				ase S											20)
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			Cor	tin		is As [200		ssmei rks]	nt (4	0%)							En	d
C	CA 1:	100	Mark	s					C	A 2	: 100) Ma	arks			Se	eme	ster
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Marks)	(20.1	l		(0	- I	-		Mortes	5)	(20	- Mork	2)	(0)			[10	0 M	arks]
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R2020 (Batch:2021-2025)

21ME913		TURBO MACHINES	3/0/0/3
Nature of C	ourse	Theory analytical	
Pre requisit	es	Engineering Thermodynamics and Thermal Engineering	
Course Obj	ectives:		
1	To stud	ly the concept of unified theory applicable to all turbo machines	
2	To imp machin	part the fundamental knowledge about the design variations es.	s of turbo
3	To desi	gn and develop the turbo machines.	
Course Out	comes:		
Upon comp	letion of	the course, students shall have ability to	
C913.1		the basics of turbo machines including dimensional analysis	[U]
C913.2		ne concept of velocity triangle in determining the performance urbo machines	[Ap]
C913.3		te the efficiencies and losses in the performance teristics of the turbo machines	[A]
C913.4	Estimat compre	te the power and operational characteristics of the essors.	[E]
C913.5		the power and operational characteristics of the Wind	[E]
	Turbine	es.	
Introduction triangles, Wo of compres and future in	ntents: n: Therm ork, T-S sible flov idustries.	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines	arameter in presen
Introduction triangles, We of compres and future in Compresso Stage effic Centrifugal p minimum sta details - No Wind turbin turbine, Pow	ntents: n: Therm ork, T-S sible flow dustries. rs: class iencies oumps – v arting spe n-dimens nes: Def ver develo	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines	diagram s Pumps priming structiona lic pumps axis wind
triangles, Wo of compres and future in Compresso Stage effic Centrifugal p minimum sta details - No Wind turbin turbine, Pow	ntents: n: Therm ork, T-S sible flow dustries. rs: class iencies oumps – v arting spe n-dimens nes: Def ver develo	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines sifications, Constructional details, Stage velocity triangles, H-S and losses, Surging and Stalling, Performance characteristic Work done - Head developed - Pump output and Efficiencies - eed - Cavitation, Axial flow pumps – Characteristics - Con sional parameters – Efficiencies - Vibration and Noise in hydrau inition and classifications, Constructional details, Horizontal oped, Axial thrust and Efficiency. Turbo expander, Turbo prop, I	diagram s Pumps priming structiona lic pumps
Introduction triangles, We of compress and future in Compresso Stage effic Centrifugal p minimum sta details - No Wind turbin turbine, Pow	ntents: n: Thermork, T-S sible flow idustries. nrs: class iencies pumps – V arting spen- n-dimens nes: Def ver develo Case stu	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines sifications, Constructional details, Stage velocity triangles, H-S and losses, Surging and Stalling, Performance characteristic Work done - Head developed - Pump output and Efficiencies - eed - Cavitation, Axial flow pumps – Characteristics - Con sional parameters – Efficiencies - Vibration and Noise in hydrau inition and classifications, Constructional details, Horizontal oped, Axial thrust and Efficiency. Turbo expander, Turbo prop, I udy in Turbo Machine for power plants.	diagram s Pumps priming structiona lic pumps axis wind Mixed flow
Introduction triangles, Wo of compres and future in Compressor Stage effic Centrifugal p minimum sta details - No Wind turbin turbine, Pow compressor.	ntents: n: Thermork, T-S sible flow idustries. nrs: class iencies pumps – V arting spen- n-dimens nes: Definer ver develo Case stu	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines sifications, Constructional details, Stage velocity triangles, H-S and losses, Surging and Stalling, Performance characteristic Work done - Head developed - Pump output and Efficiencies - eed - Cavitation, Axial flow pumps – Characteristics - Con sional parameters – Efficiencies - Vibration and Noise in hydrau inition and classifications, Constructional details, Horizontal oped, Axial thrust and Efficiency. Turbo expander, Turbo prop, I udy in Turbo Machine for power plants.	diagram diagram s Pumps priming structiona lic pumps axis wind Mixed flow
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Introduction triangles, We of compress and future in Compressor Stage effic Centrifugal p minimum sta details - No Wind turbin turbine, Pow compressor. Text Books 1	ntents: n: Thermork, T-S sible flow idustries. rs: class iencies pumps – V arting spen- n-dimens nes: Def ver develo Case struents Yahya, 2019. Dixon, Edition, Books: Cohen	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines ifications, Constructional details, Stage velocity triangles, H-S and losses, Surging and Stalling, Performance characteristic Work done - Head developed - Pump output and Efficiencies - eed - Cavitation, Axial flow pumps – Characteristics - Con sional parameters – Efficiencies - Vibration and Noise in hydrau inition and classifications, Constructional details, Horizontal oped, Axial thrust and Efficiency. Turbo expander, Turbo prop, I udy in Turbo Machine for power plants. S M, Turbines Compressors and fans, 4 th edition, Tata McGrav S L, Fluid Mechanics and Thermodynamics of Turbo machiner	diagram diagram s Pumps priming structiona- lic pumps axis wine Mixed flow 45 w-Hill,
Introduction triangles, Wo of compress and future in Compressor Stage effic Centrifugal p minimum sta details - No Wind turbin turbine, Pow compressor. Text Books 1 2 Reference I	tents: n: Thermork, T-S sible flow dustries. rs: class iencies pumps – V arting spen- n-dimens nes: Def ver develo Case stu : Yahya, 2019. Dixon, 5 Edition, Books: Cohen Wiely, 6	nal Turbo machines, Classification, General energy equation and H-S diagram, Dimensional analysis, Non-dimensional p w Turbo machines, Similarity laws. Role of turbo machines sifications, Constructional details, Stage velocity triangles, H-S and losses, Surging and Stalling, Performance characteristic Work done - Head developed - Pump output and Efficiencies - eed - Cavitation, Axial flow pumps – Characteristics - Con sional parameters – Efficiencies - Vibration and Noise in hydrau inition and classifications, Constructional details, Horizontal oped, Axial thrust and Efficiency. Turbo expander, Turbo prop, I udy in Turbo Machine for power plants. Total Hours: S M, Turbines Compressors and fans, 4 th edition, Tata McGrar S L, Fluid Mechanics and Thermodynamics of Turbo machiner , Elsevier Butterworths Heinemann, 2017. H, Rogers,G F C and Saravan motto H I H, Gas Turbine Theor	diagram diagram s Pumps priming structiona- lic pumps axis wine Mixed flow 45 w-Hill,

Web References:						
1 www.academia.edu/turbomachines						
Online Re	esources:					
1	https://nptel.ac.in/courses/112106200/					

1 11103.7		12100200/		
	Continuous Assessr	nent		E. J
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment	End Semester Examination

Formative Assessment based on Capstone Model	

120

Assessment Methods & Levels (based on Blooms' Taxonomy)

80

Course Bloom's Outcome Level		Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C913.1	Understand	Quiz	20
C913.2	Apply	Assignment	20
C913.3	Analyse	Assignment/Case Study	20
C913.4 & C913.5	Evaluate	Group Assignment	20

200

40

60

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Ass [120 M	· · ·	End Semester Examination (60%)
	CIA1: [60 Marks]	CIA2: [60 Marks]	[100 Marks]
Remember	30	30	30
Understand	20	20	20
Apply	30	30	30
Analyse	10	10	10
Evaluate	10	10	10
Create	-	-	-

Assessment based on Continuous and End Semester Examination

	С	ontinuous As: [200 N	sessment /larks]	(40%)		End
	CA 1: 100 Ma	arks		Semester Examination		
SA 1	FA 1 (4	0 Marks)	SA 2	FA 2 (4	l0 Marks)	(60%)
(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	(60 Marks)	Component - I (20 Marks)	Component - II (20 Marks)	[100 Marks]

Total

100

<u> </u>		POs									PSOs				
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C913.1	3	3												1	
C913.2	3	2	2											2	
C913.3	3	2	2											2	
C913.4	3	3	3											3	
C913.5	3	3	3											3	

21ME914		GAS DYNAMICS AND JET PROPULSION						
Nature of Course Theory analytical								
Pre requisites Engineering Thermodynamics and Thermal Engineering								
Course Ob	jectives:							
1	erstand the basic difference between incompressible and co	mpressible						
	flow.							
2	To analy	yse the phenomenon of shock waves and its effect on flow.						
3	3 To gain basic knowledge about jet propulsion.							
Course Ou	tcomes:							
Upon comp	oletion o	f the course, students shall have ability to						
C914.1	Study th	ne behavior of various flow regimes.	[U]					
C914.2	Assess	the properties of fluid when the fluid flows under different flow	[Ap]					
	conditio	ns.						
C914.3	Analyse	the flow behavior and consequent loads due to flow.	[A]					
C914.4	Analyse	the shock in flows.	[A]					
C914.5	Estimate	e propulsion efficiency and design inlets and nozzles.	[E]					
Course Co	ntents:							
Compressi	ble flow	fundamentals: Energy and momentum equations for compre-	ssible fluid					

Compressible flow fundamentals: Energy and momentum equations for compressible fluid flows, Various regions of flow, Reference Velocities, Stagnation state, velocity of sound, Critical states, Mach Number, (Significance and Characteristics) Critical Mach number, Types of waves, Mach cone, Mach angle, Effect of Mach Number on compressibility. **Flow through variable area ducts:** Isentropic flow through variable area ducts, T-s, h-s diagrams for nozzles & diffusers, Mach number variation, Area ratio as a function of Mach number, Mass flow rate through nozzles & diffusers, Effect of friction in flow through Nozzles.

Fanno and Rayleigh flow: Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. Isothermal flow with friction in constant area ducts, Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties.

Normal shock: Governing equations, variation of flow parameters like static pressure, static temperature density, stagnation pressure and entropy across the normal shock, Prandtl-Meyer Equation, Impossibility of shock in subsonic flows, Flow in convergent and divergent nozzles with shock, normal shock in Fanno and Rayleigh flows. Flow with oblique shock (Elementary treatment only), The shock tube. **Jet propulsion:** Aircraft propulsion, Types of Jet Engines, Energy flow through Jet Engines, Study of turbojet engine, Performance of Turbo jet engines-thrust and thrust power, propulsive and overall efficiencies.

	Total Hours: 45
Text Books	S:
1	Yahya. S.M., "Fundamental of Compressible Flow", New Age International (p) Ltd., New Delhi, 2018.
2	Patrich.H. Oosthvizen, William E.Carscallen, "Compressible Fluid Flow", McGraw- Hill Education, 2017.
Reference	Books:
1	Cohen. H., Rogers R.E.C and Sravanamutoo, "Gas Turbine Theory", Addison Wesley Ltd., 2016.
2	Ganesan. V., "Gas Turbines", McGraw-Hill Education, New Delhi, 2015.
3	Balachandran.P, "Fundamentals of Compressible Fluid Dynamics", Prentice Hall of India, New Delhi, 2018.
Web Refer	ences:
1	http://www.grc.nasa.gov/WWW/K-12/airplane/bgp.html
2	https://ocw.mit.edu/search/ocwsearch.htm?q=gas%20dynamics

1		https	s://np	tel.ac	.in/co	ourses	s/112	21061	66/												
2		http:	//hist	ory.n	asa.g	jov/SF	P-4 21	19/Cc	onter	nts.h	tml										
Form Asses			Su		nuous Assessm Summative Assessment		sme	Total Continu		al Continu				Total Continuous Assessment		End Semeste Examinati		IS Semest		То	tal
8	0				120			200)		40)		60		10)0				
Assessm											xor	omy)								
Formative Course Outcome	9	Assessment based on Capstone ModelAssessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)											FA (16%) [80 Marks]								
C914.1	l	Jnde	rstar	nd	Quiz				- 3							20					
C914.2	A	Apply	/		Grou	p Ass	ignm	nent								20					
C914.3 C914.4		Analy				Stud										20					
C914.5	E	Evalu	late		Assig	nmer	nt									20					
Assessm	ent b	base									Exa	amina	atio	<u>1</u>							
Bloom's	Leve	el	ç	Sumn		e Ass 120 N			(249	%)		Er	nd S		nester Examination (60%)						
			CIA	1: [60		'ks]	CI	A2: [/lark	s]			[100		Marks]					
Remembe	-			1	-				10						10						
Understar	nd			2					10						10	-					
Apply				4					40						40	-					
Analyse Evaluate				3	0				<u>30</u> 10						30 10						
Create									-						-						
Assessm	ent ł	hase	d on	Con	tinuo	us ar	nd Fr	nd Se	me	ster	Fx	amin	atio	n							
7.00000111					uous	Asse 00 Ma	essm									End					
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SA 1			· · ·) Mar			SA 2 FA 2 (•				amina						
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Marks)	(20	' Mark	(S)	(20	- II Mark	s)	Mar	ks)	(20) Mai	rks)	6	li 20 M	arks)	1.1		i vəl				
Mapping Specific (Itcom			vith F	Progr	amr	ne C	Outo				ogran	nme					
							P	Os								PSOs					
COs		а	b	с	d	е	f	g	h	i	i	j	k	I	1	2	3				
C914.1		2	3	1												1					
C914.2		3	3	2											2						
C914.3		3	3	2												2					
C914.4	.	3	3	3												2					
C914.5	;	3	3	3												3					
		3	3 St	trongl	y agr	eed	2	Mode	erate	ely a	igre	ed	1	Reaso	onably	agree	d				

21ME915	POWER PLANT ENGINEERING 3/0/							
Nature of Co	ourse	Theory application						
Pre Requisites Engineering thermodynamics and Thermal engineering								
Course Obj	ectives:							
1 To provide a general perspective of power plant engineering indicating the role of mechanical engineers in their operation and maintenance.								
2	To understand the construction, working principles and advantages of a combined gas turbine, steam turbine, hydro, diesel and nuclear power plants.							
3	3 To create awareness about renewable energy, cost of electric energy, tariff calculation and economics of various power plants.							
Course Out	comes:							
Upon comp	letion of	the course, students shall have ability to						
C915.1	Recall t	he various techniques used for power generation.	[R]					
C915.2	Describ	e the functioning of components in steam power plant.	[U]					
C915.3		the design layout and explain the working of diesel, gas hydroelectric, nuclear power plants.	[Ap]					
C915.4	-	the ways to extract power from renewable/non-conventional sources.	[Ap]					
C915.5	-	e the economic feasibility and its implications on power ting units.	[A]					
Course Con	tents:							
Coal based	thermal	power plant: Components and layout, Boiler classification	 Types of 					
boiler – Fire	tube an	d water tube boilers - High pressure and supercritical boilers	 Positive 					

boiler – Fire tube and water tube boilers - High pressure and supercritical boilers – Positive circulation boilers - Fluidized bed boilers – Waste heat recovery boiler – Feed water heaters – Super heaters – Reheaters – Economiser – Air heaters, Coal handling and preparation – Combustion equipment and firing methods – Mechanical stokers – Pulverized coal firing systems, Ash handling systems, Electrostatic precipitator, Feed water treatment, Forced draft and induced draught, Surface condenser, Cooling tower – Types.

Hydro power plant: Classification of hydro-electric power plants – Selection of prime movers – Governing of turbines. **Diesel power plant:** Components and layout, Selection of Engine type, Starting and stopping – Heat balance – Supercharging of diesel engines. **Nuclear power plant:** Principles of nuclear energy – Energy from fission and fuel burnup – Decay rates and half-lives – Nuclear reactor – Types – Boiling Water Reactor – Pressurized Water Reactor – Fast Breeder Reactor – Reactor materials – Radiation shielding. **Gas turbine power plant:** Components and layout, Open and closed cycles – Intercooling – Reheating and regenerating – Combined cycle power plant.

Renewable/Non-conventional energy based power plant: Construction and working of wind, tidal, solar photo voltaic, geothermal, biogas and ocean Thermal Energy Conversion power plants. **Economics of power plant:** Actual load curves – Cost of electric energy - Fixed and operating costs - Energy rates – Types of tariffs – Energy management and energy audit - Economics of load sharing – variable load operation – Comparison of economics of various power plants.

	Total Hours	45
Text Books	:	
1	P.K. Nag, "Power Plant Engineering", McGraw – Hill Education, Fou 2017.	rth Edition,
2	Frederick T. Morse, "Power Plant Engineering", Affiliated East-West-Pr Ltd., New Delhi, 2015.	ess Private

Reference Bo	ooks:
1	Dipak Kumar Mandal, Somnath Chakrabarti, Arup Kumar Das, Prasanta Kumar
	Das, "Power Plant Engineering: Theory and Practice", Wiley, 2019.
2	Domkundwar, Arora Domkundwar, "Power Plant Engineering", Dhanpat Raj & Co. (P) Ltd., 2016.
3	R. K. Rajput, "A Textbook of Power Plant Engineering", Shree Hari Publications,
	2021.
Web Referen	ces:
1	www.academia.edu
Online Reso	urces:
1	https://nptel.ac.in/courses/112107216/
2	https://nptel.ac.in/courses/108105058/8
3	https://nptel.ac.in/courses/121/106/121106014/

		Co	ontinu	ious Asse	ssme	nt			End			
Form Asses		t	Summative Assessment			Total	Tota Continu Assessi	ious	Semester Examination		Total	
8	0			120		200	40		60		100	
				evels (bas				omy)				
Formativ	e Ass	essme	ent ba	sed on Ca	apstor	ne Mod	el					
							nent (Cho					
Course		Bloon					om the lis				A (16%)	
Outcom	е	Leve	el	Assign	ment,		Study, Ser	ninar	, Group	[8	0 Marks]	
						Assi	nment)					
C915.1		emem		Quiz							20	
C915.2		nderst	and	Group Di	scussi	ion / As	signment				20	
C915.3 8	Δ	pply		Assignme	ent					20		
C915.4				•						-		
C915.5		nalyze		Case Stu						20		
Assessm	ent b	ased o		mmative a								
			Sum	mative As		•	4%)	End	Semester	-	mination	
Bloom's	Level				Marks				(60		-	
<u> </u>		C	_	60 Marks]	CL	-	Marks]	[100 Marks]				
Remembe	-			20		20			20			
Understar	nd			30		30			30			
Apply				40		40			40			
Analyse				10		10			1	0		
Evaluate				-		-			-			
Create				-		-						
Assessm	ent b			ntinuous a				mina	tion			
			Conti	nuous Ass			%)					
				[200 N	larks]					-	End	
		100 N				CA	2: 100 M			-	emester	
SA 1		FA 1 (SA	2	FA 2 (4				amination	
(60	Comp	onent ·	· Co	mponent	(6)		omponent	Con	nponent -		(60%)	
Marks)	(20 1	ı Marks)	(2)	- II 0 Marks)	Marl	ka)	- I 20 Marks)	(20	ll) Marks)		0 Marks]	
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<u> </u>		POs										PSOs			
COs	а	b	С	d	е	f	g	h	I	j	k	Ι	1	2	3
C915.1	3	3	1											1	
C915.2	3	2	1											2	
C915.3	3	3	3											2	
C915.4	3	3	3											2	
C915.5	3	2	1												

21ME916		ENERGY CONSERVATION AND MANAGEMENT	3/0/0/3
Nature of 0	Course	Theory	
Pre requis	ites	Engineering Thermodynamics Thermal Engineering	
Course Ob	jectives	:	
1	To stuc	dy the concept of energy audit used in energy calculation.	
2	To und	erstand the energy management and conservation.	
3	To impa	art the fundamental knowledge on energy conservation in thermal	systems.
Course Ou	tcomes	:	
Upon com		of the course, students shall have ability to	
C916.1	Identify	the demand supply gap of energy and it's utilization.	[U]
C916.2		e the energy accounting and balancing.	[A]
C916.3	energy	te the energy data of industries and suggest methodologies for savings.	[E]
C916.4		the energy flow diagram of an industry and identify the energy or a waste stream	[Ap]
C916.5	Measu	re the performance of Electrical machines used in Industries.	[E]
Course Co	ntents:		
internal rate Energy Cor	omputeri of Retur	gy auditing. Energy resource management – Energy Management in ized energy management – Energy economics – discount rate, payba n, life cycle costing on in Thermal Systems - Boiler – efficiency testing, excess air contr	ck period ol, Stearr
internal rate Energy Cor distribution Heat excha conservation and air cond Potential A Opportunitie Factors Invo	computeri of Retur nservatic & use – s nger net n in Pum ditioning s Areas for es in Elec olved in E	 ized energy management – Energy economics – discount rate, payba n, life cycle costing on in Thermal Systems - Boiler – efficiency testing, excess air contristeam traps, condensate recovery, flash steam utilization, Thermal I working –concept of pinch, target settling, problem table approach ps, Fans (flow control) and blowers, Compressed Air Systems, Refsystems – Waste heat recovery recuperators, heat sheets. r Electrical Energy Conservation in Industries – Energy Marctrical Heating, Lighting System, Cable Selection – Energy Efficient Determination of Motor Efficiency- Adjustable AC Drives, Application 	ck period ol, Steam nsulation n, Energy rigeration nagemen t Motors
internal rate Energy Cor distribution Heat excha conservation and air cond Potential A Opportunitie Factors Invo	computeri of Retur nservatic & use – s nger net n in Pum ditioning s Areas for es in Elec olved in E	 ized energy management – Energy economics – discount rate, payba n, life cycle costing in Thermal Systems - Boiler – efficiency testing, excess air contristeam traps, condensate recovery, flash steam utilization, Thermal I working –concept of pinch, target settling, problem table approach ps, Fans (flow control) and blowers, Compressed Air Systems, Refsystems – Waste heat recovery recuperators, heat sheets. r Electrical Energy Conservation in Industries – Energy Marctinical Heating, Lighting System, Cable Selection – Energy Efficient Determination of Motor Efficiency- Adjustable AC Drives, Application as Belt Drives. 	ck period ol, Steam nsulation n, Energy rigeratior nagemen t Motors & its use
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internal rate Energy Cor distribution Heat excha conservation and air cond Potential A Opportunitie Factors Invo	omputeri of Return servatic & use – s nger net n in Pum ditioning s Areas for es in Elec blved in E eed Drive s: P. Venka	ized energy management – Energy economics – discount rate, payba n, life cycle costing on in Thermal Systems - Boiler – efficiency testing, excess air contristeam traps, condensate recovery, flash steam utilization, Thermal I working –concept of pinch, target settling, problem table approach ps, Fans (flow control) and blowers, Compressed Air Systems, Ref systems – Waste heat recovery recuperators, heat sheets. r Electrical Energy Conservation in Industries – Energy Marctrical Heating, Lighting System, Cable Selection – Energy Efficient Determination of Motor Efficiency- Adjustable AC Drives, Application as Belt Drives. Total Hours:	ck period ol, Steam nsulation n, Energy rigeration nagement Motors & its use 45
internal rate Energy Cor distribution Heat excha conservation and air cond Potential A Opportunitie Factors Invo Variable Sp Text Books	computeri of Return nservatic & use – s nger net n in Pum ditioning s Areas for es in Elec blved in E eed Drive s: P. Venka publicati	ized energy management – Energy economics – discount rate, payba n, life cycle costing on in Thermal Systems - Boiler – efficiency testing, excess air contristeam traps, condensate recovery, flash steam utilization, Thermal I working –concept of pinch, target settling, problem table approach ps, Fans (flow control) and blowers, Compressed Air Systems, Refsystems – Waste heat recovery recuperators, heat sheets. r Electrical Energy Conservation in Industries – Energy Management and Conservation of Motor Efficiency- Adjustable AC Drives, Application as Belt Drives. Total Hours: ataseshaiah K.V. Sharma "Energy Management and Conservation, 2019.	ck period ol, Steam nsulation n, Energy rigeration nagement Motors & its use 45
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internal rate Energy Cor distribution Heat excha conservation and air cond Potential A Opportunitie Factors Invo Variable Sp Text Books 1 2 Reference 1 2	omputeri of Return servatic & use – s nger net n in Pum ditioning s Areas for es in Elec blved in E eed Drive s: P. Venk publicati Umesh I Books: Witte. L Utilisatic William	ized energy management – Energy economics – discount rate, payba n, life cycle costing on in Thermal Systems - Boiler – efficiency testing, excess air contri- steam traps, condensate recovery, flash steam utilization, Thermal I working –concept of pinch, target settling, problem table approach ps, Fans (flow control) and blowers, Compressed Air Systems, Ref- systems – Waste heat recovery recuperators, heat sheets. r Electrical Energy Conservation in Industries – Energy Man- certrical Heating, Lighting System, Cable Selection – Energy Efficient Determination of Motor Efficiency- Adjustable AC Drives, Application es Belt Drives. Total Hours: ataseshaiah K.V. Sharma "Energy Management and Conservatio ion, 2019. Rathore, "Energy Management", S.K. Kataria & Sons, 2016C., P.S. Schmidt, D.R. Brown, "Industrial Energy Manager on" Hemisphere Publ, Washington, 2018.	ck period ol, Steam nsulation n, Energy rigeration nagemen t Motors & its use 45
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Online Resources:							
1	https://www.gutenberg.org/cache/epub/11448/pg11448.html						
2	https://www.udemy.com/course/energy-management-principles-revealed/						

		C	Continuous Assessment										'n d				
Forma Assess					native smen		То	tal	Con	Fotal tinuoi essme			ind neste ninat		То	otal	
80)			12	20		2	00		40			60		10	00	
Assessm										onom	ıy)						
Formative	e Ass	sessm	nent b														
Course Outcome	•	Bloo Lev	-		Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)									FA (16%) [80 Marks]			
C916.1	l	Inders	stand	Qu	liz										20		
C916.2		nalys	е	As	signm	nent									20		
C916.3 8 C916.5	' E	Ivalua	te	Те	chnic	al Pre	esenta	ation							20		
C916.4	A	Apply		As	signm	nent									20		
Assessm	ent b	ased															
Bloom's I	_evel		Sur	nmat	ive A [120	sses) Mar		nt (24	%)	E	nd	Seme	ster (60%		amina	tion	
		(CIA1:	[60 N	larks		CIA2:	[60	Mark	s]		[10	о N ÓС	,	s]		
Remembe	r			30				30					30)			
Understan	d			20				20			20						
Apply				30				30			30						
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			Com	muo	us As [200			. (407	' 0)						End		
	CA 1	: 100	Marks		[200		<u>.</u>	CA	2.10	0 Mar	ks			S	emes		
	•/ • •		(40 M)				-	2 (40	-	rks)		Exa	amina	ation	
SA 1 (60	Com	ponen		ompo			6A 2	Co	mpon	ent C	· · · · · · · · · · · · · · · · · · ·			(60%)		-	
(00 Marks)	(1		- 11		N/A	(60 - I Morko)				II I)0 Ma	rks]	
		Marks								ks)							
Mapping of Specific O					(00)	with	Prog	Irami	ne O	utcom	es	(PO) I	Prog	ran	nme		
opecific o		mes	(1 30)			Р	Os							F	SOs		
COs	а	b	С	d	е	f	g	h	i	i	k	1	1	Ť	2	3	
C916.1	3	3			-	•	3		-					+	3	•	
C916.2	3	3													2		
C916.3	3	3													2		
C916.4	3	2													2		
C916.5	3	3													2		
	3 S	trongl	y agre	ed	2 N	lodei	rately	agre	ed	1 Re	easo	onably	' agr	eed			

21ME917		INTERNAL COMBUSTION ENGINES	3/0/0/3					
Nature of	Course	Theory Application						
Pre Requis	sites	Engineering Thermodynamics, Thermal Engineering						
Course Ok	ojectives:							
1		rstand the working of different IC engines and components.						
2	•	rt knowledge on pollutant formation, pollution control and alterna	ate fuels.					
3		e awareness about recent developments in IC engines.						
Course Ou		f the course, students shall have ability to						
C917.1		Recall the concepts of combustion in IC engines	[R]					
0017.1	Flaborat	e on the working principles of spark ignition and compression	[U]					
C917.2	ignition engines							
C917.3	Explore	the formation of exhaust gas components	[Ap]					
C917.4	Analyse	Analyse the characteristics of various emission control methods [A]						
C917.5	,	r the advances in IC engines	[Ap]					
Course Co			rL.1					
systems -	- Combus	el Injection Systems - Stages of combustion –Direct and Indirec stion chambers – Fuel spray behavior - Spray structure a tion - Introduction to Turbo charging.						
systems – penetration Pollutant F burnt hydro Emissions Methods of Recent Tr engines – engine ma Injection Sy	- Combus - Air mo Formation Decarbon, C - Cataly f measure rends: Ai Lean bur anagemen	stion chambers – Fuel spray behavior - Spray structure a	nd spray oxide, Un- controlling Traps – n ignition Electronic ail Direct					
systems – penetration Pollutant I burnt hydro Emissions Methods of Recent Tr engines – engine ma	- Combus - Air mo Formation Decarbon, C - Cataly f measure rends: Ai Lean bur anagemen	stion chambers – Fuel spray behavior - Spray structure a tion - Introduction to Turbo charging. n and Control: Pollutant – Sources – Formation of Carbon Mond Dxides of Nitrogen, Smoke and Particulate matter – Methods of o tric converters, Selective Catalytic Reduction and Particulate ement - Emission norms (Bharat stage VI) and Driving cycles. ir assisted Combustion - Homogeneous charge compression on engine - Stratified charge engine, Surface ignition engine, I at systems- Variable Geometry turbochargers – Common R	nd spray oxide, Un- controlling Traps – n ignition Electronic ail Direct					
systems – penetration Pollutant F burnt hydro Emissions Methods of Recent Tr engines – engine ma Injection Sy	- Combus - Air mo Formation carbon, (- Cataly f measure rends: Air Lean bur anagemen ystems – (stion chambers – Fuel spray behavior - Spray structure a tion - Introduction to Turbo charging. n and Control: Pollutant – Sources – Formation of Carbon Mond Dxides of Nitrogen, Smoke and Particulate matter – Methods of or tric converters, Selective Catalytic Reduction and Particulate ement - Emission norms (Bharat stage VI) and Driving cycles. ir assisted Combustion - Homogeneous charge compression in engine - Stratified charge engine, Surface ignition engine, I at systems- Variable Geometry turbochargers – Common R Onboard Diagnostics – Other competing technologies (hybrid vel Total Hours:	nd spray oxide, Un- controlling Traps – n ignition Electronic ail Direct nicles and 45					
systems – penetration Pollutant I burnt hydro Emissions Methods of Recent Tr engines – engine ma Injection Sy fuel cells)	Combus – Air mo Formation carbon, (– Cataly f measure rends: Ai Lean bur anagemen ystems – (s: John B	stion chambers – Fuel spray behavior - Spray structure a tion - Introduction to Turbo charging. n and Control: Pollutant – Sources – Formation of Carbon Mond Dxides of Nitrogen, Smoke and Particulate matter – Methods of or tric converters, Selective Catalytic Reduction and Particulate ement - Emission norms (Bharat stage VI) and Driving cycles. ir assisted Combustion - Homogeneous charge compression on engine - Stratified charge engine, Surface ignition engine, I at systems- Variable Geometry turbochargers – Common R Onboard Diagnostics – Other competing technologies (hybrid vel <u>Total Hours:</u> Heywood, "Internal Combustion Engine Fundamentals", Mo	nd spray oxide, Un- controlling Traps – n ignition Electronic ail Direct nicles and 45					
systems – penetration Pollutant I burnt hydro Emissions Methods of Recent Tr engines – engine ma Injection Sy fuel cells) Text Book	- Combus - Air mo Formation Decarbon, C - Cataly f measure rends: Air Lean bur anagemen ystems – C s: John B Educatic	stion chambers – Fuel spray behavior - Spray structure a tion - Introduction to Turbo charging. n and Control: Pollutant – Sources – Formation of Carbon Mond Dxides of Nitrogen, Smoke and Particulate matter – Methods of or tric converters, Selective Catalytic Reduction and Particulate ement - Emission norms (Bharat stage VI) and Driving cycles. ir assisted Combustion - Homogeneous charge compression on engine - Stratified charge engine, Surface ignition engine, I at systems- Variable Geometry turbochargers – Common R Onboard Diagnostics – Other competing technologies (hybrid vel <u>Total Hours:</u> Heywood, "Internal Combustion Engine Fundamentals", Mo on, 2018.	nd spray oxide, Un- controlling Traps – n ignition Electronic ail Direct nicles and 45					
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systems – penetration Pollutant F burnt hydro Emissions Methods of Recent Tr engines – engine ma Injection Sy fuel cells) Text Book 1	 Combustion – Air mo Formation Carbon, C Cataly f measure rends: Air Lean bur anagement ystems – C s: John B Education Ganesar Books: William I Newness 2016. James B Technol 	stion chambers – Fuel spray behavior - Spray structure a tion - Introduction to Turbo charging. n and Control: Pollutant – Sources – Formation of Carbon Mond Daides of Nitrogen, Smoke and Particulate matter – Methods of of tric converters, Selective Catalytic Reduction and Particulate ement - Emission norms (Bharat stage VI) and Driving cycles. ir assisted Combustion - Homogeneous charge compression in engine - Stratified charge engine, Surface ignition engine, I systems- Variable Geometry turbochargers – Common R Onboard Diagnostics – Other competing technologies (hybrid vel Total Hours: Heywood, "Internal Combustion Engine Fundamentals", Mo on, 2018. n, "Internal Combustion Engines", Tata McGraw-Hill, 2017. B. Ribbens, Norman P. Mansour," Understanding Automotive Ele (an imprint of Butterworth-Heinemann Ltd); 8th Revised editio E. Duffy, Howard Bud Smith,"Auto Fuel and Emission Control ogy", Goodheart-Willcox, 2017.	nd spray oxide, Un- controlling Traps – n ignition Electronic ail Direct nicles and 45 cGraw-Hill ectronics", on edition, Systems					
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		Contin	Jous Assessi	ment		Final					
Forma Assess		-	ummative sessment	Total	Total Continuous Assessmen	- Evaminat		otal			
80)		120	200	40	60	1	00			
Assessme	ent Meth	ods & L	evels (based	on Bloom	s' Taxonomy)					
Formative	Assess	ment ba	sed on Caps	tone Mode							
					nent (Choose						
	Course Bloom's				om the list - C		FA (16				
Outcome	L	evel	Assignme	•	tudy, Semina	ir, Group	[80 Ma	rks]			
					nment)						
C917.1		ember	Objective typ	be Quiz			20				
C917.2	Unde	erstand	Assignment				20				
C917.3, C917.5	Apply	/	Assignment				20				
C917.4	Anal	/ze	Case study/	Presentatio	on		20				
Assessme	ent base	d on Su	mmative and	End Seme	ster Examination	ation					
	Assessment based on Summative and End Semester Examination Summative Assessment (24%) End Semester Examination										
Bloom's L	.evel		[120 Ma	rks]	,	(60	%)	ation			
		CIA1: [[120 Ma 60 Marks]	rks] CIA2: [60	,	609) [100 M	%) arks]	ation			
Remember	r	CIA1: [[120 Ma 60 Marks] 40	rks] CIA2: [60 30	,	(60) [100 M 30	%) arks]	ation			
Remember Understan	r	CIA1: [[120 Ma 60 Marks] 40 30	rks] CIA2: [60 30 30	,	(60° [100 M 30 30	%) arks])				
Remember Understand Apply	r	CIA1: [[120 Ma 60 Marks] 40 30 20	rks] CIA2: [60 30 30 30	,	(60) [100 M 30 30 30	%) arks]))				
Remember Understand Apply Analyse	r	CIA1: [[120 Ma 60 Marks] 40 30	rks] CIA2: [60 30 30	,	(60° [100 M 30 30	%) arks]))				
Remember Understand Apply Analyse Evaluate	r	CIA1: [[120 Ma 60 Marks] 40 30 20	rks] CIA2: [60 30 30 30	,	(60) [100 M 30 30 30	%) arks]))				
Remember Understand Apply Analyse Evaluate Create	r d	CIA1: [[120 Ma 60 Marks] 40 30 20 10 - -	rks] CIA2: [60 30 30 30 10 - -	Marks]	(60) [100 M 30 30 30 - -	%) arks]))				
Remember Understand Apply Analyse Evaluate Create	r d	CIA1: [[120 Ma 60 Marks] 40 30 20 10 - - - ntinuous and	rks] <u>CIA2: [60</u> 30 30 10 - - I End Sem	Marks]	(60) [100 M 30 30 30 - -	%) arks]))				
Remember Understand Apply Analyse Evaluate Create	r d	CIA1: [[120 Ma 60 Marks] 40 30 20 10 - - - ntinuous and nuous Asses	rks] CIA2: [60 30 30 30 10 - I End Seme sment (40	Marks]	(60) [100 M 30 30 30 - -	%) arks])))				
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Remember Understand Apply Analyse Evaluate Create Assessme	r d ent base	CIA1: [d on Co Conti 0 Marks	[120 Ma 60 Marks] 40 30 20 10 - - - ntinuous and nuous Asses [200 Mar	rks] <u>CIA2: [60</u> <u>30</u> <u>30</u> <u>30</u> <u>10</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u>	Marks] Marks] ester Examin %) 2: 100 Marks	(60) [100 M 30 30 30 10 - ation	%) arks])))) Enc Semes	d ster			
Remember Understand Apply Analyse Evaluate Create Assessme	r d ent base CA 1: 10 FA	CIA1: [d on Co Conti 0 Marks 1 (40 Ma	[120 Ma 60 Marks] 40 30 20 10 - - - ntinuous and nuous Asses [200 Mar arks)	rks] CIA2: [60 30 30 30 10 - I End Seme sment (40° ks] CA SA 2	Marks] Marks] ester Examin %) 2: 100 Marks FA 2 (40 M	(60 [100 M 30 30 30 10 - - ation - ation s arks)	%) arks]))))) Enc Semes Examina	d ster ation			
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Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs		POs											PSOs		
COS	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C917.1	3													2	
C917.2	3		2											1	
C917.3	3	2												3	
C917.4	3	3												3	
C917.5	3	2												2	
	•	•	•	•	•	•	•	•	•	•	•	•			
	3 Sti	rongly	/ agre	ed	2 M	odera	tely a	gree	d 1	Re	asona	ably a	greed		

21ME918		CRYOGENIC ENGINEERING	3/0/0/3
Nature of C	Course	Theory Application	
Pre Requis	sites	Engineering Thermodynamics	
	leathras	Thermal Engineering	
Course Ob		te the students understand the properties of cryogenic fluids,	variou
I		tion cycles, liquefaction systems and components in liquefaction sy	
2		ke them understand the effect of rectification, absorption sys	
-		ion, binary mixtures, T-C and H-C diagrams	
3		e the students understand the types of cryogenic refrigerators	, variou
		s of handling cryogens and its applications.	
Course Ou			
		f the course, students shall have ability to	(D)
C918.1		he basic concepts of cryogenic and liquefaction cycles.	[R]
C918.2	liquefact	te the working principles of rectification, purification and	[U]
C918.3		the various types of cryogenic refrigerator and understand its	[Ap]
0010.0		procedure.	[, h]
C918.4		the characteristics of various cryogens and explain their	[A]
	applicat		
C918.5	Analyse	the safety of cryogenic propellants.	[A]
Course Co	ntents:		
and second Material pro F.O.M. and Cycle, Pred	d law ana operties at Yield of L cooled Lii	ht on Cryogenics, Methods of producing cold - thermodynamic bal alyses, Vapour compression systems, Properties of Cryogenic flu t Cryogenic temperatures. Liquefaction Cycles: Carnot Liquefaction Liquefaction Cycles, Inversion Curve-JouleThomson Effect. Linde H nde Hampson Cycle, Claudes Cycle, Dual Cycle, Helium Reg on Systems. Critical components in Liquefaction Systems.	uids, an on Cycle Hampso
and second Material pro F.O.M. and Cycle, Pred Hydrogen L Separation Rectification gurification. G.M.Cryoco Magnetic R Handling Cryogenic T for rocket pl and Tempe	d law ana operties at Yield of L cooled Lin iquefaction of Cryog colers, Pu efrigerato of Cryog fransfer L ropulsion, erature. Ap	Alyses, Vapour compression systems, Properties of Cryogenic flut t Cryogenic temperatures. Liquefaction Cycles: Carnot Liquefaction Liquefaction Cycles, Inversion Curve-JouleThomson Effect. Linde H nde Hampson Cycle, Claudes Cycle, Dual Cycle, Helium Reg on Systems. Critical components in Liquefaction Systems. ogenic Gases: Binary Mixtures, T-C and H-C Diagrams, Prin- cation Column Analysis – McCabe Thiele Method. Adsorption Sys- enic Refrigerators: J.T.Cryocoolers, Stirling Cycle Refri- ulse Tube Refrigerators, Regenerators used in Cryogenic Refri- ors. gens and Applications: Cryogenic Dewar Construction and ines. Insulations used in Cryogenic Systems, Safety of cryogenic pr- Different Types of Vacuum Pumps, Instrumentation to measure Flo- pplications of Cryogenics in Space Programmes, Superconductiv	uids, an on Cycle Hampso rigerate nciple of stems fo gerators gerators Desigr opellant ow, Leve
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and second Material pro F.O.M. and Cycle, Pred Hydrogen L Separation Rectification gurification. G.M.Cryoco Magnetic R Handling Cryogenic T for rocket pr and Tempe Metallurgy, Text Books	d law ana operties at Yield of L cooled Lin iquefaction of Cryogo olers, Pu efrigerato of Cryogo fransfer L ropulsion, erature. Ap Medical a St Springe Thomas	Alyses, Vapour compression systems, Properties of Cryogenic fluct Cryogenic temperatures. Liquefaction Cycles: Carnot Liquefaction Liquefaction Cycles, Inversion Curve-JouleThomson Effect. Linde H ande Hampson Cycle, Claudes Cycle, Dual Cycle, Helium Reg on Systems. Critical components in Liquefaction Systems. Ogenic Gases: Binary Mixtures, T-C and H-C Diagrams, Prin cation Column Analysis – McCabe Thiele Method. Adsorption Systemic enic Refrigerators: J.T.Cryocoolers, Stirling Cycle Refri ulse Tube Refrigerators, Regenerators used in Cryogenic Refri ors. Gens and Applications: Cryogenic Dewar Construction and ines. Insulations used in Cryogenic Systems, Safety of cryogenic print Different Types of Vacuum Pumps, Instrumentation to measure Flo pplications of Cryogenics in Space Programmes, Superconductive applications. D.Timmerhaus and Thomas M.Flynn, "Cryogenic Process Engi r US, 2018.	uids, an on Cycle Hampso rigerate nciple of stems fo gerators Desigr opellant ow, Leve vity, Cry <u>45</u>
and second Material pro F.O.M. and Cycle, Pred Hydrogen L Separation Rectification gurification. G.M.Cryoco Magnetic R Handling Cryogenic T for rocket pl and Tempe Metallurgy, Text Books 1	d law ana operties at Yield of L cooled Lin iquefaction of Cryoge colers, Pu efrigerato of Cryoge fransfer L ropulsion, erature. Ap Medical a Springe Thomas Books: Mukh	Alyses, Vapour compression systems, Properties of Cryogenic fluct Cryogenic temperatures. Liquefaction Cycles: Carnot Liquefaction Liquefaction Cycles, Inversion Curve-JouleThomson Effect. Linde H ande Hampson Cycle, Claudes Cycle, Dual Cycle, Helium Reg on Systems. Critical components in Liquefaction Systems. Ogenic Gases: Binary Mixtures, T-C and H-C Diagrams, Prin cation Column Analysis – McCabe Thiele Method. Adsorption Systemic enic Refrigerators: J.T.Cryocoolers, Stirling Cycle Refri ulse Tube Refrigerators, Regenerators used in Cryogenic Refri ors. Gens and Applications: Cryogenic Dewar Construction and ines. Insulations used in Cryogenic Systems, Safety of cryogenic print Different Types of Vacuum Pumps, Instrumentation to measure Flo pplications of Cryogenics in Space Programmes, Superconductive applications. D.Timmerhaus and Thomas M.Flynn, "Cryogenic Process Engi r US, 2018.	uids, an on Cycle Hampso rigerate nciple of stems fo gerators Design opellant ow, Leve rity, Cry 45 neering
and second Material pro F.O.M. and Cycle, Pred Hydrogen L Separation Rectification gurification. G.M.Cryoco Magnetic R Handling Cryogenic T for rocket pl and Tempe Metallurgy, Text Books 1 2 Reference	d law ana operties at Yield of L cooled Lin iquefaction of Cryogo olers, Pu efrigerato of Cryogo fransfer L ropulsion, erature. Ap Medical a Springe Thomas Books: Mukh Hall In G.Ver	Alyses, Vapour compression systems, Properties of Cryogenic fluct Cryogenic temperatures. Liquefaction Cycles: Carnot Liquefaction Liquefaction Cycles, Inversion Curve-JouleThomson Effect. Linde H ande Hampson Cycle, Claudes Cycle, Dual Cycle, Helium Reg on Systems. Critical components in Liquefaction Systems. Ogenic Gases: Binary Mixtures, T-C and H-C Diagrams, Print cation Column Analysis – McCabe Thiele Method. Adsorption Systemic Refrigerators: J.T.Cryocoolers, Stirling Cycle Refri ulse Tube Refrigerators, Regenerators used in Cryogenic Refri ars. Gens and Applications: Cryogenic Dewar Construction and ines. Insulations used in Cryogenic Systems, Safety of cryogenic print Different Types of Vacuum Pumps, Instrumentation to measure Flo pplications. D.Timmerhaus and Thomas M.Flynn, "Cryogenic Process Engine r US, 2018. M.Flynn, "Cryogenic Engineering", Marcel Dekker, New York, 201 opadhyay, Mamata, "Fundamentals of Cryogenic Engineering",	uids, an on Cycle Hampso rigerate nciple of stems fo gerators gerators Desigr opellant ow, Leve <i>i</i> ty, Cry 45 neering 8, Prentice

4	Robert W. Vance, "Cryogenic Technology", John wiley & Sons, Inc.2016, New
	York.
Web Referer	ices:
1	http://www.wiley-vch.de/contents/ullmann/ull_10211.html.
2	http://www.onecro.com
3	http://www.caddet-ee.org/search/produce.cfm?ID=R072
4	http://www.sumkasons.20m.com/In2.html
5	http://www.thtcryogenics.freeserve.co.uk/crogenics.html

Continuous Assessment													
Formative Assessment			Summative Assessment			Tota	-	Total Continuous Assessment		End Semest Examinat	-		
80				120		200		40		60		100	
Assessm	ent M	ethoo	ds & Lo	evels (bas	sed on Blooms' Taxonomy)								
Formative Assessment based on Capstone Model													
Course Outcom		Bloom's Level		Assessment Component (Choose a components from the list - Qu Assignment, Case Study, Seminar Assignment)					ıiz, ·	A (16%) 0 Marks]			
C918.1	R	emen	nber	Presentation/Quiz							20		
C918.2	U	nders	tand	Assignment							20		
C918.3	A	pply		Group Assignment							20		
C918.4 C918.5		nalyze	Case Study 20										
Assessm	Assessment based on Summative and End Semester Examination												
Bloom's	Bloom's Level		Sum		sessi Marks				End	Semester Examination (60%)			
	C	CIA1: [60 Marks]			CIA2: [60 Marks]			[100 Marks]					
Remembe		40			30				30				
Understand			40			40			40				
Apply			10			20			20				
Analyse			10				10			10			
Evaluate			-			-			-				
Create													
Assessm	ent b	ased		ntinuous a					mina	tion			
Continuous Assessment (40%)													
[200 Marks] CA 1: 100 Marks CA 2: 100 Marks											End Semester		
					<u> </u>								
SA 1 (60 Marks)	I		mponent - II 0 Marks)	SA (6 Mar	0	FA 2 (40 Component (- I (20 Marks)		Con	nrks) nponent - II Marks)		(60%) (60 Marks]		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)																		
COs		POs													PSOs			
	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3			
C918.1	3	3												1				
C918.2	3	3												1				
C918.3	3	3												2				
C918.4	3	3												3				
C918.5	3	3												3				
		3 Strongly agreed					Moderately agreed 1 Rea						sonably agreed					

Elective Stream III – Manufacturing/ Industrial Engineering

	COMPOSITE MATERIALS, PROCESSING AND APPLI	CATIONS	3/0/0/3
Nature of (Course Theory Application		•
Pre Requis	sites Metallurgy and Materials Testing		
Course Ob	ojectives:		
1	Introduce the concepts of modern composite materials an with the knowledge on fabrication and testing of composites		students
2	To make the students understand the different types of con properties and applications.	nposite materi	als, their
3	Describe the fundamental fabrication processes for polyme and ceramic matrix composites.	er matrix, meta	al matrix
Course Ou			
	pletion of the course, students shall have ability to		
C919.1	Recall the types of composite materials and their characteria		[R]
C919.2	Identify the suitable technique for manufacturing difference composite materials.	ent types of	[U]
C919.3	Estimate the mechanical properties of composites.		[A]
C919.4	Predict the applications of composite materials for automotiv and industrial sectors.	e, aerospace	[Ap]
C919.5	Discover the advancements in composites and its application	ons.	[Ap]
Course Co	ontents:		
thermosetti applications processes,	matrix composites : Understand the concepts of Poing, thermoplastic-various types of reinforcements used in PMC s of PMC. PMC manufacturing processes : Hand layup, Bag moulding, Compression moulding, Reinforced reactions for moulding. Pultrusion, Filament winding.	Č, merits, dem processes, S	erits and Spray up
thermosetti applications processes, Resin trans Metal mat composites of interface coating on Nanocomp casting – so	ing, thermoplastic-various types of reinforcements used in PM s of PMC. PMC manufacturing processes : Hand layup	Č, merits, dem processes, S on injection m ypes of Meta e of mixtures, I roperties of co /MC, Nanofill diffusion bon	erits and Spray up noulding, al matrix nfluence mposite, ers and ding, stir
thermosetti applications processes, Resin trans Metal mat composites of interface coating on Nanocomp casting – so Inspection Ceramic m and applica (CIP), Hot Understand CCC. Proc	ing, thermoplastic-various types of reinforcements used in PMG s of PMC. PMC manufacturing processes : Hand layup Bag moulding, Compression moulding, Reinforced reactions for moulding. Pultrusion, Filament winding. trix composites: Understand the concepts of MMC, Types s, Types of reinforcements used in MMC, Volume fraction, Rule bonding between matrix and reinforcement on mechanical p in reinforcements, merits, demerits and applications of M posites. Processing of MMC – Powder metallurgy process – queeze casting, friction stir processing, Testing of composites and	Č, merits, dem processes, S on injection m ypes of Meta e of mixtures, I roperties of co /IMC, Nanofill diffusion bon as per ASTM s ing ceramic m osites, merits, Cold isostatic n-Carbon Con rits and applica	erits and Spray up houlding, al matrix nfluence mposite, ers and ding, stir standard, haterials, demerits pressing nposites: ations of
thermosetti applications processes, Resin trans Metal mat composites of interface coating on Nanocomp casting – so Inspection Ceramic m and applica (CIP), Hot Understand CCC. Proc	ing, thermoplastic-various types of reinforcements used in PME is of PMC. PMC manufacturing processes : Hand layup Bag moulding, Compression moulding, Reinforced reactions for moulding. Pultrusion, Filament winding. trix composites: Understand the concepts of MMC, Types of reinforcements used in MMC, Volume fraction, Rule bonding between matrix and reinforcement on mechanical put in reinforcements, merits, demerits and applications of M posites. Processing of MMC – Powder metallurgy process – queeze casting, friction stir processing, Testing of composites and of components using ultrasonic flaw detector. matrix composites: Understand the concepts of Engineering attrix composites, and various types of Ceramic Matrix compo- ations of CMC. Processing of CMC : Sintering - Hot pressing, t isostatic pressing, Advances in Composites: Carbon d the concepts of Carbon-carbon composites, merits, demeri cessing of Carbon composites: chemical vapour deposition, composites.	Č, merits, dem processes, S on injection m ypes of Meta e of mixtures, I roperties of co /IMC, Nanofill diffusion bon as per ASTM s ing ceramic m osites, merits, Cold isostatic n-Carbon Con rits and applica	erits and Spray up houlding, al matrix nfluence mposite, ers and ding, stir standard, haterials, demerits pressing nposites: ations of
thermosetti applications processes, Resin trans Metal mat composites of interface coating on Nanocomp casting – so Inspection Ceramic m and applica (CIP), Hot Understand CCC. Proc	ing, thermoplastic-various types of reinforcements used in PMe s of PMC. PMC manufacturing processes : Hand layup , Bag moulding, Compression moulding, Reinforced reaction sfer moulding. Pultrusion, Filament winding. trix composites: Understand the concepts of MMC, Types of reinforcements used in MMC, Volume fraction, Rule bonding between matrix and reinforcement on mechanical pul- n reinforcements, merits, demerits and applications of Moosites. Processing of MMC – Powder metallurgy process – queeze casting, friction stir processing, Testing of composites i of components using ultrasonic flaw detector. matrix composites: Understand the concepts of Engineerin attrix composites, and various types of Ceramic Matrix compo- ations of CMC. Processing of CMC : Sintering - Hot pressing, t isostatic pressing, Advances in Composites: Carbon d the concepts of Carbon-carbon composites, merits, demerices composites.	Č, merits, dem processes, S on injection m ypes of Meta e of mixtures, I roperties of co MC, Nanofill diffusion bon- as per ASTM s ing ceramic m osites, merits, Cold isostatic rocarbon Con rits and applica Sol-gel techn	erits and pray up houlding, al matrix nfluence mposite, ers and ding, stir standard, haterials, demerits pressing nposites: ations of ique, 3D
thermosetti applications processes, Resin trans Metal mat composites of interface coating on Nanocomp casting – so Inspection Ceramic m and applica (CIP), Hot Understand CCC. Proc printing of c	ing, thermoplastic-various types of reinforcements used in PMe s of PMC. PMC manufacturing processes : Hand layup , Bag moulding, Compression moulding, Reinforced reaction sfer moulding. Pultrusion, Filament winding. trix composites: Understand the concepts of MMC, Types of reinforcements used in MMC, Volume fraction, Rule bonding between matrix and reinforcement on mechanical per neterinforcements, merits, demerits and applications of Moosites. Processing of MMC – Powder metallurgy process - queeze casting, friction stir processing, Testing of composites and of components using ultrasonic flaw detector. matrix composites: Understand the concepts of Engineering atoms of CMC. Processing of CMC : Sintering - Hot pressing, t isostatic pressing, Advances in Composites: Carbon d the concepts of Carbon-carbon composites, merits, demeri cessing of Carbon composites: chemical vapour deposition, composites.	Č, merits, dem processes, S on injection m ypes of Meta e of mixtures, I roperties of co /MC, Nanofill diffusion bon as per ASTM s ing ceramic m osites, merits, Cold isostatic n-Carbon Con rits and applica Sol-gel techn Total Hours:	erits and pray up houlding, al matrix nfluence mposite, ers and ding, stir standard, haterials, demerits pressing nposites: ations of ique, 3D 45 Edition,

Reference B	ooks:
1	Deborah D.L. Chung, "Composite Materials", Second Edition, Springer, 2014.
2	Nikhilesh Chawla, Krishan K. Chawla, "Metal Matrix Composites", Second
	Edition, Springer, 2013.
3	Chawla K.K., "Composite Materials", Springer – Verlag, 2012.
Web Referen	nces:
1	https://www.youtube.com/watch?v=VMH6qbED7pg
2	https://www.youtube.com/watch?v=LHHAPJbakEc
Online Reso	urces:
1	https://nptel.ac.in/courses/112104168/
2	https://nptel.ac.in/courses/101104010/1

		C	Continu	Jous Asse	essmer	nt						
Form Asses				ummative sessment		Total	Tota Continu Assessi	ious	End Semeste Examinat	-	Total	
	0			120		200	40		60		100	
				Is & Levels (based on Blooms' Taxonomy) ent based on Capstone Model								
Formativ	e Ass	sessm	ent ba							1		
Course Outcom		Bloo Lev		со	mpone	ents fr Case \$	onent (Cho om the lis Study, Ser gnment)	t - Qı	ıiz, ·		FA (16%) 80 Marks]	
C919.1	F	Remen	nber	Quiz			.				20	
C919.2	l	Inders	stand	Assignme	ent						20	
C919.3	A	Analys	е									
C919.4 C919.5		Apply		Technica	l Prese	entatio	า				40	
Assessm	nent b	based	on Su	mmative a	Ind En	d Sem	ester Exa	minat	tion			
			Sum	mative As			24%)	Enc		er Examination		
Bloom's	Level	-			Marks					60%)		
		(60 Marks]) Marks]			Marks]		
Remembe	-			50		20	-			20		
Understar	nd			30		30			-	0		
Apply				20		30			-	0		
Analyse				-		20	J		2	0		
Evaluate Create				-		-				-		
	ont h	based	on Co	- ntinuous (and En	- d San	nester Exa	mina	tion	-		
~22C2211		aseu						mind				
			Sonth	nuous Assessment (40%) [200 Marks]							End	
CA 1: 100 Marks CA 2: 100 Marks									S	Semester		
			(40 Ma	arks)			FA 2 (4		rks)	Ex	amination	
SA 1 (60 Marks)		ponent I	- Co	mponent - II	SA (60 Mark		Component - I	Con	nponent - II	[1	(60%) 00 Marks]	
/	(20	Marks) (2	0 Marks)		<i>'</i> (20 Marks)	(20) Marks)			

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
00-		POs PSOs														
COs		а	a b c d e f g h i j k l 1 2 3													
C919.1		3													2	
C919.2		3													1	
C919.3		3	3	3											3	
C919.4		3	3	3											3	
C919.5		3	3 3 3													
	3	Stror	ngly a	gree	d 2	Mod	lerate	ly ag	reed	1	Rea	asona	ably a	greed		•

21ME920	I	NDUSTRIAL LAYOUT, ERGONOMICS AND SAFETY ENGINEERING	3/0/0/3							
Nature of C	ourse	Theory application								
Pre Requis	ites	Manufacturing Technology I & II								
Course Objectives:										
1	To acqu	ire knowledge about the importance of industrial layout and safe	ty.							
2	To enab	ble the students to identify the causes of accidents and its impact								
3	To impa	art knowledge on Occupational Safety and Health Assessment	Series in							
	jobsite s	safety.								
4	To enab	ble students to implement the hazard and risk assessment technic	ques.							
Course Out	comes:									
	pletion of	the course, students shall have ability to	_							
C920.1	Identify	the key factors for location decision and site selection.	[R]							
C920.2	Interpre	t all types of plant layouts for better industrial layout design.	[U]							
C920.3		rize the OSHA's general reporting and record keeping rules and	[U]							
	guidelin	es.								
C920.4	Impleme	ent the ergonomic aspects in product design.	[Ap]							
C920.5	Examine	e the ability to avoid, prevent and control workplace hazards.	[A]							
Course Co	ntents:									
Plant Layo	ut: Plant I	location and site selection, Importance of Plant Location, Dynam	ic Nature							
of Plant Loc	of Plant Location, Facilities Design Procedure, Principles of Plant layout and Types, factors									
	affecting layout, methods, factors governing flow pattern, travel chart, analytical tools of plant									
		nufacturing shop floor, repair shop, services sectors and proce	•							
Evaluation a	and Impr	ovement of Layout, Quantitative methods of Plant layout: CR	AFT and							

Hazards: Industrial accidents, Electrical hazards, detection and prevention of electrical hazards, Chemical hazardous materials, material safety Material Safety Data Sheet (MSDS Fire hazard and life safety) Mechanical hazards and machine safe guarding common mechanical hazards, safeguarding and OSHA's requirement for safeguarding Industrial safety awareness Safety health and the environment Hazards of the environment Hazardous waste reduction Cost of accident and accident preventions Workman's compensation issues. Hazard analysis, prevention and safety management, Tactile and non-tactile methods

Safety and Health: Safety and health training, Introduction to OHSAS, OSHA Worker's Rights, Employer Responsibilities Occupational safety and work place violence. **Ergonomics:** Interdisciplinary nature of ergonomics, Ergonomic considerations including repetitive motion, Stress and safety, Economics of Ergonomics considerations in workplace lightings, workstation design, welfare facilities, work posture.

	Total Hours: 45
Text Boo	ks:
1	Theresa Stack, Lee T. Ostrom, Cheryl A. Wilhelmsen "Occupational Ergonomics: A
	Practical Approach", John Wiley & Sons, 2016.
2	Mark A. Friend, James P. Kohn "Fundamentals of Occupational Safety and Health",
	6th edition by Government Institutes Inc., 2014.
Referenc	e Books:
1	Charles D. Reese "Occupational Health and Safety Management: A Practical
	Approach", Third edition, CRC Press 2015.
2	Gavriel Salvendy, "Handbook of Human Factors and Ergonomics", Fourth edition,
	John Wiley & Sons 2012.
Web Refe	erences:
1	https://alison.com/course/workstation-ergonomics-revised

CORELAP, Relationship diagrams.

2	http://ergonomics.org/
Online Re	esources:
1	http://nptel.ac.in/courses/107103004/31
2	https://ehs.mst.edu/generalsafety/ergonomics/ergonomicslinks/

			Continuous Assessment Enc														
Forma Assess				_	nmativ essme	-	T	otal	Co	Tota ntinu sessn	ous		neste		То	tal	
80)				120		2	200		40			60		10)0	
Assessme										onon	ny)						
Formative	Ass	sessi	ment l	nent based on Capstone Model								r					
Course Outcome	•		oom's .evel	vel Assignment, Case Study, Seminar, Group Assignment)									-	FA (16%) [80 Marks]			
C920.1			nembe		Quiz										20		
C920.2			erstan		Techni				/						40		
C920.3			erstan	d (Group	Discu	ission	1							10		
C920.4		App		— F	Poster	prese	entatio	on							20		
C920.5		Ana				•				Vere	in at la						
Assessme	ent K	based			hative hative					:xam		on Seme	otor	Eve	mina	tion	
Bloom's L	مىرە		3	umm		Asse 20 Ma		ent (Z	470)		Ena	Seme	(60%		mina	tion	
Bioom 3 E		•	CIA	1 · [60	Mark			2: [60	Mark	sl		[1	00 Ma	-	1		
Remember	•		0177	40		.	017 (2	20		.0]		L · ·	20		1		
Understand				40				30					30				
Apply				20)			30)				30				
Analyse				-				20					20	20			
Evaluate				-				-					-				
Create				-				-					-				
Assessme	ent k	based								Exam	inati	on					
			Col	ntinu	ous A [200]	Mark		t (40%	%)						End		
(1: 10	0 Mar	ks				CA	2: 1	00 Ma	arks				mes		
SA 1		FA	1 (40				SA 2			A 2 (4					mina		
(60	Co	mpon	ent -		ponen	t	(60	C	ompo	nent	Con	npone	nt -		(60%		
Marks)	(2	ı 0 Mai	ks)		- II Marks)	N	(làrks)) (- I 20 Ma	rks)	(20	ll) Marks	e)	[100	0 Ma	rksj	
Mapping o	f Co	ourse	Outc	omes			Prog							amm	e		
Specific O	uico	mes	(F30)		PC)s							P	SOs		
COs –	а	b	С	d	е	f	g	h	i	j	k	I	1		2	3	
C920.1	2	3				-	ฮ		-	,		-	1		- 1	-	
C920.2	3	3	2												1		
C920.3	3												2				
C920.4	2	2	3						L				3				
C920.5	3														1		
		3	Stron	gly ag	reed	2	Mode	rately	/ agre	ed	1	Reaso	nably	' agr	eed		

21ME921		ADDITIVE MANUFACTURING	3/0/0/3
Nature of C	Course	Theory Application	
Pre requisi		Manufacturing Technology I &II	
Course Ob	jectives		
1	To deve	elop skills, ideas and knowledge about additive manufacturing pro	cess.
2	To dem	onstrate liquid, solid and powder based additive manufacturing pr	ocess.
3	To impa	art knowledge about additive manufacturing and its wide application	ons.
Course Ou	tcomes	•	
Upon com	pletion o	of the course, students shall have ability to	
C921.1	Recall t	he fundamentals of additive manufacturing process	[R]
C921.2		rize the basics of reverse engineering and data processing	[U]
C921.3	Use the	e various post processing techniques based on response	[Ap]
C921.4	Apply th	ne various types of additive manufacturing techniques.	[Ap]
C921.5	Develop	p critical parts using generative design technology	[A]
Course Co	ntents:		
Chain, Re Prototyping Software's improvement non-therma Liquid Bas Solid Base Principle of parameters studies.	verse E Process - Post - nt, accui I and the ed AM F ed AM F operatic effect o	pid Prototyping, Classification of AM process, Rapid Prototyping Engineering – Basic concepts, Digitization Techniques Type s Chain, Data Processing for AM: Conceptualization to Build m Processing Techniques: Support material removal, surface racy improvement, aesthetic improvement, property enhancemer ermal techniques Process: Stereo lithography Apparatus, Digital Light Processing Process: Laminated Object Manufacturing, Fused Deposition Me on, Machine details and variants, Materials used, Process details, on responses and Applications, Advantages and Disadvantage	es,Rapid odel,AM texture its using , Polyjet- odeling - Process es, Case
Melting, Ele Principle of parameters studies – G Self studie	ectron B operatic effect o enerativ	apid Prototyping Systems: Selective laser sintering, Selective eam Melting, Laser metal Deposition - Laser Engineered Net S on, Machine details and variants, Materials used, Process details, on responses and Applications, Advantages and Disadvantage e Design technology for developing critical parts. Arc AM, ceramic printing for core and cavities, 3D sand printing	haping - Process es, Case
exam)		Total Hours:	45
Text Books			40
		prototyping: Principles and Applications - Chua C.K., Leong K.F.	and LIM
•		orld Scientific publications, Third Edition, 2010.	
2		Noorani, "Rapid Prototyping-Principles and Applications", John nc., 2006.	Wiley &
Reference			
1	Rapid N	Manufacturing – D.T. Pham and S.S. Dimov, Springer, 2011.	
2		s Gebhardt, — Rapid Prototypingll, Hanser Gardner Publicatio	ons Inc.,

Г

Web Refe	erences	6:								
1	htt	os://www.y	outube.com	/watch?v=	Nk(C8TNts4	B4			
Online Re										
1	http	o://nptel.ac	in/courses/	11210707	7/38	32				
2	http	o://nptel.ac	in/courses/	11210707	8/37	7				
3	htt	o://nptel.ac	.in/courses/	11210210	3/16	6				
		Contin	uous Asses	sment				Final		
Form Asses	End Semeste Examinat	ter Total								
8	30 120 200 40 ·									100
			evels (base				omy)			
Formative	e Asse	ssment ba	ased on Ca							
Course Outcome		Bloom's Level	con	ent Comp nponents nent, Case As	fro e St	m the lis	st - Qı	ıiz,		FA (16%) 30 Marks]
C921.1	Re	member	Assignme							40
C921.2	Un	derstand							40	
C921.3			Hands on	•	e –	AM proc	ess ar	nd		
C921.4			Project Wo							40
C921.5		alyze	(Print a Pa				-			
Assessm	ent bas		mmative ar							
Bloom's I	Level		mative Ass [120 M	larks]	•		Enc	l Semeste (60 [100 N	%)	
Remembe		-	60 Marks] 30	CIA2: [20	viarksj		[100 M		.5]
Understar			<u> </u>		<u>20</u> 30				0	
Apply			30		30				0	
Analyse			-		20				0	
Evaluate			-		-				-	
Create			-		-				-	
Assessm	ent ba	sed on Co	ntinuous a	nd End Se	eme	ester Exa	amina	tion		
		Conti	nuous Asso [200 Ma		40%	%)				End
	CA 1: 1	00 Marks			CA	2: 100 N	larks			Semester
SA 1 (60 Marks)	Compo I		arks) omponent - II	SA 2 (60 Marks)		FA 2 (mponent - I	Con	nponent - II	Examination (60%) [100 Marks]	
iviai 183 <i>j</i>	(20 Ma	arks) (2	0 Marks)	wiai 183)	(20	0 Marks)	(20) Marks)		

· · · –	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
60-	POs PS												PSOs	Os	
COs	а	a b c d e f g h i j k l 1											1	2	3
C921.1	3														
C921.2	3														
C921.3	3	1	1											1	
C921.4	3	1	1											3	
C921.5	3	3	3											3	
3	Stror	ngly a	greed	d 2	Mod	derate	ely ag	reed	1	Re	ason	ably a	agreed		

21ME922		LEAN SIX SIGMA	3/0/0/3
Nature of	Course	Theory Application	
Pre requis	ites	Manufacturing Technology – I	
-		Manufacturing Technology – II	
Course Ob	jectives:		
1	To impa	art knowledge pertaining to lean six sigma and its importance in	n value-
		to products and services.	
2	To unde	erstand the general guidelines for implementation of lean six sigma	
3	To enab	ble students to minimize the cost/time and maximize quality using	lean six
	sigma.		
4	To exec	ute various phases of lean six sigma for real time projects	
5	To gain practice:	i insights about the importance of lean manufacturing and sizes	x sigma
Course Ou			
		of the course, students shall have ability to	
C922.1		he various applications of lean six sigma tools in industries.	[R]
C922.2		ne challenges in implementing six sigma.	[U]
C922.3		e the various principles of lean six sigma in different sectors.	[Ap]
C922.4		the process variation and improve the efficiency of the process	[A]
		e tools of lean six sigma	
C922.5		e the various industrial projects and to improve the performance.	[E]
Course Co			
		sactional vs. Manufacturing six sigma – common terms, Lean Si ct Selection.	- eigina
Business – Software . Histograms System Ar Analyse Pl Experimen improveme	- High lev Measure s, Control nalysis – nase - Pro ts (DOE) ent alterna	ases: Define & Measure Phases- Project charter – Voice of the Curvel process map – Project Tteam – Data Collection – Choosing S tools – Process Maps, Pareto Charts, Cause And Effect Di Charts – Six Sigma Measurements – Cost of Poor Quality – Meas Process Capability Calculations – Quality Function Deployment ocess analysis – Failure Modes and Effects Analysis (FMEA), D). Improve And Control Phases– process redesign – geatives – Pilot Experiments – Cost/Benefit Analysis – Implementatio ess Scorecard - SPC Charts, Final Project Report And Documenta	tatistical agrams, urement t (QFD). esign of nerating n Plan –
DMADV, D Lean Six S	MADOV Sigma – S	plications: Case Studies in various sectors - Design for Six Sigma – Lean Six Sigma Audits – Factors of Lean Six Sigma – Sustair Softwares for Lean Six Sigma – Integration of Lean Six Sigma w ix Sigma in Industry 4.0 Scenario.	iment of ith other
		Total Hours:	45
Text Book			
1	2019.	is Ehrlich, "Transactional Six Sigma and Lean Servicing", St. Luci	
2	Manufact	an S R, Mohan Sivakumar V, Murugesh R and Shalij P R, "Lean a turing: Theoretical, Practical and Research Futurities", Prentice Hal vate Limited, New Delhi, India, 2016.	

Referenc	e Books:
1	Jay Arthur, "Lean Six Sigma – Demystified", Tata McGraw Hill Companies Inc, 2018.
2	Michael L George, David T Rowlands, and Bill Kastle, "What is Lean Six Sigma",
	McGraw Hill, New York, 2014.
3	Jay Arthur, "Lean Six Sigma – Demystified", Tata McGraw Hill Companies Inc, 2014.
Web Refe	erences:
1	https://ocw.mit.edu/courses
2	https://www.tutorialspoint.com/six_sigma/six_sigma_introduction.htm
Online R	esources:
1	http://nptel.ac.in/courses/110105039/

	C	ontinuc	ous Assess	sment				F in d		
Forma Assessi			ummative sessment	Tot	al	Tota Continu Assessn	ous	End Semest Examinat		Total
80			120	20)	40		60		100
Assessmen	t Methods	s & Leve	els (based)	on Bloom	is' T	axonomy	()			
Formative A	ssessme	nt base	d on Capst	tone Mod	el				-	
				nent Com	•	•		-		
Course		om's		nponents						A (16%)
Outcome	Le	evel	Assignr	nent, Cas As		tudy, Sen nment)	ninar	, Group	[8	0 Marks]
C922.1	Reme	mber	Quiz		<u></u>					20
C922.2	Unde	rstand	Assignme	nt						20
C922.3	Apply									
C922.4	Analy	ze	Tutorial							40
C922.5	Evalu	ate								
Assessmen	t based o	n Sumn	native and	End Sem	este	er Examin	atio	า		
	Summative					%)	End	Semester		mination
Bloom's Lev	vel			[120 Marks]					%)	_
			60 Marks]					[100 N		5
Remember			30	30				30		
Understand			40	20				30		
Apply			20		30			20		
Analyse			10		10			1(
Evaluate			-		10			1()	
Create		• • • • •	-	F 10	-			-		
Assessmen	t based o						natio	n		
		Contini	uous Asse [200 Ma		W%)				End
С	A 1: 100	Marks			CA	2: 100 Ma	arks			emester
	FA [·]	1 (40 Ma	arks)	SA 2		FA 2 (4			-	mination
SA 1 (60 Marks)	Compone I		mponent - II	(60 Marks)		omponent - I O Morko)		nponent - II		(60%) 0 Marks]
L	(20 Mark	ອ) (2	0 Marks)	,	(2	0 Marks)	(20) Marks)		

<u> </u>						P	os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C922.1	3	3													
C922.2	3	3													
C922.3	3	3													
C922.4	3						2					3			
C922.5				3							3		1		1

C923.1 C923.2	jectives: To famili To provi To impa To educ tcomes:	Theory Application Manufacturing Technology – I Manufacturing Technology – II arize the student with tool nomenclature and cutting forces. de knowledge about heat distribution and thermal aspects of mach rt knowledge on tool materials, tool life and tool wear. ate the students on machining dynamics and economics.	hining.
Course Ob 1 2 3 4 Course Ou Upon comp C923.1 C923.2	jectives: To famili To provi To impa To educ tcomes:	Manufacturing Technology – II arize the student with tool nomenclature and cutting forces. de knowledge about heat distribution and thermal aspects of mach rt knowledge on tool materials, tool life and tool wear.	hining.
1 2 3 4 Course Ou Upon comp C923.1 C923.2	To famili To provi To impa To educ tcomes:	arize the student with tool nomenclature and cutting forces. de knowledge about heat distribution and thermal aspects of macl rt knowledge on tool materials, tool life and tool wear.	hining.
1 2 3 4 Course Ou Upon comp C923.1 C923.2	To famili To provi To impa To educ tcomes:	arize the student with tool nomenclature and cutting forces. de knowledge about heat distribution and thermal aspects of macl rt knowledge on tool materials, tool life and tool wear.	hining.
3 4 Course Ou Upon comp C923.1 C923.2	To provi To impa To educ tcomes:	de knowledge about heat distribution and thermal aspects of mach rt knowledge on tool materials, tool life and tool wear.	hining.
3 4 Course Ou Upon comp C923.1 C923.2	To impa To educ tcomes:	rt knowledge on tool materials, tool life and tool wear.	hining.
4 Course Ou Upon comp C923.1 C923.2	To educ tcomes:		
Course Ou Upon comp C923.1 C923.2	tcomes:	ate the students on machining dynamics and economics.	
Upon comp C923.1 C923.2			
C923.1 C923.2		he course students chall have chility to	
C923.2		the course, students shall have ability to	וחו
	Enumera	ate tool materials, tool life and tool wear.	[R]
	Analyse	the cutting forces in turning, drilling and milling operations.	[A]
C923.3		tool information and thermal aspects of various machining	[Ap]
C923.4	Describe	e the machine dynamics during metal cutting	[U]
C923.5	Optimize	e machining cost and establish feasible solution	[A]
Course Co		5	
Thermal A machining - measureme Wear: Ess specification - tool wear Machining (Chatter) - t chatter- Wa Machining	spects of Effects of ent in made ential re ns for inse and weat Dynamic types of c types of c types of c types of c	sure and energy. Machining: Thermodynamics of chip formation - Heat distribu- of various machining parameters on temperature - Method of tem chining – Hot machining –Cutting fluids. Tool Materials, Tool Life a quirements of tool materials - Developments in tool materi- erts and tool holders -Tool life - Conventional and accelerated tool r mechanisms - Concepts of machinability and machinability index cs: Types of machine tool vibration – forced vibration – self exited v hatters - Chatter prediction – vibration control – Introduction to rege ation. Phase shifts- Block diagram level analysis of machining dy and energy consideration-Machining economics and optim- - relationship between machining cost, production rate and cutting	perature and Too rials-ISC life tests c. ibrations enerative namics nizations
		Total Hours:	45
Text Books			
1	Elsevier,		
2	Shaw.M	.C., "Metal cutting Principles ", Oxford Clarendon Press, 2nd Editic	on, 2012
3	•	B. L and Sekhon.G. S, "Fundamentals of Metal Cutting and Machine e International (P) Ltd., 2017.	e Tools"
Reference			
	(Manu	enson, David A and Agapiou, John S, "Metal Cutting Theory and facturing Engineering and Materials Processing)". CRC Press, 20	16
1		shames UNAstal Outlines Theorem and Describes U. Navy Osertaal Descl.	
1 2 3	2012.	charya, "Metal Cutting Theory and Practice ", New Central Book ey Boothroyd and Knight. W.A "Fundamentals of Machining and	•••

4	Machining Dynamics by T. Schmitz & K. Smith; Springer, 2019
Online Reso	burces:
1	https://nptel.ac.in/downloads/112105127/
2	https://nptel.ac.in/courses/112104195/43

		С	ontir	uous	s Asse	essm	ent						T in al			
Forma Assess					native smen		То	otal	Con	Total ntinuo essm	ous		End nest ninat		Тс	otal
80)			12	20		2	00		40			60		1	00
Assessme	nt Me	thod	s & L	evels	s (bas	ed or	1 Blo	oms'	Taxo	onom	iy)					
Formative	Asse	ssme	ent ba	ased	on Ca	psto	ne M	odel								
Course Outcome		Bloc Lev	vel		Assig	ompo	onen nt, Ca	ts fro ase S	m th	e list Sem	- Qı	ıiz,	-		A (16 0 Ma	-
C923.1		emer		-	uiz										20	
C923.2		nalys	e	Ca	ase sti	udy/T	utoria	al							20	
C923.3		pply		┥.												
C923.4			stand	As	ssignm	nent									40	
C923.5		nalyz			41				1 a v 🗖							
Assessme	nt ba	sed c											-1	F		tion:
Bloom's Le			Su	mma	tive A			nt (24	-%)		Ena	Seme			mina	ation
BIOOM'S L	evei		<u></u>	[60 M	<u>liz</u> Marks) Mar		. [60	Mark	c1		F 4	(60) 00 M		-1	
Remember			JAI.	30	Viaiks		GIAZ	20 <u>20</u>	viai K	5]		['	20		2	
Understand				30				30					4(
Apply				40				30					20	-		
Analyse				-				20					20			
Evaluate				-				-					-	-		
Create				-				-					-			
Assessme	nt ba	sed c	on Co	ntinu	ious a	nd E	nd S	emes	ster E	xami	inati	on				
			Cont		us As: [200 N			: (40%	6)						Enc	
	CA 1:	100 I	Marks	5				CA	2:10	0 Ma	irks			-	emes	
SA 1			•	larks		s	5A 2			2 (4						ation
(60	Com	onen	t- C	•	onent		(60	Co	ompon	ent	Con	npone	nt -		(60%	,
Marks)	(20	ı Marks	a	- \20 M/	l arks)	64	· orko)	(2	- 0 Mar	ks)	(20	ll) Mark	c)	[10	0 Ma	irksj
Mapping of				mos	(CO) v	vith F								amn	00	
Specific OL				incs (VICII I	iogi	anni	c ou		100 (. 0) .	logi	anni		
						РС)e							P	SOs	
COs			1			-										
	а	b	С	d	е	f	g	h	i	J	k		1		2	3
C923.1	3	2	2												1	
C923.2	3	3	3												2	
C923.3	3	2	2												3	
C923.4	3	2													3	
C923.5	3	2													2	
3	3 Sti	rongly	/ agre	ed	2 M	odera	ately	agree	d 1	R	easo	nably	agre	ed		

21ME924	ENTR	EPRENEURSHIP DEVELOPMENT AND MANAGERIAL SKILLS	3/0/0/3
Nature of C	ourse	Theory Skill based	
Pre Requis		Nil	
Course Ob	ectives	b:	
1	develo	ke the students understand the scope of entrepreneurship and key a popment.	
2	institut	hable the students to identify the financial assistance offered tions, methods of taxation and tax benefits.	-
3		able the students to realize the government policies for establishin business entities.	g small
Course Out	comes	:	
		of the course, students shall have ability to	
C924.1		e the basic concepts of entrepreneurship and skills needed for preneurial management.	[R]
C924.2	opport	y the motivational factors and techniques for evaluating business tunities	[U]
C924.3		ne the opportunities for launching start-ups and expansion	[Ap]
C924.4	•	nent the accounting and financing skills to make sound business ons and overcome risks.	[Ap]
C924.5		s the performance of a new venture	[A]
Course Cor		Entrepreneur, Types of Entrepreneurs, Difference between Entrep	
Project Forr Business op Preparation Classificatio of Intellectu Financing Financial In Analysis, N Introduction causes and Small Scale	nulation portunit of Pre n of Ne Jal Prop And Ad stitution letwork . Suppo conseq Enterp	nterprises, Definition, Classification, Characteristics, Ownership Struch, Steps involved in setting up a Business, Identifying, selecting a ty, Market Survey and Research, Techno Economic Feasibility Assesse eliminary Project Reports, Project Appraisal, Sources of Inforreds and Agencies, Business plan preparation, MSME Schemes. Ovperty: Introduction and need for intellectual property rights. ccounting: Need, Sources of Finance, Term Loans, Capital Struct, management of working Capital, Costing, Balance sheet, Bread Analysis Techniques of PERT/CPM, Taxation, Income Tax. Cort To Entrepreneurs: Sickness in small Business, Concept, Maguences, Corrective Measures, Business Incubators, Government Performent Structures in small industry, Expansion, Diversification	a Good ssment, mation, verview ructure, k Even SST-An gnitude, blicy for n, Joint
Venture, Me State Gover	erger ar rnment	nd Sub Contracting, Entrepreneurship Development Support, Cent Industrial Policies: Atmanirbhar Bharat Abhiyaan (ABA), M-SIPS,S clearance and liberalization.	ral and
		Total Hours:	45
Text Books			
<u>1</u> 2	Donald	n R D and Peters M P, "Entrepreneurship", 11th Edition, Mc Graw-Hil d F Kuratko, "Entreprenuership – Theory, Process and Practice n, Cengage Learning, 2017.	
Reference I			
1		Khanka "Entrepreneurial Development" S.Chand& Co. Ltd., 2020.	
2	Nuzh	hanka Entrepreneurial Development "S.Chand& Co. Etd., 2020. hath Khatoon, "Entrepreneurial Development", Himalaya Publishing Ltd, 2016.	House
	1		

R2020 (Batch:2021-2025)

Web Refe	rences:
1	https://www.shopify.in/encyclopedia/entrepreneurship
2	https://nisp.mic.gov.in/
Online Co	purses:
1	http://nptel.ac.in/courses/118105009/50
2	https://www.coursera.org/specializations/wharton-entrepreneurship

		Сог	ntinuous Asse	essmer	nt			Final		
Form Asses			Summative Assessment		Total	Total Continu Assessn	ous	End Semest Examinat	-	Total
8	0		120		200	40		60		100
Assessm	ent Me	thods	& Levels (bas	ed on	Blooms	s' Taxono	my)			
Formativ	<u>e Asse</u>	ssmer	nt based on Ca							
Course Outcom		Bloom [;] Level	's co						A (16%) 0 Marks]	
C924.1	Re	memb	er Quiz		Acciginitional					20
C924.2	-	dersta		esentat	tion/ Ass	signment				20
C924.3 C924.4	1 / n	ply	Group As			5				20
C924.5	An	alyze	Case Stu	idy						20
Assessm	ent ba	sed or	Summative a	mative and End Semester Examination						
Bloom's Level			Summative As [120	sessn Marks	•	%)	End	Semester (60	-	mination
		CIA	1: [60 Marks]	CI	A2: [60	Marks]		[10Ò N		5]
Remembe	ər		40		30			30	0	
Understar	nd		40		30			30		
Apply			20		30			30	0	
Analyse			-		10			1(0	
Evaluate			-		-			-		
Create			-		-			-		
Assessm	ent ba		Continuous a				mina	tion		
		С	ontinuous Ass		ent (40%	%)				
	<u> </u>	100 17	[200 N	larks]		0 400 15			c .	End
	CA 1: ′				CA	2: 100 Ma			-	emester
SA 1 (60 Marks)		onent -	0 Marks) Component - II (20 Marks)	SA (60 Mark		FA 2 (4 omponent - I 0 Marks)	Con	nrks) nponent - II Marks)	Examination (60%) [100 Marks]	

<u> </u>						P	Os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C924.1						3	3	2			1	2			
C924.2						3	3	2			2	3			
C924.3						3	3	2			1	2			
C924.4						1	1	1			3	2			
C924.5						2	2	1			3	1			

21ME925		SPECIAL MANUFACTU		SSES	3/0/0/3
Nature of C	Course	Theory technology			
Pre-Requis	sites	Manufacturing Technology I	(with lab)		
Course Ob					
1		ect unconventional manufact ventional techniques.	uring processe	es and study its a	dvantages
2		t knowledge about nano mani			
3	To impar	t knowledge on surface engin	eering process		
Course Ou Upon com		the course, students shall	have ability to		
C925.1	Explain application			processes and	[R]
C925.2		e the importance of process p			[U]
C925.3		rate the preparation of nano r			[Ap]
C925.4	v	te the various nano finishing p			[U]
C925.5 Course Co		propriate surface treatment for	or property enh	ancing.	[Ap]
top down a process - magneto ri principles, e	approach Abrasive f neological equipment	g and finishing processes: G – Co precipitation – ultraso low machining, chemo-mecha finishing, magneto rheolog is, effect of process paramete ng – laser shock peening – na	nication – me inical polishing ical abrasive rs, applications	chanical milling – , magnetic abrasive flow finishing thei , advantages and li	finishing finishing, r working
ceramic and deposition- cladding -	d plastic co plasma s aser glad	g: Surface Cleaning - Metho pating - economics of coating - praying - Ion implantation - d ding- Friction stir processing ng and ultrasonic shot peening	- physical vapo iffusion coating – laser hard t	r deposition - Chem - boriding and chr	ical vapor omizing –
				Total Hours	45
Text Books	P.C.Pano	dey and H.S.Shan, "Modern	Machining Pro	ocess", Tata McGr	a Hill, Ne
2	Delhi 201 R. A. Line	dburg, "Process and Materials	of Manufactur	ing" PHI, 4 th edition	2015
Reference	Books:				
1		Lakhtakia, "The Hand Book	of Nano Techn	ology, Nanometer	Structure.
		Modeling and Simulations". Pr			
2		Davim, "Materials and Surface			
3	Yi Qin, M	licro-manufacturing Engineeri	ng and Techno	logy, William Andre	w, 2015
Web Refer	ences:				
1	https://np	otel.ac.in/courses/112/107/112	2107078/		
2	https://np	tel.ac.in/courses/113/105/113			
			3105086/		
Online Res	ources:	www.udemy.com/course/non-			

Formative AssessmentSummative AssessmentTotalIotal Continuous AssessmentSemester ExaminationTotal801202004060100Assessment Methods & Levels (based on Blooms' Taxonomy)Formative Assessment based on Capstone ModelCourseBloom'sAssessment (Choose and map components from the list - Quiz,FA (16%)			Contin	lous Assessi	ment		E		
Assessment Methods & Levels (based on Blooms' Taxonomy) Formative Assessment based on Capstone Model Course Bloom's Assessment Components (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) FA (16%) C925.1 Remember Quiz 20 C925.2 Understand Assignment 20 C925.3 Apply Group Assignment and Case Study 20 C925.4 Understand Case Study 40 C925.5 Apply Group Assignment and Case Study 40 Bloom's Level [120 Marks] End Semester Examination (60%) Bloom's Level CIA1: [60 Marks] CIA2: [60 Marks] [100 Marks] Remember 20 20 20 20 Understand 40 40 40 40 Analyse - - - - Create - - - - Create - - - - Continuous Assessment (40%) [200 Marks] Component - - Create - -			_		Total	Continuous	5 Evaminat		
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C925.3 Apply Group Assignment and Case Study 40 C925.4 Understand Case Study Group Assignment and Case Study 40 Assessment based on Summative and End Semester Examination Bloom's Level Summative Assessment (24%) End Semester Examination Bloom's Level [120 Marks] CIA1: [60 Marks] [100 Marks] Remember 20 20 20 20 Understand 40 40 40 40 Apply 40 40 40 40 Analyse - - - - Create - - - - Create - - - - Image: Continuous Assessment (40%) [200 Marks] End Semester Examination Semester SA 1 FA 1 (40 Marks) SA 2 Group onent - Component - 1 Component - 1 Component - 1 Component - 1 Component - 1 (60%) [100 Marks]	C925.1	Rem	ember	Quiz		-		20	
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C925.5 Apply Assessment based on Summative and End Semester Examination Assessment based on Summative Assessment (24%) End Semester Examination (60%) Bloom's Level [120 Marks] ClA1: [60 Marks] ClA2: [60 Marks] [100 Marks] Remember 20 20 20 20 20 Understand 40 40 40 40 40 Apply 40 40 40 40 40 Analyse - - - - - Evaluate - - - - - - Create - - - - - - - - - - - - - - End Semester Examination Semester Examination Semester Examination Gow I I I	C925.4	Und	erstand		nment and			40	
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$\begin{array}{c c c c c c c c } \hline Bloom's Level & [120 Marks] & ClA2: [60 Marks] & [100 Marks] \\\hline ClA1: [60 Marks] & ClA2: [60 Marks] & [100 Marks] \\\hline Remember & 20 & 20 & 20 \\\hline Understand & 40 & 40 & 40 \\\hline Apply & 40 & 40 & 40 & 40 \\\hline Apply & 40 & 40 & 40 & 40 \\\hline Analyse & - & - & - & - \\\hline Evaluate & - & - & - & - \\\hline Create & - & - & - & - \\\hline Create & - & - & - & - \\\hline Assessment based on Continuous and End Semester Examination \\\hline Continuous Assessment (40%) \\\hline I & -II & Marks) & SA 2 \\\hline (60 & Gmponent - & Component \\\hline I & -II & Marks) & -1 & II \\\hline \end{array}$	Assessm	ent base	ed on Su	mmative and	End Seme	ster Examin	ation		
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Analyse - - - Evaluate - - - - Evaluate - - - - - Create - - - - - - Assessment based on Continuous and End Semester Examination Continuous Assessment (40%) End End Continuous Assessment (40%) [200 Marks] End Semester End CA 1: 100 Marks CA 2: 100 Marks End Semester Examination SA 1 FA 1 (40 Marks) SA 2 FA 2 (40 Marks) Examinatio (60 I - II Marks) - I II I00 Marks					20		- 20)	
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[200 Marks] End CA 1: 100 Marks CA 2: 100 Marks End CA 1: 100 Marks CA 2: 100 Marks Semester SA 1 Component - Component Component - Componen	Understar Apply Analyse Evaluate Create	nd		20 40 40 - - -	20 40 40 - - -		20 40 40 - -))	
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SA 1 (60 Marks)Component - - IIComponent - IISA 2 (60 - IComponent - (60%)(60%) (60%)	Understar Apply Analyse Evaluate Create Assessm	ent base	ed on Co Conti	20 40 40 - - - - ntinuous and nuous Asses	20 40 - - - I End Seme sment (40%	ester Examir %)	2(4(4(- - - - - -	5 5 5 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7	
	Understar Apply Analyse Evaluate Create Assessm	ent base	ed on Co Conti 00 Marks	20 40 40 - - ntinuous and nuous Asses [200 Mar	20 40 - - - I End Seme sment (40%	ester Examir %) 2: 100 Marks	20 40 40 - - - - - - - - - - - - - - - -	End Semester	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

<u> </u>						P	Os							PSOs	
COs	а	b	С	d	е	f	g	h	-	j	k	I	1	2	3
C925.1	3													2	
C925.2	3													2	
C925.3	3													3	
C925.4	3	2												2	
C925.5	3	2												3	
														_	
	3 Str	ongly	agree	ed 2	2 M	odera	ately a	agree	d 1	Re	ason	ably a	agreed		

21ME926	ENGI	NEERING MANAGEMENT AND FINANCIAL ACCOUNTING	3/0/0/3
Nature of (Course	Theory application	
Pre Requis	sites	Nil	
Course Ob	jectives:		
1		t the fundamental knowledge on demand and supply analysis.	
2	fix the pri	the students understand the methods of calculating production of a product thereof.	
3	adapted	le the students to understand the principles, functions and p in industry for the successful management of financial accounting	J.
4		te the fundamental knowledge on capital budgeting to evaluate a	project.
Course Ou			
		the course, students shall have ability to	.
C926.1	analysis.	rate the fundamental knowledge on demand and supply	[U]
C926.2	gross exp	e the production cost and fix price tag for a product based on the penses and market scenario.	[Ap]
C926.3		e basic principles, functions and practices for managing the accounts.	[Ap]
C926.4	Make inv	estment decisions based on the projected return on investments.	[A]
C926.5	Interpret software	the importance of cost analysis and application of accounting	[U]
Course Co	ntents:		
Types of de forecasting Production - Least cos make/buy. curves - Co under differ	emand - D - Supply - n and Cos st input – Cost Cond ost Output rent object	 And Supply Analysis Break even analysis - Demand - Supplier d Determinants of demand - Demand function - Demand elasticity - Determinants of supply - Supply function - Supply elasticity. Analysis Production function - Returns to scale - Production opti Isoquants - Managerial uses of production function, Decision cepts- Cost function - Determinants of cost - Short run and Long Decision - Estimation of Cost – Pricing - Determinants of Price ives and different market structures- Price discrimination - Pricing rysis using Software-Overview. 	Demand mization making- run cost - Pricing
Loss Stater flow analys of financial return evalu	ment and is -Funds f statement uation of ir ernal rate o s: C. M. Ch Press, S	bg (Elementary Treatment) Balance sheet and related concepts - related concepts - Financial Ratio Analysis – Break even analysis flow analysis - Comparative financial statements - Analysis & Interp ts Capital Budgeting (Elementary Treatment) Investments - R nvestment decision - Average rate of return- Payback Period - Net of return. Introduction to Accounting software packages Total Hours: nang, "Engineering Management: Meeting the Global Challenge Second Edition, 2016. "Accounting for Managers", New Age Publications (Academic)	s - Cash pretation isks and Present 45 s", CRC
۷	First, 201		

Reference E	Books:
1	A.K. Gupta, "Engineering Management", S. Chand Publication, 2016.
2	Narayanaswamy R., "Financial Accounting: A Managerial Perspective", PHI
	Learning Private Limited; 6th Revised edition, 2017.
Web Refere	nces:
1	http://bookboon.com/en/accounting-basics-ebooks
2	http://bookboon.com/en/management-organisation-ebooks
Online Reso	burces:
1	https://nptel.ac.in/courses/110101003/
2	https://onlinecourses.nptel.ac.in/noc16_mg02/course

		C	Continu	ious Asse	ssme	nt			F in al		
Form Asses				immative sessment		Total	Tota Continu Assessr	ious	End Semest Examinat		Total
8	-			120		200	40		60		100
				evels (bas				omy)			
Formativ	e Ass	sessm	nent ba	sed on Ca							
Course Outcom		Bloo Lev		со	mpon	ents fr Case \$	nent (Cho om the lis Study, Sen gnment)	t - Qı	ıiz, ·		A (16%) 0 Marks]
C926.18 C926.5	-	Inders	stand	Quiz		•					20
C926.2 8 C926.3		Apply		Assignme	ent						20
C926.4		Analys		Software							40
Assessm	ent b	based	on Su	mmative a	ind En	nd Sem	ester Exai	minat	tion		
Bloom's	Leve	1	Sum	mative As [120	sessr Marks	•	4%)	End	Semester (60		mination
		(CIA1: [(60 Marks]	CI	A2: [60	Marks]		[10Ò M		5]
Remembe	ər			30		20)		20	0	
Understar	nd			40		40)		4(0	
Apply				30		30			30	0	
Analyse				-		10)		1(0	
Evaluate				-		-			-		
Create				-		-			-		
Assessm	ent b	based		ntinuous a				mina	tion		
			Contii	nuous Ass [200 N		•	1%)				End
	CA 1	: 100	Marks			CA	2: 100 M	arks		-	emester
SA 1 (60 Marks)		FA 1 ponent I Marks		nrks) mponent - II 0 Marks)	SA (60 Marl	0 ^C	FA 2 (4 component - I 20 Marks)	Con	nrks) nponent - II) Marks)		amination (60%) 00 Marks]

Mapping of Outcomes (utcon	nes (C	CO) w	ith P	rogra	imme	Out	come	es (PC)) Pro	gram	me Sp	ecific
605						P	Os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C926.1	2	1				1	2				3	1			
C926.2	1										3				
C926.3	2										3				
C926.4		2		1							3				
C926.5	2	2		1	3						3	3			
		3 S	trong	ly agr	eed	2	Mode	eratel	y agre	ed	1	Reaso	onably	agree	b

21ME927	ADVANCED CASTING AND WELDING PROCESSES	3/0/0/3
Nature of C	ourse Theory	
Pre Requisi	tes Manufacturing technology I	
•	Industrial Metallurgy	
Course Obj	ectives:	
<u> </u>	o recollect the principle of casting design.	
	o study the different types of special casting process.	
	o descrive the fundamentals of the welding process.	
	o validate the welded structure.	
Course Out		
	letion of the course, students shall have ability to	
	escribe the casting metallurgy.	[U]
	laborate the metallurgy of welded structure	[U]
w	npart the importance of design parameters governing casting and elding process.	[Ap]
	ummarize the advancement in casting processes and welding processes	[U]
	fer the quality of casting and welding joints	[A]
Course Cor	tents:	
Welding Me - various zor welded struc Recent Tren welding, MIA welding, Las Testing of Surface mod specimens - strength, In Electrochem	chanisation, automation and pollution control - smart foundry. tallurgy and Design: Arc characteristics – current and voltage – electrod hes and its characteristics - Heat transfer and solidification - Analysis of st trures - pre and post welding heat treatments - weld joint design - weldin hds in Welding: Hot wire GTAW, Active and keyhole TIG, high frequency AB welding, cold metal transfer welding process, ultrasonic welding, electric er beam welding, Plasma welding and under water welding Robot welding lification techniques - heat treatment, shot and laser peening. Character - Optical microscope, SEM, EDS, EBSD - Macro and Micro hardness hard strength, flexural strength, fatigue strength, wear and friction ical corrosion. Non-Destructive test: Radiographic test - Electromagne	resses i g defect inductio ron bear ng. tandard ization c , Tensil n test
	ng methods Leak test.	1
Teerl D	Total Hours:	45
Text Books		
	L Jain, "Principles of Foundry Technology (paper back)", Tata McGraw H	
	ichard L Little, "Welding and Welding Technology", Tata McGraw Hill, 201	7
Reference I		
	George E Dieter. "Mechanical Metallurgy", McGraw Hill Education (Ir rd.,2017.	ndia) pv
<u> </u>	which "Advenced welding presses" Meed Lloed Dublishing in	

 Norrish, "Advanced welding process", Wood Head Publishing in Materials, Cambridge, UK, 2006.
 Larry Jeffus," Welding Principles and Applications", Cengage learning, 2011.
 H Howard B cary, "Modern Welding Technology, Prentice Hall 2004

- John Campbell, "Casting Practice" Elsevier Science Publishing Co., 2004.
- 6 "ASM Hand Book Volume 15: Casting", ASM International 2008.

Online Resources:

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1 https://nptel.ac.in/courses/112107077/

			С	ontin	uou	s As	sess	ment	:					F in al			
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8	0				12	20			200		40)		60			100
Assessm											Taxon	omy)					
Formative	e A	sses	ssme	ent b											1		
Course Outcom			loor Leve	el		(comp	one ent, C	nts fr	om Stud	the lis ly, Se	oose st - Q mina	uiz,	-			l6%) arks]
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C927.2			derst	and	As	sign	ment	/ Ser	minar							4	0
C927.3		App		!	_												
C927.4 C927.5			derst alyze		As	sign	ment	/ Cas	se stu	ıdy						4	0
Assessm	en				Imm	ative	and	End	Sem	este	er Fya	mina	tion		1		
A3363311	CII								ent (2					nester	Fxa	mir	nation
Bloom's	Lev	/el		Uui	mina		20 Ma		one (1	,	,		001	(60)			
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Remembe	ər				20				2					20			
Understar	nd				40				4)				30)		
Apply					40				2)				30)		
Analyse					-				2)				20)		
Evaluate					-				-					-			
Create					-				-					-			
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Mapping of Programme								Prog	gram	ne C	Outco	mes	(PO)				
rogramm		peer			mee	PC									PS	Os	
COs		а	b	С	d	е	f	g	h	i	i	k	I	1	2		3
C927.1		3	3	3	2	-		3					_		2		-
C927.2		3													2		
C927.3		3													3		
C927.4		3	2	2											3		
C927.5		3	3												3		
	3	Stro	ongly	agre	ed	2	Mode	erate	ly agr	eed	1	Reas	sona	bly agr	eed]	

Emerging Elective Courses

Nature of C		APPLIED SOFT COMPUTING TECHNIQUES	3/0/0/3
	ourse	Theory	
Pre-Requis	ites	-	
Course Ob	jectives:		
1	To intro	duce the idea of fuzzy sets, fuzzy logic and heuristics for solving	problems.
2	To becc	ome familiar with neural networks and form appropriate rules fo	r inferring
	the syst		
3		vide the mathematical background for carrying out the op	timizatior
		ted with neural network learning.	
4		liarize with genetic algorithms and other random search procedu	res usetu
<u>Course Ou</u>		king global optimum in self-learning situations.	
Course Ou		f the course, students shall have ability to	
C007.1		f the course, students shall have ability to he basics of soft computing concepts and techniques.	[R]
C007.1		the supervised and unsupervised artificial neural networks and	[N] [U]
0007.2	its appli		[0]
C007.3		various primitive operations on fuzzy sets with dynamic	[Ap]
200110	compon		17 YI
C007.4		enetic algorithms to combinatorial optimization problems.	[Ap]
C007.5		the process parameters of EDM and solve the travelling	[A]
	salesma	an problem	
Course Co	ntents:		
Network- S	upervised	AL NETWORK- Basic Models and Terminologies of Artificiand Learning Neural Networks: Perceptions-Adaptive Linear Neural	uron-Bac
Network- S propagation Difference Learning a organization GENETIC mutation- g parameters	upervised Multilay Learning- nd other n-Hebbiar ALGORIT enetic alg in adva	d Learning Neural Networks: Perceptions-Adaptive Linear Neuver Perception Applications. Learning from Reinforcement: -Art of Dynamic Programming-Q-Learning-Applications. Uns Neural Networks: Kohenen self-organizing Networks-Learning h Learning-Hopfield Network-Applications. THMS- Simple GA-Classification of Genetic Algorithm- cross gorithms in search and optimization- Applications: optimization of anced machining process- Electrical Discharge Machining	uron-Bac Tempora upervised ng vecto sover and of process
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	2	https://nptel.ac.in/courses/106105173/

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Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

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CO 2							P	Os							PSOs	
COs		а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
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21ME008	11	NTERNET OF THINGS FOR MECHANICAL ENGINEERS	3/0/0/3
Nature of	Course	Theory Application	
Pre Requis	sites	Basics of Electrical and Electronics Engineering	
Course Ob	ojectives	:	
1	-	et acquainted with the building blocks of Internet of Thing steristics and taxonomy of IoT levels.	s (loTs)
2		pact the value creation for an industry using IoT.	
3		n knowledge on the real time application of IoT.	
Course Ou			
		of the course, students shall have ability to	
C008.1		be the main components used in the world of IoT.	[U]
C008.2	Select solution	the tools and technologies to create new Internet of Things ns.	[Ap]
C008.3	Apply I	M2M and IoT in value creation of manufacturing Industry	[Ap]
C008.4	Implem	nent IoT in various fields like automobiles and transport system	[Ap]
C008.5	Design	and create IoT based systems for real time applications.	[C]
Course Co		- · · · ·	
Sources, C Wireless C Value Cre a	communic ommunic ation for	ntrol Units, Components in IoT -Sensors, Communication module cation Technologies, RFID, Bluetooth, Zigbee, Wifi, Rflinks, Mobile cation, Arduino boards, Data Monitoring using Arduino, Rasberry F Industry: Introduction to M2M, Architecture and Protocol of M2 mmunication, Value Creation and Challenges, Future Factory (e Internet ^D i. M, Smar
Sources, C Wireless C Value Crea Cards in M Brownfield supply cha IoT for Au parking, In system, Ele Environme	tommunic ommunic ation for A2M Con IoT- Tecl in tomotive telligent ectric To nt- Weat	cation Technologies, RFID, Bluetooth, Zigbee, Wifi, Rflinks, Mobile cation, Arduino boards, Data Monitoring using Arduino, Rasberry F Industry: Introduction to M2M, Architecture and Protocol of M2 mmunication, Value Creation and Challenges, Future Factory C hnologies for Retrofitting, IoT for Oil and Gas Industry. IoT in Manu e: Vehicle Utility control, Navigation, Tracking and Self driving ca transport system, Monitoring Driving Habits using smart phone Il collection, Smart signals. Application: Smart Factory , Smart ther Monitoring system, Air Pollution Monitoring , Forest Fire I	e Internet Pi. M, Smar Concepts ufacturing urs, Smar es, e-Ca t Objects
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Mapping of Outcomes (utcor	nes (CO)	with F	Prog	ramm	ne Ou	itcon	nes (l	PO) P	Progran	nme Sp	ecific
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C008.2	3				3										3
C008.3	3				3										3
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21ME009		DATA ANALYTICS FOR MECHANICAL ENGINEERS	3/0/0/3
Nature of C	Course	Theory	
Pre requisi	ites	Probability and Numerical Methods	
Course Ob	jectives	:	
1	To enab	ble the students to learn the principles of data analytics and decision	making.
2	To enab	ble the students to understand the concept of data exploration.	
3	To prep	are the students to apply statistical Inference.	
4		ble the students to analyze the scenario using probability an	d make
		ns under uncertainty.	
Course Ou			
Upon com	pletion o	of the course, students shall have ability to	
C009.1		e the properties of normal, binomial, poisson and exponential	[R]
00000		tions and provide suitable examples for the same.	F A 3
C009.2		v sample data to infer the properties of the entire population and	[A]
C009.3		e data files using software. ine the relationships between variables using hypothesis testing	[Ap]
C009.3		decision variables that involve uncertainty and apply linear	[A]
0003.4		nming techniques to solve the variables	נרין
C009.5		n statistical analysis and apply management science techniques to	[E]
		ecisions.	
Course Co	ntents:		
Making, Do Variables, F	escribing Probabili	ta Analysis & Decision Making: Introduction to Data Analysis and I g the Distribution of a Single Variable, Finding Relationships ty and Probability Distributions, Decision Making under Uncertainty, Support Systems, Predective Analytics	among
of data, Na forecasting series data regression, Advanced Analyzing E - Application machine le SPSS, OTA	ture and problem and ma Time 3 Data Ai Data With ns: Impo arning a A analytic	ce: Data Description - Graphical presentation of data - Numerical de d uses of forecasts – An overview of forecasting techniques - Define – methods of forecasting, qualitative and quantitative forecasting odel Hypothesis Testing, Regression analysis: linear regression, Series Analysis, Confidence Interval Estimation, Statistical Re- nalysis, Data Mining, Structural Equation Modeling, Cluster A n Correspondence Analysis, Introduction to Machine learning orting data into excel, analysis of variance and experimental design lgorithm tools: SAS Eminer, Tableau public tool – Data visualizat cs, Role of Data Analytics in Product Design and Inventory and D avioural Data Analytics, Introduction to Big Data Analytics	ning the g – Time , logistic eporting, Analysis, n. R tool ion tool:

	Total Hours:	45
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Text Boo	oks:
1	Albright, S. C., Winston, W. L., Zappe, C. J., & Broadie, M. N. "Data analysis and
	decision making (Vol. 577)". South-Western/Cengage Learning Press, 2019
2	Hamburg, M., and P. Young. Fort Worth, "Statistical Analysis for Decision Making",
	TX: Dryden Press, 2021.
3	Regi Mathew., "Business Analytics for Decision Making", First Edition By Pearson,
	2020
Reference	ce Books:
1	S. Christian Albright, Wayne Winston, Christopher Zappe, "Data Analysis and
	Decision Making with Microsoft Excel (with CD-ROM, InfoTrac, and Decision Tools
	and Statistic Tools Suite)", South-Western College Publishing, 2020.
2	Aczel Amir, Sounder pandian, Jayvel, "Complete Business Statistics", 6th Edition,
	Tata McGraw Hill, 2017.
Online	Resources:
1	www.coursera.org

		Cont	inuous As	sessm	ent				F ia al		
Forma Assess			Summati Assessm	-	Tota	I	Tota Continu Assessr	ous	End Semest Examinat		Total
80			120		200		40		60		100
Assessme							Taxonon	ny)			
Formative	Assess	sment									
Course	в	loom'					ent (Cho m the lis			F	A (16%)
Outcome	•	Level	Ass	ignmer			udy, Sen nment)	ninar	, Group	[8	0 Marks]
C009.1	Rei	nembe	er Quiz			<u> </u>					20
C009.2	Ana	alyze	Assig	nment							20
C009.3	App	oly	Tutori	al							20
C009.4	Ana	alyze	Casa	study /	Project						20
C009.5	Eva	aluate	Case	Sludy /	FIOJECI						20
Assessme	nt base	d on S	Summative	and E	nd Sem	est	ter Exam				
Bloom's L	evel	5	Summative [1	e Asses 20 Mar		(24	%)	End	Semester (60		mination
		CIA	1: [60 Mar		CIÁ2: [6	50 I	Marks]		[10Ò M		5]
Remember			30		2	20			20		
Understand	ł		30		2	20			30)	
Apply			20			40			30)	
Analyse			20			10			1(
Evaluate			-			10			1()	
Create			-			-			-		
Assessme	nt base							inati	on		
		Co	ntinuous / [20	Assess 0 Marks	•	0%	»)				End
(CA 1: 10)0 Mar	ks		C	CA	2: 100 M	arks		-	emester
SA 1) Marks)		6A 2		FA 2 (4				amination
(60 Marks)	Compo I (20 Ma		Compone - II (20 Marks	nt M	(60 arks)		omponent - I 0 Marks)		nponent - II) Marks)		(60%) 0 Marks]

COs						P	Ds							PSOs	
COS	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C009.1	3	3			3										
C009.2	3				3								3		2
C009.3	3		2		3										1
C009.4	3				3										2
C009.5	3			2	3										

21ME01	10	EXPERT SYSTEM AND MACHINE LEARNING	3/0/0/3
Nature o	of Course	Theory Application	
Pre Req		Probability and Statistical Applications	
	Objectives		
1		ne basic concepts of artificial intelligence and neural network te	chniques.
2		ize with the various steps involved in applying Artificial Intelliger	
3		tand the basic concepts of expert systems.	
4		tand the fundamentals of machine learning.	
Course	Outcomes:		
Upon co	mpletion o	of the course, students shall have ability to	
C010.1	Describe t	he fundamental problems in several sub-disciplines/domains	[U]
	of artificial	intelligence, expert systems and machine learning.	
C010.2		tensive problem-solving and inquiry-based efforts to formulate	[Ap]
	proto-type	s of AI domain constructs.	
C010.3	Apply fund	damental mathematics to formulate probabilistic models of	[Ap]
	•	systems such as expert systems, neural nets and Bayesian	
	inference s	, ,	
C010.4	Apply clas	sical logic in AI context to solve complex problems.	[Ap]
C010.5	Study the	fundamentals of machine learning its types and applications.	[U]
Course	Contents:		
formulati Problem Problem climbing- performa INTROD Supervis issues in	ion, Probler characteris solving me Depth first ance and an UCTION T sed learning machine le	TO AI AND PRODUCTION SYSTEMS : Introduction to m definition -Production systems, Control strategies, Search stics, Production system characteristics -Specialized producti ethods – Problem graphs, matching, Indexing and heuristic fur and breath first, Constraints satisfaction – Related algorithms, halysis of search algorithms. TO MACHINE LEARNING: Learning – Types of machine	strategies. on system- nctions -Hill
maximai	lv specific h	 The brain and the neuron – Design a learning system – Persp earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algorithm 	ectives and – Finding a
11102111101	ly specific h	earning – Concept learning task – Concept learning as search sypothesis – Version spaces and the candidate elimination algor	ectives and – Finding a rithm.
		earning – Concept learning task – Concept learning as search	ectives and – Finding a
	oks:	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours:	ectives and – Finding a rithm. 45
Text Bo	oks: D.W. Rols	earning – Concept learning task – Concept learning as search sypothesis – Version spaces and the candidate elimination algor	ectives and – Finding a rithm. 45 Delhi.2018
Text Bo	oks: D.W. Rols	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 6. Nagpal - Artificial Intelligence and Expert Systems, Mercury L	ectives and – Finding a rithm. 45 Delhi.2018
Text Bo	oks: D.W. Rols I. Gupta, G Dullus, 20	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 6. Nagpal - Artificial Intelligence and Expert Systems, Mercury L	ectives and – Finding a rithm. 45 Delhi.2018 .earning,
Text Bo 1 2	oks: D.W. Rols I. Gupta, G Dullus, 20 Hui Jiang	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New B. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20.	ectives and – Finding a rithm. 45 Delhi.2018 .earning,
Text Bo 1 2	oks: D.W. Rols I. Gupta, G Dullus, 20 Hui Jiang University Tom M Mit	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 3. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20. , - "Machine Learning Fundamentals A Concise Introduction", C	ectives and – Finding a rithm. 45 Delhi.2018 .earning, ambridge
Text Bo 1 2 3 4	oks: D.W. Rols I. Gupta, G Dullus, 20 Hui Jiang University Tom M Mit 2021.	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 3. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20. , - "Machine Learning Fundamentals A Concise Introduction", C Press,2021	ectives and – Finding a rithm. 45 Delhi.2018 .earning, ambridge
Text Bo 1 2 3 4	oks: D.W. Rols I. Gupta, O Dullus, 20 Hui Jiang University Tom M Mit 2021. ce Books:	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 6. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20. , - "Machine Learning Fundamentals A Concise Introduction", C Press,2021 tchell, "Machine Learning", First Edition, McGraw Hill Education	ectives and – Finding a rithm. 45 Delhi.2018 earning, ambridge , 6 th Edition
Text Bo 1 2 3 4 Referen 1	oks: D.W. Rols I. Gupta, C Dullus, 20 Hui Jiang, University Tom M Mit 2021. ce Books: E. Ric	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 6. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20. , - "Machine Learning Fundamentals A Concise Introduction", C Press,2021 tchell, "Machine Learning", First Edition, McGraw Hill Education th & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2017	ectives and – Finding a rithm. 45 Delhi.2018 .earning, ambridge , 6 th Edition 7.
Text Bo 1 2 3 4 Referent 1 2	oks: D.W. Rols I. Gupta, G Dullus, 20 Hui Jiang, University Tom M Mit 2021. Ce Books: E. Ric P.H. V	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New B. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20. , - "Machine Learning Fundamentals A Concise Introduction", C Press,2021 tchell, "Machine Learning", First Edition, McGraw Hill Education tchell, "Machine Learning", First Edition, McGraw Hill Education tchell, "Machine Learning", First Edition, McGraw Hill Education	ectives and – Finding a rithm. 45 Delhi.2018 earning, ambridge , 6 th Edition 7. 2014.
Text Bo 1 2 3 4 Referent 1	oks: D.W. Rols I. Gupta, G Dullus, 20 Hui Jiang University Tom M Mit 2021. ce Books: E. Ric P.H. V Jason	earning – Concept learning task – Concept learning as search hypothesis – Version spaces and the candidate elimination algor Total Hours: ton, Principles of AI & Expert System Development, TMH, New 6. Nagpal - Artificial Intelligence and Expert Systems, Mercury L 20. , - "Machine Learning Fundamentals A Concise Introduction", C Press,2021 tchell, "Machine Learning", First Edition, McGraw Hill Education th & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2017	ectives and – Finding a rithm. 45 Delhi.2018 earning, ambridge , 6 th Edition 7. 2014.

Web Refer	ences:
1	www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_overview.html
2	https://onlinecourses.nptel.ac.in/noc17_cs26/preview
Online Res	sources:
1	https://www.coursera.org/learn/machine-learning#syllabus
2	https://nptel.ac.in/courses/106105077/25
3	https://nptel.ac.in/courses/106105077/17

		Continu	ious Asses	ssment				E		
Forma Assess		_	ummative ssessment	ר	Fotal	Tota Continu Assessr	ious	End Semest Examinat	-	Total
80)		120		200	40		60		100
Assessme						Taxonor	ny)			
Formative	Assess	ment bas								
Course Outcome		loom's Level	со	mpone	nts fro Case S	ent (Cho m the lis tudy, Sen nment)	t - Qı	ıiz, ·		A (16%) 0 Marks]
C010.1	Und	lerstand	Assignme	ent						20
C010.2 C010.3 C010.4	App	ly	Case stu	dy / Pro	ject					40
C010.5	Und	lerstand	Assignme	ent						20
Assessme					Semes	ter Exam	inatio	on		
Bloom's L	evel	Sun	nmative As [120	sessm Marks]	ent (24	%)	End	Semester (60	-	mination
		CIA1: [60 Marks]		2: [60	Marks]		[100 N		5]
Remember			20		20			20	0	
Understand	ł		40		40			4(0	
Apply			40		40			40	0	
Analyse			-		-			-		
Evaluate			-		-			-		
Create			-	<u> </u>	-			-		
Assessme	nt base						ninati	on	1	
		Contir	nuous Ass [200 M		11 (40%	•)				End
(CA 1: 10	0 Marks			CA	2: 100 M			-	emester
SA 1 (60 Marks)	F/ Compor I (20 Ma		arks) omponent - II 20 Marks)	SA 2 (60 Marks	Co	FA 2 (4 omponent - I 0 Marks)	Con	nrks) nponent - II 0 Marks)		amination (60%) 00 Marks]

Mapping of Outcomes (utco	mes ((CO)	with	Prog	ramr	ne O	utcoi	nes (PO)	Prograr	nme Sp	ecific
						P	Os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C010.1	3				3										3
C010.2	3				3										2
C010.3	3	3		2	3										3
C010.4	3	3	3	2	3										3
C010.5	3				3										3
	3	Stro	ngly a	agree	d 2	We	akly	agre	ed ′	1 M	odera	ately	agreed		

21ME011		FUEL CELLS	3/0/0/3
Nature of C	ourse	Theory and Application	
Pre Requis	ites	Engineering Physics, Engineering Chemistry	
Course Ob	ectives:		
1	To enab	le students to understand the performance characteristics of fue	el cell and
	its comp		
2		he the performance, design characteristics and operating issues	of various
2	fuel cells		
3		rt sufficient knowledge to students about the working of fuel cell	industry.
Course Out		the course, students shall have ability to	
C011.1		e the fundamentals of fuel cell.	[U]
C011.2		the performance of fuel cell systems.	[0] [A]
C011.3		e the construction and operation of fuel cell stack and fuel cell	[U]
001110	system		[0]
C011.4		e the modelling techniques for fuel cell systems.	[Ap]
C011.5		t the different methods of fuel processing for fuel cells.	[Ap]
Course Co	ntents:		
kinetics - ty	pes of vol	otential – theoretical fuel cell efficiency – hydrogen storage – tage losses — fuel cell efficiency –- Safety issues, economic and	
kinetics – typ analysis of f Fuel cell pro- membrand pressure, te stack and de stack and sy Fuel proces – CO ₂ and	pes of vol uel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial c	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons invidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs.	d life cycle processes nditions – cells – cell cks – cell, s by steam – carbon
kinetics – ty analysis of f Fuel cell pro- membrand pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi	pes of vol uel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial c on – sulp	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons oxidation – direct electro-catalytic oxidation of hydrocarbons	d life cycle processes nditions – cells – cell cks – cell, s by steam
kinetics – typ analysis of f Fuel cell pro- membrand pressure, te stack and de stack and sy Fuel proces – CO ₂ and	pes of vol uel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial c on – sulp	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bixidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile	d life cycle processes nditions – cells – cell cks – cell, s by steam – carbon 45
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi	opes of vol uel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial co on – sulp Andrew Inc., 201 Revanka	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bixidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile	d life cycle processes nditions – cells – cell cks – cell, s by steam – carbon 45 cy & Sons.
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi Text Books	oes of vol uel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial c on – sulp : Andrew Inc., 201 Revanka publicati Dushyar	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile 18. ar shrip, "Fuel Cells: Principles, Design and Analysis",	d life cycle processes nditions – cells – cell cks – cell, by steam – carbon 45 cy & Sons. Auerbach
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi Text Books 1	opes of voluel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial co on – sulp Andrew Inc., 20' Revanka publicati Dushyar Holland Books:	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile 18. ar shrip, "Fuel Cells: Principles, Design and Analysis", ions, 2019. nt Shekhawat, "Fuel Cells: Technologies for fuel processin Publishing Co., 2018.	d life cycle processes nditions – cells – cell cks – cell, by steam – carbon 45 cy & Sons. Auerbach
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi Text Books 1 2 3 Reference I	opes of vol uel cells. ocess de e, electro mperatur esign – el /stem mo ssing Dire partial c on – sulp : Andrew Inc., 201 Revanka publicati Dushyar Holland Books: Ohayre,	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bxidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile 18. ar shrip, "Fuel Cells: Principles, Design and Analysis", ions, 2019. nt Shekhawat, "Fuel Cells: Technologies for fuel processin Publishing Co., 2018. "Fuel Cell Fundamentals", John Wiley & Sons Inc., 2018.	d life cycle processes nditions – cells – cell cks – cell, by steam – carbon 45 cy & Sons. Auerbach ng", North
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi Text Books 1 2 3 Reference I 1 2	ocess de e, electro mperatur esign – el /stem mo ssing Dire partial co on – sulp : Andrew Inc., 20 ² Revanka publicati Dushyar Holland Books: Ohayre, F. Barb Press, 2	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile 18. ar shrip, "Fuel Cells: Principles, Design and Analysis", ions, 2019. It Shekhawat, "Fuel Cells: Technologies for fuel processin Publishing Co., 2018. "Fuel Cell Fundamentals", John Wiley & Sons Inc., 2018. ir, PEM Fuel Cells: Theory and Practice (2nd Ed.) Elsevier/. 017.	d life cycle processes nditions – cells – cell cks – cell, by steam – carbon 45 cy & Sons. Auerbach ng", North Academic
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi Text Books 1 2 3 Reference 1 1 2 3	ocess of vol uel cells. ocess de e, electro mperatur esign – el ystem mo ssing Dire partial c on – sulp : Andrew Inc., 201 Revanka publicati Dushyar Holland Books: Ohayre, F. Barb Press, 2 San Pin Material	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons bxidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile 18. ar shrip, "Fuel Cells: Principles, Design and Analysis", ions, 2019. nt Shekhawat, "Fuel Cells: Technologies for fuel processin Publishing Co., 2018. "Fuel Cell Fundamentals", John Wiley & Sons Inc., 2018. ir, PEM Fuel Cells: Theory and Practice (2nd Ed.) Elsevier/.	d life cycle processes nditions – cells – cell cks – cell, by steam – carbon 45 cy & Sons. Auerbach ng", North Academic
kinetics – ty analysis of f Fuel cell pro- pressure, te stack and de stack and sy Fuel proces – CO ₂ and decompositi Text Books 1 2 3 Reference I 1 2	ocess de e, electro mperatur esign – el /stem mo ssing Dire partial c on – sulp : Andrew Inc., 207 Revanka publicati Dushyar Holland Books: Ohayre, F. Barb Press, 2 San Pin Material ources:	tage losses — fuel cell efficiency — Safety issues, economic and sign Main PEM fuel cell components, materials, properties and p de, gas diffusion layer, bi-polar plates – fuel cell operating co e, flow rates, humidity – main components of solid-oxide fuel c ectrode polarization – testing of electrodes – cells and short sta delling. ect and indirect internal reforming – reformation of hydrocarbons boxidation – direct electro-catalytic oxidation of hydrocarbons hur tolerance and removal – using renewable fuels for SOFCs. Total Hours: L. Dicks and David A. J. Rand, "Fuel Cell Explained", John Wile 18. ar shrip, "Fuel Cells: Principles, Design and Analysis", ions, 2019. nt Shekhawat, "Fuel Cells: Technologies for fuel processin Publishing Co., 2018. "Fuel Cells: Theory and Practice (2nd Ed.) Elsevier/. 017. g Jiang, Qingfeng Li, "Introduction to Fuel Cells Electrochem	d life cycle processes nditions – cells – cell cks – cell, by steam – carbon 45 cy & Sons. Auerbach ng", North Academic

		C	Continu	ious Asses	sment				E. J				
Formative Assessment				immative sessment	То	tal	Total Continuous Assessment		End Semest Examinat		Total		
80			120	20	200 40			60		100			
Assessm	ent M	Metho	ds & Lo	evels (base	ed on Blo	ooms	s' Taxono	omy)					
Formativ	e As	sessm	nent ba	sed on Ca									
Course Bloom's Outcome Level		Assessm con Assignn	nponent	ıiz, ·	FA (16%)								
C011.1 C011.3		Jnders Jnders		Objective type Quiz							20		
C011.2		Analyz	е	Case stud	40								
C011.4	ŀ	Apply		Tutorial		20							
	C011.5 Apply										20		
Assessm	ent k	based		mmative ar									
Bloom's	l eve	1	Sum	mative Ass [120 M	t (24	End	d Semester Examination (60%)						
Bloom's Level		-		60 Marks]		[60]	Marks]		[100 Marks]				
Remember			-	10		10			10				
Understand			:	30		30							
Apply			40		40			40					
Analyse			20		20			20					
Evaluate		-		-									
Create				-		-			-				
Assessm	ent k	based		ntinuous a				mina	tion				
			Contii	nuous Asso [200 Mi		(40%	%)				End		
CA 1: 100 Marks CA 2: 100 Marks									S	Semester			
	FA 1	rks)			FA 2 (4		rks)	Exa	amination				
SA 1 (60 Marks)		Component - (mponent - II 0 Marks)	SA 2 (60 Marks)		omponent Cor - I		nponent - II [1 0 Marks)		(60%) 00 Marks]		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs													PSOs		
	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3	
C011.1	3	2	1		3											
C011.2	3	3	3		3									3		
C011.3	3	2			3									1		
C011.4	3	2	1		3									1		
C011.5	3		1		3									1		
	•	•	•			•	•	•	•	•	•	•			•	
3	3 Strongly agreed 2 Moderately agreed 1 Reasonably ag										agreed					

21ME012		PRODUCT LIFECYCLE MANAGEMENT	3/0/0/3			
Nature of 0	Course	Theory				
Pre requisi	ites	CAD/CAM laboratory				
Course Ob	jectives:	·				
1	applicatio	re knowledge on the principles, best practices, current advancen ons of Product Life cycle Management.				
2	To study phase".	all the aspects of a product's life cycle from "design phase" to "e	end of life			
3	product c	rstand and experience effective integration of PLM technolo development process that provides competitive advantage to ind sectors to deliver innovative products.				
Course Ou	tcomes:					
Upon com	pletion of	the course, students shall have ability to				
C012.1		ze with the fundamentals of the product lifecycle and thus he capability to apply them.	[R]			
C012.2						
C012.3	Manage developm	and analyze the challenges in different stages of product nent.	[A]			
C012.4	Apply the problems	e tools/techniques of product life cycle management to industrial	[Ap]			
C012.5		ital manufacturing framework in product development process ness considerations.	[Ap]			
Course Co	ntents:					
Elements; S Extended E Architecture	Stages; Co Enterprise, es Of PDM	INTRODUCTION: Product Lifecycle -Definition, Need and Corporate Challenges; E-Commerce -B To B, B ToC Forms of I Product Data Management -CIM Data, PDM Functions, Definition Systems, Information Flow Model In Product Development, En Manufacturing Bill Of Materials.	Business, hition And			
Validation a	nt process and analy:	OPMENT PROCESS & METHODOLOGIES: Integrated s Conceive – Specification, Concept design, Design - Detaile sis, Concurrent engineering - work structuring and team Dep refinition of concepts - Fundamental issues - Role of Process ch	d design, ployment,			

product models, Value engineering in product design. Introduction to product design tools -Computer Aided Design, DFM, DFA, Ergonomics in product design, Product launch & engineering change, Sustainable design.

ENABLING TECHNOLOGIES AND RECENT ADVANCEMENTS: Business Process Reengineering; Enterprise Resource Planning; Managing a design project; Introduction to Digital Manufacturing; Applications of soft computing in product development process; PLM Softwaresover view; Use of visualization in several stages of lifecycle - Case studies.

	Total Hours	45
Text B	ooks:	
1	Uthayan Elangovan, "Product Lifecycle Management (PLM): A Digital Journ Industrial Internet of Things (IIoT) ", CRC Press; 1st edition July 9, 2020	ey Using
2	John Stark, "Product Lifecycle Management: 21 Century Paradigm for Realisation", 2 nd Edition Springer Publisher, 2011.	Product
3	Grieves Michael, Product Lifecycle Management- Driving the Next Generatio Thinking, McGraw-Hill, 2006.	n of Lean

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Reference B	ooks:
1	Kevin Roebuck, Product Lifecycle Management (PLM): High-impact Strategies –
	What You Need to Know: Definitions, Adoptions, Impact, Benefits, Maturity,
	Vendors, Emereo, 2020.
2	Ohn Stark, Product Lifecycle Management: 21st Century Paradigm for Product
	Realisation, Springer Publisher, 2020
3	Abele, E. et al., Environmentally-friendly Product Development Methods and
	Tools, Springer, 2005.
Web Refere	nces:
1	http://plmbook.com/
2	www.aberdeen.com
Online Reso	urces:
1	https://nptel.ac.in/courses/110104070/9
2	https://nptel.ac.in/courses/110/104/110104084/
3	https://nptel.ac.in/courses/112107217/2

		Continu	ious Asses	sment				End				
Forma Assess		-	ummative ssessment	То	otal	Tota Continu Assessr	ous	End Semest Examinat	-	Total		
80			120		00	40		60		100		
Assessme	nt Met	nods & Le	vels (base	d on Blo	oms'	Taxonon	ny)					
Formative	Asses	sment bas	1									
				Assessment Component (Choose and map components from the list - Quiz,								
Course		Bloom's			FA (16%)							
Outcome		Level	Assign	, Group	[80 Marks]							
00404												
C012.1	-	member	Quiz						20			
C012.2	-	member	Assignme	ent						20		
C012.3		alyze										
C012.4	Ap		Project / I	Project / Lab Tutorial 40								
C012.5	Ap											
Assessme	nt base	1										
Discusion		Sur	mative As		nt (24	·%)	End		Examination			
Bloom's L	evei	CIA4. [Marks]	100	Markal	(60%) [100 Marks]					
Remember		-	60 Marks] 30	CIAZ:	20	Marks]	20			5]		
Understand			<u> </u>		<u>20</u> 50		30					
	1		20		20							
Apply			20		20		40					
Analyse Evaluate			-		10		10					
Create			-		-			-				
Assessme	nt bac	d on Con	- tinuous an		-	tor Exam	inati	- 01				
A336321116	111 0450		nuous Ass				mau					
			[200 M		(40 /					End		
(CA 1: 1	00 Marks			CA	2: 100 Ma	arks		-	emester		
SA 1	F	A 1 (40 Ma		SA 2		FA 2 (4			-	amination		
(60	Compo	onent - Co	omponent	(60	Co	omponent	Con	nponent -		(60%)		
Marks)	ו (20 M	arks) (2	- II 0 Marks)	(00 Marks)	(2	- I 0 Marks)	(20	ll) Marks)	[10	0 Marks]		

	Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
00-		POs											PSOs			
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3	
C012.1	3	3									3			1		
C012.2	3							2			2			2		
C012.3	3	3	3					2			2			2		
C012.4	3							2				3				
C012.5	3				3			2						3		
3	Stro	ongly	agree	ed 2	Mo	odera	itely a	agree	d 1	Re	easor	ably	agreed			

Open Elective Courses

21ME001

Nature of CourseTheoryPre RequisitesNil

Course C	Objectives:
1	To enable students to understand the basic Industrial safety engineering acts and rules.
2	To impart knowledge on OSHAS (Occupational Safety and Health Assessment Series) in engineering Industry.
3	To enable the students to identify the causes of accidents and its preventions.
4	To produce the desire to the interaction of the second s

4 To make students to identify hazard and assess the risks using suitable techniques. Course Outcomes:

Upon completion of the course, students shall have ability to

C001.1	Identify the evolution of industrial safety acts, rules and health standards.	[R]
C001.2	Summarize different safety management activities in industry.	[U]
C001.3	Prepare accident, investigation report and preventive guidelines to industry.	[Ap]
C001.4	Analyse the process to avoid, prevent and control workplace hazards.	[A]
C001.5	Evaluate the role of government agencies and private consulting agencies in safety training	[E]

Course Contents:

BASICS OF SAFETY ENGINEERING & ACTS: Evolution of modern safety concept – safety audit; Acts – factories act – 1948 – statutory authorities – inspecting staff – Tamilnadu factories Rules 1950 under safety and health – environment act 1986 – air act 1981, water act 1974 – labour laws; safety in industries – general safety concepts, machine guarding, hazards in metal removing process, check list for LPG installations, safety precautions using CNG. Introduction to OHSAS 18000 and 14000, National Disaster Management Act.

SAFETY MANAGEMENT: History of Safety movement – general concepts of management – planning for safety for optimization of productivity -productivity, quality and safety-line staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling. Fire Explosion and toxicity Index. **ACCIDENT INVESTIGATION AND REPORTING:** Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents - Class exercise with case study

SAFETY PERFORMANCE MONITORING: Reactive and proactive monitoring techniques -Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate. **SAFETY EDUCATION AND TRAINING:** Importance of training - identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice motivation – communication - 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 Hours: 45

Text Books:	
1	Charles D. Reese "Occupational Health and Safety Management: A Practical
	Approach", 3 rd Edition CRC press 2015.
2	Mark A. Friend, James P. Kohn "Fundamentals of Occupational Safety and
	Health" 6 th Edition Bernan press, 2014.
3	Krishnan N.V., "Safety Management in Industry", Jaico Publishing House,
	Bombay, 2015.
Reference Be	ooks:
1	Joel M. Haight, "Principles of Industrial Safety", ASSE publishers, 2017
2	R.K. Mishra, "Safety Management", AITBS publishers, 2016
3	Relevant India Acts and Rules, Government of India, 2017
4	C. Ray Asfahl, David W. Rieske "Industrial Safety and health management",
	Practice,7th Edition, Pearson, 2018
Web Referen	Ces:
1	www.nptel.ac.in/courses/110105094
Online Reso	urces:
1	http;//nptel.ac.in/courses/112107143/40
2	http://dce.mst.edu/credit/certificates/safety engineering

		Continu	ious Asses	sment	t		End				
Format Assessi	-	_	ummative ssessment		Total	Tota Continu Assessi	ious	Semester Examination		Total	
80			120		200	40		60		100	
Assessmen						Taxonor	ny)				
Formative A	Assess	ment bas									
						nent (Cho					
Course		oom's		components from the list - Quiz,							
Outcome	L	_evel	Assignr	ment, (, Group	[80 Marks]					
C001.1	Rem	nember	Quiz			-				20	
C001.2	Und	erstand	Assignme	ent						20	
C001.3	Арр	У	Technical	Somir	oor				20		
C001.4	Ana	yse	Technical	Technical Seminar							
C001.5	Eva	uate	Case stud	dy			20				
Assessmen	t based										
		Sun	nmative As		•	4%)	End	Semester	-	mination	
Bloom's Le	vel			Marks				•	(60%)		
			60 Marks]	CIA		Marks]	[100 Marks]				
Remember			30		10		30				
Understand			40		40		30				
Apply			30		40		30				
Analyse			-		10		10				
Evaluate			-		-			-			
Create	4 6 6 6 6 6	l an Can	-	d End	-	ter Even		-			
Assessmen	it pased		nuous an				innati				
		Contil	[200 Ma		iit (407	oj				End	
C	A 1: 10	0 Marks			CA	2: 100 M	arks		-	emester	
SA 1	FA	1 (40 Ma	arks)	SA	2	FA 2 (4	40 Ma	rks)	Exa	amination	
(60	Compon	ent - Co	omponent	(60		omponent	Con	nponent -		(60%)	
Marks)	ا (20 Maı	·ks) (2	- II 20 Marks)	Mark	\sim	- I 0 Marks)	(20	ll) Marks)	[10	0 Marks]	

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<u> </u>	POs											PSOs			
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3
C001.1	3		2			2		2				2			2
C001.2	3		2			2		3							
C001.3	3	2				3		3				3			2
C001.4	3	2				3		3				3			
C001.5	3	2				3		3				3			

		FUNDAMENTALS OF MEMS/NEMS	3/0/0/3
Nature of C	ourse	Theory	
Pre requisit	tes	Basics of Physics and Chemistry	
Course Obj	ectives:		
1		e the students learn various techniques available to make micro arious materials.	shapes
2		rt the methodologies to be followed in micro fabrication and form	ning.
3	To enha applicati	nce the students knowledge about MEMS / NEMS devices and ions.	their
Course Out			
Upon comp	letion of	f the course, students shall have ability to	
C002.1	Recall th	ne basic concepts related to MEMS / NEMS.	[R]
C002.2		e the various fabrication techniques and micro machining es for MEMS / NEMS.	[U]
C002.3	Apply va System.	arious fabrication techniques to develop a MEMS / NEMS	[Ap]
C002.4	Analyse	the characteristics of MEMS and NEMS devices.	[A]
C002.5	Discuss	the principles and applications of MEOMS	[U]
Course Co	ntents:		
-Line-Width and Experin Photolithogr Generation ADDITIVE T Physical Va Sol-Gel Dep	- Lithogra nental De aphy Re – Emergi FECHNO por Depo position Te	 HOGRAPHY: Introduction, Photolithography- Overview Critical D raphic Sensitivity and Intrinsic Resist Sensitivity Resist Profiles- etermination of Lithographic Sensitivity Resolution in Photolithor esolution - Enhancement Technology Beyond Moore's L ing Lithography Technologies. LOGY: Introduction –Silicon Growth -Doping of Si - Oxidation of position - Chemical Vapor Deposition- Silk-Screening or Screen- echnique. Plasma Spraying - Deposition and Arraying Methods of and BIONEMS - Thin versus Thick Film Deposition - Selection O 	Contrast ography - aw Next of Silicon- Printing -
Deposition N	Method. N		

Text Books:	
1	Tai-Ran-Hsu, "MEMS & Microsystems: Design and Manufacture", McGraw Hill, 17 th Reprint, 2013.
2	Chang Liu, "Foundations of MEMS", Pearson education India limited, 2nd Edition, 2011.
Reference B	poks:
1	V.K. Jain, "Micro manufacturing Processes", CRC Press, 2016.
2	Marc J Madou, "Fundamentals of Microfabrication and Nanotechnology", CRC Press, 2011.
Web Referen	ces:
1	https://youtu.be/ZcCXFrHQ7Ao/Introduction to Materials Science for MEMS and NEMS
Online Reso	urces:
1	MEMS and Microsystems- https://nptel.ac.in/courses/117105082/
2	https://www.coursera.org/learn/MEMS/NEMS

			Continu	Jous Asse	essment				E. J			
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8	-			120		00	40		60		100	
				evels (bas				omy)				
Formative	<u>e A</u> :	ssessi	nent ba	ised on Ca								
Course Outcome		Assignment)						Jiz, ·	FA (16%)			
C002.1		Reme	mber	Quiz			20					
C002.2 C002.5		Under	stand	Assignment							20	
C002.3		Apply		Technical Presentation							20	
C002.4		Analy	se	Assignment							20	
Assessm	ent	based	l on Su	mmative a	nd End	Seme	ster Exa	minat	tion			
Bloom's	Lev	el	Sum	mative As [120	ssessme Marks]	nt (24	%)	Enc		r Ex)%)	amination	
			CIA1: [60 Marks]		: [60	Marks]			Marks]		
Remembe	ər		-	20		30	_		2	20	_	
Understar	nd			40		30				-0		
Apply				40		30			-	80		
Analyse				-		10			1	0		
Evaluate				-		-				-		
Create				-		-	/ F		· · · · · ·	-		
Assessm	ent	pased		ntinuous a				mina	tion			
				nuous Ass [200 N		•				_	End	
	CA		Marks			CA	2: 100 M			-	Semester	
SA 1 (60 Marks)		mponei I		mponent - II	SA 2 (60 Marks)		FA 2 (4 omponent - I	Con	nponent - II		amination (60%) 00 Marks]	
	(2	0 Mark	s) (2	0 Marks)		(2	0 Marks)	(20) Marks)			

COs	POs											PSOs			
	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C002.1	3				3										
C002.2	3				3										
C002.3	3				3									2	
C002.4	3	1	2	2	3										
C002.5	3				3										3

21ME003		TOTAL QUALITY MANAGEMENT	3/0/0/3
Nature of C	ourse	D (Theory Application)	
Pre Requis	ites	Nil	
Course Ob	jectives:		
1.	To reco control	ollect the engineering and management aspects of quality planr	ning and
2.		he methodology of improving quality in manufacturing process / p	roducts
3.	To impl	ement the concepts of quality management system	
Course Ou	tcomes:		
Jpon comp	oletion o	f the course, students shall have ability to	
C003.1	Define t	the basic concepts of quality management	[U]
C003.2	Recall t	he fundamentals of Total Quality Management and its tools.	[R]
C003.3		e the role of TQM tools and techniques in elimination of es and reduction of defects.	[A]
C003.4	Inculcat	te the concepts of quality and continuous improvement as a n and habit.	[Ap]
C003.5		e and understand the industrial problem and provide the optimal	[A]
	ntents:		
QUALITY C costs. Cost Quality Gur Design Cor Design for F PROCESS	CONCEP estimatic ru's, Crite ncepts ar Robustne	TS: Definition of quality, dimensions of quality, quality planning on and principles, leadership, quality council, quality statements, seria for Deming's Prize. PRODUCT DESIGN AND ANALYSIS and TQM Principles, Failure Mode Effect Analysis, Fault Tree A ess, Value Analysis.	strategic S: Basi Analysis
QUALITY C costs. Cost Quality Gur Design Cor Design for F PROCESS Sigma App Paradigms, Fools, Qual QUALITY SO9000, T	CONCEP estimatic ru's, Crite acepts ar Robustne IMPROV proach, Quality ity Functi MANAG S16949:	on and principles, leadership, quality council, quality statements, seria for Deming's Prize. PRODUCT DESIGN AND ANALYSIS and TQM Principles, Failure Mode Effect Analysis, Fault Tree A ess, Value Analysis. /EMENT AND MODERN PRODUCTION MANAGEMENT TOO Total Productive Maintenance, Just-In-Time, Lean Manuf Improvement Tools and Continuous Improvement. Q-7Tools, N ion Deployment, Kaizen, 5S, Poka- Yoke, SMED. EMENT SYSTEMS: Quality Management Systems, Introdu 2002 and EMS 14001certifications. OHSAS 18001 Occupational	strategic S: Basi Analysis DLS: Si acturing New Q-
QUALITY C costs. Cost Quality Gur Design Cor Design for F PROCESS Sigma App Paradigms, Fools, Qual QUALITY SO9000, T	CONCEP estimatic ru's, Crite acepts ar Robustne IMPROV proach, Quality ity Functi MANAG S16949:	on and principles, leadership, quality council, quality statements, seria for Deming's Prize. PRODUCT DESIGN AND ANALYSIS and TQM Principles, Failure Mode Effect Analysis, Fault Tree A ess, Value Analysis. /EMENT AND MODERN PRODUCTION MANAGEMENT TOC Total Productive Maintenance, Just-In-Time, Lean Manuf Improvement Tools and Continuous Improvement. Q-7Tools, N ion Deployment, Kaizen, 5S, Poka- Yoke, SMED. EMENT SYSTEMS: Quality Management Systems, Introdu 2002 and EMS 14001certifications. OHSAS 18001 Occupationant Series.	strategic S: Basi Analysis DLS: Si acturing New Q- ction to al Healt
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QUALITY Coosts. Cost Quality Gur Design Cor Design for F PROCESS Sigma App Paradigms, Tools, Qual QUALITY SO9000, T & Safety As Text Books 1. 2. Reference 1. 2.	CONCEP estimatic ru's, Crite ncepts ar Robustne IMPROV proach, Quality ity Functi MANAGI S16949: sessmer DaleH. E Educatic Sunil Sh India Lin Books: Poornim Educatic James F Learning	on and principles, leadership, quality council, quality statements, seria for Deming's Prize. PRODUCT DESIGN AND ANALYSIS and TQM Principles, Failure Mode Effect Analysis, Fault Tree A ess, Value Analysis. /EMENT AND MODERN PRODUCTION MANAGEMENT TOO Total Productive Maintenance, Just-In-Time, Lean Manuf- Improvement Tools and Continuous Improvement. Q-7Tools, N ion Deployment, Kaizen, 5S, Poka- Yoke, SMED. EMENT SYSTEMS: Quality Management Systems, Introdu 2002 and EMS 14001certifications. OHSAS 18001 Occupationa at Series. Total Hours: Besterfield "Total Engineering Quality Management", 6thEdition, Ma nited, 2019. a M.Charantimath, "Total Quality Management", 5thEdition, on, 2019. R Evans, "Quality and Performance Excellence", 8thEdition, 0	strategic S: Basi Analysis OLS: Si acturing New Q- ction to al Health <u>45</u> Pearso ac Milla Pearso
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		Co	ntinu	ous Asse	ssme	ent			E. J		
Form Asses	ative sment			mmative sessment		Total	Tota Continu Assessi	ious	End Semest Examinat	-	Total
8	0			120		200	40		60		100
Assessm	nent M	ethods	s & Le	vels (bas	ed or	n Bloom	is' Taxono	omy)			
Formativ	e Asse	essme	nt ba	sed on Ca							
Course Outcom		Bloom Leve		со	mpoi	nents fr , Case S	nent (Cho om the lis Study, Ser	t - Qı	ıiz, ·		A (16%) 0 Marks]
C002 1		adarate	Assignment)								20
C003.1 C003.2			erstand Quiz								20 20
C003.2 C003.3		nalyze	nember Assignment lyze Assignment								20
C003.4											-
C003.5	Assignment/Lutorial										20
			n Sun	nmative a	nd E	nd Sem	ester Exa	mina	tion		
				mative As					Semester	Exa	mination
Bloom's	Level			[120	Mark	s]	-		(60	%)	
		CL	A1: [6	0 Marks]	С	IA2: [60	Marks]		[100 N	lark	6]
Remembe	er		4	10		40			30	0	
Understa	nd		4	10		30)		4(0	
Apply			1	0		10)		20	0	
Analyse			1	0		20)		1(0	
Evaluate				-		-			-		
Create				-		-			-		
Assessm	nent ba			tinuous a				mina	tion		
		(Contin	uous Ass [200 N		•	%)				End
CA 1: 100 Marks CA 2: 100 Marks Semester											
SA 1		FA 1 (4	10 Ma	rks)	5/	2	FA 2 (4		1	Exa	amination
(60 Marks)	-	onent - I Iarks)		nponent - II Marks)	(6	50 C	omponent - I 20 Marks)		nponent - II) Marks)	(60%) [100 Marks]	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

005		-				P	Os						PSOs			
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3	
C003.1	3											3				
C003.2	3	2				2										
C003.3	3	3	3						3							
C003.4	3	2	2			2			3							
C003.5	3					2			3							
	•															
3	S Stro	Strongly agreed 2 Moderately agreed 1 Reasonably agreed														

21ME004	PRODUCT DEVELOPMENT	3/0/0/3
Nature of 0	Course Theory application	
Pre Requis	sites Nil	
Course Ob	jectives:	
1	To describe the basic concept of product development.	
2	To learn the concepts and tools that is necessary for product design	gn and
	manufacturing	
3	To apply the new product development process by devising a new pro	duct or
	service and an introductory launch plan.	
Course Ou		
	pletion of the course, students shall have ability to	F1 13
C004.1	Identify concept generation activities and summarize the methodology involved in concept selection and testing.	[U]
C004.2	Describe the different stages involved in product development.	[U]
C004.3	Analyze the relative importance of customer needs in establishing product	[A]
	specifications.	
C004.4	Applying the design knowledge in design for manufacturing.	[Ap]
C004.5	Devise innovative product development plan with environmental and	[Ap]
	societal consideration.	
Course Co		
	CTION: Importance of engineering design, New product development p	
	velopment Methodologies - Identifying Market Opportunities -Identifying Cu	
	leeds - Concept generation- Concept selection - Pugh Matrix method - c	concept
screening a	and scoring-Concept testing-Product Planning - Strategic Planning.	
	HINKING TECHNIQUES: Product Specifications - Product Architecture - In	
•	ser Interface Design – Function based design - Designing to codes and star	ndards.
IRIZ- axior	natic design - Product Development Economics.	
	DR MANUFACTURING: Design for Manufacturing Robust Design - Proto	tvnina -
	esting and Reliability - Simulation and Design Tools. DESIGN FOR	
	IENT: Design for the Environment - Product Life Cycle Management. Role	
	s (Aero, Auto, Electronics), Human factors design - Sustainable Manufact	
Product La		5
	Total Hours:	45
Text Books	8:	
1	Ulrich, Karl, and Steven Eppinger. "Product Design and Development", 7 th New York, Y: McGraw-Hill, 2020.	edition.
2	Chitale, AK, Gupta, RC, "Product Design and Manufacturing" PHI, 2013.	
∠ Reference		
1	Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Develo	
I		opmont
2		opment
	", 4th Edition, , Tata McGraw-Hill Education, 2015.	
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3	", 4th Edition, , Tata McGraw-Hill Education, 2015. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Edu 2014.	
	", 4th Edition, , Tata McGraw-Hill Education, 2015. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Edu 2014.	ication,
	 ", 4th Edition, , Tata McGraw-Hill Education, 2015. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Edu 2014. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGramiternational Edition, 4th Edition, 2017. 	ication,
3	 ", 4th Edition, , Tata McGraw-Hill Education, 2015. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Edu 2014. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGramiternational Edition, 4th Edition, 2017. 	ication,
3 Online Res	 ", 4th Edition, , Tata McGraw-Hill Education, 2015. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Edu 2014. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGi International Edition, 4th Edition, 2017. 	raw-Hill
3 Online Res 1	 ", 4th Edition, , Tata McGraw-Hill Education, 2015. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Edu 2014. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGr International Edition, 4th Edition, 2017. sources: www.nptel.ac.in/courses/112107217/ 	raw-Hill

		Con	ntinuous Asse	ssment				E a al			
Form Assess			Summative Assessment	То	tal	Tota Continu Assessr	ous	End Semeste Examinat	-	Total	
8)		120	20	0	40		60		100	
			& Levels (bas				omy)				
Formative	e Asse	ssmen	t based on Ca						1		
Course Outcome		Bloom' Level	s co	ment Component (Choose and map omponents from the list - Quiz, ment, Case Study, Seminar, Group Assignment)						A (16%) 0 Marks]	
C004.1 C004.2		derstand Quiz								20	
C004.3	An	lyse Assignment							20		
C004.4	Ар	ply								20	
C004.5		Apply Seminar								20	
Assessm	ent ba	1	Summative a								
		5	Summative As		t (24	.%)	End	Semester		mination	
Bloom's I	_evel			Marks]	T CO 1	Marikal		(60)		.1	
Remembe	.r		1: [60 Marks] 30		20	Marks]		[100 M			
Understar			40		40			30	-		
Apply	iu -		20		20		30				
Analyse			10		20			20			
Evaluate			-		-			-	-		
Create			-		-			-			
Assessm	ent bas	sed on	Continuous a	and End S	Seme	ester Exa	mina	tion			
		Co	ontinuous Ass	sessment	(40%	%)					
			[200 N	larks]					-	End	
	CA 1: 1				CA	2: 100 M				emester	
SA 1		<u> </u>) Marks)	SA 2		FA 2 (4			-		
(60 Marks)	Compo I (20 Ma		Component - II (20 Marks)	Component (60 Component Component - II Marks) - I II						(60%) [100 Marks]	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

outcomes (1 00)															
<u> </u>		POs										PSOs			
COs	а	b	С	d	е	f	g	h	i	j	k	-	1	2	3
C004.1	3		3			2							1		
C004.2	3	3	3			2							1		
C004.3	3	3	3			2							3		
C004.4	3		3			3	3						2	3	
C004.5	2	2	2				3					1		2	
3 Strongly agreed 2 Moderately agreed 1 Reasonably agreed															

21ME005	I	FUNDAMENTALS OF ADDITIVE MANUFACTURING	3/0/0/3
Nature of 0	Course	Theory application	
Pre requis	ites	-	
Course Ob	jectives:		
1.	To provid	e a detailed insite on the additive manufacturing processes.	
2.		n understanding the need, types, application, method of operation AM system in industrial applications.	and the
3.	To enhan	ce innovative thinking and solve business case studies in AM tec	chnique.
Course Ou Upon com		the course, students shall have ability to	
C005.1		e basic concepts of Additive manufacturing technologies along nt trends in advanced manufacturing.	[R]
C005.2		the different methods used for pre-processing and post of additive manufactured products.	[U]
C005.3		rate the uses of additive manufacturing in automobile, e and biomedical fields.	[Ap]
C005.4	Select ar printed pa	nd use the correct CAD formats in the manufacturing of 3D arts.	[Ap]
C005.5	Design th	e product using additive manufacturing techniques.	[E]
Course Co	ntents:		

INTRODUCTION TO RAPID MANUFACTURING:

Evolution, fundamental fabrication processes, CAD for AM, product design and rapid product development – Needs – Impact of AM and Rapid Tooling on Product Development – The Generalized AM Process chain – CAD Model - 3D modelling -3D solid modeling software and their role in AM – Input file formats – Generation and Conversion of STL file – File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing - AM Benefits - Classification of AM systems

TYPES OF ADDITIVE MANUFACTURING PROCESS:

Liquid based systems: Stereolithography – Solid Ground Curing – Polyjet printing – Applications. Solid based systems: Fusion Deposition Modeling – Laminated Object Manufacturing – Solid Deposition Manufacturing –Applications. Powder based systems: Selective Laser Sintering – 3-Dimensional Printers – Laser Engineered Net Shaping – Electron Beam Melting Process – Applications. Other Systems: Metal Additive Manufacturing (SLM, Inkjet, etc), Sand/Ceramics Printing. Advanced materials - Electronic Materials, Bio printing-Food Printing.

APPLICATIONS OF ADDITIVE MANUFACTURING:

Rapid Tooling and Applications of AM: Direct Rapid Tooling, Indirect Rapid Tooling: Soft tooling and Hard tooling – Conversion of CT / MRI scan data – Customized implant - Reverse engineering – Case studies on current application of AM – Novel Application of AM systems – Future trends of AM system. Application of AM in Medical, Automotive, Aeronautical, Space and Construction Industries. Customized design and fabrication for medical applications.

	I Otal Hours: 45
Text Book	S:
1	C.K. Chua, K.F. Leong, C.S. Lim, "Rapid prototyping Principles & Application (3rd Edition), World Scientific Publication, 2018.
2	Additive Manufacturing Design, Methods & Processes, Steinarkilli, Taylor & Francis Publication, 2017.

Reference Bo	oks:
1	Liou, W.F., Rapid Prototyping and Engineering Applications, A toolbox for
	prototype development, CRC Press, Taylor & Francis Group LLC, USA, 2018.
2	Hopkinson, N., Hague, R.J.M, and Dickens, P.M., Rapid Manufacturing, An
	Industrial Revolution for the Digital Age, John Wiley & Sons, Ltd, UK, 2016.
Web Reference	ces:
1	http://nptel.ac.in/courses/112107077/382.
2	http://nptel.ac.in/courses/112107078/37
3	http://nptel.ac.in/courses/112102103/16
Online Resou	rces:
1	https://www.technosofteng.com
2	https://schooledbyscience.com
3	https://www.metal-am.com

		Contir	nuous Asse	essmei	nt			E			
Form Asses			Summative ssessment		Total	Tota Continu Assessr	ious	End Semest Examinat		Total	
8	0		120		200	40		60		100	
			Levels (bas				omy)				
Formative	e Asse	ssment k	ased on Ca								
Course Outcom		Bloom's Level	со	mpon	ents fro Case S	nent (Cho om the lis tudy, Ser nment)	t - Qı	ıiz, ·		A (16%) 0 Marks]	
C005.1	Re	member	Assignment)							20	
C005.2	_	derstand								20	
C005.3	Ap									20	
C005.4	Ap		,							20	
C005.5		Aluate Assignment								20	
Assessment based on Summative and End Semester Examination											
		Su	mmative As		•	4%)	End	Semester	Exa	mination	
Bloom's	Level			Marks				(60			
		CIA1:	[60 Marks]	CI	A2: [60	Marks]			Marks]		
Remembe			30		20				20		
Understar	nd		50		40			4(-		
Apply			20		40			4(0		
Analyse			-		-			-			
Evaluate			-		-			-			
Create			-		-			-			
Assessm	ent ba		ontinuous a				mina	tion			
		Con	tinuous Ass [200 N		ient (40	70)				End	
		00 Mark		nai Koj	C۵	2: 100 M	arks		S	emester	
						FA 2 (4		rks)	-	amination	
SA 1 (60 Marks)	Compo I	FA 1 (40 Marks)Component -ComponentI- II(20 Marks)(20 Marks)				omponent - I 0 Marks)	Con	nponent - II) Marks)		(60%) 00 Marks]	

COs						P	Os							PSOs	
COS	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C005.1	3	2												3	
C005.2	3	2			2									3	
C005.3	3													3	
C005.4	3		3		2									3	
C005.5	3	3	3	3										3	

21	М	F0	06
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Nature of CourseTheoryPre RequisitesNil

e e quit		
Course Ob	jectives:	
1	To expos	se the student to the basic concepts of management in order to make them
	understa	nding how an organization function.
2	To creat	e awareness among the students about the impact of technology and
	innovatio	n on business management.
3	To make	the students understand the social issues in technology management.

Course Outcomes:

Upon completion of the course, students shall have ability to

C006.1	Recognize the role and significance of technology management	[R]
C006.2	Interpret the human issues and ethics involved in the technology usage	[U]
	and implementation.	
C006.3	Illustrate the environmental impact of technological change.	[A]
C006.4	Relate the issues in preparation of EIA report	[Ap]
C006.5	Categorize the elements of the environmental problem	[A]
-		

Course Contents:

Introduction to Technology Management: Concept and Meaning of Technology and Technology Management- Technology; Technology management, Evolution and Growth of Technology, Role and Significance of Technology Management, Impact of Technology on Society and Business- components of technology management -Technology and competition; Key issues in managing technological innovation, Forms of Technology- Process technology; Product technology.

Managing Technology Based Innovation: Innovation and Technology- role of technology in innovation; Technological innovation and management, Process of Technology - Based Innovation, Measures of Innovative Performance, Characteristics of Innovative Work Environment, three perspectives of technology management, Measures for Building High-Performing Innovative Technology- Based Organizations.

Social Issues in Technology Management: Social Issues, Technological Change and Industrial Relations- Implementation of rationalization and automation in India; Impact of technological change, Technology Assessment and Environmental Impact Analysis-Environmental impact analysis process- Guidelines on the scope of EIA; Issues in preparation of EIA report; Elements of the environmental problem.

Total Hours: 45

Text Bo	oks:
1	Sanjiva Shankar, Technology and innovation management, Dubey publisher: PHI
	learning, 2017.
2	Margaret A. White, Garry D. Bruton, The Management of Technology and Innovation:
	A Strategic Approach, 2nd Edition, 2014.
Referen	ce Books:
1	Joe Tidd, John Bessant, Managing Innovation: Integrating Technological, Market and
	Organizational Change, 6th Edition 2018.
2	Hellriegel, Jackson and Slocum, Management: A Competency-Based Approach,
	South Western, 11 th edition, 2015.
3	Koontz, Essentials of Management, Tata McGraw-Hill, 10 th Edition, 2015.
4	Bateman Snell, Management: Competing in the new era, McGraw-Hill Irwin,5th
	Edition, 2018.

Web Refere	nces	S:														
1	http	os://w	ww.y	outul	be.co	m/wa	tch?۱	/=Shj	pfL1ji	-ZE						
2	•									ot3HE						
Online Reso			,						<u>, , , , , , , , , , , , , , , , , , , </u>							
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				nuot	12 M2	3633	men			То	tal		End			
Forma	tive			Sur	nmat	ive		Tota	. (-	nuous		Semest	er	Т	otal
Assessi	men	t		Ass	essm	ent		TOL			smen		kaminat	ion		
80					120			200			0		60			100
Assessmen	t Mo	thod	s & I	ονοί	-	sed (on Bl				-		00			100
Formative A										<u>x0110</u>	<u>, , , , , , , , , , , , , , , , , , , </u>					
T Officiative A	1330	331110		aseu						nt (Cl	hoose	and	d map			
Course		Blo	om's	-	A33									F	Δ (1	6%)
Outcome														•	arks]	
Catoonic	Evel Assignment, Case Study, Seminar, Group Assignment)												10	• •		
C006.1		Reme	embe	r	Quiz			7.0	Jigin	nonty					20	0
C006.2		Unde		h												
C006.4	Apply Assignment 20															
C006.3	Apply Apply Analyze Assignment													2	0	
C006.5		Analy			Tutor									20		
Assessmen							End S	Seme	ester	Exan	ninatio	on				-
					native								mester	Exa	mir	nation
Bloom's Lev	vel		_				larks			-7			(60			
			CIA	1: [60	0 Mar				60 M	arks]			[100 M	-	5]	
Remember				1				•	10				1(
Understand				1	0				20				20)		
Apply				4	0				40				4()		
Analyse				4	0				30				30)		
Evaluate				-	-				-				-			
Create				-					-				-			
Assessmen	t ba	sed o	on Co	ontin	uous	and	End	Sem	ester	Exar	ninati	on				
			Con	tinu	ous A	sse	ssme	nt (4	0%)							
					[200) Ma	rks]								Er	
C	A 1:	: 100							CA 2		Marks			-		ester
	L		<u>1 (40</u>				SA	2			(40 N					nation
SA 1	Cor	npone	ent -	Con	npone	nt	(6)		Com	nponer	nt Co		onent -		(60)	
(60 Marks)	(20	ו Mark ((6)	(20	- II Morke	~	Mar		(20)	- I Marks		 м ос	arks)	[10	UIV	arks]
Mapping of (<u> </u>				Mark		Droc	iram	•		/			nmo	. Cn	ocific
Outcomes (F			uico	mes	(00)	WILII	FIQ	Jiann	ine O	ulcoi	1162 (1	-0)	Flogra	IIIIe	; əp	ecinc
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C006.1	3		1							-			2			
C006.2	3	2	2			3		3	+				-			
		2	2	0		3		3								
C006.3	3			2					+							
C006.4	3	-		2					<u> </u>				2			
C006.5	3	2		2		. ·			<u> </u>							
3	S	trongl	y agr	eed	2	IVIOD	erate	iy ag	reed	1	ĸeas	onat	oly agre	ed		

Mandatory Courses

21MC103

Nature of 0	Course	MANDATORY COURSE							
Pre Requis	sites	Nil							
Course Ob	ojectives	:							
1 To impart the skills required for working in the corporate world									
2	To study the required interpersonal and management skills								
3	To deve	elop self-confidence, positive attitude, emotional intelligence, socia	al grace,						
	flexibilit	y and friendliness among the students							
4	To impa	art the requisite Entrepreneurial Skills to the students.							
Course Ou	itcomes:								
Upon com	pletion o	of the course, students shall have ability to							
C103.1		the significance of soft skills in professional and interpersonal nications	[R]						
C103.2		tand the soft skills that helps for achieving excellence in career	[U]						
C103.3	Prepare	an effective resume using advanced writing skills	[Ap]						
C103.4	Examin organiz	e the importance of stress and time management in an ation	[Ap]						
Course Co	ontents:								
In the all the file									

Introduction to Soft skills

Soft Skills – definition – scope and importance – workplace communication, process and barriers- Interpersonal and Intra-personal communication skills

Meeting Management

Team building- emotional intelligence and Critical thinking- developing self-esteem, time and stress management- group discussions, interviews, and presentation skills

Advanced skills

Drafting an effective Resume- campus to company- Entrepreneurial Skills Development-Project Reading

			Total Hours: 1	5
Reference	Books:			
1	Chauhan, G.S. and Sange	eta Sharma. Soft Skills. Nev	v Delhi: Wiley. 2016	
2	Sharma, R.C. and Krishna	Mohan. Business Correspo	ndence and Report	
	Writing. New Delhi: TMH. 2	2016		
Web Refere	ences:			
1	https://nptel.ac.in/courses/	109/107/109107121/		
2	https://nptel.ac.in/courses/	109/104/109104115/		
Tentative A	ssessment Methods & Lev	vels (based on Bloom's Ta	xonomy)	
Formative a	assessment based on Cap	stone Model		
Course	Bloom's Level	Assessment	Marks	
Outcome	BIOOIII S Level	Component	IVIdI KS	
C103.1	Remember			
C103.2	Understand	NPTEL Swayam /	50	
C103.3	Apply	MOOC / Assignments		
C103.4	Apply			

1														
					Ter	m Ei					atio	า		
								30						
								40						
	30													
								-						
								-						
								-						
	Out	com	es ((CO) \	with	Prod	aram	me	Outc	ome	es (P	O) Prog	gramme	•
omes	(PSC	D)	•	,	-						`		_	
omes	(PSC	C)	•) Ds							PSOs	
a a	(PSC) b	C) c	d	e			h	i	j	k		1	_	3
			-			Os	- 		j 3		1		PSOs	
			-			Os	h		j	k	, 		PSOs	
			-			Os	h 2	i	j 3	k 2	1		PSOs	
	ourse		urse Outcom	urse Outcomes ((ourse Outcomes (CO)			[5	[50 ma 30 40 30 - -	[50 marks] 30 40 30 - - -	[50 marks] 30 40 30 - - - -	[50 marks] 30 40 30 - - - -	30 40 30 - - -	[50 marks] 30 40

	08	CONSTITUTION OF INDIA	2/0/0/0
Nature o	of Course	Mandatory Course	
Pre Req	uisites	NIL	
Course	Objectives:		
1	To explore	various aspects of the Indian political and legal system from a h	istorical
		e highlighting the events that led to the making of the Indian Cons	
2		he basic structure and operative dimensions of Indian Constitutio	
3		students aware of the theoretical and functional aspects of the	e Indian
	parliamenta		
4		lize students' thinking towards basic understanding of the legal co lications for engineers.	oncepts
5	To make st	tudents learn about role of engineering in business organizations	s and e-
	governance	રે.	
	Outcomes:		
		f the course, students shall have ability to	
C108.1		ne nature of Indian Political and legal system.	[R]
C108.2		e structure of Indian Constitution.	[Ap]
C108.3		e and relate the functioning of Indian parliamentary system at the	[U]
<u></u>	center and		
C108.4		e different aspects of Indian Legal System and its related bodies	[U]
C108.5	Correlate th models	ne role of engineers with different organizations and governance	[A]
Course	Contents:		
Constitut Rule, Fir Indian C Principle Relations Constitu Legislatu	nancial Emer Constitution es of the Co is – Division of ution and St	dments in India, Emergency Provisions: National Emergency, F gency, and Local Self Government – Constitutional Scheme in In onstitution – Fundamental Rights – Directive Principles – Cen of Power. ructure ve, Judiciary; Institutions: President, Governors, Statutory b	dia. tre-State
		Total Hours:	15
		Total Hours.	
Referen	ce Books:	· · · · · ·	
Referen 1	D D Basu Butterworth	u, "Introduction to the Constitution of India", 23rd Edn.,Le	exisnexis
	D D Basu Butterworth	u, "Introduction to the Constitution of India", 23rd Edn.,Le ns, 2021. e Sharma: Introduction to the Indian Constitution, 8th Edition, PHI	exisnexis
1 2	D D Basu Butterworth Brij Kishore	u, "Introduction to the Constitution of India", 23rd Edn.,Le ns, 2021. e Sharma: Introduction to the Indian Constitution, 8th Edition, PHI	exisnexis
1 2	D D Basu Butterworth Brij Kishore Pvt. Ltd, 20 ferences:	u, "Introduction to the Constitution of India", 23rd Edn.,Le ns, 2021. e Sharma: Introduction to the Indian Constitution, 8th Edition, PHI	exisnexis

Formative a	isses	sme	ent b	asec	d on	Cap	stor	ne M	odel						
Course Outcome		Bloc	om's	Lev	/el			Asse	essm	nent	Com	npone	ent	Ма	rks
C108.1	Re	mem	nber												
C108.2	Ap	oly						IDTE	o /						
C108.3	Un	derst	tand				Ч	IPTE	C/	50					
C108.4	Un	derst	tand						AS	signi	ment	:S			
C108.5	Ana	alyze	;												
Summative		,		base	ed or	1 Co	ntin	uous	s an	d En	d Se	mest	er Exam	ination	
Bloom's Level								End	Мо		Exar	ninati			
Remember										30					
Understand										30					
Apply										30					
Analyze										10					
Evaluate										-					
Create	<u> </u>		• • •		(0)	<u>_</u>		.		-					
Mapping of Specific Ou					s (C	0) w		rog	ram	me	Jutc	omes	(PO) Pr	ogramme	9
		103 (100	/		P	Os							PSOs	
COs	а	b	С	d	е	f	g	h	i	j	k	I	1	2	3
C108.1						3	3								
C108.2						3	3								
C108.3						3	2	1							
C108.4						3	3								
C108.5						3	1	3							
						_		_							
				reed	2		lodei	-			1			agreed	

21MC1	09 ESSENCE OF INDIAN TRADITIONAL KNC	WLEDGE	2/0/0/0
Nature o	of Course Mandatory Course		
Pre Req	uisites NIL		
Course	Objectives:		
1	To study the basic science followed in Indian tradition.		
2	To enable the students to understand the importance		gs and
	encourage the students to contribute towards sustainab		
3	To sensitize students towards issues related to 'Indi composite character.		
4	To make the students aware of holistic life styles of		
	capsules in Sanskrit literature that are important in	modern society v	with rapid
_	technological advancements and societal disruptions.		f un a d'a un
5	To acquaint students with Indian knowledge system, In		
Course	scientific world-view and basic principles of Yoga and he Outcomes:	Distic health care s	ystem.
	ompletion of the course, students shall have ability to		
C109.1	Understand the basic science of Indian Traditional Know		[U]
C109.2			[U]
0100.2	knowledge with modern scientific perspective.		[0]
C109.3		e development	[Ap]
C109.4	Explore the importance of traditional knowledge in		[U]
0.0011	Medicine.	, ignound o and	[0]
C109.5		the protection of	[Ap]
	traditional knowledge.	•	
Course	Contents:		
Basic str	knowledge and Tradition System ructure of Indian Knowledge System -Modern Science and nd Holistic Health care – Philosophical Tradition-Indian Fradition.		
Astronor	e and Management my in India - Chemistry in India - Mathematics in India - - Medicine in India - Metallurgy in India – Geo ogies.	•	•
Indian A Pottery,	I Heritage and Performing Arts Architect, Engineering and Architecture in Ancient Indi Puppetry, Dance, Music, Theatre, drama, Painting, Mart s, Current developments in Arts and Cultural, Indian's Cultu Cinema	ial Arts Traditions, ural Contribution to	Fairs and
		Total Hours:	15
-	ice Books:		
1	V. Sivaramakrishna (Ed.), Cultural Heritage of India-Cou	irse Material, Bhara	tiya Vidya
	Bhavan, Mumbai, 5th Edition, 2014		
2	S. Baliyan, Indian Art and Culture, Oxford University Pre	ess, India. 2020	
Web Re	ferences:		
1	https://nptel.ac.in/courses/109/104/109104102/		
2	https://www.iare.ac.in/?q=courses/r18-auto-aero/essen	ce-indian-traditiona	-
	knowledge		

Formative as	ssess	men	t bas	ed o	n Ca	psto	ne M	odel												
Course Outcome	В	loom	's Le	evel		As	sess	smen		Marks										
C109.1	Unc	lersta	and																	
C109.2	App	ly				NPTEL Swayam / MOOC /														
C109.3	Unc	lersta	and			INF		-			007			50						
C109.4	Unc	lersta	and				1	Assig	nmer	าเร										
C109.5	Арр	lv																		
Summative		•	nt ba	sed	on C	ontin	uou	s and	l End	Sen	neste	r Exa	minati	on						
Bloom's Level								I Mo		xam	inatio									
Remember		30																		
Understand		50																		
Apply									20											
Analyze									-											
Evaluate									-											
Create			4						-	4			_							
Mapping of (Specific Out				nes (CO)	with	Prog	ramn	ne O	utco	mes ((PO)	Progra	mme						
		, i) C,	00)			P	os							PSOs)s					
COs	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3					
C109.1			1			3	3													
C109.2			1			3	3													
C109.3			1			3	3													
C109.4			2			3	3													
C109.5			1			3	3													
	Stro	I	agre	L	2	Mode	1	1	1	1	1	1	y agree	·	1					

Service Courses

21ME1	03	ENGINEERING PRACTICES LABORATORY												
Nature	of Course	Practical application	I											
Pre Rec	quisites	Nil												
Course	Objectives:													
1		e use of basic hand tools and to know the need for safety i hands on experience in Carpentry, Sheet metal, Plumbing,		•										
	–	Foundry.												
2		To learn about basic electrical devices, meters and electronics devices and to ga												
	Ų	about the fundamentals of various electrical and electronic education of the shooting.	gadget	s thei										
	Outcomes:													
		the course, students shall have ability to		F 4 1										
C103.1	workplace.	d solve the basic engineering problems at home and		[Ap]										
C103.2		e surfaces and make simple components like tray and funne		[Ap]										
C103.3	Make simpl	e metal joints using welding equipment and wooden joints us pols.	sing	[Ap]										
C103.4		e connections and sand moulds.		[Ap]										
C103.5		the fundamentals of hot forging and injection moulding		[U]										
C103.6	Examine ar Contents:	nd troubleshoot electrical and electronic circuits		[A]										
		GROUP A (CIVIL & MECHANICAL) ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injectior												
TIG & I Carpent List of I	MIG welding.	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines	n moul	ding										
TIG & I Carpent List of E S.No	MIG welding. ry work using Experiments:	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments	n moul											
TIG & I Carpent List of I	MIG welding. ry work using Experiments: Preparation of	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments C Map of butt joints and lap joints using arc welding C10	n moul	ding										
TIG & I Carpent List of E S.No	MIG welding. ry work using Experiments: Preparation of	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments C Map of butt joints and lap joints using arc welding C10	n moul	ding RBT										
TIG & I Carpent List of E S.No 1	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels.	ds – Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments of butt joints and lap joints using arc welding Forming and Bending, Model making – Trays and C10	n moul	ding RBT [Ap]										
TIG & I Carpent List of E S.No 1 2	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling	ds – Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments of butt joints and lap joints using arc welding Forming and Bending, Model making – Trays and of wooden joints by sawing, planning and cutting. pipe connections involving the fittings like valves, g, unions, reducers, elbows and other components	n moul	ding RBT [Ap] [Ap]										
TIG & I Carpent List of E S.No 1 2 3	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling used in house Demonstration	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments of butt joints and lap joints using arc welding Forming and Bending, Model making – Trays and of wooden joints by sawing, planning and cutting. pipe connections involving the fittings like valves, g, unions, reducers, elbows and other components po of foundry operations like mould preparation for	n moul CO pping 03.3 03.2 03.3	ding RBT [Ap] [Ap] [Ap]										
TIG & I Carpent List of E S.No 1 2 3 4	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling used in house Demonstratic solid and spli	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelinesList of ExperimentsC Map C10of butt joints and lap joints using arc welding Forming and Bending, Model making – Trays and C10C10of wooden joints by sawing, planning and cutting. pipe connections involving the fittings like valves, g, unions, reducers, elbows and other components ehold fittings.C10on of foundry operations like mould preparation for t piece pattern.C10	n moul CO pping 03.3 03.2 03.3 03.4	ding RBT [Ap] [Ap] [Ap] [Ap]										
TIG & I Carpent List of E S.No 1 2 3 4 5	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling used in house Demonstratic Demonstratic Demonstratic	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelinesList of ExperimentsC Map C10of butt joints and lap joints using arc welding Forming and Bending, Model making – Trays and c10C10of wooden joints by sawing, planning and cutting. pipe connections involving the fittings like valves, g, unions, reducers, elbows and other components ehold fittings.C10on of foundry operations like mould preparation for t piece pattern.C10on of Smithy operationsC10on of smithy operationsC10 <t< td=""><td>n moul CO pping 03.3 03.2 03.3 03.4 03.4</td><td>RBT [Ap] [Ap] [Ap] [Ap] [U]</td></t<>	n moul CO pping 03.3 03.2 03.3 03.4 03.4	RBT [Ap] [Ap] [Ap] [Ap] [U]										
TIG & I Carpent List of E S.No 1 2 3 4 5 6 7 List of E Basic C Moving i circuits,	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling used in house Demonstratio Solid and spli Demonstratio moulding GROUE Experiments: ircuit Element ircuit Element ircuit Element	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments C of butt joints and lap joints using arc welding C10 Forming and Bending, Model making – Trays and C10 of wooden joints by sawing, planning and cutting. C10 of wooden joints by sawing, planning and cutting. C10 opipe connections involving the fittings like valves, C10 g, unions, reducers, elbows and other components C10 ehold fittings. C10 on of foundry operations like mould preparation for C10 t piece pattern. C10 on of Smithy operations C10 on of assembly of pump / Demonstration of Injection C10 ch etee pattern. C10 on of assembly of pump / Demonstration of Injection C10 ch etee pattern. C10 on of assembly of pump / Demonstration of Injection C10 ch etee pattern. C10 on of assembly of pump / Demonstration of Injection C10 ch etee pattern, inductor, capacitor. Introduction to measuring puing coil meter, Wattmeter, Energy meter, CRO,	n moul CO Dping 03.3 03.2 03.2 03.3 03.4 03.4 03.4 03.5 03.1 g equipr er. Digita amp, iro	RBT [Ap] [Ap] [Ap] [Ap] [U] [Ap] [Ap] [Ap] [Ap]										
TIG & I Carpent List of E S.No 1 2 3 4 5 6 7 List of E Basic C Moving i circuits,	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling used in house Demonstration Demonstration Demonstration Demonstration Demonstration GROUE Experiments: ircuit Element ircuit Element	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments C of butt joints and lap joints using arc welding C10 Forming and Bending, Model making – Trays and C10 of wooden joints by sawing, planning and cutting. C10 pipe connections involving the fittings like valves, C10 g, unions, reducers, elbows and other components C10 ehold fittings. C10 on of foundry operations like mould preparation for C10 t piece pattern. C10 on of Smithy operations C10 on of strip operations like mould preparation for C10 t piece pattern. C10 on of smithy operations C10 on of strip operations C10 on of strip operations C10 on of strip operations C10 on of strip operations C10 on of strip operations C10 on of strip operations C10 on of strip operations, reducer, capacitor. Introduction to measuring oving coil meter, Wattmeter, Energy	n moul CO pping 03.3 03.2 03.2 03.3 03.4 03.4 03.4 03.5 03.1 g equipr er. Digita	RBT [Ap] [Ap] [Ap] [Ap] [U] [Ap] [Ap] [Ap] [Ap]										
TIG & I Carpent List of E S.No 1 2 3 4 5 6 7 List of E Basic C Moving i circuits, mixer gr	MIG welding. ry work using Experiments: Preparation of Sheet metal I funnels. Preparation of Making basic taps, coupling used in house Demonstratic solid and spli Demonstratic moulding GROUI Experiments: ircuit Element iron meter, mo PCB design, f inder, study of Study and specification.	ds –Sheet metal operations - Welding - arc welding, gas weld Study of foundry, Demonstration of Smithy and Injection power tools - Plumbing components and pipelines List of Experiments C of butt joints and lap joints using arc welding C10 Forming and Bending, Model making – Trays and C10 of wooden joints by sawing, planning and cutting. C10 pipe connections involving the fittings like valves, C10 g, unions, reducers, elbows and other components C10 ehold fittings. C10 on of foundry operations like mould preparation for C10 t piece pattern. C10 on of assembly of pump / Demonstration of Injection C10 P B (ELECTRICAL AND ELECTRONICS ENGINEERING) C10 ts: Resistor, inductor, capacitor. Introduction to measuring oving coil meter, Wattmeter, Energy meter, CRO, Multi-meter C10 poing coil meter, Wattmeter, Energy meter, CRO, Multi-meter C f FM radio and mobile phone. C List of Experiments C identification of electronic components with C10	n moul CO pping 03.3 03.2 03.2 03.3 03.4 03.4 03.4 03.4 03.5 03.1 g equiprent of the second se	RBT [Ap] [Ap] [Ap] [Ap] [Ap] [Ap] [Ap] [Ap]										

3 Generation and measurement of signals using CRO. C103.6 [A] 4 Familiarisation of digital basic gate IC's. C103.6 [AP] 5 Soldering practice-components devices and circuits- using general purpose PCB. C103.6 [AP] 6 Demonstration of meters and electrical components. C103.6 [AP] 7 Safety precautions with electrical components. C103.6 [AP] 8 Residential house wiring. C103.6 [A] 9 Measurement of power and energy. C103.6 [A] 9 Measurement of power and energy. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 4 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. 1 www.sme.org<													
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5 purpose PCB. C103.6 [AP] 6 Demonstration of meters and electrical components. C103.6 [AP] 7 Safety precautions with electrical components. C103.6 [AP] 8 Residential house wiring. C103.6 [A] 9 Measurement of power and energy. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] 10 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). P 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. <td></td> <td>4</td> <td>Familiarisation of digital basic gate IC's.</td> <td>C103.6</td> <td>[AP]</td>		4	Familiarisation of digital basic gate IC's.	C103.6	[AP]								
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8 Residential house wiring. C103.6 [A] 9 Measurement of power and energy. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] Total Hours: 45 Reference Books: 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 www.nptel.ac.in 2 www.sme.org		6	Demonstration of meters and electrical components.	C103.6	[AP]								
9 Measurement of power and energy. C103.6 [A] 10 Trouble shooting of electrical equipments. C103.6 [A] Total Hours: 45 Reference Books: 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 www.nptel.ac.in 2 www.sme.org		7	Safety precautions with electrical components.	C103.6	[AP]								
10 Trouble shooting of electrical equipments. C103.6 [A] Total Hours: 45 Reference Books: 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 1 www.nptel.ac.in 2 www.sme.org		8	Residential house wiring.	C103.6	[A]								
Total Hours: 45 Reference Books: Total Hours: 45 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 1 www.nptel.ac.in 2 www.sme.org		9	Measurement of power and energy.	C103.6	[A]								
Reference Books: 1 Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 www.nptel.ac.in 2 www.sme.org		10	Trouble shooting of electrical equipments.	C103.6	[A]								
1Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint).2Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014.3Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012.4D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.5E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.Web References:11www.nptel.ac.in2www.sme.org			Total	Hours:	45								
Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). 2 Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 www.nptel.ac.in 2 www.sme.org		Refere	nce Books:										
Promotors Pvt Ltd., 2014. 3 Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 www.nptel.ac.in 2 www.sme.org		1											
Delhi, 2012. 4 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 5 E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. Web References: 1 www.nptel.ac.in 2 www.sme.org													
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Web References: 1 www.nptel.ac.in 2 www.sme.org		4		Tata McGr	aw Hill,								
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2 www.sme.org	١	Web R	eferences:										
5		1	www.nptel.ac.in										
3 http://www.allaboutcircuits.com/education/			U										
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Summative	asse	essm	ent b	asec	don	Cont	inuo	us ai	nd E	nd S	emes	ster E	Examina	ation			
		Co	ontinu	uous	Ass	essn	nent	(60%)	End	Sen	neste	er Exam	ination	(40%)		
Bloom's Level		FA SA							Practical Examination								
		(45 Marks) (15 Marks) (40 Marks)									s)						
Remember			1(10						10				
Understand			1(10						10				
Apply			4(·			40						40				
Analyse			4()			40						40				
Evaluate			-				-						-				
Create			-		10.0		-						-				
Mapping of Specific Ou					(CO) witl	h Pro	ogran	nme	Outo	ome	s (PC	D) Prog	ramme			
COs		POs											PSOs				
005	а	b	С	d	е	f	g	h	i	j	k	1	1	2	3		
C103.1	3																
C103.2	3	1															
C103.3	3													3			
C103.4	3	1												3			
C103.5	3	1												3			
C103.6	3																
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21ME1	11	ENGINEERING GRAPHICS	1	/0/3/2.5
Nature	of Course	Practical application		
Pre Red	quisites	Basic Drawing and Computer Knowledge		
Course	Objectives:			
1		e method to construct the conic curves used in engin		
2		an understanding of Isometric to orthographic views		sa.
3		basic projection of straight lines and plane surfaces		
4		the imagination of solids inclined to one reference pl	ane.	
5		e development of surfaces used in various fields.		
	Outcomes: ompletion of	the course, students shall have ability to		
C111.1		the basic concepts of Engineering Graphics.		[U]
C111.2	Sketch isom planes	netric, orthographic projections and projection of line	s and	[Ap]
C111.3		eral surfaces of solids including prisms and pyramids	6	[Ap]
C111.4	1	rojections of lines, planes, solids and isometric views		[A]
	modelling so	•		L, J,
	Contents:			·
	•	ecial curves – Isometric projections, Isometric to ort	• · ·	•
•	•	etric projection-Projection of lines and plane surfaces	s-Projection o	f solids-
Develop	ment of surfa	ces-Introduction to perspective projection.		<u>. </u>
S.No		List of Experiments	CO	RBT
			Mapping	
1	Introduction t	o drafting software.	C111.1	U
2		of conic curves (Ellipse, Parabola and Hyperbola)	C111.1	U
3		of special curves (Cycloid and Involutes)	C111.1	U
4		orthographic projections – manual sketches	C111.2	Ар
5		orthographic projections – software sketches	C111.4	A
6		lines - inclined to HP, VP and Both HP & VP	C111.4	A
7		plane surfaces (Hexagon, Pentagon and circle) –	0111.4	~
		y one of the principle planes	C111.4	Α
8		solids (Prism and Pyramid) – inclined to HP	C111.3	Ар
9	*	· · · · ·	C111.3	-
	•	solids (Cone and Cylinder) – inclined to VP		Ар
10	-	of surfaces (Prism, Pyramid, Cone and Cylinder)	C111.4	A
11	Introduction t	o perspective projection	C111.2	U
		Tot	al Hours:	45
Referer	nce Books:			
1	Edition, 201		-	
2	K. V. Natara 2018.	ajan, "A Text Book of Engineering Graphics", Dhan	alakshmi Put	lishers,
3	Gopalakrish Bangalore, 2	na K.R., "Engineering Drawing" (Vol. I&II combin 2011.	ed), Subhas	Stores,
4		K. and Prabhu Raja V., "Engineering Graphics", New	Age Internati	onal (P)
Web Re	eferences:			
1		ac.in/courses/112102101/		
2	www.solidw			
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		Co	ontir	nuou	s As	ses	sme	nt (6	60%)		End	Ser	nester Ex	aminatio	n (40%)		
Bloom's Level			-	A			SA					Pr	actical Ex		n		
		(45 N	lark	s)		(15	Mar	ks)				(40 Ma	arks)			
Remember			3	30				30					30)			
Understand			3	30				30					30)			
Apply			2	20				20					20)			
Analyse			2	20				20					20)			
Evaluate				0				0					0				
Create				0				0					0				
Mapping of Specific Ou					s (C	0) v	vith I	Prog	ram	me	Jutc	ome	es (PO) Pr	ogramm	e		
COs						P	Os				PSOs						
CUS	а	b	С	d	е	f	g	h	i	j	k	Ι	1	2	3		
C111.1	3		1							3							
C111.2	3		1							3							
C111.3	3		1							3							
C111.4	3		1							3							
3		ongl		rood	2		oder			and	1	Po	asonably	agrood			