Koneru Lakshmaiah Education Foundation
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DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM & SYLLABUS

OF

B.TECH MECHANICAL ENGINEERING

FOR

2023-24 ADMITTED BATCH

B. Tech Mechanical Engineering Program Structure (Y23 Admitted Batch)

Sl No	CAT	SEM	COURSE CODE	Course Title	Short Name	MODE	L	T	P	S	Cr	CH	Pre-Requisites
1	HAS	1	23UC1101	INTEGRATED PROFESSIONAL ENGLISH	IPE	R	0	0	4	0	2	4	NIL
2	HAS	2	23UC1202	ENGLISH PROFICIENCY	EP	R	0	0	4	0	2	4	NIL
3	HAS	3	22UC2103	ESSENTIAL SKILLS FOR EMPLOYABILITY	ESE	R	0	0	4	0	2	4	NIL
4	HAS	4	22UC2204	CORPORATE READINESS SKILLS	CRS	R	0	0	4	0	2	4	NIL
5	HAS	7	22UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS	ME	R/M	2	0	0	0	2	2	NIL
6	HAS	1	22UC1203	DESIGN THINKING FOR INNOVATION	DTI	R	0	0	4	0	2	4	NIL
7	HAS	1	23UC0021	SOCIAL IMMERSIVE LEARNING-1	SIL-1	R	0	0	0	4	1	4	NIL
8	HAS	2	23UC0022	SOCIAL IMMERSIVE LEARNING-2	SIL-2	R	0	0	0	4	1	4	NIL
9	HAS	3	23UC0023	SOCIAL IMMERSIVE LEARNING-3	SIL-3	R	0	0	0	4	1	4	NIL
10	HAS	4	23UC0024	SOCIAL IMMERSIVE LEARNING-4	SIL-4	R	0	0	0	4	1	4	NIL
11	HAS	5	23UC0025	SOCIAL IMMERSIVE LEARNING-5	SIL-5	R	0	0	0	4	1	4	NIL
12	HAS	7	22MBXXXX	MANAGEMENT ELECTIVE	FLE	R/M	2	0	0	0	2	2	NIL
13	HAS	7	22FLXXXX	FOREIGN LANGUAGE ELECTIVE	FLE	R/M	2	0	0	0	2	2	NIL
14	HAS	8	22IC0012	INNOVATION MANAGEMENT	INM	R	0	0	4	0	2	4	NIL
				Total			**6**	**0**	**24**	**20**	**23**	**50**	
15	AUC	BRIDGE COURSE	23UC0017	INDIAN KNOWLEDGE SYSTEMS-VEDIC MATHEMATICS	IKS-VM	R	2	0	0	0	0	2	
16	AUC	BRIDGE COURSE	23UC0018	FUNDAMENTALS OF MATHEMATICS (BiPS)	FOM	R	3	0	0	0	0	3	
17	AUC	4	22UC0011	AUDIT COURSE - 1 (GENDER & SOCIAL EQUALITY)	GSE	R	2	0	0	0	0	2	NIL
18	AUC	5	23UC0019	AUDIT COURSE - 2 (ESSENCE OF INDIAN KNOWLEDGE TRADITION)	EIKT	R	2	0	0	0	0	2	NIL
19	AUC	6	22UC0008	AUDIT COURSE - 3 (INDIAN CONSTITUTION)	IC	R	2	0	0	0	0	2	NIL
20	AUC	7	22UC009	AUDIT COURSE - 4 (ECOLOGY & ENVIRONMENT)	E&E	R	2	0	0	0	0	2	NIL
			22UC0020	INDIAN KNOWLEDGE SYSTEMS-ENGINEERING ELECTIVE	IKS	R	2	0	0	0	0	2	
				Total			**10**	**0**	**0**	**0**	**0**	**10**	
21	BSC	1	23MT1001	MATHEMATICS ELECTIVE - 1(LINEAR ALGEBRA & CALCULUS FOR ENGINEERS)	LACE	R	2	2	0	0	4	4	NIL
22	BSC	2	22MT2003	MATHEMATICS ELECTIVE - 2 (MATHEMATICAL MODELLING AND NUMERICAL METHODS)	MMNM	R	2	2	0	0	4	4	NIL
23	BSC	3	22MT2011	MATHEMATICS ELECTIVE - 3(OPTIMIZATION TECHNIQUES)	OT	R	2	2	0	0	4	4	NIL
24	BSC	4	22MT2010	MATHEMATICS ELECTIVE - 4 (COMPUTATIONS IN APPLIED MECHANICS & STATISTICS)	CAMS	R	2	2	0	0	4	4	NIL
25	BSC	1	23ME1005	PHYSICS ELECTIVE (MATERIAL SCIENCE & METALLURGY)	MSM	R	3	0	2	0	4	5	NIL
26	BSC	2	22CY1001	ENGINEERING CHEMISTRY	EC	R	3	0	2	0	4	5	NIL
				Total			**14**	**8**	**4**	**0**	**24**	**26**	
27	ESC	1	23SC1101	COMPUTATIONAL THINKING FOR STRUCTURED DESIGN	CTSD	R	3	0	2	4	5	9	NIL
28	ESC	2	23SC1202	DATA STRUCTURES	DS	R	2	0	2	4	4	8	CTSD
29	ESC	2	23CS1201	OBJECT ORIENTED PROGRAMMING	OOP	R	2	0	2	0	3	4	CTSD
30	ESC	1	22ME1103	DESIGN TOOLS WORKSHOP	DTW	R	0	0	4	0	2	4	NIL

31	ESC	1	23ME1002	ENGINEERING GRAPHICS	EG	R	0	0	4	0	2	4	NIL
32	ESC	2	23ME1004	WORKSHOP PRACTICES FOR ENGINEERS	WPE	R	0	0	4	0	2	4	NIL
33	ESC	2	23EC1203	BASIC ELECTRICAL & ELECTRONIC CIRCUITS	BEEC	R	2	0	0	0	2	2	NIL
34	ESC	2	23ME1001	ENGINEERING MECHANICS	EM	R	3	0	0	0	3	3	NIL
35	ESC	3	22CE2102	FLUID MECHANICS & HYDRAULIC MACHINES	FMHM	R	3	0	2	0	4	5	NIL
36	ESC	5	22UC3108	PROBLEM SOLVING & REASONING SKILLS - 1	PSRS-1	R	0	0	0	4	1	4	NIL
37	ESC	6	22UC3209	PROBLEM SOLVING & REASONING SKILLS - 2	PSRS-2	R	0	0	0	4	1	4	NIL
				Total			**15**	**0**	**20**	**16**	**29**	**51**	
38	PCC	3	22ME2106R	SOLID MECHANICS	SM	R	3	0	2	0	4	5	EM
39	PCC	3	22ME2106A	SOLID MECHANICS	SM	A	4	0	4	0	6	8	EM
40	PCC	3	22ME2106P	SOLID MECHANICS	SM	P	4	0	4	0	6	8	EM
41	PCC	3	22ME2208	MANUFACTURING PROCESSES	MP	R	2	0	2	0	3	4	WPE
42	PCC	3	22AD2001R	DATA DRIVEN ARTIFICIAL INTELLIGENT SYSTEMS	DDAIS	R	2	0	2	0	3	4	CTSD
43	PCC	3	22AD2001A	DATA DRIVEN ARTIFICIAL INTELLIGENT SYSTEMS	DDAIS	A	3	0	4	0	5	7	CTSD
44	PCC	3	22AD2001P	DATA DRIVEN ARTIFICIAL INTELLIGENT SYSTEMS	DDAIS	P	3	0	4	0	5	7	CTSD
45	PCC	3	22ME2107	THERMODYNAMICS	TD	R	3	0	0	0	3	3	NIL
46	PCC	4	22ME3113R	MANUFACTURING TECHNOLOGY	MT	R	2	0	2	0	3	4	MP
47	PCC	4	22ME3113A	MANUFACTURING TECHNOLOGY	MT	A	3	0	4	0	5	7	MP
48	PCC	4	22ME3113P	MANUFACTURING TECHNOLOGY	MT	P	3	0	4	0	5	7	MP
49	PCC	4	22ME2209R	KINEMATICS & DYNAMICS OF MACHINES	KDOM	R	2	1	2	0	4	5	EM
50	PCC	4	22ME2209A	KINEMATICS & DYNAMICS OF MACHINES	KDOM	R	3	1	4	0	6	8	EM
51	PCC	4	22ME2209P	KINEMATICS & DYNAMICS OF MACHINES	KDOM	R	2	1	2	0	6	8	EM
52	PCC	4	22ME3112	THERMAL SYSTEMS ENGINEERING	TES	R	3	0	0	4	4	7	TD
53	PCC	5	22ME3215	DIGITAL MANUFACTURING & ROBOTICS	DMR	R	3	0	0	0	3	3	KDOM
54	PCC	5	22ME3110R	HEAT TRANSFER	HT	R	3	0	2	0	4	5	TD
55	PCC	5	22ME3110A	HEAT TRANSFER	HT	A	4	0	4	0	6	8	TD
56	PCC	5	22ME3110P	HEAT TRANSFER	HT	P	4	0	4	0	6	8	TD
57	PCC	5	22ME3111R	MECHANICAL ENGINEERING DESIGN	MED	R	3	0	0	0	3	3	SM
58	PCC	5	22ME3111A	MECHANICAL ENGINEERING DESIGN	MED	A	4	1	0	0	5	5	SM
59	PCC	5	22ME3111P	MECHANICAL ENGINEERING DESIGN	MED	P	4	1	0	0	5	5	SM
60	PCC	6	22ME3214R	MACHINE DESIGN	MD	R	2	0	0	4	3	6	MED
61	PCC	6	22ME3214A	MACHINE DESIGN	MD	A	3	1	0	4	5	8	MED
62	PCC	6	22ME3214P	MACHINE DESIGN	MD	P	3	1	0	4	5	8	MED
63	FCC	4	22ME2221	FLEXI-CORE 1 (SUPPLY CHAIN & QUALITY MANAGEMENT)	SCQM	R	3	0	0	0	3	3	MP
64	FCC	5	22ME2226	FLEXI-CORE 2 (ELECTRIC VEHICLE TECHNOLOGY)	EVT	R	2	0	2	0	3	4	TD
65	FCC	6	22ME2225	FLEXI-CORE 3 (INDUSTRIAL INTERNET OF THINGS)	IOT	R	2	1	0	0	3	3	FIOT
				Total			**33**	**2**	**12**	**8**	**46**	**55**	
66	PEC	5		PROFESSIONAL ELECTIVE - 1	PE-1	R	2	0	2	4	4	8	RELEVANT COURSE
67	PEC	5		PROFESSIONAL ELECTIVE - 2	PE-2	R	2	0	2	0	3	4	RELEVANT COURSE

68	PEC	6		PROFESSIONAL ELECTIVE - 3	PE-3	R	2	0	2	4	4	8	RELEVANT COURSE
69	PEC	6		PROFESSIONAL ELECTIVE - 4	PE-4	M	3	0	0	0	3	3	RELEVANT COURSE
70	PEC	6		PROFESSIONAL ELECTIVE - 5		R	2	0	2	0	3	4	RELEVANT COURSE
				Total			**11**	**0**	**8**	**8**	**17**	**27**	
71	SDC	3		SDP1		R	0	0	2	4	2	6	RELEVANT COURSE
72	SDC	4		SDP2		R	0	0	2	4	2	6	RELEVANT COURSE
73	SDC	5		SDP3		R	0	0	2	4	2	6	RELEVANT COURSE
74	SDC	6		SDP4(SPECIALIZATION WISE)			0	0	2	4	2	6	RELEVANT COURSE
75	SDC	1S	22TBME01	TOOL BASED LEARNING - 1(PYTHON)		R	0	0	0	4	0	4	NIL
76	SDC	2S	22TBME02	TOOL BASED LEARNING - 2(JAVA)		R	0	0	0	4	0	4	NIL
				Total			**0**	**0**	**8**	**24**	**8**	**32**	
77	OEC	8		OPEN ELECTIVE - 1		R/M	3	0	0	0	3	3	NIL
78	OEC	8		OPEN ELECTIVE - 2		R/M	3	0	0	0	3	3	NIL
79	OEC	8		OPEN ELECTIVE - 3		R/M	3	0	0	0	3	3	NIL
				Total			**9**	**0**	**0**	**0**	**9**	**9**	
80	PRI	1S	22IE2040	SOCIAL INTERNSHIP		R	0	0	0	4	0	4	DTI
81	PRI	2S	22IE3041	TECHNICAL INTERNSHIP		R	0	0	0	8	0	8	NIL
82	PRI	6	22IE3043	TERM PAPER		R	0	0	2	4	2	6	RELEVANT COURSE
83	PRI	7	22IE4053R	ENGINEERING CAPSTONE PROJECT - PHASE 1		R	0	0	0	24	6	24	RELEVANT COURSE
84	PRI	8	22IE4054R	ENGINEERING CAPSTONE PROJECT - PHASE 2		R	0	0	0	24	6	24	RELEVANT COURSE
				Total			**0**	**0**	**2**	**64**	**14**	**66**	
85	VAC	3		SPORTS / YOGA CERTIFICATION		R	2	0	0	0	0	2	NIL
86	VAC	4		VALUE ADDED COURSE - 1		R	0	0	0	8	0	8	NIL
87	VAC	5		VALUE ADDED COURSE - 2		R	0	0	0	8	0	8	RELEVANT COURSE
88	VAC	6		VALUE ADDED COURSE - 3		R	0	0	0	8	0	8	RELEVANT COURSE
				Total			**2**	**0**	**0**	**24**	**0**	**26**	
				Grand Total			**100**	**10**	**78**	**164**	**170**	**352**	

HUMANITIES ARTS AND SCIENCES COURSES

INTEGRATED PROFESSIONAL ENGLISH(IPE)

COURSE CODE	23UC1101	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding the language Mechanics in Basic Grammar & Interactive Listening & Speaking	2	PO9 & PO10 PSO 1
CO2	Applying Integrated Reading skills & Techniques of Writing	3	PO9 & PO10 PSO 1

Syllabus

Module 1	A. Discuss people you admire (review of tenses, Character adjectives) Discuss a challenge questions]B.Discuss a challenge (Questions, Trying and succeeding)C. Explain what to do and check understanding (Rapid Speech)D. Give advice on avoiding danger (Future time clauses and conditionals) Breaking off a conversation, Explaining and checking understanding.E. Discuss dangerous situations (Narrative tenses, Expressions with 'get')F. Give and respond to compliments (Intonation in Question Tags, Agreeing using question tags; giving compliments and responding)
Module 2	Discuss ability and achievement (Multi-word verbs, Ability and achievement)[Text Wrapping Break] Discuss sports activities and issues (present perfect and present perfect continuous, words connected with sports). C. Make careful suggestions (Keeping to the topic of the conversation; Making careful suggestions) D. Discuss events that changed your life (used to and would, cause and result)[Text Wrapping Break]
Module 3	A. Discuss choices, discuss changes (infinitives and ing forms, the passive)[Text Wrapping Break]B. Introduce requests and say you are grateful (Consonant sounds)[Text Wrapping Break]C. Discuss living in cities (too / enough; so / such, Describing life in cities)[Text Wrapping Break]D. Discuss changes to a home (Causative have / get Film and TV; Houses)[Text Wrapping Break]E. Imagine how things could be (Stress in compound nouns)[Text Wrapping Break]F. Discuss personal finance (First and second conditionals)
Module 4	A. Discuss moral dilemmas and crime (Third conditional; should have + past participle), Stressed and unstressed words; Sound and spelling[Text Wrapping Break]B. Discuss new inventions (Relative clauses), Discuss people's lives and achievements Reported speech; Reporting verbs, verbs describing thought and knowledge.[Text Wrapping Break]C. Express uncertainty (Linking and intrusion, Clarifying a misunderstanding)[Text Wrapping Break]D. Speculate about the past (Past modals of deduction Adjectives with prefixes)[Text Wrapping Break]E. Discuss life achievements (Wishes and regrets, Verbs of effort)[Text Wrapping Break]F. Describe how you felt (Consonant clusters, describing how you felt; Interrupting and announcing news)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	EMPOWER	Andrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones	Cambridge University Press	2022

2	PRACTICAL ENGLISH USAGE, 4TH EDN: Michael Swan's guide to problems in English (Practical English Usage, 4th edition)	Michael Swan	OXFORD	2022
3	Word Power Made Easy	Norman Lewis	OXFORD	2022

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Linguaskills	Canbridge University	y	Online	Cambridge University	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Padlet		OPEN SOURCE
2	Lexipedia		OPEN SOURCE

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	12.5	
	Project Continuous Evaluation	12.5	
In-Sem Summative	Sem-in 1	17.5	
	Sem-in 2	17.5	
End-Sem Summative	Closed Book Exam/Paper Based		40

ENGLISH PROFICIENCY (EP)

COURSE CODE	23UC1202	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding Language Mechanics in advanced Grammar and advanced Communicative Listening & Speaking	2	PO9,10 PSO 1
CO2	Applying the advanced Reading techniques and Advanced Techniques of Writing	3	PO9,10 PSO 1

Syllabus

Module 1	A. Talk about learning a second language (adverbs and adverbial language learning noun forms, word stress and noun forms with – *tion* and -*ity*) B. Describe extreme sensory experiences (Comparison, multi-word verbs, C. Talk about crime and punishment (relative clauses) D. Talk about using instinct and reason (noun phrases); Express yourself in an inexact way. E. Describe photos and hobbies (simple and continuous verbs and adjectives) F. Idioms: body parts, movement, landscapes, crime and feelings
Module 2	A. Talk about plans, intensions, and arrangements (intensions and arrangements, verbs of movement); Give advice (advising a friend about a problem) B. Emphasis positive and negative experiences by describing journeys and landscapes; architecture and buildings (future in the past, narrative tenses, ellipsis, and substitutions) C. Listen to Job Profiles. Talk about job requirements and fair pay (obligation, necessity, and permission) D. Listen to/Tell a descriptive narrative – a personal story (participle clauses) E. Emphasis opinions about the digital age- explain how you would overcome a hypothetical problem. F. Describe sleeping habits, routines, lifestyles and life expectancy (gerunds, infinitives and conditionals)
Module 3	A. Paraphrasing and summarising B. Read and talk about memories and remembering (structures with have and get) C. Speculate about inventions and technology (compound adjectives) D. City life and urban space (reflexive and reciprocal pronouns, verbs with re-) E. Superstitions and rituals (passive reporting verbs) F. Read a review, report, and recommendation of a committee.
Module 4	A. Write a web forum post (expressing opinions) B. Write a report and travel review. C. Write a profile article (read an Interview of a celebrity and write an article) D. Write an essay: opinion essay and discussion essay. E. Write an application e-mail.

	F. Write promotional material using persuasive language.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Empower 3rd Edition	Andrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones	Cambridge	2022
2	The Cambridge Guide to English Usage	Pam Peters	Cambridge	2020
3	Academic English	Letty Chan	Hong Kong : Hong Kong University Press ; London : Eurospan distributor	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Lingua Skills Business	Cambridge university	y	online	Cambridge university	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/information-about-the-test/test-formats-and-task-types/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	padlet		Open source
2	lexipedia		Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	12.5	25
	Project continuous evaluation	12.5	
In-Sem Summative	Sem in 1	17.5	35
	Sem in 2	17.5	
End-Sem Summative	Closed book/paper based exam		40

ESSENTIAL SKILLS FOR EMPLOYABILITY (ESE)

COURSE CODE	22UC2103	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NA

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Developing basic grammar Identify and organize sentence structures based on grammar and apply in writing skills	3	PO5
CO2	Develop effective interpersonal skills, cultivate a positive attitude, apply positive self-talk techniques, and use SWOC analysis to enhance employability.	3	PO6
CO3	Develop drafting skills through Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing	3	PO5
CO4	Develop effective communication skills through JAM and extempore, describing products and processes through JAM and extempore, demonstrating proper email and phone etiquette, and improving listening skills to enhance personal and professional relationships.	3	PO 5

Syllabus

Module 1	Grammar:: Tenses, Voice, Reported Speech, Spotting Errors, Sentence Improvement, Sentence Rearrangement
Module 2	SWOC, Self-awareness, Attitude, Self-Confidence & Positive Self-Talk, Grooming, Intrapersonal skills, and Interpersonal Skills.
Module 3	Writing Skills: Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing
Module 4	Speaking from the script through JAM & Extempore, Product & Process Description through JAM & Extempore, Transactional Analysis, Persuasion & Negotiation, Etiquettes (E-Mail & Phone), Listening Skills.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Objective English for Competitive Examination	Hari Mohan Prasad and Uma Sinha.	McGraw Hill	2017
2	English Language Communication Skills, C	Y. Prabhavati	Cenage	2014
3	Bridging the Softskills Gap	Bruce Tulgan	Jossey-Bass	2015
4	The Soft Skills Book-The Key Difference to Becoming Highly Effective & Valued	Dan White	LID Publishing	2121

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1		LINGUA SKILLS	yes	online	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2		IELTS	yes	online	BRITISH COUNCIL	https://www.britishcouncil.in/teach/teacher-training/masterclass-ielts-trainers

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	LINGUA SKILLS INTERMEDIATE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	LINGUA SKILLS VANTAGE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	12.5	25
	Group Discussion (CO2)	6.25	
	Quiz (CO4)	6.25	
In-Sem Summative	Project Evaluation	8.75	35
	Sem in -1 (Co1)	8.75	
	Exercise (CO2)	8.75	
	Semester In Exam II (CO4)	8.75	
End-Sem Summative	End Semester Exam (online MCQ) (CO1,CO2,CO3 &CO4)	40	40

CORPORATE READINESS SKILLS (CRS)

COURSE CODE		MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	ESE

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Extend word power for developing effective speaking and writing skills	3	PO10, PO12
CO2	Apply Interpersonal Skills in day-to-day life	3	PO10, PO12
CO3	Differentiate and enhance critical and general reading skills	3	PO10, PO12
CO4	Demonstrate necessary skills to be employable	3	PO10, PO12

Syllabus

Module 1	Verbal Ability: Synonyms and Antonyms, Sentence Completion, Idioms & Phrases, One Word Substitutes, Analogies, Spellings, Selecting words, Sentence Formation.
Module 2	Life Skills: Goal Setting, Team Building, Leadership, Time Management, Managing Stress, Work Ethics.
Module 3	Reading Skills: Reading Comprehension and Types of Questions and Critical Reading .
Module 4	Employability Skills: Empathy, Assertiveness, Group Discussion, CV, Video Resume and Interview Skills.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The 7 Habits of Highly Effective College Students: Succeeding in College...and in Life	Covey, Stephen R.	Franklin Covey	2014
2	The Complete Guide to Mastering Soft Skills for Workplace Success	Adams, John	Adams Media	2019
3	Objective English for Competitive Examination	Hari Mohan Prasad, Uma Sinha	McGraw Hill Education	2017
4	The Business Student's Handbook: Skills for Study and Employment	Fisher, Julie and Bailey, Peter	Cengage Learning	2017
5	Writing Tools: 55 Essential Strategies for Every Writer	Roy Peter Clark	Little, Brown and Company	2006

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		LINGUA SKILLS	YES	ONLINE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2		IELTS	YES	ONLINE	BRITISH COUNCIL	https://www.britishcouncil.in/teach/teacher-training/masterclass-ielts-trainers

Tools used in Practical / Skill:

S. No.	Tool Name	Parent Industry	Open Source/ Commercial
1	LINGUA SKILLS INTERMEDIATE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	LINGUA SKILLS VANTAGE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab Weekly Exercise/ Continuous Evaluation	12.5	25
	Project Continuous Evaluation	12.5	
In-Sem Summative	Semester in Exam-I	17.5	35
	Semester in Exam-II	17.5	
End-Sem Summative	Viva	740	40

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS (UHV&PE)

COURSE CODE	22UC0010	MODE	Offline	LTPS	2-0-0-0	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand and analyse the essentials of human values and skills, self exploration, happiness and prosperity.	2	PO1
CO2	Evaluate coexistence of the "I" with the body.	3	PO4
CO3	Identify and associate the holistic perception of harmony at all levels of existence.	4	PO5
CO4	Develop appropriate technologies and management patterns to create harmony in professional and personal lives.	4	PO10

Syllabus

Module 1	Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - The Basic Human Aspirations, Right Understanding, Relationship and Physical Facilities, Happiness and Prosperity – Current Scenario, Method to fulfil the Basic Human Aspirations.
Module 2	Harmony in the Human Being: Understanding the Human Being as Co-existence of Self ('I') and Body, Discriminating between the Needs of the Self and the Body, The Body as an Instrument of 'I', Understand Harmony in the Self ('I'), Harmony of the Self ('I') with the Body, Program to Ensure Sanyam and Svasthya.
Module 3	Harmony in the Family and Society: Harmony in the Family - the Basic Unit of Human Interaction, Values in Human-to-Human Relationships, 'Trust' – the Foundational Value in Relationships, 'Respect' – as the Right Evaluation, Understand Harmony in the Society, Vision for the Universal Human Order.
Module 4	Harmony in the Nature (Existence): Understand Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing 'Existence is Co-existence' at All Levels, The Holistic Perception of Harmony in Existence.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A FOUNDATION COERSE IN HUMAN VALUES & PROFESSIONAL ETHICS	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books, New Delhi	1996
2	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	Dr. ARCHANA CHAUDHARY	Book Rivers	2001
3	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	Dr. Ritu Soryan	katson print	2001
4	HUMAN VALUES AND PROFESSIONAL ETHICS	B.S.Raghavan	S. Chand	2004

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		AICTE	Yes	Online	AICTE	https://www.uhv.org.in/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	10	20
	Home assignments	10	
In-Sem Summative	Sem in 1	20	40
	Sem in 2	20	
End-Sem Summative	40	40	40

DESIGN THINKING AND INNOVATION (DTI)

COURSE CODE	22UC1203	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the importance of Design thinking mindset for identifying contextualized problems	2	PO2, PO6
CO2	Analyze the problem statement by empathizing with user	4	PO3, PO7
CO3	Develop ideation and test the prototypes made	3	PO5, PO7
CO4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity	2	PO5, PO8

Syllabus

Module 1	Introduction to Design Thinking and Innovation • Introduction to design thinking and its principles • Learning, listening, observation, dialogue, and reading in the context of design thinking • Design definitions and stories: desirability, feasibility, viability, mystery, heuristics, algorithm, requirements, patterns, connect, blind spots • Laws of Design Thinking: less is more, last 2% equals 200%, theory of prioritization • Design mind: definitions, 5 forces of growth (SEPIA), 5 frictional forces (DCAFE), 3 capacity levers (VAL)
Module 2	Design Thinking Process • Overview of the design thinking process • Design thinking for contextualized problem-solving • Incorporating sustainable development goals into design thinking • Design framework (L0) • Empathy research: understanding user needs and perspectives • Persona development: creating user profiles • Customer journey mapping: visualizing user experiences • Define phase: asking the right questions and problem statement formulation
Module 3	Ideation and Prototyping • Ideation techniques: brainstorming and generating creative ideas • Identifying patterns and anti-patterns in ideation • Evaluation of ideas using different criteria (10/100/1000 gm) • Prototyping and testing: translating ideas into tangible prototypes
Module 4	Entrepreneurial Innovation • Introduction to innovation management • Basics of business models and their role in innovation • Financial estimation for innovation projects • Pitch decks: creating persuasive presentations for innovation • Considerations for intellectual property rights (IPR) in innovation

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Design Thinking in Classroom	David Lee	Ulysses Press	2018
2	The Art of Innovation Lessons in Creativity from IDEO	Tom Kelley	IDEO	2001
3	The Design Thinking *Play Book*	Michael Lewrick, Patrick Link & Larry Leifer	Wiley Press	2018
4	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown	Harper Business	2009
5	Unmukt-Science and Art of Design Thinking	Arun Jain	Arun Jain and School of Design Thinking	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Design Thinking Professional (CDTP)	Global innovative Institute	Y	Written	Global innovative Institute	https://www.gini.org/cdtp
2	Design Thinking for Innovation	University of Virginia	Y	Online	Coursera	https://www.coursera.org/learn/uva-darden-design-thinking-innovation
3	IBM Enterprise Design thinking	IBM	N	Online	IBM	https://www.ibm.com/design/thinking/page/courses/Practitioner

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Participation (Breakout Activities)	10	60
	Continuous Evaluation Project (Work in Progress)	30	
	Quiz	20	
End-Sem Summative	SEM-End Project	40	40

INNOVATION MANAGEMENT (IM)

COURSE CODE	22UC0012	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Develop value proposition for the problem identified	3	PO2, PO3, PO11
CO2	Build MVP for the solution developed	3	PO3, PO5, PO11
CO3	Devise go to market strategy	4	PO2, PO4, PO11
CO4	Create a Pitch-deck with funding strategy	6	PO5, PO10, PO11

Syllabus

Module 1	**Problem Identification and Opportunity Discovery** • Conduct Opportunity Discovery: Learn techniques to identify potential opportunities in the market and explore new ideas. • Problem Validation: Understand how to validate the identified problems by gathering data, conducting market research, and analyzing customer needs. • Sharpen the Problem Pitch: Develop effective pitching skills to communicate the identified problem clearly and persuasively.
Module 2	**Customer and Markets** • Identify the Market Type: Learn about different market types such as B2B, B2C, and C2C, and understand their characteristics and dynamics. • Explore Market Segments: Discover various customer segments within a target market and identify their unique needs and preferences. • Determine Market Positioning: Define the positioning strategy for a product or service to differentiate it from competitors and attract the target market. • Create Customer Persona: Develop detailed profiles of target customers, including demographics, behaviors, and preferences.
Module 3	**Creating a Compelling Value Proposition** • Craft your Core Value Proposition: Define the unique value your product or service offers to customers and how it solves their problems or fulfills their needs. • Create Sustainable Differentiation Strategy: Identify and implement strategies to create sustainable competitive advantages over competitors. • Deliver Value: Explore techniques for delivering value to customers, including customer experience design, service delivery, and product innovation.
Module 4	**Competitive Advantage** • Identify Competitors: Analyze the competitive landscape and identify direct and indirect competitors. • Identify Critical Product Features: Determine the key features and attributes that will differentiate your product or service in the market. • Conduct Feature Ranking: Prioritize and rank product features based on their importance and impact on customer satisfaction and market success.
Module 5	**Business Model and MVP Development** • Build and Test a Business Model: Develop and refine a business model that outlines the key elements of your venture, such as revenue streams, cost structure, and customer acquisition channels.

	• Pivot or Persevere: Learn how to assess and adapt your business model based on market feedback and changing circumstances. • Identify the Riskiest Assumptions: Identify the assumptions underlying your business model and test them systematically to mitigate risks. • Build your MVP: Develop a minimum viable product (MVP) or prototype to test with early adopters and gather feedback for further iteration and improvement.

Reference Books

Sl No	Title	Author(s)	Publisher	Year
1	"The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses"	Eric Ries	Crown Publishing Group	2011
2	"Value Proposition Design: How to Create Products and Services Customers Want"	Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith	Wiley	2014
3	"The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail"	Clayton M. Christensen	Harvard Business Review Press	1997
4	"Disciplined Entrepreneurship: 24 Steps to a Successful Startup"	Bill Aulet	Wiley	2013
5	"The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company"	Steve Blank, Bob Dorf	K&S Ranch Inc.	2012

Global Certifications

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Innovation Professional (CInP)	Global innovative Institute	Y	Written	Global innovative Institute	https://www.gini.org/cinp

Tools used in Practical / Skill

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Component:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Participation (Breakout Activities)	10	60
	Continuous Evaluation Project (Work in Progress)	30	
	Quiz	20	
End-Sem Summative	SEM-End Project	40	40

BASIC & SCIENCE ELECTIVE COURSES

LINEAR ALGEBRA AND CALCULUS FOR ENGINEERS (LACE)

COURSE CODE	23MT1001	MODE	Regular	LTPS	2-2-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	**CO Description**	**BTL**	**PO Mapping**
CO1	Apply matrix algebra to the real-world problems - engineering, physical and biological sciences, finance and economics.	3	PO1
CO2	Apply multivariate differential calculus to find extremum of functions and solve differential equations.	3	PO1
CO3	Solve improper integrals using beta and gamma functions and evaluate double and triple integrals in 2-D and 3-D geometry.	3	PO1
CO4	Make use of vector differentiation and integration, solve the real-world problems.	3	PO1, PO5

Syllabus

Module 1	**Introduction to Matrix theory**: Row echelon form and rank of a matrix, Systems of linear equations, Solution by Gauss elimination, LU-Decomposition, Eigen values and eigen vectors. Diagonalization of matrices, quadratic forms and their canonical forms.
Module 2	**Multivariate Differential calculus:** Partial derivatives, Jacobian, total differentiation and their applications, chain rule, Taylor's series for function of two variables, maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers. Differential Equations: Mathematical models used in differential equations. Second and higher-order differential equations, along with the methods of solutions and their applications.
Module 3	**Multivariate Integral Calculus:** Improper integrals, Beta, Gamma functions and their relationship. Line integrals- length of the arc, double and triple integrals and applications to area, volume, mass & moment of inertia. Change of order of integration, change of variables in polar, cylindrical and spherical polar coordinates.
Module 4	**Vector Calculus:** Scalar and vector point functions, Gradient, Directional Derivative, Divergence and Curl, Evaluation of line integrals , Introduction to Greens and Stoke's theorems and their applications.

Text Books :

Sl No	Title	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Willey & Sons, New Delhi, India.	10th edition, 2010,

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Higher Engineering Mathematics	B.S. Grewal	Khanna, New Delhi, India.	42Edition, 2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Mathematics for Engineers Specialization	Coursera	Y	Online Objective	Coursera	https://www.coursera.org/specializations/mathematics-engineers
2	Advanced Matrix Theory and Linear Algebra for Engineers	IISc Bangalore	Y	Online Objective	NPTEL	https://nptel.ac.in/courses/111108066

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	24
	Tutorial	8	
	Home Assignment andTextbook	8	
In-Sem Summative	Semester in Exam-I	18	36
	Semester in Exam-II	18	
End-Sem Summative	End Semester Exam	40	40

MATHEMATICAL MODELING AND NUMERICAL METHODS (MM&NM)

COURSE CODE	22MT2003	MODE	R	LTPS	2-2-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply mathematical methods to model the phenomena intofirstand higher-order differential equations and obtain the solutions.	3	PO1
CO2	Apply Lagrange's and Charpit's method and solve first order partial differential equations.Apply method of separation of variables and finite difference method to solve one dimensional wave and heat equations and two-dimensional Laplace equations	3	PO1
CO3	Apply Numerical methods for obtaining the unknown value from the given data points.	3	PO1
CO4	Apply numerical techniques to solve the ordinary differential equations.	3	PO1

Syllabus

Module 1	Definitions and terminology and mathematical models used in differential equations. First-order and higher-order differential equations, along with the methods of solutions and their applications.
Module 2	Formation of partial differential equations, solutions of first order linear and nonlinear PDEs by Lagrange method, solution of second order PDEs by method of separation of variables i.e., one dimensional wave and heat equations, Laplace equation in two dimensions. Solving Laplace equation by finite difference method.
Module 3	Solution of algebraic and transcendental equations: Bisection method and Newton –Raphson method. Finite differences: Forward, Backward, Central differences, Shift operators, average operator and relations between the difference operators. Interpolation: Lagrange's and Newton's divided difference formulas.
Module 4	Taylor's,Euler's, Modified Euler's and Runge-Kutta method of fourth order.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley &Sons, Inc	2015

2	Advanced Engineering Mathematics	M.K.Jain, S.R.K.Iyengar and R.K.Jain,	New age international publishers(5thEdn), New Delhi	
3	Applied Numerical methods with MATLAB for Engineers and Scientists.	Steven C, Chapra	Tata McGraw-Hill (3rdedn.)	2012
4	Higher Engineering Mathematics	Dr. B.S. Grewal,	Khanna Pub, NewDelhi.	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Mathematical modelling: Analysis and Applications	NPTEL	YES	ONLINE	NPTEL	https://archive.nptel.ac.in/courses/111/107/111107113/
2	Numerical Methods for Engineers	COURSERA	YES	ONLINE	COURSERA	https://www.coursera.org/learn/numerical-methods-engineers

Tools used in Practical / Skill: NIL

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	8	24
	Tutorial	8	
	Home Assignment and Book.	8	
In-Sem Summative	In-Sem Exam-I	18	36
	In-Sem Exam-II	18	
End-Sem Summative	END SEM EXAM	40	40

OPTIMIZATION TECHNIQUES (OT)

COURSE CODE	22MT2011	MODE	R	LTPS	2-2-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Identify Optimum solutions for various single objective problems using Linear Programming models	3	PO1, PO5, PSO2
CO2	Identify Optimum Solutions through Transportation and Assignment models	3	PO1, PO3, PSO2
CO3	Identify Optimum Solutions through Game theory, DPP, Queuing theory & Simulation models	3	PO1, PO3, PSO2
CO4	Solve project management problems using CPM, PERT and inventory	3	PO1, PO3, PSO2

Syllabus

Module 1	**Linear Programming Problem:** Introduction to Operations Research, Models, Scope, limitations, applications of OR. Introduction, Graphical method, Simplex method, Big M method, Two phase method, multiple solutions, infeasible solutions, unbounded solution, degeneracy, Dual Simplex method.
Module 2	**Transportation:** Introduction, methods of feasible solution, optimality test, Degeneracy in transportation problem, unbalanced transportation problem. Assignment Problem: Introduction, Hungarian method, travelling salesman problem.
Module 3	**Queueing Theory:** Introduction, single channel, Poisson arrival, exponential service time with finite population and infinite population. Dynamic Programming – Introduction, Bellman's principle of optimality, application to shortest route problem.
Module 4	**Project Management by CPM/PERT:** Introduction, simple network techniques, construction rules of drawing, Fulkerson's rule, Critical path method (CPM) – floats, critical path, project duration. PERT – Introduction, different time estimates, expected time, variance, expected project duration and probability of completion.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Introduction to Operations Research	F.S.Hiller, G.J.Liberman	Tata McGraw Hill Education (India) Pvt. Ltd.	2017
2	Operations Research – An Introduction	Hamdy.A.Taha	Pearson Education	2017
3	Operations Research-Theory, Methods & Applications	S.D. Sharma	Kedar Nath Ram Nath.	2017

4	Operations Research	R. Paneerselvam	PHI	2006

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Python	IBM	Y	Online MCQ	Etrain	https://courses.etrain.skillsnetwork.site/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	24
	Home Assignments	8	
	Tutorial Continuous Evaluation	8	
In-Sem Summative	In-Sem 1	18	36
	In-Sem 2	18	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

COMPUTATIONAL METHODS FOR APPLIED MECHANICS AND STATISTICS (CMAMS)

COURSE CODE	22MT2010	MODE	R	LTPS	2-2-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply various approximate methods to solve problems in structural mechanics and to provide simplicity involved in Finite Element Method.	3	PO2, PSO2
CO2	Apply Galerkin method for solving problems on heat transfer, torsion, and fluid flow.	3	PO2, PSO2
CO3	Analyze dynamic problems for longitudinal and transverse vibration of beam, and critical load estimation of columns to Engineering Devices.	4	PO2, PSO2
CO4	Analyze the experimental data using simple and useful methods of Statistics	4	PO2, PSO2

Syllabus

Module 1	Exact Method – Approximate Method (Variational Approach & Weighted Residual Method: Collocation method, Subdomain method, Least Square method, Galerkin method) - Finite Difference Method – Finite Element Formulation - Solution Techniques - Problems of axially loaded beams and beam bending.
Module 2	– Governing equations for boundary value problems – Heat Transfer (one & two-dimensional steady state heat transfer problems) – Torsion of non-circular section – Fluid flow problem (Stream function approach & Potential function approach)
Module 3	Governing Equations – Longitudinal Vibration – Bar of varying cross-section – Lateral Vibration – Stability of column
Module 4	Characterizing Statistical Distributions – Representing Data – Measures of Central Tendency – Statistical Distribution Functions (Gaussian Distribution, Weibull Distribution) – Confidence Intervals for Predictions – Comparison of Means – Statistical Safety Factor – Statistical Conditioning of Data – Regression Analysis (linear regression – Multivariate Regression – Linear & Nonlinear Least-Squares Methods – Chi-square Analysis.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Finite Element Method", 3rd Edition	Yunus A. Cengel & Michael Boles	Tata McGraw Hill, NewDelhi	

2	"Finite Element Method"	R. Dhanraj and K. Prabhakaran Nair	Oxford University Press	
3	Advanced Engineering Mathematics	John Willey & Sons,	Pearson Education India limited.	
4	Probability and Statistics for Engineers and Scientists	R.E. Walpole, R.H. Myers, S.L. Myes, Keying Ye,	McGraw Hill	

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Numerical Methods for Engineers	Mathworks	Y	Online	Math works	https://in.mathworks.com/products/simulink.html?s_tid=hp_products_simulink

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	24
	Home Assignments	8	
	Tutorial Continuous Evaluation	8	
In-Sem Summative	In-Sem 1	18	36
	In- Sem 2	18	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

MATERIAL SCIENCE & METALLURGY (MSM)

COURSE CODE	23ME1005	MODE	Regular	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand crystallography and various material testing methods to solve the relevant problems.	2	PO1, PO2,PSO1
CO2	Distinguish and analyze various types of materials based on their engineering applications.	2	PO1, PO3
CO3	Apply the concepts of cooling curves and phase diagrams.	3	PO1, PO4
CO4	various heat treatment processes and their strengthening mechanisms apply for various materials	3	PO1, PO5
CO5	Gain hands on experience to conduct various experiments of metallograpy and heat treatment process practically.	3	PO1, PO5,PSO1

Syllabus

Module 1	Introduction-Testing Introduction to Engineering materials, Crystallography, Crystal systems and Bravi's lattices, Crystal imperfections, Material testing Methods-Destructive and Non Destructive Methods- Dye penetrate test, Magnetic flux test, Radiography and Ultrasonic test.
Module 2	Materials Ferrous and Non-Ferrous Materials, Ceramics, Composites and Biomaterials- Introduction, classification and applications. Smart Materials: Introduction, shape memory effect, classification of shape memory alloys, compositions, properties applications of shape memory alloys.
Module 3	Constitution of alloys, Necessity of alloying, Solid solutions, Gibb's Phase rule, Cooling Curves, Phase Diagrams-Introduction, classification based on components and transformations, construction, reactions involved in Fe-C, Cu-Ni and Al-Cu type.
Module 4	Heat Treatment of steels-Introduction, stages, classification, Annealing, Normalising, Tempering, Hardening, Harden ability test by Jominy end quench apparatus, Isothermal transformation diagrams-TTT diagram &CCT diagram, special heat treatment techniques-Introduction, classification, surface hardening and case hardening methods such as carburising, nitriding, cyaniding and carbonitriding.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Materials science and Engineering	V. Raghavan	Prentice-Hall of India	2015
2	Engineering Metallurgy	R.A.Higgins	Butterworth-Heinemann	2006

3	Engineering Physical Metallurgy,	Y. Lakhtin,	Univ Pr of the Pacific	2005
4	Engineering materials science	Milton Ohring	Academic Press	1995
5	Materials Science and Engineering	William D. Callister (Jr.)	Wiley India	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

ENGINEERING CHEMISTRY (EC)

COURSE CODE	23CY1001	MODE	General	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the operation of electrochemical systems to produce electric energy and storage devices.	3	PO 1, PO 6
CO2	Use the fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena.	3	PO 1, PO 2, PO 6
CO3	Examine water quality and apply appropriate purification technique for intended problem.	3	PO 1, PO 2, PO 7
CO4	Employ the fundamental principles and general properties of materials in various engineering applications.	3	PO 1, PO 3, PO 6
CO5	Analyse the data, develop skills in chemical analysis and their application in engineering.	4	PO 1, PO 3, PO 7

Syllabus

Module 1	Electrochemistry: Single electrode potential and its measurement, Electrochemical cells, EMF series, Nernst equation, Cell emf measurement, Reversible and irreversible cells, Concentration cells, Reference Electrodes-Determination of pH using glass electrode. Gas Sensors: Capacitance Manometer and Mass Spectrometer. Batteries: Chemistry, construction, and engineering aspects of Primary (mercury battery) and secondary (lead-Acid cell, Ni-Metal hydride cell, Lithium cells) and fuel cells– Hydrogen–Oxygen fuel cell, methanol fuel cell advantages of fuel cell.
Module 2	CORROSION & ITS CONTROL: Causes and different types of corrosion and effects of corrosion. Theories of corrosion– Chemical, Electrochemical corrosion, Pitting corrosion, stress corrosion, Galvanic corrosion. Factors affecting corrosion– Nature of metal, galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment-effect of temperature, effect of pH, Humidity, effect of oxidant. Cathodic protection, sacrificial anode, impressed current cathode, electroplating.
Module 3	WATER Technology: Introduction, Hardness: Causes, expression of hardness – units – types of hardness, estimation of temporary and permanent hardness of water, numerical problems. Alkalinity and estimation of alkalinity of water, numerical problems. Boiler troubles – Scale &sludge formation, caustic embrittlement, Boiler corrosion, priming &foaming. Softening of water: Internal and external treatments -Lime soda, Ion exchange process. Desalination-reverse osmosis and electrodialysis.
Module 4	Molecules and Materials: polymers- Types of polymerization-Mechanisms, Plastics – Thermoplastic resins and thermosetting resins -Preparation, properties and engineering applications of polyethylene, PVC, Teflon, Bakelite, Urea Formaldehyde. Conducting Polymers: Polyacetylene, polyaniline, conduction, doping and applications. Carbon nano tubes and Applications.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Company	2015
2	Chemistry in Engineering and Technology	J C Kuriacose & J Rajaram,	Tata McGraw Hill	2001
3	Chemistry for Engineers	Rajesh Agnihotri	Wiley	2014
4	Engineering Chemistry: Fundamentals and Applications	Shikha Agarwal	Cambridge University Press	2016

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment & Textbook	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

ENGINEERING SCIENCE COURSES

COMPUTATIONAL THINKING FOR STRUCTURED DESIGN (CTSD)

COURSE CODE	23SC1101	MODE	R	LTPS	3-0-2-4 (R)	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Develop and apply logical building blocks to solve real world problems	3	PO1, PO2
CO2	Apply computational thinking for designing solutions	3	PO1, PO2
CO3	Develop and apply the CRUD operations on arrays	3	PO1, PO2
CO4	Apply CRUD operations on Linear Data Structures	3	PO4
CO5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems	3	PO1, PO2, PO4, PSO1
CO6	Skill the students in such a way that students will be able to develop logic that help them to create programs as well as applications in C	3	PO1, PO2, PO4

Syllabus

Module 1	Structured Programming Paradigm: Problem Solving Approach, Algorithms and Algorithm Analysis, Program Development Steps, Structure of C Program, Pre-Processor Directives, Design of Building Blocks for solving real world problems: Modularization: Functions, Scope of Variables and Storage classes, Data Types: Primitive, Extended and Derived Including Pointers, Operators: Types of operators, Precedence, Associativity, Formatted I/O, Decision Making using conditional statements.
Module 2	Definite and indefinite Iterative statements. Recursion, logic building using complex building blocks, Bitwise operators, Redirecting I/O: Files and File Operations.
Module 3	Command line arguments, CRUD operations on Basic Data Structures: Basic Data Structure: Arrays, 2-D Arrays, Dynamic Memory Allocation Searching: Linear Search and Binary Search Sorting: Bubble Sort.
Module 4	CRUD operations on Linear Data Structures: Stacks, Queues, Single Linked List, Introduction to nonlinear data structures.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The C Programming Language: ANSI C Version	Brian W. Kernighan, Dennis M. Ritchie	Prentice-Hall/Pearson Education-2005	2005
2	Fundamentals of Data structures in C	Horowitz, Sahni, Anderson Freed	Pearson Education	1993
3	Data structures and Program Design in C	Robert Kruse, C. L. Tondo, Bruce Leung, Shashi Mogalla.	Pearson Education	2006

4	Programming in ANSI C	E. Balagurusamy	Tata McGraw-Hill Education, Edition	2019
5	Programming in ANSI C	Mark Allen Weiss	Pearson Education	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	C Programming Language Certified Associate	C++ institute	Yes	Online/Multiple Choice	Pearson Vue	https://cppinstitute.org/cla-exam-syllabus

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Dev C++	Software Development	Open Source
2	Coding platforms	Skill development	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	5	22
	Quiz	5	
	Global Challenges Participation	2	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1	12	38
	In-Sem 2	12	
	Practical In-Sem	7	
	Skill In-Sem	7	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

DATA STRUCTURES (DS)

COURSE CODE	23SC1202	MODE	R	LTPS	2-0-2-4 (R)	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand various sorting algorithms and analyse the efficiency of the algorithms.	4	PO1, PO2
CO2	Implement and evaluate Linear Data Structures and Demonstrate their applications.	4	PO2, PO3, PO1
CO3	Implement and evaluate tree data structures and understand hashing techniques	4	PO1, PO2, PO3
CO4	Understand graph data structures and apply graphs to solve problems	3	PO1, PO2
CO5	Design, Develop and evaluate common practical applications for linear and nonlinear data structures.	4	PO7, PO10, PO9
CO6	Skill the students in such a way that students will be able to develop logic that help them to create programs on both linear and non-linear data structures and its applications.	3	PO7, PO9, PO10

Syllabus

Module 1	Understand various sorting algorithms and analyse the efficiency of the algorithms.
Module 2	Implement and evaluate Linear Data Structures and Demonstrate their applications.
Module 3	Implement and evaluate tree data structures and understand hashing techniques
Module 4	Understand graph data structures and apply graphs to solve problems

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Structures and Algorithms	A.V.Aho, J. E. Hopcroft, and J. D. Ullman	Pearson Education"	2003
2	Fundamentals of data structures in C	Horowitz, Sahni, Anderson Freed	Pearson Education"	2007
3	Data Structures	R. F. Gilberg, B. A. Forouzan,	Thomson India Edition	2004
4	Data Structures & Program Design in C	Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla	Thomson India Edition	2007

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Dev C++	Software Development	Open Source
2	Online GDB	Software Development	Open Source
3	Coding platforms	Skill development	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	4	20
	Home Assignments	2	
	Global Challenges Participation	2	
	Practical Continuous Evaluation	6	
	Skill Continuous Evaluation	6	
In-Sem Summative	In-Sem 1	12	40
	In-Sem 2	12	
	Practical In-Sem	8	
	Skill In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

OBJECT ORIENTED PROGRAMMING (OOP)

COURSE CODE	23CS1201	MODE	R	LTPS	2-0-2-0 (R)	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Basic Data types, Operators, Decision and Looping Control Statements, Strings	3	PO3, PO5
CO2	Apply the concepts of Lists, Tuples, Dictionaries. Functions, Modules, Class, Object, OOPS principles.	3	PO3, PO5
CO3	Apply Concepts of OOP principles, classes and objects, Call by value vs. Call by reference, recursion, and Nested classes	3	PO3, PO5
CO4	Apply Concepts of Files, Interfaces, Packages, Threads	3	PO3, PO5
CO5	Design, implement, and evaluate Python programs using basic data types, variables, expressions, conditional statements, loops, functions, built-in data structures, object-oriented programming concepts, Python libraries and modules, debugging techniques, and file I/O to solve programming problems.	4	PO7, PO9, PO10, PSO1
CO6	Apply object-oriented programming concepts to write programs and Analyses requirements and design to implement lab-based project with SDLC in a group of students	4	PO7, PO9, PO10, PSO1

Syllabus

Module 1	**Python interpreter and interactive mode:** values and types: int, float, Boolean, string, and list, variables, expressions, statements, tuple assignment, precedence of operators, comments .Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Strings: string slices, immutability, string functions and methods, string module
Module 2	**Fruitful functions**: functions, function definition and use, flow of execution, parameters and arguments return values, parameters, local and global scope, recursion; List, Tuples, Set, Dictionary data types, Classes, Object: command line arguments, Class, object, methods, constructors, OOP's principles.
Module 3	**Polymorphism:** Static and Dynamic Polymorphism (Overloading, Overriding), Inheritance – Super classes- sub classes –Protected members – constructors in sub classes, Super keyword, Encapsulation: Data Encapsulation and Data Abstraction, Object as argument and return value: Call by value vs. Call by reference, recursion, and Nested classes.
Module 4	**Files, Interfaces, Packages, and Threads: Introduction To files:** Create, Read Write, Append, Delete Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces, Packages, importing packages, differences between classes and interfaces, Implementing & Applying interface. Exception Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions fundamentals, Threads: Difference between multi-threading and Multitasking, Different Thread objects.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Think Python: How to Think like a Computer Scientist	Allen B. Downey	O'Reilly Publishers, 2016	2016
2	Python for Programmers	Paul Deitel and Harvey Deitel	Pearson Education	2021
3	Python: The Complete Reference	Martin C. Brown	Mc-Graw Hill, 2018	2018
4	Python 3 Object-oriented Programming	Dusty Phillips	Packet Publishing	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	PCAP	Python Institute	Yes	Objective Type	PearsonVue	https://pythoninstitute.org/pcap

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	IDLE	Software Development	Open Source
2	Pycham (Community Version)	Software Development	Open Source
3	Coding platforms	Skill development	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	6	24
	Quiz	6	
	Global Challenges Participation	4	
	Practical Continuous Evaluation	8	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	12	
End-Sem Summative	End-Sem Exam (Paper Based)	26	40
	Lab End-Sem Exam	14	

DESIGN TOOLS WORKSHOP (DTW)

COURSE CODE	22ME1103	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate proficiency in typing sentence , paragraph , report , presentations along spread sheets using office tools, LaTeX tools and PowerBI	2	PSO2,PO5
CO2	Build a static website and blog with using html along with Special features of HTML5, CSS and Javascript	3	PO10,PO5
CO3	Develop a virtual environment with cospace and construct a marker based Augumented Reality and create a 3D terrain	3	PSO1,PO3
CO4	Utilising the softwares of Autodesk Fusion 360 and the same can be printed in 3D printer as physical prototype, Fundamentals of electrical circuit: Ohms law, KCL and KVL law	3	PSO1,PO3

Syllabus

Module 1	Office management and documentation
Module 2	Basics of Web Development
Module 3	Augmented Reality, Virtual Reality, Mixed Reality and Extended Reality
Module 4	Conceptual Design, Modelling and Prototyping

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	MS-Office		Laxmi Publications Pvt Limited	2008
2	LaTeX Cookbook	Kottwitz, Stefan	Packt Publishing	2015
3	HTML & CSS: Design and Build Web Sites	Duckett, Jon	Wiley	2011
4	3D Printing: Understanding Additive Manufacturing	Thurn, Laura, et al	Carl Hanser Verlag GmbH & Company KG	2018
5	Augmented Reality and Virtual Reality: New Trends in Immersive Technology		Springer International Publishing	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	Autodesk	Y	Online	Certiport	www.certiport.com
2			Y	Online	Microsoft	

	Power BI Data Analyst	Microsoft				https://learn.microsoft.com/en-us/certifications/exams/pl-300/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Office	Microsoft	Commercial
2	Overleaf	Overleaf	Open source
3	Power BI	Microsoft	Commercial
4	Notepad++	Notepad++	Open source
5	Cospaces	Cospacesedu	Open source
6	Fusion 360	Microsoft	Commercial
7	Tinkercad	Microsoft	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	25
	Project Continuous Evaluation	10	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	Lab End-Sem Exam	40	40

ENGINEERING GRAPHICS (EG)

COURSE CODE	23ME1002	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Model Engineering Curves in engineering Practice, Conic sections and special curves, scales both manually and using computer aided design tool (CAD).	2	PO1, PO5& PSO1
CO2	Project points, lines and planes in first angle third angle both manually and using CAD.	3	PO1, PO5& PSO1
CO3	Project solids and generate the sectional views of solids, development of surfaces of regular solids both manually and using CAD.	3	PO1, PO5 & PSO1
CO4	Convert orthographic projections to create isometric view and isometric view to orthographic projection both manually and using CAD.	3	PO1. PO5, PSO1

Syllabus

Module 1	**Introduction to Engineering Drawing**: Principles of Engineering Graphics and their significance – Drawing Instruments and their Use- Conventions in Drawing – Lettering – Conic Sections: Ellipse, Parabola, Hyperbola and Rectangular Hyperbola – oblong, concentric method. Special Curves: Cycloid, Epicycloids, Hypocycloid, and Involutes. Scales: Plain and Vernier scales.
Module 2	**Projection of Lines, points and Projections of Planes:** First and Third Angle Projections of Points and Lines inclined to planes, True lengths, traces. Constructions, Projections of regular planes inclined to both planes.
Module 3	**Projections of Solids and Developments of surfaces**: Projections of Regular solids inclined to one plane. Sections and Sectional Views: Right Regular Solids - Prism, Cylinder, Pyramid, Cone. Surface development of right regular solids – Prisms, Cylinder, Pyramid cone and their parts. Understand the fundamentals of modelling and design for manufacturing
Module 4	**Orthographic Projection in First Angle Projection and Isometric Projections**: Principles of Orthographic Projections- conventions - Principles of Isometric Projection- Isometric Scale- Isometric view conventions- Isometric View of Lines, Plane Figures, and simple problems. Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions. Analyse manufacturing processes and their impact on product design. Utilize Fusion 360 software for computer-aided design (CAD) modeling and visualization

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Drawing	N.D.Bhat/ Charotar	Pearson Education	2019
2	Engineering Graphics,	Agrawal B. &Agrawal C. M	TMH Publication.	2012
3	Fundamentals of Engineering Drawing	.W.J. Luzadder and J.M. Duff	PHI learning	1978

4	Visualization, Modeling, and Graphics for Engineering Design	D.K. Lieu and S.A. Sorby	Cengage Learning	2015
5	Engineering Graphics With Autocad	D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar	PHI Learning	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	AUTOCAD	AUTODESK	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	12.5	25
	Project Continuous Evaluation	12.5	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	Lab End-Sem Exam	40	40

WORKSHOP PRACTICES FOR ENGINEERS (WPFE)

COURSE CODE	23ME1004	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Prepare different components using Carpentry, Tin-smithy trade	2	PSO2,PO5
CO2	Basic electrical engineering knowledge for house wiring practice	3	PO10,PO5
CO3	Prepare different components using various manufacturing techniques	3	PSO1,PO3
CO4	Perform various machining operations	3	PSO1,PO3

Syllabus

Module 1	Carpentry (simple exercise in wood working, pattern making)
Module 2	Fitting operations & power tools.
Module 3	Electrical &Electronics, Sheet metal working, Welding (arc welding & gas welding and gas cutting), brazing, Plastic moulding, glass cutting.
Module 4	Manufacturing Methods: casting, forming, machining, joining, advanced manufacturing Methods. CNC machining, Additive manufacturing.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Elements of Workshop Technology	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.	Media promoters and publishers private limited, Mumbai.	3rd Edition
2	Production drawing	K.L.Narayana and P.Kannaiah	New Age International	2nd Edition
3	Processes and Materials of Manufacture	Roy A. Lindberg	Prentice Hall India	4th edition

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	Autodesk	Y	Online	Certiport	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Carpentry	Carpentry	Commercial

2	Fitting	Fitting	Commercial
3	Sheet metal	Sheet metal	Commercial
4	Welding	Welding	Commercial
5	CNC machine	CNC machine	Commercial
6	Tinkercad	Microsoft	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	25
	Project Continuous Evaluation	10	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	Lab End-Sem Exam	40	40

BASIC ELECTRICAL & ELECTRONIC CIRCUITS (BEEC)

COURSE CODE	23EC1203	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the Loop and Nodal methods to solve complex Electrical and electronic circuits.	3	PO2/PSO1
CO2	Apply the Study State Analysis techniques to study the response of R, L and C circuits.	3	PO2/PSO1
CO3	Examine the applications of Semiconductor Devices.	3	PO2/PSO1
CO4	Examine the applications of different Analog and Digital ICs.	3	PO2, PO3/PSO1

Syllabus

Module 1	Basic circuit elements, Circuit fundamental: Mesh analysis and Nodal analysis, Thevenin's theorem, Norton's theorem, Super position theorem, Maximum power transfer theorem.
Module 2	AC fundamentals: RMS value, Average Values, Form & Peak factor, Steady state analysis (R, L, C, etc), Reactance, Impedance, Phase & Phase difference, Real power, Reactive power, and Power factor.
Module 3	Operation of the diode, Diode as switch, Rectifiers, Clipper, Clampers, Zener Diode as a regulator, Operation of Transistor, Transistor as switch.
Module 4	Analog & Digital ICs: Voltage regulators 7805, 7905, and LM723, Operational Amplifiers IC 741, Timer IC 555, Comparators LM 339

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Electrical Circuit Theory and Technology	John Bird	Routledge	2010
2	Electronic Devices and Circuit Theory	Robert L. Boylestad	Prentice Hall	2006
3	Circuits and Networks: Analysis and Synthesis	A Sudhakar, Shyam Mohan S Palli	Tata MGH	2005
4	Electronic Devices and Circuits	David A. Bell	Oxford Press	2005
5	Basic Electrical Circuits	B.L Theraja, A.K Theraja	S. Chands	1998

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	N/A					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	N/A		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	10	20
	Home Assignment and Book. (Min. 4 Assignments etc.)	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

ENGINEERING MECHANICS (EM)

COURSE CODE	23ME1001	MODE	Regular	LTPS	3-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of forces, governing static equations and analyse planar system of forces.	3	PO1
CO2	Use analytical techniques for analysing forces in statically determinate structures.	4	PO1
CO3	Apply the concepts of planar and non-planar system of parallel forces and estimate the moment of inertia for lamina and material bodies.	3	PO2
CO4	Apply fundamental concepts of kinematics and kinetics of particles to solve simple practical problems.	4	PO2

Syllabus

Module 1	Introduction, Basic concepts, Laws of motion, Principle of Transmissibility of forces, Resultant of a force system, force laws, Resultant of two dimensional concurrent and Non- Concurrent Force systems, Free body diagrams, Applications. Equilibrium of Rigid bodies– Equilibrium and Equations of Equilibrium, Lami's theorem, Type of supports and their reactions, Moments and couples, Varignon's theorem, Resultant moment and applications
Module 2	SPATIAL FORCE SYSTEM & TRUSSES: Spatial force systems – Forces in space, resultant and equilibrium of spatial force system. Truss Analysis-Trusses -Assumptions involved in the Method of joints and sections.
Module 3	FRICTION AND PROPERTIES OF AREAS: Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Applications-ladder friction, wedge friction. CENTRIOD AND MOMENT OF INERTIA: Centroid, Centre of gravity, Moment of inertia - Area and Mass- polar moment of inertia, Parallel axis theorem.
Module 4	KINEMATICS OF RIGID BODY: Introduction, Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational motion. Virtual Work: Introduction - Principle of virtual work - Equilibrium of ideal systems. KINETICS OF RIGID BODY: Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D-Alembert's Principles and Dynamic Equilibrium.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Mechanics	Timoshenko, D. Young, J Rao	Tata McGraw Hill	2013
2	Engineering Mechanics: Statics and Dynamics	Statics and Dynamics by A K Tayal	Umesh publications	2008
3	Engineering Mechanics: Statics and Dynamics	R C Hibbeler	Pearson	2015

4	Engineering Mechanics	Irving H. Shames	Prentice-Hall	2005
5	Vector Mechanics for Engineers (in SI units) Statics & Dynamics	F. P. Beer and E.R. Johnston	Mc Graw Hill Publications	2017
6	Engineering Mechanics (Statics)	J L Meriam and L G Kraige	Wiley student edition	2018

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		Nil				

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Nil		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	24
	Home Assignments	8	
	Quiz	8	
In-Sem Summative	In-Sem 1	18	36
	In-Sem 2	18	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

FLUID MECHANICS & HYDRAULIC MACHINES (FMHM)

COURSE CODE	22CE2102	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the knowledge of fluid properties and the laws of fluid statics to estimate the total pressure, Centre of pressure and forces on submerged and floating bodies	3	PO1, PO2
CO2	Analyse the flow through pipes	4	PO1, PO2
CO3	Analyse the flow through open channel	4	PO1, PO2
CO4	Analyse the performance of hydraulic turbines and pumps	4	PO1, PO2
CO5	Analyse the flow through pipes and open channel by conducting experiment in laboratory	4	PO1, PO2

Syllabus

Module 1	Fluid Properties: Definition of fluid, properties of fluids - density, specific weight, specific gravity, viscosity, classification of fluids, surface tension, capillarity, vapor pressure. Fluid Statics: Introduction, pressure, Pascal law, hydrostatic law, measurement of pressure, simple and differential manometers; total pressure and centre of pressure on vertical, horizontal, inclined, and curved surfaces. Buoyancy: Buoyancy, centre of buoyancy, meta-centre, meta-centric height, forces on submerged bodies, stability of submerged and floating bodes. Fluid kinematics: Introduction, types of fluid flow, discharge, continuity equation, potential function and stream function.
Module 2	Fluid dynamics: Introduction, Euler's equation of motion, Bernoulli's equation and applications. Flow through pipes: Introduction, major and minor energy losses, friction coefficient in laminar and turbulent flow, Hagen-Poiseuille law, Hydraulic gradient and total energy line, pipes in series and parallel, power transmission through pipes, Water hammer. Boundary layer theory: Introduction, laminar and turbulent boundary layers, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, boundary layer separation.
Module 3	Open channel hydraulics: Steady and Unsteady Flows, Uniform and Nonuniform flows, Laminar and Turbulent Flows, Subcritical, Supercritical, and Critical Flows; Chezy's Equation, Manning Equation in Uniform Flow, Most Efficient Hydraulic Section for rectangular and trapezoidal channel, Specific Energy and Specific Force for Rectangular and Non-rectangular Channel; Critical Flow; Hydraulic Jump: Ratio of Sequent Depths, Length of Jump, Jump types, Energy loss. Gradually Varied Flow, Governing Equation for gradually varied flow, Classification of Water-Surface Profiles. Dimensional analysis: Buckingham Pi Theorem method for dimensional analysis, Prototype, Model similitude, Model laws based on Reynolds and Froude number law.
Module 4	Impact of Jets: Introduction to impulse-momentum equation and its applications, force exerted by jet on fixed target, moving target, and series of curved vanes. Turbines: Introduction, types and classification Pelton wheel, Francis turbine, Kaplan turbine-theory, work done and efficiency. Centrifugal and Reciprocating Pumps: Definition of pump, classification, description and general principle of working; priming, work done and efficiency of pump, specific speed, cavitation, slip, multi-stage pumps.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Fluid Mechanics and Hydraulic Machines	R. K. Bansal	Laxmi Publication	2019
2	Fluid Mechanics and Hydraulic Machines	D. S. Kumar	Narosa Publishing House Private Limited	2012
3	Fluid Mechanics	S. K. Som and G. Biswas	McGraw Hill publications	2017
4	Fluid Mechanics	Yunus A. Cengel	McGraw Hill publications	2010
5	Fluid Mechanics & Hydraulics	Modi & Seth	Standard Book House, New Delhi.	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate Certification in Basics of Fluid Dynamics	Ansys	Y	Online	Ansys	https://certifications.ansys.com/courses/basics-of-fluid-dynamics-associate-certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA (For practical, instruments/machines available in the laboratory will be used)	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	08	22
	Home Assignments	07	
	Practical Continuous Evaluation	07	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	08	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

PROBLEM SOLVING & REASONING SKILLS-1 (PSRS-1)

COURSE CODE	22UC3108	MODE	R	LTPS	0-0-0-4	PRE-REQUISITE	NONE

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Linear Equations, concepts of Ratios, Averages, Partnership, Percentages and Interest to solve the problems related to Ages, Ratio & Proportion, Variation& Partnership, Percentages, Profit, Loss& Discounts, Simple & Compound Interest, Averages & Allegations or Mixtures.	3	1,5
CO2	Apply the concepts of Co-primes, Divisibility rules, LCM & HCF concepts to solve problems in Numbers, Apply the concepts of Algebra to solve the problems based on Sets, Relations, Functions and Graphs, Surds & Indices, Logarithms, Quadratic Equations, Inequalities & Progressions.	3	1,5
CO3	Apply Venn diagrams and other applicable diagrams to solve questions in Syllogism, Logical Venn Diagrams, Cubes & Dice. Understand the principles used in forming Number& letter series, Number, letter & word Analogy, Odd man out, Coding & Decoding.	3	1,5
CO4	Understand the underlying assumptions in the arguments presented in the topics: Statements & conclusions, statements & Arguments (Critical Reasoning), statements & Assumptions, logical connectives, Binary logic.	2	1,5

Syllabus

Module 1	Simple Equations, Problem on Ages, Ratio & Proportion, Variation& Partnership, Percentages, Profit, Loss & Discounts, Simple & Compound Interest, Averages & Allegations or Mixtures.
Module 2	Numbers, Divisibility, Decimal Fractions, LCM & HCF, Simplification, Sequence, Series & Progressions, Linear Algebra, Quadratic Equations & Inequalities, Theory of Equations. Sets, Relations, Functions and Graphs, Surds & Indices, Logarithms
Module 3	Syllogism, Number& letter series, Number, letter & word Analogy, Odd man out, coding & decoding, Cubes & Dice, Logical Venn Diagrams, Ranking, Logical choice, Analytical reasoning
Module 4	Statements & conclusions, statements & Arguments (Critical Reasoning), statements & Assumptions, logical connectives, Binary logic, Statement - Courses of Action, Inferred meaning, Logical order

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Quantitative Aptitude	R S Aggarwal	S Chand	
2	A Modern Approach to Verbal Reasoning	R S Aggarwal	S Chand	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	
	SKILLING CONTINUOUS EVALUATION	10	
In-Sem Summative	SKILL IN SEM	20	
	SEM IN 1	10	
	SEM IN 2	10	
End-Sem Summative	SKILL SEM END EXAM	24	
	END SEM EXAM (ONLINE MCQ)	16	

PROBLEM SOLVING & REASONING SKILLS-2 (PSRS-2)

COURSE CODE	22UC3209	MODE	R	LTPS	0-0-0-4	PRE-REQUISITE	PSRS-1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Unitary method in solving problems in Time & Work, Chain Rule, Pipes & Cisterns. Apply the concept of Average speed and Relative speed to solve the problems related to Time, Speed &Distance, Trains, Boats & Streams, Races & games. Apply the concept of counting principles to solve the problems related to Permutations & Combinations and Probability.	3	1,5
CO2	Apply the concepts of Perimeter, Area, Surface Area & Volume to solve the problems in 2D & 3D Geometry. Apply the concepts of Trigonometry to solve problems related to Heights & Distances. Apply the concepts of Lines, Angles, Triangles, Quadrilaterals & Polygons to solve the problems related to Geometry, Analyzing the data given in the Table, Bar Graph, Pie Chart and Line Graph to solve the problems in Data Interpretation. Data Sufficiency, Statistics, Crypt arithmetic.	3	1,5
CO3	Apply the fundamental relationships and principles in solving questions in Blood Relations, Directions, Clocks, Calendars, Alphabet Test, Number, ranking & Time sequence test, Seating Arrangements, Mathematical Operations, Data Sufficiency, Nonverbal - series, analogy, classification.	3	1,5
CO4	Apply the conditions mentioned in the question statement to solve questions in Input & Output, Assertion and Reason, dot situation. embedded figures, figure matrix, mirror and water images, paper cutting, paper folding pattern completion, rule detection, flowcharts, Puzzles, Sudoku puzzles	3	1,5

Syllabus

Module 1	Time & Work, Chain Rule, Pipes & Cisterns, Time, Speed & Distance, Problems on Trains, Boats & Streams, Races & games, Permutations & Combinations, Combinatorics, Probability
Module 2	Areas & Perimeters, Mensuration, Trigonometry, Heights & Distances, Geometry, Coordinate Geometry, Data Interpretation, Data Sufficiency, Statistics, Simplification, Crypt arithmetic, Spatial Ability
Module 3	Blood Relations, Directions, clocks, calendars, Alphabet Test, Number, ranking & Time sequence test, Seating Arrangements, Mathematical Operations, Data Sufficiency, Nonverbal - series, analogy, classification, Team Formations, Rule detection
Module 4	Input & Output, Assertion and reason , dot situation, embedded figures, figure matrix, mirror and water images, paper cutting, paper folding pattern completion, rule detection, flowcharts, Logical Puzzles, Sudoku, Playing cards puzzles, Attention to details, Grouping of images, Shape construction, Game based puzzles (Gamification)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Quantitative Aptitude	R S Aggarwal	S Chand	
2	A Modern Approach to Verbal Reasoning	R S Aggarwal	S Chand	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	
	SKILLING CONTINUOUS EVALUATION	10	
In-Sem Summative	SKILL IN SEM	20	
	SEM IN 1	10	
	SEM IN 2	10	
End-Sem Summative	SKILL SEM END EXAM	24	
	END SEM EXAM (ONLINE MCQ)	16	

PROFESIONAL CORE COURSES

SOLID MECHANICS (SM)

COURSE CODE	22ME2106	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	22PH1010

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyze stresses in members with axial loading or torsion	4	PSO1, PO1, PO2
CO2	Analyze members with multi axial loading and lateral loading	4	PSO1, PO1, PO2
CO3	Analyze deflections and stresses in beams	4	PSO1, PO1, PO2
CO4	Analyse columns and pressure vessels	4	PSO1, PO1, PO2
CO5	Apply the theoretical concepts to conduct various experiments of strength of materials practically and analyze the data	3	PSO1,PO5

Syllabus

Module 1	Introduction: Types of Stress, Strains, Stress Strain Diagram, Hooke's Law. stress strain diagram for various ductile and brittle materials. Axially Loaded Members: Uniaxial Loading and Material Properties, Force-deformation Relationships and Static Indeterminacy; Compound Bars, Stress-strain-temperature Relationships. Torsion: Introduction, Torsion of a Circular Bar, Non- Uniform Torsion, Transmission of Power by Circular Shafts, Strain Energy, Resilience-Gradual, sudden, impact and shock loadings simple applications.
Module 2	Multi axial stresses and strains: Multi-axial Stress and Strain- Relationships, Stress and Strain Transformations and Principal Stresses, Graphical representation of Stress: Mohr's circle. Failure of Materials and Examples, Theories of Failure. Shearing Forces and Bending Moments: Shear Force and Bending Moment, Relationship Between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams.
Module 3	Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams. Stresses in Beams: Normal Stresses in Beams, Cross Section Shapes of Beams, Shear Stresses in Rectangular Beams, Shear Stresses in The Webs of Beams with Flanges.
Module 4	Thin-walled Pressure Vessels: Concepts of Hoop and Longitudinal Stresses, Simple Problems for Cylinders and Shells. Columns: Buckling and Stability, The Euler's formula for columns with different end restraints; Limitations of the Euler's formulas; Generalized Euler buckling - load formulas; Rankine's empirical formula.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanics of Materials	Gere & Goodno	Cengage Publishers	2017
2	Mechanics of Materials	RC Hibbeler	Pearson	2016
3	Mechanics of Materials	E.P. Popov	Prentice Hall Publications	2015

4	Strength of Materials	S. Ramamrutham	Dhanpat Rai Publications	2011
5	Strength of Materials	S.S. Rattan	Tata McGraw Hill	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-Structral Analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS- Structural Analysis	ANSYS	Commercial
2	Hardware Experimental Set up		OpenSource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignments and Textbook	7	
	Continuous Evaluation- Lab Exercise	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Lab In-Sem	8	
End-Sem Summative	End Sem Exam	24	40
	Lab End Sem Exam	16	

SOLID MECHANICS (SM)

COURSE CODE	22ME2016	MODE	A	LTPS	4-0-4-0	PRE-REQUISITE	22PH1010

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyze stresses in members with axial loading or torsion	4	PSO1, PO1, PO2
CO2	Analyze members with multi axial loading and lateral loading	4	PSO1, PO1, PO2
CO3	Analyze deflections and stresses in beams	4	PSO1, PO1, PO2
CO4	Analyse columns and pressure vessels	4	PSO1, PO1, PO2
CO5	Analyze the structural members with Multi-axial loading using ANSYS	5	PSO1, PO1, PO2
CO6	Apply the theoretical concepts to conduct various experiments of strength of materials practically and analyze the data	3	PSO1,PO5

Syllabus

Module 1	Introduction: Types of Stress, Strains, Stress Strain Diagram, Hooke’s Law. stress strain diagram for various ductile and brittle materials. Axially Loaded Members: Uniaxial Loading and Material Properties, Force-deformation Relationships and Static Indeterminacy; Compound Bars, Stress-strain-temperature Relationships. Torsion: Introduction, Torsion of a Circular Bar, Non- Uniform Torsion, Transmission of Power by Circular Shafts, Strain Energy, Resilience-Gradual, sudden, impact and shock loadings simple applications.
Module 2	Multi axial stresses and strains: Multi-axial Stress and Strain- Relationships, Stress and Strain Transformations and Principal Stresses, Graphical representation of Stress: Mohr's circle. Failure of Materials and Examples, Theories of Failure. Shearing Forces and Bending Moments: Shear Force and Bending Moment, Relationship Between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams.
Module 3	Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams. Stresses in Beams: Normal Stresses in Beams, Cross Section Shapes of Beams, Shear Stresses in Rectangular Beams, Shear Stresses in The Webs of Beams with Flanges.
Module 4	Thin-walled Pressure Vessels: Concepts of Hoop and Longitudinal Stresses, Simple Problems for Cylinders and Shells. Columns: Buckling and Stability, The Euler’s formula for columns with different end restraints; Limitations of the Euler’s formulas; Generalized Euler buckling - load formulas; Rankine’s empirical formula.
Module 5	Analyze the structural members with Multi-axial loading using ANSYS, Evaluation of various strength parameter using ANSYS.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanics of Materials	Gere & Goodno	Cengage Publishers	2017
2	Mechanics of Materials	RC Hibbeler	Pearson	2016
3	Mechanics of Materials	E.P. Popov	Prentice Hall Publications	2015

4	Strength of Materials	S. Ramamrutham	Dhanpat Rai Publications	2011
5	Strength of Materials	S.S. Rattan	Tata McGraw Hill	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-Structral Analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS- Structural Analysis	ANSYS	Commercial
2	Hardware Experimental Set up		Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignments and Textbook	7	
	Continuous Evaluation- Lab Exercise	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Lab In-Sem	8	
End-Sem Summative	End Sem Exam	24	40
	Lab End Sem Exam	16	

SOLID MECHANICS (SM)

COURSE CODE	22ME2106	MODE	P	LTPS	4-0-4-0	PRE-REQUISITE	22PH1010

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyze stresses in members with axial loading or torsion	4	PSO1, PO1, PO2
CO2	Analyze members with multi axial loading and lateral loading	4	PSO1, PO1, PO2
CO3	Analyze deflections and stresses in beams	4	PSO1, PO1, PO2
CO4	Analyse columns and pressure vessels	4	PSO1, PO1, PO2
CO5	Analyze the structural members with Multi-axial loading using ANSYS	5	PSO1, PO1, PO2
CO6	Apply the theoretical concepts to conduct various experiments of strength of materials practically and analyze the data	3	PSO1,PO5

Syllabus

Module 1	Introduction: Types of Stress, Strains, Stress Strain Diagram, Hooke's Law. stress strain diagram for various ductile and brittle materials. Axially Loaded Members: Uniaxial Loading and Material Properties, Force-deformation Relationships and Static Indeterminacy; Compound Bars, Stress-strain-temperature Relationships. Torsion: Introduction, Torsion of a Circular Bar, Non- Uniform Torsion, Transmission of Power by Circular Shafts, Strain Energy, Resilience-Gradual, sudden, impact and shock loadings simple applications.
Module 2	Multi axial stresses and strains: Multi-axial Stress and Strain- Relationships, Stress and Strain Transformations and Principal Stresses, Graphical representation of Stress: Mohr's circle. Failure of Materials and Examples, Theories of Failure. Shearing Forces and Bending Moments: Shear Force and Bending Moment, Relationship Between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams.
Module 3	Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams. Stresses in Beams: Normal Stresses in Beams, Cross Section Shapes of Beams, Shear Stresses in Rectangular Beams, Shear Stresses in The Webs of Beams with Flanges.
Module 4	Thin-walled Pressure Vessels: Concepts of Hoop and Longitudinal Stresses, Simple Problems for Cylinders and Shells. Columns: Buckling and Stability, The Euler's formula for columns with different end restraints; Limitations of the Euler's formulas; Generalized Euler buckling - load formulas; Rankine's empirical formula.
Module 5	Analyze the structural members with Multi-axial loading using ANSYS, Evaluation of various strength parameter using ANSYS.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanics of Materials	Gere & Goodno	Cengage Publishers	2017

2	Mechanics of Materials	RC Hibbeler	Pearson	2016
3	Mechanics of Materials	E.P. Popov	Prentice Hall Publications	2015
4	Strength of Materials	S. Ramamrutham	Dhanpat Rai Publications	2011
5	Strength of Materials	S.S. Rattan	Tata McGraw Hill	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-Structral Analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS- Structural Analysis	ANSYS	Commercial
2	Hardware Experimental Set up		Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	45
	Home Assignments and Textbook	10	
	Article Writing	15	
	Practical Continuous Evaluation	10	
In-Sem Summative	Lab In-Sem	15	15
End-Sem Summative	Poster Presentation	20	40
	Lab End Sem Exam	20	

MANUFACTURING PROCESSES (MP)

COURSE CODE	22ME2208	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify appropriate casting process for producing a component	3	PO1, PO3, PSO2
CO2	Examine the joints obtained by welding process	3	PO1, PO3, PSO2
CO3	Apply principles of cold/hot forming processes	3	PO1, PO3, PSO2
CO4	Apply sheet metal processes and design sheet metal dies	3	PO1, PO3, PSO2
CO5	Prepare parts using appropriate manufacturing process	3	PO1, PO3, PSO2

Syllabus

Module 1	Casting: Patterns and Pattern making, Allowances, Moulding methods and processes, Design considerations in casting, Riser and gating design, Different castings - Sand castings, pressure die casting, permanent mould casting, centrifugal casting, precision investment casting, shell Moulding, continuous casting-squeeze casting, electro slag casting, casting defects and Inspection of castings.
Module 2	Joining Processes - Types of welding - Arc welding, Shielded metal arc welding, GTAW, GMAW, SAW, Resistance welding, Thermit welding, Gas welding, Soldering, brazing, Electron beam and Laser welding, weld stress-calculations, design of weld size, estimation of weld dilution, heat input, effect of welding parameters, Inspection of welds, Defects in welding, causes and remedies.
Module 3	Metal Forming - Hot/Cold forming processes, Metallurgical aspects of metal forming, Forging and rolling processes: Forging principle, parameters and calculation of forces and power requirements during forging, Rolling processes, calculation of forces and geometrical relationship in rolling, analysis of rolling load, torque and power. Rolling and forging defects, causes and remedies. Types of Extrusion processes and drawing processes, Problems on extrusion and drawing.
Module 4	Sheet metal forming processes - Sheet metal / Press working operations, Types of presses and selection of presses, HERF processes - Electro hydraulic forming, Magnetic pulse forming.
Module 5	Lab for producing profiles/parts using Casting, Welding processes

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Processes and Materials of Manufacture	Lindberg	Prentice hall India (p) Ltd.	
2	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven R. Schmid	Prentice Hall	
3	Manufacturing Technology	P.N.Rao	TMH Ltd	

4	Mechanical Metallurgy	Dieter	McGrawhill	
5	Manufacturing science	Amitabha Ghosh and Asok Kumar Mallik	TMH publisher	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-297212512959&gclid=EAIaIQobChMI9br7l-rp_gIVfDVyCh0RzwEmEAAYASAAEgIb9vD_BwE
2	IIW International Diploma in Welding	TWI	Y	Online	TWI	https://www.twi-global.com/locations/south-east-asia/training/iiw-diploma/iiw-international-diploma-in-welding

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	AutoDesk	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem – 1	15	38
	In-Sem -2	15	
	Practical In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

DATA DRIVEN ARTIFICIAL INTELLIGENT SYSTEMS (DDAIS)

COURSE CODE	23AD2001	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand and Apply the concepts of intelligent agents and various search algorithms, to solve real-world problems.	3	PO1, PO2, PSO2
CO2	Analyse satisfaction problems, discover knowledge using logic, and analyse reasoning techniques to make informed decisions in uncertain environments.	4	PO2,PO3, PSO1
CO3	Apply and analyse various Machine Learning algorithms and Analyze CNN and Deep Learning Networking techniques for problem solving	4	PO1, PO3, PSO2
CO4	Apply various Data Visualization Techniques, Analyse Data analytics techniques, Discover the insights from complex datasets for decision making.	4	PO3, PO5, PSO2
CO5	Generate the code to solve real world problems using AI and Data science Techniques using python Language.	3	PO3, PO5, PSO2

Syllabus

Module 1	Foundations of Artificial Intelligence, Intelligent agents, their environments, heuristic search techniques, including A* search and other best-first search algorithms, Constraint Satisfaction and Reasoning, solve constraint satisfaction problems using backtracking, forward checking, and other methods, knowledge representation techniques, such as propositional and first order logic.
Module 2	Probabilistic reasoning for AI, including Bayesian networks and inference algorithms, Machine Learning and Neural Networks: machine learning algorithms, such as supervised and unsupervised learning techniques, and how to pre-process and analyse data, Find S, Concept learning search and Candidate Elimination Algorithm (CEA), evaluating a hypothesis, probably learning approximately correct hypothesis, and function approximation.
Module 3	Artificial Neural Networks (ANN), including the structure and functionality of feedforward and recurrent networks. Architecture, learning and inferencing. Performance measures. Convolutional Neural Networks (CNN) and Deep Learning techniques for tasks like image recognition, natural language processing, and reinforcement learning.
Module 4	Data Science and Analytics: This module focuses on the essentials of data science, including data classification, analytics, visualization, and processing techniques. various data science algorithms, such as decision trees, k-means clustering, and principal component analysis, Linear Regression, Logistic Regression, Decision Trees different types of data analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, and understand how they can be applied to real-world problems.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence	Russel and Norvig	Pearson Education, PHI	2015

2	Artificial Intelligence	Elaine Rich & Kevin Knight	Tata McGraw-Hill Edition, Reprint	2008
3	Data science Handbook	Field cady	Wiley	2012
4	Artificial Intelligence	Patrick Henry Winston	Pearson Education	2003
5	Introducing Data science	Davy Cielen	Manning Publications	2016

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Azure AI Engineer Associate	Microsoft	Y	MCQ	Microsoft / KLEF	Microsoft Certified: Azure AI Engineer Associate - Certifications | Microsoft Learn
2	NPTEL : Search Methods for Problem Solvin	IIT Madras	y	MCQ	IIT Madras	https://nptel.ac.in/courses/106106126

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Language	Python Software Foundation	Open Source
2	Tableau software	Salesforce Inc	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	7	22
	ALM - Quiz	8	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem Exam-1	15	38
	In Sem Exam-2	15	
	Practical In-Sem Exam	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

DATA DRIVEN ARTIFICIAL INTELLIGENT SYSTEMS (DDAIS)

COURSE CODE	23AD2001	MODE	A	LTPS	3-0-4-0	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand and apply the concepts of intelligent agents and various search algorithms, to solve real-world problems.	3	PO1, PO2, PSO2
CO2	Analyse satisfaction problems, discover knowledge using logic, and analyse reasoning techniques to make informed decisions in uncertain environments.	4	PO2,PO3, PSO1
CO3	Apply and analyse various Machine Learning algorithms, Examine CNN and Deep Learning techniques	4	PO1, PO3, PSO2
CO4	Apply various Data Visualization Techniques, Analyse Data analytics techniques, Discover the insights from complex datasets.	4	PO3, PO5, PSO2
CO5	Evaluate performance measures, different types of data analytics including descriptive, diagnostic, predictive and prescriptive analytics.	5	PO2,PO3, PSO1
CO6	Examine AI for Data science lab in the python environment.	4	PO3, PO5, PSO2

Syllabus

Module 1	Foundations of Artificial Intelligence, Intelligent agents, their environments, heuristic search techniques, including A* search and other best-first search algorithms, Constraint Satisfaction and Reasoning, solve constraint satisfaction problems using backtracking, forward checking, and other methods, knowledge representation techniques, such as propositional and first order logic.
Module 2	Probabilistic reasoning for AI, including Bayesian networks and inference algorithms, Machine Learning and Neural Networks: machine learning algorithms, such as supervised and unsupervised learning techniques, and how to pre-process and analyse data, Find S, Concept learning search and Candidate Elimination Algorithm (CEA), evaluating a hypothesis, probably learning approximately correct hypothesis, and function approximation.
Module 3	Artificial Neural Networks (ANN), including the structure and functionality of feedforward and recurrent networks. Architecture, learning and inferencing. Performance measures. Convolutional Neural Networks (CNN) and Deep Learning techniques for tasks like image recognition, natural language processing, and reinforcement learning.
Module 4	Data Science and Analytics: This module focuses on the essentials of data science, including data classification, analytics, visualization, and processing techniques. various data science algorithms, such as decision trees, k-means clustering, and principal component analysis, Linear Regression, Logistic Regression, Decision Trees different types of data analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, and understand how they can be applied to real-world problems.
Module 5	Adversarial Search (Minimax, Alpha-Beta pruning), ML algorithms: Classification Techniques(ID3,CART, ADABOOST Classifier), Introduction of Recurrent Neural Network (RNN), Data Visualisation techniques using Tableau tool on complex datasets (Only for advanced/peer mentoring courses)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence	Russel and Norvig	Pearson Education, PHI	(2015)
2	Artificial Intelligence	Elaine Rich & Kevin Knight	Tata McGraw-Hill Edition, Reprint	(2008)
3	Data science Handbook	Field cady	Wiley	2012
4	Artificial Intelligence	Patrick Henry Winston	Pearson Education	(2003)
5	Introducing Data science	Davy Cielen	Manning	(2016)

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Azure AI Engineer Associate	Microsoft	Y	MCQ	Microsoft / KLU	Microsoft Certified: Azure AI Engineer Associate - Certifications | Microsoft Learn

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Programming	The Python Software Foundation	Open Source
2	Matlab	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	5	22
	Global Challenges Participation	4	
	Practical Continuous Evaluation	5	
	Project Conitnuous Evaluation	4	
	MOOCs Review	4	
In-Sem Summative	In-Sem 1	12	38
	In-Sem 2	12	
	Practical In-Sem	9	
	MOOCs Exam	5	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

DATA DRIVEN ARTIFICIAL INTELLIGENT SYSTEMS (DDAIS)

COURSE CODE	23AD2001	MODE	P	LTPS	3-0-4-0	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand and apply the concepts of intelligent agents and various search algorithms, to solve real-world problems.	3	PO1, PO2, PSO2
CO2	Analyse satisfaction problems, discover knowledge using logic, and analyse reasoning techniques to make informed decisions in uncertain environments.	4	PO2,PO3, PSO1
CO3	Apply and analyse various Machine Learning algorithms, Examine CNN and Deep Learning techniques	4	PO1, PO3, PSO2
CO4	Apply various Data Visualization Techniques, Analyse Data analytics techniques, Discover the insights from complex datasets.	4	PO3, PO5, PSO2
CO5	Evaluate performance measures, different types of data analytics including descriptive, diagnostic, predictive and prescriptive analytics.	5	PO2,PO3, PSO1
CO6	Examine AI for Data science lab in the python environment.	4	PO3, PO5, PSO2

Syllabus

Module 1	Foundations of Artificial Intelligence, Intelligent agents, their environments, heuristic search techniques, including A* search and other best-first search algorithms, Constraint Satisfaction and Reasoning, solve constraint satisfaction problems using backtracking, forward checking, and other methods, knowledge representation techniques, such as propositional and first order logic.
Module 2	Probabilistic reasoning for AI, including Bayesian networks and inference algorithms, Machine Learning and Neural Networks: machine learning algorithms, such as supervised and unsupervised learning techniques, and how to pre-process and analyse data, Find S, Concept learning search and Candidate Elimination Algorithm (CEA), evaluating a hypothesis, probably learning approximately correct hypothesis, and function approximation.
Module 3	Artificial Neural Networks (ANN), including the structure and functionality of feedforward and recurrent networks. Architecture, learning and inferencing. Performance measures. Convolutional Neural Networks (CNN) and Deep Learning techniques for tasks like image recognition, natural language processing, and reinforcement learning.
Module 4	Data Science and Analytics: This module focuses on the essentials of data science, including data classification, analytics, visualization, and processing techniques. various data science algorithms, such as decision trees, k-means clustering, and principal component analysis, Linear Regression, Logistic Regression, Decision Trees different types of data analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, and understand how they can be applied to real-world problems.
Module 5	Adversarial Search (Minimax, Alpha-Beta pruning), ML algorithms: Classification Techniques(ID3,CART, ADABOOST Classifier), Introduction of Recurrent Neural Network (RNN), Data Visualisation techniques using Tableau tool on complex datasets (Only for advanced/peer mentoring courses)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence	Russel and Norvig	Pearson Education, PHI	(2015)
2	Artificial Intelligence	Elaine Rich & Kevin Knight	Tata McGraw-Hill Edition, Reprint	(2008)
3	Data science Handbook	Field cady	Wiley	
4	Artificial Intelligence	Patrick Henry Winston	Pearson Education	(2003)
5	Introducing Data science	Davy Cielen	Manning	(2016)

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Azure AI Engineer Associate	Microsoft	Y	MCQ	Microsoft / KLU	Microsoft Certified: Azure AI Engineer Associate - Certifications | Microsoft Learn

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Programming	The Python Software Foundation	Open Source
2	Matlab	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	7	22
	Practical Continuous Evaluation	7	
	MOOCs Review	8	
In-Sem Summative	Global Challenges - Leaderboard	10	38
	Practical In-Sem	8	
	MOOCs Exam	20	
End-Sem Summative	Poster Presentation	10	40
	Lab End-Sem Exam	16	
	Global Challenges - Rating/Points	10	
	Global Certification	4	

THERMODYNAMICS (TD)

COURSE CODE	22ME2107	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	Nill

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Examine the basic terminology used in thermodynamics	2	PO1, PSO1
CO2	Apply first law of thermodynamics to various flow and non-flow processes.	3	PO1, PSO2
CO3	Apply second law of thermodynamics and principle of entropy to Engineering Devices.	3	PO1, PSO2
CO4	Apply thermodynamic principles to estimate the performance of different air standard cycles and different psychrometric processes	3	PO2, PSO2

Syllabus

Module 1	Fundamental Concepts and Definitions: Thermodynamic system and control volume, macroscopic and microscopic points of view, thermodynamic properties, processes, state, path, cycle, thermodynamic equilibrium and quasi-static process. Reversible and irreversible processes
Module 2	zeroth law, concept of temperature. Work and Heat: Definition of work, units, work done at the moving boundary of system, work done in various non-flow processes, definition of heat, units, comparison of heat and work. First Law of Thermodynamics for Non-Flow Systems: First law of thermodynamics for a closed system undergoing a cycle and for a change of state; energy - a property of system, internal energy and enthalpy. Specific heat at constant volume and constant pressure. First Law of Thermodynamics for Flow Systems: Control mass, control volume, first law of thermodynamics for a control volume, steady flow energy equation and applications to engineering equipment and PMM-1
Module 3	Second Law of Thermodynamics: Thermal reservoirs, Kelvin-Plank and Clausius statements of second law of thermodynamics; Equivalence of Kelvin-Plank and Clausius statements, PMM-2; Carnot cycle, Carnot engine, corollary of Carnot's theorem, absolute thermodynamic temperature scale. Entropy: Definition of entropy, Clausius theorem, entropy change in reversible process temperature-entropy plot, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, applications of entropy principle, entropy change of an ideal gas; availability and irreversibility. Air standard cycles: Performance analysis of Otto ,Diesel,Dual,and Brayton cycles.
Module 4	Psychometric: Psychrometric properties, psychrometric chart and air-conditioning process

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Thermodynamics, an Engineering Approach	Yunus A. Cengel & Michael Boles	Tata McGraw Hill, NewDelhi	1989
2	Engineering Thermodynamics -	P. K. Nag	Tata McGraw Hill, NewDelhi.	1982
3	Engineering Thermodynamics	Cohen and Rogers	Pearson Education India limited.	1980
4	Thermodynamics	E Rathakrishnan	Eastern economy edition	2005

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Thermodynamics	TATA STEEL	Y	Online	TATA STEEL	https://capabilitydevelopment.org/Coursedesc/THERMODYNAMICS

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In- Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

MANUFACTURING TECHNOLOGY (MT)

COURSE CODE	22ME3113	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	22ME2208

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Analyze cutting forces using Merchants equation	**4**	PO1, PO3, PSO2
CO2	Identify the constructional and operational features of Lathe machine tools	**3**	PO1, PO3, PSO2
CO3	Select the appropriate reciprocating machine tools for generation of profiles	**3**	PO1, PO3, PSO2
CO4	Implement CNC programming for machining basic components	**3**	PO1, PO3, PSO2
CO5	Implement CNC programming in part production	**4**	PO1, PO3, PSO2

Syllabus

Module 1	Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.
Module 2	Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle.
Module 3	Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods. Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods.
Module 4	Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features. Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.
Module 5	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Processes and Materials of Manufacture	Lindberg	Prentice hall India	1990

2	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven R. Schmid	Prentice Hall	2018
3	Manufacturing Technology	P. N Rao	TMH Ltd	2013
4	Mechanical Metallurgy	Dieter	Mcgraw	1986
5	CAD/CAM	Zimmers & Groovers	Prentice hall India	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-297212512959&gclid=EAIaIQobChMI9br7l-rp_gIVfDVyCh0RzwEmEAAYASAAEgIb9vD_BwE
2						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	AutoDesk	Open Source
2	CNC Machine Tool Setup Programmer	Institute of Machine Tool Technology	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem – 1	15	38
	In-Sem-2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

MANUFACTURING TECHNOLOGY (MT)

COURSE CODE	22ME3113	MODE	A	LTPS	3-0-4-0	PRE-REQUISITE	22ME2208

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Analyze cutting forces using Merchants equation	**4**	PO1, PO3, PSO2
CO2	Identify the constructional and operational features of Lathe machine tools	**3**	PO1, PO3, PSO2
CO3	Select the appropriate reciprocating machine tools for generation of profiles	**3**	PO1, PO3, PSO2
CO4	Implement CNC programming for machining basic components	**3**	PO1, PO3, PSO2
CO5	Choose relavent Jig / Fixture for holding workpiece for machining operation	**3**	PO1, PO3, PSO2
C06	Implement CNC programming in part production	**4**	PO1, PO3, PSO2

Syllabus

Module 1	Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.
Module 2	Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle.
Module 3	Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods. Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods.
Module 4	Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features. Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.
Module 5	Jigs and Fixtures: Introduction, Main components, Principles of Jigs & Fixture Design, Principles of Location, Clamping Devices, Tyes: Jigs and Fixtures
Module 6	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Processes and Materials of Manufacture	Lindberg	Prentice hall India	

2	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven R. Schmid	Prentice Hall	
3	Manufacturing Technology	P. N Rao	TMH Ltd	
4	Mechanical Metallurgy	Dieter	Mcgraw	
5	CAD/CAM	Zimmers & Groovers	Prentice Hall of India Private Limited	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-297212512959&gclid=EAIaIQobChMI9br7l-rp_gIVfDVyCh0RzwEmEAAYASAAEgIb9vD_BwE

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	AutoDesk	Open Source
2	CNC Machine Tool Setup Programmer	Institute of Machine Tool Technology	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

MANUFACTURING TECHNOLOGY (MT)

COURSE CODE	22ME3113	MODE	P	LTPS	3-0-4-0	PRE-REQUISITE	22ME2208

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the mechanism of metal removal process and to identify the factors involved in improving machinability	**3**	PO3, PSO2
CO2	Describe the constructional and operational features of centre lathe and other special purpose lathes	**3**	PO3, PSO1
CO3	Describe the constructional and operational features of reciprocating machine tools	**3**	PO3, PSO1
CO4	Apply the constructional and operational features of abrasive particle prepared cutting tools	**3**	PO3, PSO2
CO5	Apply the constructional features and working principles of CNC machine tools	**4**	PO3, PSO2
C06	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.	**4**	PO3, PSO2

Syllabus

Module 1	Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.
Module 2	Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle.
Module 3	Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods
Module 4	Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods.
Module 5	Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features. Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.
Module 6	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Processes and Materials of Manufacture	Lindberg	Prentice hall India	
2	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven R. Schmid	Prentice Hall	
3	Manufacturing Technology	P. N Rao	TMH Ltd	
4	Mechanical Metallurgy	Dieter	Mcgraw	
5	CAD/CAM	Zimmers & Groovers	Prentice Hall of India Private Limited	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-297212512959&gclid=EAIaIQobChMI9br7l-rp_gIVfDVyCh0RzwEmEAAYASAAEgIb9vD_BwE

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	AutoDesk	Open Source
2	CNC Machine Tool Setup Programmer	Institute of Machine Tool Technology	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	Presentation – 1	15	38
	Presentation -2	15	
	Project Based Lab	8	
End-Sem Summative	Sem End Project	24	40
	Project Review	16	

KINEMATICS & DYNAMICS OF MACHINES(KDOM)

COURSE CODE	22ME2209R	MODE	R	LTPS	2-1-2-0	PRE-REQUISITE	23ME1001

Course Outcomes

CO#	CO Description	BTL	PO
CO1	Apply the basic principles and concepts of kinematics and mobility of the mechanisms.	3	PO1, PO5,
CO2	Analyze and kinematic design of mechanisms and machines using velocity and acceleration analysis.	4	PO1, PO5,
CO3	Apply principles of cams to draw cam profiles and understand gear systems and gear trains for various applications.	3	PO1, PO5,
CO4	Understand the principles of balancing and vibrations and analyze gyroscopic effect on naval ships and automobiles.	4	PO1, PO5,
CO5	Apply and analyze the concepts learned in theory to perform experiments related to mechanisms and machines using the ADAMS simulation software for data analysis.	4	PO1, PO3,

Syllabus

Module 1	Introduction to Kinematics and Dynamics of Machines: Basic concepts and definitions, Types of motion, Degrees of freedom,Kinematics of Mechanisms: Linkages and mechanisms'
Module 2	Velocity and acceleration analysis of Mechanisms by IC and relative velocity method.
Module 3	Cams: classification of cams and followers, cam profiles of knife edge and roller followers of both radial and offset reciprocating motion.Gears and Gear trains: Gears – terminology, fundamental law of gearing, Length of path of contact and length of arc contact, contact ratio, Interference and undercutting in gears.Gear Trains– simple, compound, reverted and epicyclic gear trains.
Module 4	Balancing: Introduction, Static balancing, dynamic balancing, transferring of a Force from one plane to another.Balancing of Several Masses in Different planes, Balancing of Reciprocating Mass, Secondary Balancing.Gyroscope: Gyroscopic Effect on Naval Ships, aeroplanes, Stability of an Automobile Two and four Wheel vehicle. Vibrations in Machines: Free and forced vibrations, critical and whirling speed of shafts, Vibration isolation and transmissibility.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year/Edition
1	Theory of Machines	S S Ratan	Tata McGraw-Hill Education	4th Edition
2	Mechanisms and Machines	Amitabha Ghosh, Asok Kumar Mallik	Affiliated East-West Press Pvt. Ltd.	3rd
3	Kinematics and Dynamics of Machines	George H. Martin	McGraw-Hill	3rd

4	Theory of Machines and Mechanisms	John J. Uicker Jr., Gordon R. Pennock, Joseph E. Shigley	Oxford University Press	4th
5	The Theory of Machines through Solved Problems	J.S. Rao	New Age International	1st

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Kinematics and Dynamics of Machines Certification	Society of Manufacturing Engineers (SME)	Y	Online	SME	https://www.sme.org/
2	Machine Design and Dynamics Certification	American Society of Mechanical Engineers (ASME)	Y	Online	ASME	https://www.asme.org/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Adams multibody dynamics software tool	*MSC Software* Corporation is an American simulation software technology company based in Newport Beach, California	Open Source
2	Hard ware tools of the laboratory	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	6	26
	Quiz	6	
	Tutorial Continuous Evaluation	6	
	Practical Continuous Evaluation	8	
In-Sem Summative	In-Sem 1(Presentation mode)	14	34
	In-Sem 2 (Presentation mode)	14	
	Practical In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

KINEMATICS & DYNAMICS OF MACHINES(KDOM)

COURSE CODE	22ME2209A	MODE	A	LTPS	3-1-4-0	PRE-REQUISITE	23ME1001

Course Outcomes

CO#	CO Description	BTL	PO
CO1	Apply the basic principles and concepts of kinematics and mobility of the mechanisms.	3	PO1, PO5,
CO2	Analyze and kinematic design of mechanisms and machines using velocity and acceleration analysis.	4	PO1, PO5,
CO3	Apply principles of cams to draw cam profiles and understand gear systems and gear trains for various applications.	3	PO1, PO5,
CO4	Understand the principles of balancing and vibrations and analyze gyroscopic effect on naval ships and automobiles.	4	PO1, PO5,
CO5	Develop computational skills to analyze the kinematics and dynamics of machines, enabling efficient design and optimization.	4	PO1, PO5,
CO6	Apply and analyze the concepts learned in theory to perform experiments related to mechanisms and machines using the ADAMS simulation software for data analysis.	4	PO1, PO3,

Syllabus

Module 1	Introduction to Kinematics and Dynamics of Machines: Basic concepts and definitions, Types of motion, Degrees of freedom,Kinematics of Mechanisms: Linkages and mechanisms'
Module 2	Velocity and acceleration analysis of Mechanisms by IC and relative velocity method.
Module 3	Cams: classification of cams and followers, cam profiles of knife edge and roller followers of both radial and offset reciprocating motion.Gears and Gear trains: Gears – terminology, fundamental law of gearing, Length of path of contact and length of arc contact, contact ratio, Interference and undercutting in gears.Gear Trains– simple, compound, reverted and epicyclic gear trains.
Module 4	Balancing: Introduction, Static balancing, dynamic balancing, transferring of a Force from one plane to another.Balancing of Several Masses in Different planes, Balancing of Reciprocating Mass, Secondary Balancing.Gyroscope: Gyroscopic Effect on Naval Ships, aeroplanes, Stability of an Automobile Two and four Wheel vehicle. Vibrations in Machines: Free and forced vibrations, critical and whirling speed of shafts, Vibration isolation and transmissibility.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year/Edition
1	Theory of Machines	S S Ratan	Tata McGraw-Hill Education	4th Edition
2	Mechanisms and Machines	Amitabha Ghosh, Asok Kumar Mallik	Affiliated East-West Press Pvt. Ltd.	3rd
3	Kinematics and Dynamics of Machines	George H. Martin	McGraw-Hill	3rd

4	Theory of Machines and Mechanisms	John J. Uicker Jr., Gordon R. Pennock, Joseph E. Shigley	Oxford University Press	4th
5	The Theory of Machines through Solved Problems	J.S. Rao	New Age International	1st

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Kinematics and Dynamics of Machines Certification	Society of Manufacturing Engineers (SME)	Y	Online	SME	https://www.sme.org/
2	Machine Design and Dynamics Certification	American Society of Mechanical Engineers (ASME)	Y	Online	ASME	https://www.asme.org/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Adams multibody dynamics software tool	*MSC Software* Corporation is an American simulation software technology company based in Newport Beach, California	Open Source
2	Hard ware tools of the laboratory	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	6	26
	Quiz	6	
	Tutorial Continuous Evaluation	6	
	Practical Continuous Evaluation	8	
In-Sem Summative	In-Sem 1(Presentation mode)	14	34
	In-Sem 2 (Presentation mode)	14	
	Practical In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

KINEMATICS & DYNAMICS OF MACHINES (KDOM)

COURSE CODE	22ME2209P	MODE	P	LTPS	3-1-4-0	PRE-REQUISITE	23ME1001

Course Outcomes

CO#	CO Description	BTL	PO
CO1	Apply the basic principles and concepts of kinematics and mobility of the mechanisms.	3	PO1, PO5,
CO2	Analyze and kinematic design of mechanisms and machines using velocity and acceleration analysis.	4	PO1, PO5,
CO3	Apply principles of cams to draw cam profiles and understand gear systems and gear trains for various applications.	3	PO1, PO5,
CO4	Understand the principles of balancing and vibrations and analyze gyroscopic effect on naval ships and automobiles.	4	PO1, PO5,
CO5	Develop computational skills to analyze the kinematics and dynamics of machines, enabling efficient design and optimization.	4	PO1, PO5,
CO6	Apply and analyze the concepts learned in theory to perform experiments related to mechanisms and machines using the ADAMS simulation software for data analysis.	4	PO1, PO3,

Syllabus

Module 1	Introduction to Kinematics and Dynamics of Machines: Basic concepts and definitions, Types of motion, Degrees of freedom,Kinematics of Mechanisms: Linkages and mechanisms'
Module 2	Velocity and acceleration analysis of Mechanisms by IC and relative velocity method.
Module 3	Cams: classification of cams and followers, cam profiles of knife edge and roller followers of both radial and offset reciprocating motion.Gears and Gear trains: Gears – terminology, fundamental law of gearing, Length of path of contact and length of arc contact, contact ratio, Interference and undercutting in gears.Gear Trains– simple, compound, reverted and epicyclic gear trains.
Module 4	Balancing: Introduction, Static balancing, dynamic balancing, transferring of a Force from one plane to another.Balancing of Several Masses in Different planes, Balancing of Reciprocating Mass, Secondary Balancing.Gyroscope: Gyroscopic Effect on Naval Ships, aeroplanes, Stability of an Automobile Two and four Wheel vehicle. Vibrations in Machines: Free and forced vibrations, critical and whirling speed of shafts, Vibration isolation and transmissibility.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year/Edition
1	Theory of Machines	S S Ratan	Tata McGraw-Hill Education	4th Edition
2	Mechanisms and Machines	Amitabha Ghosh, Asok Kumar Mallik	Affiliated East-West Press Pvt. Ltd.	3rd
3	Kinematics and Dynamics of Machines	George H. Martin	McGraw-Hill	3rd

4	Theory of Machines and Mechanisms	John J. Uicker Jr., Gordon R. Pennock, Joseph E. Shigley	Oxford University Press	4th
5	The Theory of Machines through Solved Problems	J.S. Rao	New Age International	1st

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Kinematics and Dynamics of Machines Certification	Society of Manufacturing Engineers (SME)	Y	Online	SME	https://www.sme.org/
2	Machine Design and Dynamics Certification	American Society of Mechanical Engineers (ASME)	Y	Online	ASME	https://www.asme.org/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Adams multibody dynamics software tool	*MSC Software* Corporation is an American simulation software technology company based in Newport Beach, California	Open Source
2	Hard ware tools of the laboratory	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	6	34
	Article Writing	10	
	Case Study - Analysis	10	
	Practical Continuous Evaluation	8	
In-Sem Summative	Practical In-Sem	20	26
	MOOCs Exam	6	
End-Sem Summative	Project Demonstration	16	40
	Lab End-Sem Exam	16	
	Poster Presentation	8	

THERMAL SYSTEMS ENGINEERING (TSE)

COURSE CODE	22ME3112	MODE	R	LTPS	3-0-0-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify the properties of pure substances at various pressures and temperatures and apply those to evaluate the performance Of a vapour power cycle.	3	PO1, PO2
CO2	Model the convergent-divergent steam nozzle dimensional parameters and identify the performance of a steam condenser	3	PO2, PO1
CO3	Understand the working principles of SI and CI engines.	2	PO1,PO2
CO4	Choose various refrigeration cycles by identifying their performance. Apply psychrometry properties to calculate various air-conditioning process parameters.	3	PO4
CO5	Analyze internal & external fluid flows in steady state and transient heat transfer systems.	4	PO4

Syllabus

Module 1	PURE SUBSTANCE: Vapour-liquid-solid phase equilibrium, independent properties, Equations of state, Tables of thermodynamic properties. VAPOUR POWER CYCLES: Rankine cycle, Effect of pressure and temperature, Regenerative cycle, Binary vapour cycle. STEAM NOZZLES & CONDENSERS:
Module 2	Types of nozzles, isentropic flow through nozzles, effect of friction, nozzle efficiency, critical pressure ratio and maximum discharge, throat and exit areas using Mollier diagram, Condensers - Jet and surface condensers, condenser vacuum and vacuum efficiency, condenser efficiency, thermodynamic analysis.
Module 3	IC ENGINES: Engine nomenclature, classification of I.C. Engines, working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke) - valve and port timing diagrams - Differences between SI & CI and 2 stroke & 4 stroke engines and combustion in S.I and CI engines.
Module 4	IC ENGINES: Engine nomenclature, classification of I.C. Engines, working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke) - valve and port timing diagrams - Differences between SI & CI and 2 stroke & 4 stroke engines and combustion in S.I and CI engines.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Thermodynamics	T.D Eastop,	Tata McGraw Hill.	1993
2	Engineering Thermodynamics	C. P. Aarora	John Wiley and Sons.	2001
3	. I.C Engines	Obert	Intex Educational Publishers	1973

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate certification	Ansys	Y	MCQs	Ansys	https://certifications.ansys.com/courses/basics-of-fluid-dynamics-associate-certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys-Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Skill Continuous Evaluation	7	
In-Sem Summative	IN Sem-1	15	38
	In Sem-2	15	
	Skill In sem	8	
End-Sem Summative	End Sem Exam	24	40
	Skill End Sem Exam	16	

DIGITAL MANUFACTURING AND ROBOTICS (DMR)

COURSE CODE	23ME3215	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	23ME2209 (KDOM)

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the digital manufacturing framework	2	PO1 PO2 + PSO1
CO2	Understand the functions of the basic components of a Robot and its applications	3	PO1 PO2 + PSO1
CO3	Understand the image processing techniques in Robot vision	2	PO1 PO2 + PSO1
CO4	Understand the various Robot Languages	2	PO1 PO2 + PSO1

Syllabus

Module 1	Digital manufacturing Fundamentals of CNC, basic Additive Manufacturing processes and technologies, solid modelling & 3D scanning, and applications of AM
Module 2	FUNDAMENTALS OF ROBOT Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load-Robot Parts and their Functions-Need for Robots-Different Applications. ROBOT DRIVE SYSTEMS AND END EFFECTORS Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.
Module 3	SENSORS AND MACHINE VISION Requirements of a sensor, Principles and Applications of the various types of sensors-Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors. Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.
Module 4	ROBOT PROGRAMMING Lead through Programming, Robot programming Languages-VAL, AML, RAIL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs. Introduction to forward and reverse robot kinematics.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Additive Manufacturing Technologies	Ian Gibson, David Rosen, Brent Stucker	Springer	2nd Edition
2	Robotic Engineering - An Integrated Approach	Klafter R.D., Chmielewski T.A and Negin M.	Prentice Hall	2003
3	Industrial Robotics -Technology Programming and Applications	Groover M.P	McGraw Hill	2001

4	Introduction to Robotics Mechanics and Control	Craig J.J.	Pearson Education	2008
5	Robotics Technology and Flexible Automation	Deb S.R.	Tata McGraw Hill Book Co.,	1994

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Robotics Foundation II - Robot Control	EdX	N	Online	EdX	https://www.edx.org/course/robotics-foundation-ii-robot-control?index=product&queryID=a13afd24ee222ca2a0a0aa243fcbcfb2&position=2&search_index=product&results_level=first-level-results&term=robotics&campaign=Robotics+Foundation+II+-+Robot+Control&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

HEAT TRANSFER (HT)

COURSE CODE	22ME3110R	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply Fourier law of conduction and combined conduction convection concepts to 1-D heat transfer problems	3	PO1,PO2,PSO1
CO2	Analyze heat transfer through extended surfaces and apply unsteady state heat transfer to various systems.	4	PO1,PO2,PSO1
CO3	Apply the emperical correlations for solving convection heat transfer and heat transfer through during phase change problems	3	PO1,PO2,PSO1
CO4	Analyze various types of heat exchangers by applying the principles of conduction, convection, radiation	4	PO1,PO2,PSO1
CO5	Analyze various parameters of heat transfer in different thermal systems physically/numerically	4	PO1,PO2,PSO1

Syllabus

Module 1	Introduction to fundamental processes of heat transfer and their governing laws. 1-D steady state heat conduction in single and multi-layered plane walls, cylinders and spheres along with concepts of thermal contact resistance and critical thickness of insulation. One dimensional heat conduction with internal heat generation
Module 2	Fins-applications and performance analysis; Transient conduction-lumped capacitance, semi-infinite body and application of Heisler and Grober charts
Module 3	Elementary convection including laminar and turbulent boundary layers in external flows and internal flows of forced convection, natural convection. Heat transfer in boiling and condensation
Module 4	Basic concepts of heat exchangers; Thermal radiation-Stefan-Boltzmann law, small object in a large enclosure, parallel plates and shape factor.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Heat Transfer – A practical approach	Yunus A. Cengel	Tata McGraw Hill.	1998
2	Introduction to Heat Transfer	Incropera, F. P. and Dewitt, D. P	John Wiley and Sons.	1990
3	Heat Transfer - A Conceptual Approach	P. K. Sarma and K. Ramakrishna	New Age International Publishers	2006
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	1997
5	Heat Transfer - A Basic Approach	M. Necati Özışık	McGraw-Hill	1985

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat Transfer Methods	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/HEAT-TRANSFER
2	Thermodynamics	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/THERMODYNAMICS

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys-Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	IN Sem-1	15	38
	In Sem-2	15	
	Practical In sem	8	
End-Sem Summative	End Sem Exam	24	40
	Practical End Sem	16	

HEAT TRANSFER (HT)

COURSE CODE	22ME3110A	MODE	A	LTPS	4-0-4-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply Fourier law of conduction and combined conduction convection concepts to 1-D heat transfer problems	3	PO1,PO2,PSO1
CO2	Analyze heat transfer through extended surfaces and apply unsteady state heat transfer to various systems.	4	PO1,PO2,PSO1
CO3	Apply the emperical correlations for solving convection heat transfer and heat transfer through during phase change problems	3	PO1,PO2,PSO1
CO4	Analyze various types of heat exchangers by applying the principles of conduction, convection, radiation	4	PO1,PO2,PSO1
CO5	Analyze the performance of heat exchangers using nanofluids	4	PO1,PO2,PSO1
CO6	Analyze various parameters of heat transfer in different thermal systems physically/numerically	4	PO1,PO2,PSO1

Syllabus

Module 1	Introduction to fundamental processes of heat transfer and their governing laws. 1-D steady state heat conduction in single and multi-layered plane walls, cylinders and spheres along with concepts of thermal contact resistance and critical thickness of insulation. One dimensional heat conduction with internal heat generation
Module 2	Fins-applications and performance analysis; Transient conduction-lumped capacitance, semi-infinite body and application of Heisler and Grober charts
Module 3	Elementary convection including laminar and turbulent boundary layers in external flows and internal flows of forced convection, natural convection. Heat transfer in boiling and condensation
Module 4	Basic concepts of heat exchangers; Thermal radiation-Stefan-Boltzmann law, small object in a large enclosure, parallel plates and shape factor.
Module 5	Nanaofluid preparation, characteization and applications in heat exchangers

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Heat Transfer – A practical approach	Yunus A. Cengel	Tata McGraw Hill.	1998
2	Introduction to Heat Transfer	Incropera, F. P. and Dewitt, D. P	John Wiley and Sons.	1990
3	Heat Transfer - A Conceptual Approach	P. K. Sarma and K. Ramakrishna	New Age International Publishers	2006
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	1997
5	Heat Transfer - A Basic Approach	M. Necati Özışık	McGraw-Hill	1985

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat Transfer Methods	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/HEAT-TRANSFER
2	Thermodynamics	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/THERMODYNAMICS

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys-Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	IN Sem-1	15	38
	In Sem-2	15	
	Practical In sem	8	
End-Sem Summative	End Sem Exam	24	40
	Practical End Sem	16	

HEAT TRANSFER (HT)

COURSE CODE	22ME3110P	MODE	P	LTPS	4-0-4-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply Fourier law of conduction and combined conduction convection concepts to 1-D heat transfer problems	3	PO1,PO2,PSO1
CO2	Analyze heat transfer through extended surfaces and apply unsteady state heat transfer to various systems.	4	PO1,PO2,PSO1
CO3	Apply the emperical correlations for solving convection heat transfer and heat transfer through during phase change problems	3	PO1,PO2,PSO1
CO4	Analyze various types of heat exchangers by applying the principles of conduction, convection, radiation	4	PO1,PO2,PSO1
CO5	Analyze the performance of heat exchangers using nanofluids	4	PO1,PO2,PSO1
CO6	Analyze various parameters of heat transfer in different thermal systems physically/numerically	4	PO1,PO2,PSO1

Syllabus

Module 1	Introduction to fundamental processes of heat transfer and their governing laws. 1-D steady state heat conduction in single and multi-layered plane walls, cylinders and spheres along with concepts of thermal contact resistance and critical thickness of insulation. One dimensional heat conduction with internal heat generation
Module 2	Fins-applications and performance analysis; Transient conduction-lumped capacitance, semi-infinite body and application of Heisler and Grober charts
Module 3	Elementary convection including laminar and turbulent boundary layers in external flows and internal flows of forced convection, natural convection. Heat transfer in boiling and condensation
Module 4	Basic concepts of heat exchangers; Thermal radiation-Stefan-Boltzmann law, small object in a large enclosure, parallel plates and shape factor.
Module 5	Nanofluid preparation, characterization and applications in heat exchangers

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Heat Transfer – A practical approach	Yunus A. Cengel	Tata McGraw Hill.	1998
2	Introduction to Heat Transfer	Incropera, F. P. and Dewitt, D. P	John Wiley and Sons.	1990
3	Heat Transfer - A Conceptual Approach	P. K. Sarma and K. Ramakrishna	New Age International Publishers	2006
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	1997
5	Heat Transfer - A Basic Approach	M. Necati Özışık	McGraw-Hill	1985

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat Transfer	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/HEAT-TRANSFER

	Methods					
2	Thermodynamics	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/THERMODYNAMICS

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys-Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study-Analysis	15	22
	Practical Continuous Evaluation	7	
In-Sem Summative	Practical In Sem Exam	19	38
	MOOC’s Exam	19	
End-Sem Summative	End Sem Exam(MCQ Based)	24	40
	MOOC’s Exam	16	

MECHANICAL ENGINEERING DESIGN (MED)

COURSE CODE	22ME3111R	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	22ME2106R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply engineering design phases and general considerations to design any machine component	3	PO2, PSO2
CO2	Apply the mechanical behavior of engineering materials concept to solve any material failure problem	3	PO2, PSO2
CO3	Design of machine components for static strength	4	PO2
CO4	Design of machine components for fatigue strength	4	PO2

Syllabus

Module 1	Design Philosophy, Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design. General considerations and procedure in machine design, Codes & Standards, Reliability, Preferred numbers
Module 2	Selection of Materials and Shapes: Mechanical behavior of engineering materials, Selection of Materials, Selection of Shapes. Fundamentals of mechanical behavior of materials, as well as design with materials: elasticity, plasticity, fatigue, fracture, and creep
Module 3	Design for Static Strength: Simple Stresses - Combined stresses - Torsional and Bending stresses - Factor of safety and theories of failure
Module 4	Design for Fatigue Strength: Stress concentration – Methods of reducing stress concentration factor, Design for fluctuating stresses- Endurance limit, Estimation of Endurance strength – Notch sensitivity– Goodman's line and Soderberg's line, Combined fluctuating stresses.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of machine elements	V. B. Bhandari	McGraw-Hill International	2007
2	Machine Design	Robert L. Norton	Pearson	2019
3	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2010
4	Materials selection in Mechanical Design	Michael F. Ashby	Elsevier Butterworth-Heinemann	2011
5	Engineering Design	George E. Dieter	McGraw-Hill International	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/

2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

MECHANICAL ENGINEERING DESIGN (MED)

COURSE CODE	22ME3111A	MODE	A	LTPS	4-1-0-0	PRE-REQUISITE	22ME2106R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply engineering design phases and general considerations to design any machine component	3	PO2, PSO2
CO2	Apply the mechanical behavior of engineering materials concept to solve any material failure problem	3	PO2, PSO2
CO3	Design of machine components for static strength	4	PO2
CO4	Design of machine components for fatigue strength	4	PO2
CO5	Prototyping robust design and product evaluation for performance	4	PO2

Syllabus

Module 1	Design Philosophy, Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design. General considerations and procedure in machine design, Codes & Standards, Reliability, Preferred numbers
Module 2	Selection of Materials and Shapes: Mechanical behavior of engineering materials, Selection of Materials, Selection of Shapes. Fundamentals of mechanical behavior of materials, as well as design with materials: elasticity, plasticity, fatigue, fracture, and creep
Module 3	Design for Static Strength: Simple Stresses - Combined stresses - Torsional and Bending stresses - Factor of safety and theories of failure
Module 4	Design for Fatigue Strength: Stress concentration – Methods of reducing stress concentration factor, Design for fluctuating stresses- Endurance limit, Estimation of Endurance strength – Notch sensitivity– Goodman's line and Soderberg's line, Combined fluctuating stresses.
Module 5	Prototyping robust design, product evaluation for performance, patents and intellectual property

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of machine elements	V. B. Bhandari	McGraw-Hill International	2007
2	Machine Design	Robert L. Norton	Pearson	2019
3	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2010
4	Materials selection in Mechanical Design	Michael F. Ashby	Elsevier Butterworth-Heinemann	2011
5	Engineering Design	George E. Dieter	McGraw-Hill International	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

MECHANICAL ENGINEERING DESIGN (MED)

COURSE CODE	22ME3111P	MODE	P	LTPS	4-1-0-0	PRE-REQUISITE	22ME2106R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply engineering design phases and general considerations to design any machine component	3	PO2, PSO2
CO2	Apply the mechanical behavior of engineering materials concept to solve any material failure problem	3	PO2, PSO2
CO3	Design of machine components for static strength	4	PO2
CO4	Design of machine components for fatigue strength	4	PO2
CO5	Prototyping robust design and product evaluation for performance	4	PO2

Syllabus

Module 1	Design Philosophy, Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design. General considerations and procedure in machine design, Codes & Standards, Reliability, Preferred numbers
Module 2	Selection of Materials and Shapes: Mechanical behavior of engineering materials, Selection of Materials, Selection of Shapes. Fundamentals of mechanical behavior of materials, as well as design with materials: elasticity, plasticity, fatigue, fracture, and creep
Module 3	Design for Static Strength: Simple Stresses - Combined stresses - Torsional and Bending stresses - Factor of safety and theories of failure
Module 4	Design for Fatigue Strength: Stress concentration – Methods of reducing stress concentration factor, Design for fluctuating stresses- Endurance limit, Estimation of Endurance strength – Notch sensitivity– Goodman's line and Soderberg's line, Combined fluctuating stresses.
Module 5	Prototyping robust design, product evaluation for performance, patents and intellectual property

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of machine elements	V. B. Bhandari	McGraw-Hill International	2007
2	Machine Design	Robert L. Norton	Pearson	2019
3	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2010
4	Materials selection in Mechanical Design	Michael F. Ashby	Elsevier Butterworth-Heinemann	2011
5	Engineering Design	George E. Dieter	McGraw-Hill International	2009

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40
Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study - Analysis	20	20
In-Sem Summative	MOOCs Exam	40	40
End-Sem Summative	Global Certification	40	40

MACHINE DESIGN (MD)

COURSE CODE	23ME3214R	MODE	R	LTPS	2-0-0-4	PRE-REQUISITE	MED

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Design of shafts and couplings	4	PO1,PO2,PSO1
CO2	Design of fasteners	4	PO1,PO4,PSO1
CO3	Design and Selection of appropriate bearings and drives	4	PO1,PO2,PSO1
CO4	Design of gears	4	PO1,PO4,PSO1
CO5	Design various mechanical systems	4	PO1,PO2,PSO1
CO6	Design various mechanical systems	4	PO1,PO2&PO4,PSO1

Syllabus

Module 1	**Shafts:** Design of solid and hollow shafts for strength and rigidity, Design of shaft for variable load, Design of shafts for gear and belt drives. **Couplings:** Design of Rigid and Flexible Couplings Design of Helical springs, Torsion springs, Spiral springs, Leaf springs.
Module 2	**Welded joints:** Design of Welded joints, Strength of welded joints, Circular fillet welds-bending and torsion, Welded joint with eccentric loading, Bolted joints: Design of bolts with pre-stresses - Design for leak Proof Joints – Design of joints under eccentric loading - Bolt of uniform strength. Power Screws: Types - Mechanics of power screws, Efficiency of Square and Self-locking screw
Module 3	**Belt Drives:** Selection of flat and V-belts from manufacturer's catalogue, Belt tensioning methods, Construction and applications of timing belts. **Chain Drives:** Polygonal effect, Power rating of roller chains, Construction of sprocket wheels. **Bearings:** modes of Lubrication, Sliding contact bearing design, bearing materials, selection of lubricant. Rolling contact bearings- selection of ball, roller bearings- under static load, dynamic load. Brakes: Analysis and Design of Block brakes, internal shoe Brakes, End shoe Brakes, Pivoted shoe Brakes, Band Brakes, Temperature raise, Friction materials.
Module 4	**Spur Gears:** Force analysis, Beam strength (Lewis) equation, Estimation of module based on beam and wear strength. **Helical Gears:** Transverse and normal module, Estimation of dynamic load by velocity factor and Buckingham's equation, Design of helical gears. **Bevel Gears**: Design criteria of bevel gears, Beam and wear strengths, Dynamic tooth load by velocity factor and Buckingham's equation, Effective load, Design of straight tooth bevel gears, Worm Gears: Design and analysis of worm gear drive
Module 5	Undestand the physical modal, Modelling and analysing the to design the mechanical system
Module 6	Undestand the physical modal, Modelling and analysing the to design the mechanical system(Combination of the shaft and coupling,shaft and gear, couplings and shafts)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of Machine Elements	V. B. Bhandari	McGraw-Hill International	2021
2	Machine Design	Robert L. Norton	Pearson	2018
3	Mechanical Engineering Design	Shigley's	McGraw-Hill International	2014
4	The Mechanical Design Process	D. Ullman	Pearson Education	2019
5	Machine Design	Black P.H. and O. Eugene Adams,	Standard Publishers	1968

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structural analysis	ANSYS	Y	MCQ	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQ	Altair University	https://altair.com/academic-program

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS	ANSYS	Commercial
2	Hypermesh	ALTAIR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Skill Continuous Evaluation	7	
In-Sem Summative	Sem In Examinations-I	15	38
	Sem In Examinations-II	15	
	Skill in Sem Exam	8	
End-Sem Summative	End semester Exam	24	40
	Skill End Sem Examination	16	

MACHINE DESIGN (MD)

COURSE CODE	23ME3214A	MODE	A	LTPS	2-0-0-4	PRE-REQUISITE	MED

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Design of shafts and couplings	4	PO1,PO2,PSO1
CO2	Design of fasteners	4	PO1,PO4,PSO1
CO3	Design and Selection of appropriate bearings and drives	4	PO1,PO2,PSO1
CO4	Design of gears	4	PO1,PO4,PSO1
CO5	Design various mechanical systems	4	PO1,PO2,PSO1
CO6	Design various mechanical systems	4	PO1,PO2&PO4,PSO1

Syllabus

Module 1	**Shafts:** Design of solid and hollow shafts for strength and rigidity, Design of shaft for variable load, Design of shafts for gear and belt drives. **Couplings:** Design of Rigid and Flexible Couplings Design of Helical springs, Torsion springs, Spiral springs, Leaf springs.
Module 2	**Welded joints:** Design of Welded joints, Strength of welded joints, Circular fillet welds-bending and torsion, Welded joint with eccentric loading, Bolted joints: Design of bolts with pre-stresses - Design for leak Proof Joints – Design of joints under eccentric loading - Bolt of uniform strength. Power Screws: Types - Mechanics of power screws, Efficiency of Square and Self-locking screw
Module 3	**Belt Drives:** Selection of flat and V-belts from manufacturer's catalogue, Belt tensioning methods, Construction and applications of timing belts. **Chain Drives:** Polygonal effect, Power rating of roller chains, Construction of sprocket wheels. **Bearings:** modes of Lubrication, Sliding contact bearing design, bearing materials, selection of lubricant. Rolling contact bearings- selection of ball, roller bearings- under static load, dynamic load. Brakes: Analysis and Design of Block brakes, internal shoe Brakes, End shoe Brakes, Pivoted shoe Brakes, Band Brakes, Temperature raise, Friction materials.
Module 4	**Spur Gears:** Force analysis, Beam strength (Lewis) equation, Estimation of module based on beam and wear strength. **Helical Gears:** Transverse and normal module, Estimation of dynamic load by velocity factor and Buckingham's equation, Design of helical gears. **Bevel Gears**: Design criteria of bevel gears, Beam and wear strengths, Dynamic tooth load by velocity factor and Buckingham's equation, Effective load, Design of straight tooth bevel gears, Worm Gears: Design and analysis of worm gear drive
Module 5	Undestand the physical modal, Modelling and analysing the to design the mechanical system
Module 6	Undestand the physical modal, Modelling and analysing the to design the mechanical system(Combination of the shaft and coupling,shaft and gear, couplings and shafts)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of Machine Elements	V. B. Bhandari	McGraw-Hill International	2021
2	Machine Design	Robert L. Norton	Pearson	2018
3	Mechanical Engineering Design	Shigley's	McGraw-Hill International	2014
4	The Mechanical Design Process	D. Ullman	Pearson Education	2019
5	Machine Design	Black P.H. and O. Eugene Adams,	Standard Publishers	1968

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQ	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQ	Altair University	https://altair.com/academic-program

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS	ANSYS	Commercial
2	Hypermesh	ALTAIR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Skill Continuous Evaluation	7	
In-Sem Summative	Sem In Examinations-I	15	38
	Sem In Examinations-II	15	
	Skill in Sem Exam	8	
End-Sem Summative	End semester Exam	24	40
	Skill End Sem Examination	16	

MACHINE DESIGN (MD)

COURSE CODE	23ME3214P	MODE	P	LTPS	3-1-0-4	PRE-REQUISITE	MED

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Design of shafts and couplings	4	PO1,PO2,PSO1
CO2	Design of fasteners	4	PO1,PO4,PSO1
CO3	Design and Selection of appropriate bearings and drives	4	PO1,PO2,PSO1
CO4	Design of gears	4	PO1,PO4,PSO1
CO5	Design various mechanical systems	4	PO1,PO2,PSO1
CO6	Design various mechanical systems	4	PO1,PO2&PO4,PSO1

Syllabus

Module 1	**Shafts:** Design of solid and hollow shafts for strength and rigidity, Design of shaft for variable load, Design of shafts for gear and belt drives. **Couplings:** Design of Rigid and Flexible Couplings Design of Helical springs, Torsion springs, Spiral springs, Leaf springs.
Module 2	**Welded joints:** Design of Welded joints, Strength of welded joints, Circular fillet welds-bending and torsion, Welded joint with eccentric loading, Bolted joints: Design of bolts with pre-stresses - Design for leak Proof Joints – Design of joints under eccentric loading - Bolt of uniform strength. Power Screws: Types - Mechanics of power screws, Efficiency of Square and Self-locking screw
Module 3	**Belt Drives:** Selection of flat and V-belts from manufacturer's catalogue, Belt tensioning methods, Construction and applications of timing belts. **Chain Drives:** Polygonal effect, Power rating of roller chains, Construction of sprocket wheels. **Bearings:** modes of Lubrication, Sliding contact bearing design, bearing materials, selection of lubricant. Rolling contact bearings- selection of ball, roller bearings- under static load, dynamic load. Brakes: Analysis and Design of Block brakes, internal shoe Brakes, End shoe Brakes, Pivoted shoe Brakes, Band Brakes, Temperature raise, Friction materials.
Module 4	**Spur Gears:** Force analysis, Beam strength (Lewis) equation, Estimation of module based on beam and wear strength. **Helical Gears:** Transverse and normal module, Estimation of dynamic load by velocity factor and Buckingham's equation, Design of helical gears. **Bevel Gears**: Design criteria of bevel gears, Beam and wear strengths, Dynamic tooth load by velocity factor and Buckingham's equation, Effective load, Design of straight tooth bevel gears, Worm Gears: Design and analysis of worm gear drive
Module 5	Undestand the physical modal, Modelling and analysing the to design the mechanical system
Module 6	Undestand the physical modal, Modelling and analysing the to design the mechanical system(Combination of the shaft and coupling,shaft and gear, couplings and shafts)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of Machine Elements	V. B. Bhandari	McGraw-Hill International	2021
2	Machine Design	Robert L. Norton	Pearson	2018
3	Mechanical Engineering Design	Shigley's	McGraw-Hill International	2014
4	The Mechanical Design Process	D. Ullman	Pearson Education	2019
5	Machine Design	Black P.H. and O. Eugene Adams,	Standard Publishers	1968

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQ	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQ	Altair University	https://altair.com/academic-program

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS	ANSYS	Commercial
2	Hypermesh	ALTAIR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	22
	Home Assignments	7	
	Skill Continuous Evaluation	5	
	Project Continuous Evaluation	5	
In-Sem Summative	Mini/Capstone Project	30	38
	Skill in Sem Exam	8	
End-Sem Summative	Sem End project	24	40
	Skill End Sem Examination	16	

FLEXI CORE COURSES

SUPPLY CHAIN & QUALITY MANAGEMENT (SCQM)

COURSE CODE	22ME2221	MODE	R	LTPS	3-0-0	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate an understanding of key concepts and principles of supply chain management.	2	PO1,PO4,PO5,PSO2
CO2	Apply quality management methodologies and tools to improve supply chain performance	3	PO1,PO4,PO5,PSO2
CO3	Understanding of supplier relationship, selection and evaluation, supplier performance	3	PO1,PO4,PO5,PSO2
CO4	Apply various data analytics tools to optimize supply chain performance	3	PO1,PO4,PO5,PSO2

Syllabus

Module 1	Introduction to supply chain management, Types of supply chains, Key concepts in supply chain management, Logistics and supply chain management, Global supply chain management, Challenges and opportunities in supply chain management.
Module 2	Introduction to quality management systems, Quality management methodologies, Six Sigma, Total Quality Management, Quality control and assurance, Continuous improvement in quality management.
Module 3	Introduction to supplier relationship management, Supplier selection and evaluation, Supplier development and partnerships, Managing supplier performance, Supplier risk management, Supplier diversity and sustainability.
Module 4	Introduction to supply chain analytics, Predictive analytics in supply chain management, Prescriptive analytics in supply chain management, Big data in supply chain management, Supply chain optimization, Supply chain simulation and modelling.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Supply Chain Management: Strategy, Planning, and Operation"	Sunil Chopra and Peter Meindl	7th	Pearson Education
2	"Quality Management for Organizational Excellence: Introduction to Total Quality"	David L. Goetsch and Stanley B. Davis	6th	Pearson Education
3	"Logistics and Supply Chain Management"	Martin Christopher	6th	Pearson Education

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Supply Chain	APICS (Association for Supply	Yes	Multiple-choice	Pearson VUE	https://www.apics.org/credentials-education/credentials/cscp

	Professional (CSCP)	Chain Management)		questions		
2	Certified Professional in Supply Management (CPSM)	ISM (Institute for Supply Management)	Yes	Multiple-choice questions	Pearson VUE	https://www.ismworld.org/certification/cpsm/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignment and Book. (Min. 4 Assignments etc.)	10	20
	ALMs	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	
	End Semester Exam		40

MATERIAL SCIENCE (MS)

COURSE CODE	22ME2222	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand crystallography and various material testing methods to solve the relevant problems.	3	PO1, PO2
CO2	Distinguish and analyze various types of materials based on their engineering applications.	3	PO1, PO3
CO3	Apply the concepts of cooling curves and phase diagrams.	3	PO1, PO4
CO4	Analyze various heat treatment processes and their strengthening mechanisms.	4	PO1, PO5
CO5	Gain hands on experience to conduct various experiments of metallography and heat treatment process practically.	3	PO1, PO6

Syllabus

Module 1	Introduction-Testing Introduction to Engineering materials, Crystallography, Crystal systems and Bravai's lattices, Crystal imperfections, Material testing Methods-Destructive and Non Destructive Methods- Dye penetrate test, Magnetic flux test, Radiography and Ultrasonic test.
Module 2	Materials Ferrous and Non-Ferrous Materials, Ceramics, Composites and Biomaterials-Introduction, classification and applications. Smart Materials: Introduction, shape memory effect, classification of shape memory alloys, compositions, properties applications of shape memory alloys.
Module 3	Constitution of alloys, Necessity of alloying, Solid solutions, Gibb's Phase rule, Cooling Curves, Phase Diagrams-Introduction, classification based on components and transformations, construction, reactions involved in Fe-C, Cu-Ni and Al-Cu type.
Module 4	Heat Treatment of steels-Introduction, stages, classification, Annealing, Normalising, Tempering, Hardening, Harden ability test by Jominy end quench apparatus, Isothermal transformation diagrams-TTT diagram &CCT diagram, special heat treatment techniques-Introduction, classification, surface hardening and case hardening methods such as carburising, nitriding, cyaniding and carbonitriding.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Materials science and Engineering	V. Raghavan	Prentice-Hall of India	1997
2	Materials Science and Engineering	C. Daniel Yesudian	Scitech	2010
3	Introduction to Physical Metallurgy	Sydney H Avner	McGraw Hill Education	2017
4	Engineering Metallurgy	R.A.Higgins	Elsevier Science & Technology Books	1993
5	Engineering Physical Metallurgy	Y. Lakhtin	Mir Publishers, Moscow	1998

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	IN-SEM-1	15	38
	IN-SEM-2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based	24	40
	Lab End-Sem Exam	16	

MANUFACTURING PROCESSES (MP)

COURSE CODE	22ME2223	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify appropriate casting process for producing a component	3	PO1, PO3, PSO2
CO2	Examine the joints obtained by welding process	3	PO1, PO3, PSO2
CO3	Apply principles of cold/hot forming processes	3	PO1, PO3, PSO2
CO4	Apply sheet metal processes and design sheet metal dies	3	PO1, PO3, PSO2
CO5	Prepare parts using appropriate manufacturing process	3	PO1, PO3, PSO2

Syllabus

Module 1	Casting: Patterns and Pattern making, Allowances, Moulding methods and processes, Design considerations in casting, Riser and gating design, Different castings - Sand castings, pressure die casting, permanent mould casting, centrifugal casting, precision investment casting, shell Moulding, continuous casting-squeeze casting, electro slag casting, casting defects and Inspection of castings.
Module 2	Joining Processes - Types of welding - Arc welding, Shielded metal arc welding, GTAW, GMAW, SAW, Resistance welding, Thermit welding, Gas welding, Soldering, brazing, Electron beam and Laser welding, weld stress-calculations, design of weld size, estimation of weld dilution, heat input, effect of welding parameters, Inspection of welds, Defects in welding, causes and remedies.
Module 3	Metal Forming - Hot/Cold forming processes, Metallurgical aspects of metal forming, Forging and rolling processes: Forging principle, parameters and calculation of forces and power requirements during forging, Rolling processes, calculation of forces and geometrical relationship in rolling, analysis of rolling load, torque and power. Rolling and forging defects, causes and remedies. Types of Extrusion processes and drawing processes, Problems on extrusion and drawing.
Module 4	Sheet metal forming processes - Sheet metal / Press working operations, Types of presses and selection of presses, HERF processes - Electro hydraulic forming, Magnetic pulse forming.
Module 5	Lab for producing profiles/parts using Casting, Welding processes

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Processes and Materials of Manufacture	Lindberg	Prentice hall India (p) Ltd.	
2	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven R. Schmid	Prentice Hall	
3	Manufacturing Technology	P.N.Rao	TMH Ltd	
4	Mechanical Metallurgy	Dieter	McGrawhill	
5	Manufacturing science	Amitabha Ghosh and Asok Kumar Mallik	TMH publisher	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-297212512959&gclid=EAIaIQobChMI9br7l-rp_gIVfDVyCh0RzwEmEAAYASAAEgIb9vD_BwE
2	IIW International Diploma in Welding	TWI	Y	Online	TWI	https://www.twi-global.com/locations/south-east-asia/training/iiw-diploma/iiw-international-diploma-in-welding

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	AutoDesk	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem – 1	15	38
	In-Sem -2	15	
	Practical In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

MANUFACTURING TECHNOLOGY (MT)

COURSE CODE	22ME3113	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	22ME2208

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Analyze cutting forces using Merchants equation	4	PO1, PO3, PSO2
CO2	Identify the constructional and operational features of Lathe machine tools	3	PO1, PO3, PSO2
CO3	Select the appropriate reciprocating machine tools for generation of profiles	3	PO1, PO3, PSO2
CO4	Implement CNC programming for machining basic components	3	PO1, PO3, PSO2
CO5	Implement CNC programming in part production	4	PO1, PO3, PSO2

Syllabus

Module 1	Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.
Module 2	Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle.
Module 3	Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods. Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods.
Module 4	Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features. Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.
Module 5	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Processes and Materials of Manufacture	Lindberg	Prentice hall India	
2	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven R. Schmid	Prentice Hall	
3	Manufacturing Technology	P. N Rao	TMH Ltd	

4	Mechanical Metallurgy	Dieter	Mcgraw	
5	CAD/CAM	Zimmers & Groovers	Prentice hall India	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	AutoDesk	Y	Online	AutoDesk	https://www.autodesk.in/campaigns/education/fusion-360-education?mktvar002=4246615|SEM|12898498478|125502127390|kwd-297212512959&gclid=EAIaIQobChMI9br7l-rp_gIVfDVyCh0RzwEmEAAYASAAEgIb9vD_BwE
2						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	AutoDesk	Open Source
2	CNC Machine Tool Setup Programmer	Institute of Machine Tool Technology	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem – 1	15	38
	In-Sem-2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

INDUSTRIAL INTERNET OF THINGS (IIOT)

COURSE CODE	22ME2225	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	FIOT

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the Industry 4.0 Globalization	2	PO2,PO5,PSO2
CO2	Apply the Model and architecture of IIIOT	3	PO2,PO5,PSO2
CO3	Understand the IIIOT Computing	2	PO2,PO5,PSO2
CO4	Analyse the Various Applications of IIIOT	3	PO2,PO5,PSO2
CO5	Apply and deploy various applications using Django	3	PO2,PO5,PSO2

Syllabus

Module 1	Industry 4.0- Globalization: The Fourth Revolution, LEAN Production Systems , Sensing & actuation, Communication, Networking types.Cyber Physical Systems and Next Generation Sensors: Collaborative Platform and Product Lifecycle Management.
Module 2	Basics of Industrial IIOT: Industrial Processes Industrial Sensing & Actuation, Industrial IIOT: Business Model and Reference Architecture, Industrial IIOT- Layers: IIIOT Sensing-Part I, Part II, IIIOT Processing, IIIOT Networking
Module 3	Industrial IIOT Computing: Big Data Analytics and Software Defined Networks, Data Center Networks, Industrial IIOT: Security and Fog Computing - Fog Computing in IIIOT, Security in IIIOT
Module 4	Industrial IIOT Application Domains: Healthcare, Power Systems, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Industry 4.0: The Industrial Internet of Things”	Alasdair Gilchrist	(Apress)	2020
2	Internet of Things – A hands-on approach	Arshdeep Bahga, Vijay Madisetti,	Universities Press	2015
3	Introduction to Industrial Automation	Stamatios Manesis George Nikolakopoulos	CRC press T&F	2018

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Global Industrial Cyber Security Professional Certification (GICSP)		yes	online 3 hours CBT		https://www.giac.org/certifications/global-industrial-cyber-security-professional-gicsp/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Raspberry pi		H/W
2	Node mcu		H/W

Evaluation Components:

<table>
<tr><td rowspan="7">1</td><td rowspan="7">IN-SEM</td><td rowspan="3">FORMATIVE</td><td>ALM</td><td>LMS</td><td>7</td><td rowspan="3">24</td></tr>
<tr><td>Lab continuoes evaluation/skill excercises</td><td>LMS / Paper Based</td><td>10</td></tr>
<tr><td>Case Study - Analysis</td><td>LMS / Paper Based</td><td>7</td></tr>
<tr><td rowspan="3">SUMMATIVE</td><td>In-Sem 1</td><td>ERP / Paper Based</td><td>12</td><td rowspan="3">36</td></tr>
<tr><td>In-Sem 2</td><td>ERP / Paper Based</td><td>12</td></tr>
<tr><td>Lab in sem exam</td><td>paper based</td><td>12</td></tr>
<tr></tr>
<tr><td rowspan="2">2</td><td rowspan="2" colspan="2">END-SEM</td><td>End-Sem Exam (Paper Based)</td><td>Paper Based</td><td>24</td><td rowspan="2">40</td></tr>
<tr><td>In Semester Exam (Lab + Skilling)</td><td>lab and skill project</td><td>16</td></tr>
</table>

ELECTRIC VEHICLE TECHNOLOGY (EVT)

COURSE CODE	22ME2226	MODE	Regular	LTPS	2-0-2-0	PRE-REQUISITE	Thermodynamics

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the subsystems and components used in electric vehicles and Differentiate electric and hybrid vehicles	2	PO1, PO2 &PSO1
CO2	Analyze & select the suitable charging methods for electric vehicles	4	PO1, PO2 &PSO1
CO3	Understand the drive trains used in different configurations of electric vehicles	2	PO1, PO2 &PSO1
CO4	Apply design considerations for electric vehicles	3	PO1, PO2, PO3 &PSO1
CO5	Analyse and modelling of Electric Vehicle Technology using ANSYS and COMSOL software	4	PO1, PO2, PO3 &PSO1

Syllabus

Module 1	NEED FOR ELECTRIC VEHICLES: Need of electric vehicles – comparative study of diesel, petrol, and pure electric vehicles. Limitations of electric vehicles, Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, Classification - according to the source of power and the drive arrangement, Configuration of electric vehicles, Performance of electric vehicles.
Module 2	ENERGY SOURCES AND CHARGING: Requirements of energy sources in electric vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Charging of electric vehicles-home charging, public charging, swap station, inductive charging. Locations and type of chargers
Module 3	ELECTRIC DRIVE TRAINS: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Steering system for electric vehicles, Suspension for electric vehicles, Brake system for electric vehicles
Module 4	DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES: Aerodynamic-Rolling resistance-Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choiceWing Mirror, Aerials and Luggage racks. Case Studies: Design of a Battery Electric Vehicle (BEV).

Reference Books:

Sl No	Title	Author(s)	Year	Publisher
1	Vehicular Electric Power Systems	Ali Emadi et al	2004	Marcel Dekker, Inc, 2004
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	2001	Oxford University Press, 2001
3	Electric Vehicle Technology Explained	James Larminie and John Lowry	2003	John Wiley & Sons, 2003
4	Vehicle Propulsion System	Lino Guzzella	2005	Springer Publications
5	Vehicular Electric Power Systems	Ali Emadi et al	2004	Marcel Dekker, Inc, 2004

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Program in Electric Vehicle Design	Great Learning	Y	Online		https://www.mygreatlearning.com/pgp-electric-vehicle-design-online-course?&utm_source=search&utm_medium=gc9298574&utm_campaign=evd_course-ph-south-ser-lead-pr-pgp_evd&adgroup_id=136608836337&campaign_id=17478854335&keyword=electric%20vehicle%20training&ad_id=609693691120&gclid=CjwKCAjwge2iBhBBEiwAfXDBR8U-7BQDYWyGEk2gqxZg26iyR5B0h3fvEySh_iZ49VYr4NXGDPNLGxoCOBsQAvD_BwE
2	PROFESSIONAL MASTER CERTIFICATION IN EV ENGINEERING	ISIE INDIA	Y	Online	ISIE INDIA	https://imperialsociety.in/pg-diploma-in-ev-engineering/#:~:text=ISIEINDIA%20in%20association%20with%20various,case%20studies%20and%20Mini%20Projects.

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS software		Commercial
2	COMSOL software		Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
	Lab End-Sem Exam	16	

THERMODYNAMICS (T.D)

COURSE CODE	22ME2227	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	Nill

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Examine the basic terminology used in thermodynamics	2	PO1, PSO1
CO2	Apply first law of thermodynamics to various flow and non-flow processes.	3	PO1, PSO2
CO3	Apply second law of thermodynamics and principle of entropy to Engineering Devices.	3	PO1, PSO2
CO4	Analyze the performance of different air standard cycles and different psychrometric processes	4	PO2, PSO2

Syllabus

Module 1	Fundamental Concepts and Definitions: Thermodynamic system and control volume, macroscopic and microscopic points of view, thermodynamic properties, processes, state, path, cycle, thermodynamic equilibrium and quasi-static process. Reversible and irreversible processes
Module 2	zeroth law, concept of temperature. Work and Heat: Definition of work, units, work done at the moving boundary of system, work done in various non-flow processes, definition of heat, units, comparison of heat and work. First Law of Thermodynamics for Non-Flow Systems: First law of thermodynamics for a closed system undergoing a cycle and for a change of state; energy - a property of system, internal energy and enthalpy. Specific heat at constant volume and constant pressure. First Law of Thermodynamics for Flow Systems: Control mass, control volume, first law of thermodynamics for a control volume, steady flow energy equation and applications to engineering equipment and PMM-1
Module 3	Second Law of Thermodynamics: Thermal reservoirs, Kelvin-Plank and Clausius statements of second law of thermodynamics; Equivalence of Kelvin-Plank and Clausius statements, PMM-2; Carnot cycle, Carnot engine, corollary of Carnot's theorem, absolute thermodynamic temperature scale. Entropy: Definition of entropy, Clausius theorem, entropy change in reversible process temperature-entropy plot, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, applications of entropy principle, entropy change of an ideal gas; availability and irreversibility. Air standard cycles: Performance analysis of Otto ,Diesel,Dual,and Brayton cycles.
Module 4	Psychometric: Psychrometric properties, psychrometric chart and air-conditioning process

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Thermodynamics, an Engineering Approach	Yunus A. Cengel & Michael Boles	Tata McGraw Hill, NewDelhi	1989
2	Engineering Thermodynamics -	P. K. Nag	Tata McGraw Hill, NewDelhi.	1982
3	Engineering Thermodynamics	Cohen and Rogers	Pearson Education India limited.	1980
4	Thermodynamics	E Rathakrishnan	Eastern economy edition	2005

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Thermodynamics	TATA STEEL	Y	Online	TATA STEEL	https://capabilitydevelopment.org/Coursedesc/THERMODYNAMICS

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In- Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

FLUID MECHANICS (FM)

COURSE CODE	22ME2228	MODE	Regular	LTPS	2-0-2-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of fluid properties and the laws of fluid statics to estimate the total pressure, Centre of pressure and forces on submerged and floating bodies.	3	PO1, PO2 &PSO1
CO2	Apply continuity, Euler and Bernoulli equations and design different flow measuring devices	3	PO1, PO2 &PSO1
CO3	Apply momentum equation and boundary layer concepts to analyze the flow through pipes and impact of jets	4	PO1, PO2 &PSO1
CO4	Analyze the fluid flow characecteristics to calculate the impact of jets on various surfaces	4	PO1, PO2, PO3 &PSO1
CO5	Conduct experiments to verify and apply various fluid flow principles and performance evaluation of various hydraulic machines like turbines and pumps	4	PO1, PO2, PO3 &PSO1

Syllabus

Module 1	Fluid Properties: Definition of fluid, properties of fluids - density, specific weight, specific gravity, viscosity, classification of fluids, surface tension, capillarity, vapor pressure. Fluid Statics: Introduction, pressure, Pascal law, hydrostatic law, measurement of pressure, simple and differential manometers; total pressure and center of pressure on vertical, horizontal, inclined and curved surfaces. Buoyancy: Buoyancy, forces on submerged bodies, stability of submerged and floating bodes.
Module 2	Fluid kinematics: Introduction, types of fluid flow, discharge, continuity equation, potential function and stream function. Fluid dynamics: Introduction, Euler's equation of motion, Bernoulli's equation and applications, venturi meter, orifice meter.
Module 3	Flow through pipes: Introduction, major and minor energy losses, friction coefficient in laminar and turbulent flow, Hagen-Poiseuille law, Hydraulic gradient and total energy line, pipes in series and parallel, power transmission through pipes, Reynold's experiment and water hammer. Boundary layer theory: Introduction, laminar and turbulent boundary layers, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, boundary layer separation, methods of preventing separation, Non dimensional Analysis
Module 4	Impact of Jets: Introduction to impulse-momentum equation and its applications, force exerted by jet on fixed target, moving target, and series of curved vanes.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Fluid Mechanics	S. K. Som and G. Biswas	Tata McGraw Hill publications	2004
2	Fluid Mechanics	Yunus A. Cengel	McGraw Hill publications	2007

3	Fluid Mechanics and Hydraulic Machines	D. S. Kumar,	Narosa Publishing House Private Limited	2010
4	Fluid Mechanics & Hydraulics	K. R. Arora	Standard Book House, New Delhi.	2011
5	Fluid Mechanics & Hydraulics	Modi & Seth	Standard Book House, New Delhi.	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate Certification in Basics of Fluid Dynamics	Ansys	Y	Online	Ansys	https://certifications.ansys.com/courses/basics-of-fluid-dynamics-associate-certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA (For practical, instruments/machines available in the laboratory will be used)	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	08	22
	Home Assignments	07	
	Practical Continuous Evaluation	07	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	08	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

ELEMENTS OF HEAT TRANSFER (EHT)

COURSE CODE	22ME2229	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply Fourier law of conduction and combined conduction convection concepts to 1-D heat transfer problems	3	PO1,PO2,PSO1
CO2	Analyze heat transfer through extended surfaces and apply unsteady state heat transfer to various systems.	4	PO1,PO2,PSO1
CO3	Apply the emperical correlations for solving convection heat transfer and heat transfer through during phase change problems	3	PO1,PO2,PSO1
CO4	Apply Stefan Boltzmann law of radiation to various shaped to calculate radiation heat transfer	3	PO1,PO2,PSO1
CO5	Analyze the performance of heat exchangers using nanofluids	4	PO1,PO2,PSO1

Syllabus

Module 1	Introduction to fundamental processes of heat transfer and their governing laws. 1-D steady state heat conduction in single and multi-layered plane walls, cylinders and spheres along with concepts of thermal contact resistance and critical thickness of insulation. One dimensional heat conduction with internal heat generation
Module 2	Fins-applications and performance analysis; Transient conduction-lumped capacitance, semi-infinite body and application of Heisler and Grober charts
Module 3	Elementary convection including laminar and turbulent boundary layers in external flows and internal flows of forced convection, natural convection. Heat transfer in boiling and condensation
Module 4	Thermal radiation-Stefan-Boltzmann law, small object in a large enclosure, parallel plates and shape factor.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Heat Transfer – A practical approach	Yunus A. Cengel	Tata McGraw Hill.	1998
2	Introduction to Heat Transfer	Incropera, F. P. and Dewitt, D. P	John Wiley and Sons.	1990
3	Heat Transfer - A Conceptual Approach	P. K. Sarma and K. Ramakrishna	New Age International Publishers	2006
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	1997
5	Heat Transfer - A Basic Approach	M. Necati Özışık	McGraw-Hill	1985

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification	Proctored (Y/N)	Format of the	Exam Provider	URL of the Certification

		Provider		Exam		
1	Heat Transfer Methods	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/HEAT-TRANSFER
2	Thermodynamics	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/THERMODYNAMICS

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys-Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	IN Sem-1	15	38
	In Sem-2	15	
	Practical In sem	8	
End-Sem Summative	End Sem Exam	24	40
	Practical End Sem	16	

Strength of Materials (SM)

COURSE CODE	22ME2230	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	22ME2232

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyze stresses in members with axial loading or torsion	4	PSO1, PO1, PO2
CO2	Analyze members with multi axial loading and lateral loading	4	PSO1, PO1, PO2
CO3	Analyze deflections and stresses in beams	4	PSO1, PO1, PO2
CO4	Analyse columns and pressure vessels	4	PSO1, PO1, PO2
CO6	Apply the theoretical concepts to conduct various experiments of strength of materials practically and analyze the data	3	PSO1,PO5

Syllabus

Module 1	Introduction: Types of Stress, Strains, Stress Strain Diagram, Hooke's Law. stress strain diagram for various ductile and brittle materials. A xially Loaded Members: Uniaxial Loading and Material Properties, Force-deformation Relationships and Static Indeterminacy; Compound Bars, Stress-strain-temperature Relationships. Torsion: Introduction, Torsion of a Circular Bar, Non- Uniform Torsion, Transmission of Power by Circular Shafts, Strain Energy, Resilience-Gradual, sudden, impact and shock loadings simple applications.
Module 2	Multi axial stresses and strains: Multi-axial Stress and Strain- Relationships, Stress and Strain Transformations and Principal Stresses, Graphical representation of Stress: Mohr's circle. Failure of Materials and Examples, Theories of Failure. Shearing Forces and Bending Moments: Shear Force and Bending Moment, Relationship Between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams.
Module 3	Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams. Stresses in Beams: Normal Stresses in Beams, Cross Section Shapes of Beams, Shear Stresses in Rectangular Beams, Shear Stresses in The Webs of Beams with Flanges.
Module 4	Thin-walled Pressure Vessels: Concepts of Hoop and Longitudinal Stresses, Simple Problems for Cylinders and Shells. Columns: Buckling and Stability, The Euler's formula for columns with different end restraints; Limitations of the Euler's formulas; Generalized Euler buckling - load formulas; Rankine's empirical formula.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanics of Materials	Gere & Goodno	Cengage Publishers	2017
2	Mechanics of Materials	RC Hibbeler	Pearson	2016
3	Mechanics of Materials	E.P. Popov	Prentice Hall Publications	2015
4	Strength of Materials	S. Ramamrutham	Dhanpat Rai Publications	2011
5	Strength of Materials	S.S. Rattan	Tata McGraw Hill	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys - Structral Analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS- Structural Analysis	ANSYS	Commercial
2	Hardware Experimental Set up		OpenSource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignments and Textbook	7	
	Continuous Evaluation- Lab Exercise	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Lab In-Sem	8	
End-Sem Summative	End Sem Exam	24	40
	Lab End Sem Exam	16	

MECHANICAL ENGINEERING DESIGN (MED)

COURSE CODE	22ME2232	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO
CO1	Apply engineering design phases and general considerations to design any machine component	3	PO2, PSO2
CO2	Apply the mechanical behavior of engineering materials concept to solve any material failure problem	3	PO2, PSO2
CO3	Design of machine components for static strength	4	PO2
CO4	Design of machine components for fatigue strength	4	PO2

Syllabus

Module 1	Design Philosophy, Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design. General considerations and procedure in machine design, Codes & Standards, Reliability, Preferred numbers
Module 2	Selection of Materials and Shapes: Mechanical behavior of engineering materials, Selection of Materials, Selection of Shapes. Fundamentals of mechanical behavior of materials, as well as design with materials: elasticity, plasticity, fatigue, fracture, and creep
Module 3	Design for Static Strength: Simple Stresses - Combined stresses - Torsional and Bending stresses - Factor of safety and theories of failure
Module 4	Design for Fatigue Strength: Stress concentration – Methods of reducing stress concentration factor, Design for fluctuating stresses- Endurance limit, Estimation of Endurance strength – Notch sensitivity– Goodman's line and Soderberg's line, Combined fluctuating stresses.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design of machine elements	V. B. Bhandari	McGraw-Hill International	2007
2	Machine Design	Robert L. Norton	Pearson	2019
3	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2010
4	Materials selection in Mechanical Design	Michael F. Ashby	Elsevier Butterworth-Heinemann	2011
5	Engineering Design	George E. Dieter	McGraw-Hill International	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

ENGINEERING MECHANICS (EM)

COURSE CODE	22ME2230	MODE	Regular	LTPS	3-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of forces, governing static equations and analyse planar system of forces.	3	PO1
CO2	Use analytical techniques for analysing forces in statically determinate structures.	4	PO1
CO3	Apply the concepts of planar and non-planar system of parallel forces and estimate the moment of inertia for lamina and material bodies.	3	PO2
CO4	Apply fundamental concepts of kinematics and kinetics of particles to solve simple practical problems.	4	PO2

Syllabus

Module 1	Introduction, Basic concepts, Laws of motion, Principle of Transmissibility of forces, Resultant of a force system, force laws, Resultant of two dimensional concurrent and Non-Concurrent Force systems, Free body diagrams, Applications. Equilibrium of Rigid bodies–Equilibrium and Equations of Equilibrium, Lami's theorem, Type of supports and their reactions, Moments and couples, Varignon's theorem, Resultant moment and applications
Module 2	SPATIAL FORCE SYSTEM & TRUSSES: Spatial force systems – Forces in space, resultant and equilibrium of spatial force system. Truss Analysis-Trusses -Assumptions involved in the Method of joints and sections.
Module 3	FRICTION AND PROPERTIES OF AREAS: Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Applications-ladder friction, wedge friction. CENTRIOD AND MOMENT OF INERTIA: Centroid, Centre of gravity, Moment of inertia - Area and Mass- polar moment of inertia, Parallel axis theorem.
Module 4	KINEMATICS OF RIGID BODY: Introduction, Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational motion. Virtual Work: Introduction - Principle of virtual work - Equilibrium of ideal systems. KINETICS OF RIGID BODY: Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D-Alembert's Principles and Dynamic Equilibrium.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Mechanics	Timoshenko, D. Young, J Rao	Tata McGraw Hill	2013
2	Engineering Mechanics: Statics and Dynamics	Statics and Dynamics by A K Tayal	Umesh publications	2008
3	Engineering Mechanics: Statics and Dynamics	R C Hibbeler	Pearson	2015
4	Engineering Mechanics	Irving H. Shames	Prentice-Hall	2005
5	Vector Mechanics for Engineers (in SI units) Statics & Dynamics	F. P. Beer and E.R. Johnston	Mc Graw Hill Publications	2017
6	Engineering Mechanics (Statics)	J L Meriam and L G Kraige	Wiley student edition	2018

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		Nil				

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Nil		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	24
	Home Assignments	8	
	Quiz	8	
In-Sem Summative	In-Sem 1	18	36
	In-Sem 2	18	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

SKILL DEVELOPMENT COURSES

VISUALIZATION & MODELLING FOR ENGINEERING DESIGN (VMED)

COURSE CODE	22SDME01R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	EG

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Orthographic projection to Generate the views and sectioning.	3	PO5,PSO2,PO1,PO3
CO2	Prepare the assembly drawing of engine parts, machine Components both in conventional form and then by using software.	3	PSO2,PO1,PO3,PO5
CO3	Generate detail drawings of individual parts of an assembled machine Component both in conventional form and then by using software.	3	PO5,PSO2,PO1,PO3
CO4	Generate Production Drawings by considering Limits, tolerances and fits, Surface roughness	3	PSO2,PO1,PO3,PO5

Syllabus

Module 1	Review: Orthographic projection, missing lines, Interpolation of views and sectioning Specification of materials: Engineering materials, code designation of steels, copper, and aluminium and its alloys.
Module 2	ASSEMBLY DRAWINGS: Introduction, stuffing box, screw jack, Lathe tailstock, gate valve, steam engine cross head etc
Module 3	PART DRAWINGS: I C Engine connecting rod, Single Tool Post, spark plug, safety Valves etc Production drawing: Introduction to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crank shaft, belt pulley, piston details etc, idea about tool drawing.
Module 4	Limits, tolerances and fits: Introduction, limit systems, tolerance, fits drawing exercises. Surface roughness: Introduction, surface roughness, machining symbols, identification of surface roughness drawing exercises. Computer aided drawing: Introduction, input, output devices, introduction to drafting software like Creo/ Solidworks, basic commands and development of simple 2D and 3D drawings.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Machine Drawing	K L Narayana, P Kannaiah & K Venkat Reddy	3rd Edition	New Age
2	Machine Drawing	N D Bhatt	4th Edition	Charotar
3	Production Drawing	K L Narayana, P Kannaiah & K Venkat Reddy	5th Edition	New Age

4	Machine Drawing	Siddeswar, Kannaiah and V V S Sastry	6th Edition	India Higher Education

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Auto Desk: certified user (3D modelling using Fusion 360)	etrain India pvt ltd Delhi	Y	mcq	Autodesk	www.autodesk.com https://certiport.pearsonvue.com/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	Auto desk	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	**Continuous Evaluation - Lab Exercise**	15	30
	Skilling Continuous Evaluation	15	
In-Sem Summative	**Skill In-Sem Exam-I**	10	30
	Skill In-Sem Exam-II	10	
	Lab In Semester Exam	10	
End-Sem Summative	**Lab End Semester Exam**	25	40
	Skill Sem-End Exam	15	

VISUALIZATION & MODELLING FOR ENGINEERING DESIGN (VMED)

COURSE CODE	22SDME01A	MODE	A	LTPS	0-0-6-4	PRE-REQUISITE	EG

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Orthographic projection to Generate the views and sectioning.	3	PO5,PSO2,PO1,PO3
CO2	Prepare the assembly drawing of engine parts, machine Components both in conventional form and then by using software.	3	PSO2,PO1,PO3,PO5
CO3	Generate detail drawings of individual parts of an assembled machine Component both in conventional form and then by using software.	3	PO5,PSO2,PO1,PO3
CO4	Generate Production Drawings by considering Limits, tolerances and fits, Surface roughness	3	PSO2,PO1,PO3,PO5

Syllabus

Module 1	Review: Orthographic projection, missing lines, Interpolation of views and sectioning Specification of materials: Engineering materials, code designation of steels, copper, and aluminium and its alloys.
Module 2	ASSEMBLY DRAWINGS: Introduction, stuffing box, screw jack, Lathe tailstock, gate valve, steam engine cross head etc
Module 3	PART DRAWINGS: I C Engine connecting rod, Single Tool Post, spark plug, safety Valves etc Production drawing: Introduction to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crank shaft, belt pulley, piston details etc, idea about tool drawing.
Module 4	Limits, tolerances and fits: Introduction, limit systems, tolerance, fits drawing exercises. Surface roughness: Introduction, surface roughness, machining symbols, identification of surface roughness drawing exercises. Computer aided drawing: Introduction, input, output devices, introduction to drafting software like Creo/ Solidworks, basic commands and development of simple 2D and 3D drawings.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Machine Drawing	K L Narayana, P Kannaiah & K Venkat Reddy	3rd Edition	New Age
2	Machine Drawing	N D Bhatt	4th Edition	Charotar
3	Production Drawing	K L Narayana, P Kannaiah & K Venkat Reddy	5th Edition	New Age
4	Machine Drawing	Siddeswar, Kannaiah and V V S Sastry	6th Edition	India Higher Education

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Auto Desk: certified user (3D modelling using Fusion 360)	etrain India pvt ltd Delhi	Y	mcq	Autodesk	www.autodesk.com https://certiport.pearsonvue.com/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	Auto desk	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	**Continuous Evaluation - Lab Exercise**	15	30
	Skilling Continuous Evaluation	15	
In-Sem Summative	**Skill In-Sem Exam-I**	10	30
	Skill In-Sem Exam-II	10	
	Lab In Semester Exam	10	
End-Sem Summative	**Lab End Semester Exam**	25	40
	Skill Sem-End Exam	15	

VISUALIZATION & MODELLING FOR ENGINEERING DESIGN (VMED)

COURSE CODE	22SDME01P	MODE	P	LTPS	0-0-6-4	PRE-REQUISITE	EG

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Orthographic projection to Generate the views and sectioning.	3	PO5,PSO2,PO1,PO3
CO2	Prepare the assembly drawing of engine parts, machine Components both in conventional form and then by using software.	3	PSO2,PO1,PO3,PO5
CO3	Generate detail drawings of individual parts of an assembled machine Component both in conventional form and then by using software.	3	PO5,PSO2,PO1,PO3
CO4	Generate Production Drawings by considering Limits, tolerances and fits, Surface roughness	3	PSO2,PO1,PO3,PO5

Syllabus

Module 1	Review: Orthographic projection, missing lines, Interpolation of views and sectioning Specification of materials: Engineering materials, code designation of steels, copper, and aluminium and its alloys.
Module 2	ASSEMBLY DRAWINGS: Introduction, stuffing box, screw jack, Lathe tailstock, gate valve, steam engine cross head etc
Module 3	PART DRAWINGS: I C Engine connecting rod, Single Tool Post, spark plug, safety Valves etc. Production drawing: Introduction to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crank shaft, belt pulley, piston details etc, idea about tool drawing.
Module 4	Limits, tolerances and fits: Introduction, limit systems, tolerance, fits drawing exercises. Surface roughness: Introduction, surface roughness, machining symbols, identification of surface roughness drawing exercises. Computer aided drawing: Introduction, input, output devices, introduction to drafting software like Creo/ Solidworks, basic commands and development of simple 2D and 3D drawings.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Machine Drawing	K L Narayana, P Kannaiah & K Venkat Reddy	3rd Edition	New Age
2	Machine Drawing	N D Bhatt	4th Edition	Charotar
3	Production Drawing	K L Narayana, P Kannaiah & K Venkat Reddy	5th Edition	New Age
4	Machine Drawing	Siddeswar, Kannaiah and V V S Sastry	6th Edition	India Higher Education

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	Auto Desk: certified user (3D modelling using Fusion 360)	etrain India pvt ltd Delhi	Y	mcq	Autodesk	www.autodesk.com https://certiport.pearsonvue.com/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	Auto desk	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	**Continuous Evaluation - Lab Exercise**	15	30
	Skilling Continuous Evaluation	15	
In-Sem Summative	**Skill In-Sem Exam-I**	10	30
	Skill In-Sem Exam-II	10	
	Lab In Semester Exam	10	
End-Sem Summative	**Lab End Semester Exam**	25	40
	Skill Sem-End Exam	15	

COMPUTER INTEGRATED MANUFACTURING (SDP-2) (CIM)

COURSE CODE	23SDME02R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Model paths with basic fundamentals of computer aided design and manufacturing	3	PO1,PO2,PSO2
CO2	Prepare CNC Part Programs for machining	3	PO1,PO2,PSO2
CO3	Implement NC Part Programming in Part Production	3	PO1,PO4,PSO2

Syllabus

Module 1	Basic concepts of CAD / CAM and their integration tools/softwares
Module 2	Basic concepts concepts and working principles of NC Machines and CNC Programming in machining
Module 3	CNC Part programming for Turning, Milling and Drilling operations and simulation on CNC Train Software

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Automation Production Systems & Computer Integrated manufacturing	Mikell P. Groover	Prentice Hall of India, New Delhi	2007
2	CNC Programming Basics & Tutorial Textbook	Michael J. Peterson	CreateSpace Independent Publishing Platform	2008
3	CNC Programming for Machining	Kaushik kumar, Chikesh Ranjan, J Paulo Davim	Springer	2020
4	Qualification for Computer Integrated Manufacturing	Felix Rauner	Springer	2012
5	Computer Integrated Manufacturing	A. Alavudeen, N. Venkateshwaran	PHI Learning	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Autodesk Certified User: Fusion 360	AUTODESK	Y	Online	Certiport	Certiport.com

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	CNC Train Simulation Software	MTAB	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study - Analysis	10	30
	Practical Continuous Evaluation	10	
	Skill Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Lab End-Sem Exam	20	40
	Skill End-Sem Exam	20	

COMPUTER INTEGRATED MANUFACTURING (SDP-2) (CIM)

COURSE CODE	23SDME02A	MODE	A	LTPS	0-0-6-4	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Model paths with basic fundamentals of computer aided design and manufacturing	3	PO1,PO2,PSO2
CO2	Prepare CNC Part Programs for machining	3	PO1,PO2,PSO2
CO3	Implement NC Part Programming in Part Production	3	PO1,PO4,PSO2
CO4	Experiment on CNC Machines with profile generated using CAM softwares	4	PO1,PO2,PSO2

Syllabus

Module 1	Basic concepts of CAD / CAM and their integration tools/softwares
Module 2	Basic concepts concepts and working principles of NC Machines and CNC Programming in machining
Module 3	CNC Part programming for Turning, Milling and Drilling operations and simulation on CNC Train Software
Module 4	Path generation and building of part programs using CAM Softwares, Hands on training on CNC machines

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Automation Production Systems & Computer Integrated manufacturing	Mikell P. Groover	Prentice Hall of India, New Delhi	2007
2	CNC Programming Basics & Tutorial Textbook	Michael J. Peterson	CreateSpace Independent Publishing Platform	2008
3	CNC Programming for Machining	Kaushik kumar, Chikesh Ranjan, J Paulo Davim	Springer	2020
4	Qualification for Computer Integrated Manufacturing	Felix Rauner	Springer	2012
5	Computer Integrated Manufacturing	A. Alavudeen, N. Venkateshwaran	PHI Learning	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	Autodesk Certified User: Fusion 360	AUTODESK	Y	Online	Certiport	Certiport.com

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	CNC Train Simulation Software	MTAB	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study - Analysis	10	30
	Practical Continuous Evaluation	10	
	Skill Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Lab End-Sem Exam	20	40
	Skill End-Sem Exam	20	

COMPUTER INTEGRATED MANUFACTURING (SDP-2) CIM)

COURSE CODE	23SDME02P	MODE	P	LTPS	0-0-6-4	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Model paths with basic fundamentals of computer aided design and manufacturing	3	PO1,PO2,PSO2
CO2	Prepare CNC Part Programs for machining	3	PO1,PO2,PSO2
CO3	Implement NC Part Programming in Part Production	3	PO1,PO4,PSO2
CO4	Experiment on CNC Machines with profile generated using CAM softwares	4	PO1,PO2,PSO2

Syllabus

Module 1	Basic concepts of CAD / CAM and their integration tools/softwares
Module 2	Basic concepts concepts and working principles of NC Machines and CNC Programming in machining
Module 3	CNC Part programming for Turning, Milling and Drilling operations and simulation on CNC Train Software
Module 4	Path generation and building of part programs using CAM Softwares, Hands on training on CNC machines

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Automation Production Systems & Computer Integrated manufacturing	Mikell P. Groover	Prentice Hall of India, New Delhi	2007
2	CNC Programming Basics & Tutorial Textbook	Michael J. Peterson	CreateSpace Independent Publishing Platform	2008
3	CNC Programming for Machining	Kaushik kumar, Chikesh Ranjan, J Paulo Davim	Springer	2020
4	Qualification for Computer Integrated Manufacturing	Felix Rauner	Springer	2012
5	Computer Integrated Manufacturing	A. Alavudeen, N. Venkateshwaran	PHI Learning	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Autodesk Certified User: Fusion 360	AUTODESK	Y	Online	Certiport	Certiport.com

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	CNC Train Simulation Software	MTAB	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Article Writing	10	30
	Case Study - Analysis	10	
	Project Conitnuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Poster Presentation	40	40

FINITE ELEMENT ANALYSIS (FEA)

COURSE CODE	23SDME03R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	23ME3111R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyse the effect of various loads on Mechanical components	4	PO2, PSO2
CO2	Analyse various fracture modes and estimate the fracture energy	4	PO2, PSO2
CO3	Design and execute a fully functional prototype	5	PO2, PSO2

Syllabus

Module 1	Introduction to Ansys workbench, Adding material properties, meshing methods and mesh controls, basic analysis procedure, Structural analysis of a block, Linear and Non linear Structural analysis
Module 2	Parameter management, Remote boundary conditions, Dynamic Analysis: Modal Analysis, Harmonic Analysis, Fatigue analysis
Module 3	Hypermesh overview: Generating mid surface and analysing, To prepare a model from concept and analyse further to improve the design, Develop a functional prototype

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Building better products with FEA	Vince Adams and Abraham	Onword press	1999
2	Finite Element Analysis	S S Bhavikatti	New Age International	2005
3	Machine Design	Robert L. Norton	Pearson	2014
4	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2011

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS-Workbench	ANSYS	Commercial
2	HYPERMESH	ALTAIR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	10	30
	Case Study - Analysis	10	
	Skill Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Lab End-Sem Exam	20	40
	Skill End-Sem Exam	20	

FINITE ELEMENT ANALYSIS (FEA)

COURSE CODE	23SDME03A	MODE	A	LTPS	0-0-6-4	PRE-REQUISITE	23ME3111R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyse the effect of various loads on Mechanical components	4	PO2, PSO2
CO2	Analyse various fracture modes and estimate the fracture energy	4	PO2, PSO2
CO3	Design and execute a fully functional prototype	5	PO2, PSO2
CO4	Analyse Fluid flow and Heat transfer in mixing chamber	4	PO2, PSO2

Syllabus

Module 1	Introduction to Ansys workbench, Adding material properties, meshing methods and mesh controls, basic analysis procedure, Structural analysis of a block, Linear and Non linear Structural analysis
Module 2	Parameter management, Remote boundary conditions, Dynamic Analysis: Modal Analysis, Harmonic Analysis, Fatigue analysis
Module 3	Hypermesh overview: Generating mid surface and analysing, To prepare a model from concept and analyse further to improve the design, Develop a functional prototype
Module 4	Introduction to CFD, cell zone & Boundary conditions, solver settings, turbulence modelling, Fluid flow in Mixing chamber

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Building better products with FEA	Vince Adams and Abraham	Onword press	1999
2	Finite Element Analysis	S S Bhavikatti	New Age International	2005
3	Machine Design	Robert L. Norton	Pearson	2014
4	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2011

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS-Workbench	ANSYS	Commercial
2	HYPERMESH	ALTAIR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	10	30
	Case Study - Analysis	10	
	Skill Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Lab End-Sem Exam	20	40
	Skill End-Sem Exam	20	

FINITE ELEMENT ANALYSIS (FEA)

COURSE CODE	23SDME03P	MODE	P	LTPS	0-0-6-4	PRE-REQUISITE	23ME3111R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyse the effect of various loads on Mechanical components	4	PO2, PSO2
CO2	Analyse various fracture modes and estimate the fracture energy	4	PO2, PSO2
CO3	Design and execute a fully functional prototype	5	PO2, PSO2
CO4	Analyse Fluid flow and Heat transfer in mixing chamber	4	PO2, PSO2

Syllabus

Module 1	Introduction to Ansys workbench, Adding material properties, meshing methods and mesh controls, basic analysis procedure, Structural analysis of a block, Linear and Non linear Structural analysis
Module 2	Parameter management, Remote boundary conditions, Dynamic Analysis: Modal Analysis, Harmonic Analysis, Fatigue analysis
Module 3	Hypermesh overview: Generating mid surface and analysing, To prepare a model from concept and analyse further to improve the design, Develop a functional prototype
Module 4	Introduction to CFD, cell zone & Boundary conditions, solver settings, turbulence modelling, Fluid flow in Mixing chamber

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Building better products with FEA	Vince Adams and Abraham	Onword press	1999
2	Finite Element Analysis	S S Bhavikatti	New Age International	2005
3	Machine Design	Robert L. Norton	Pearson	2014
4	Shigley's Mechanical Engineering Design	Richard G Budynas; J Keith Nisbett	McGraw-Hill International	2011

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Hypermesh	Altair	Y	MCQs	Altair University	https://altair.com/academic-program

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS-Workbench	ANSYS	Commercial

2	HYPERMESH	ALTAIR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study - Analysis	10	30
	MOOCs Review	20	
In-Sem Summative	MOOCs Exam	30	30
End-Sem Summative	Global Certification	40	40

ANALYSIS OF ENERGY SYSTEMS (AES)

COURSE CODE	23SDME04	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Simulate and Analyze the performance of various types of heat exchangers	4	PO5, PO10
CO2	Analyze the performance of various thermal energy storage devices	4	PO5, PO10
CO3	Model and simulation of thermal management of electronic components	4	PO5, PO10
CO4	Simulate multi-phase flows	4	PO5, PO10

Syllabus

Module 1	Tube in Tube, Shell and tube, Plate type heat exchangers. Nao fluids, heat transfer enhancement mechanisms in heat exchangers
Module 2	Sensible heat storage, Latent heat storage devices. Simulation of melting and solidification of PCMs
Module 3	Battery cooling techniques: Air cooling, liquid cooling and cooling through phase change
Module 4	Liquid liquid, Gas- liquid, liquid-solid flows

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Essential Computational Fluid Dynamics	Zikanov.O	Wiley	2010
2	Computational Fluid Dynamics	Chung T. J	Cambridge University Press	2002
3	Numerical Heat Transfer and Fluid Flow	S. V. Patankar	Hemisphere	1980

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate certification	Ansys	Y	MCQs	Ansys	https://certifications.ansys.com/courses/mbu-heat-transfer-certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	30
	Skill Continuous evaluation	15	
In-Sem Summative	Practical In-Sem	10	30
	Skill In Sem-1	10	
	Skill In Sem-1	10	
End-Sem Summative	Skill End Sem	25	40
	Lab End Sem	15	

ANALYSIS OF ENERGY SYSTEMS (AES)

COURSE CODE	23SDME04A	MODE		LTPS	0-0-6-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Simulate and Analyze the performance of various types of heat exchangers	4	PO5, PO10
CO2	Analyze the performance of various thermal energy storage devices	4	PO5, PO10
CO3	Model and simulation of thermal management of electronic components	4	PO5, PO10
CO4	Simulate multi-phase flows	4	PO5, PO10
CO5	Analysis of combustion process in IC engines	4	PO5, PO10

Syllabus

Module 1	Tube in Tube, Shell and tube, Plate type heat exchangers. Nao fluids, heat transfer enhancement mechanisms in heat exchangers
Module 2	Sensible heat storage, Latent heat storage devices. Simulation of melting and solidification of PCMs
Module 3	Battery cooling techniques: Air cooling, liquid cooling and cooling through phase change
Module 4	Liquid liquid, Gas- liquid, liquid-solid flows
Module 5	Simulation of combustion process, optimization of various design parameters on combustion in IC engines

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Essential Computational Fluid Dynamics	Zikanov.O	Wiley	2010
2	Computational Fluid Dynamics	Chung T. J	Cambridge University Press	2002
3	Numerical Heat Transfer and Fluid Flow	S. V. Patankar	Hemisphere	1980

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate certification	Ansys	Y	MCQs	Ansys	https://certifications.ansys.com/courses/mbu-heat-transfer-certification/

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Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	30
	Skill Continuous evaluation	15	
In-Sem Summative	Practical In-Sem	10	30
	Skill In Sem-1	10	
	Skill In Sem-1	10	
End-Sem Summative	Skill End Sem	25	40
	Lab End Sem	15	

ANALYSIS OF ENERGY SYSTEMS (AES)

COURSE CODE	23SDME04P	MODE		LTPS	0-0-6-4	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Simulate and Analyze the performance of various types of heat exchangers	4	PO5, PO10
CO2	Analyze the performance of various thermal energy storage devices	4	PO5, PO10
CO3	Model and simulation of thermal management of electronic components	4	PO5, PO10
CO4	Simulate multi-phase flows	4	PO5, PO10
CO5	Analysis of combustion process in IC engines	4	PO5, PO10

Syllabus

Module 1	Tube in Tube, Shell and tube, Plate type heat exchangers. Nao fluids, heat transfer enhancement mechanisms in heat exchangers
Module 2	Sensible heat storage, Latent heat storage devices. Simulation of melting and solidification of PCMs
Module 3	Battery cooling techniques: Air cooling, liquid cooling and cooling through phase change
Module 4	Liquid liquid, Gas- liquid, liquid-solid flows
Module 5	Simulation of combustion process, optimization of various design parameters on combustion in IC engines

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Essential Computational Fluid Dynamics	Zikanov.O	Wiley	2010
2	Computational Fluid Dynamics	Chung T. J	Cambridge University Press	2002
3	Numerical Heat Transfer and Fluid Flow	S. V. Patankar	Hemisphere	1980

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate certification	Ansys	Y	MCQs	Ansys	https://certifications.ansys.com/courses/mbu-heat-transfer-certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Project Continuous Evaluation	30	30
In-Sem Summative	Practical In-Sem	30	30
End-Sem Summative	Sem End Project	40	40

3D MODELLING AND DIGITAL PROTOTYPING (3DMDP)

COURSE CODE	23SDME05R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Perform 3D modelling of engineering components	4	PO2
CO2	Perform analysis and simulation of a finite element model	4	PO2
CO3	Design and execute a fully functional prototype	5	PO2

Syllabus

Module 1	3D modelling of engineering components
Module 2	Conversion of geometric model to finite element model, analysis and simulation of a finite element model
Module 3	To prepare a model from concept and analyse further to improve the design, Develop a functional prototype

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	ANSYS Tutorial Release 2022	Kent L. Lawrence	SDC publications	2022
2	Design Workbook Using SOLIDWORKS 2021	Ronald E. Barr, Davor Juricic, Thomas J. Krueger, Alejandro Reyes	SDC publications	2021
3	Building better products with FEA	Vince Adams and Abraham	Onword press	1999
4	Finite Element Analysis	S S Bhavikatti	New Age International	2005

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/all-certifications
2	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	Autodesk	Commercial

2	ANSYS-Workbench	ANSYS	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	10	30
	Case Study - Analysis	10	
	Skill Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Lab End-Sem Exam	20	40
	Skill End-Sem Exam	20	

3D MODELLING AND DIGITAL PROTOTYPING (3DMDP)

COURSE CODE	23SDME05A	MODE	A	LTPS	0-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Perform 3D modelling of engineering components	4	PO2
CO2	Perform analysis and simulation of a finite element model	4	PO2
CO3	Design and execute a fully functional prototype	5	PO2
CO4	Analysis of Engineering problems using Hypermesh optistruct solver	4	PO2

Syllabus

Module 1	3D modelling of engineering components
Module 2	Conversion of geometric model to finite element model, analysis and simulation of a finite element model
Module 3	To prepare a model from concept and analyse further to improve the design, Develop a functional prototype
Module 4	1D beam analysis and 2D plate with hole analysis in Hypermesh Optistruct solver

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	ANSYS Tutorial Release 2022	Kent L. Lawrence	SDC publications	2022
2	Design Workbook Using SOLIDWORKS 2021	Ronald E. Barr, Davor Juricic, Thomas J. Krueger, Alejandro Reyes	SDC publications	2021
3	Building better products with FEA	Vince Adams and Abraham	Onword press	1999
4	Finite Element Analysis	S S Bhavikatti	New Age International	2005

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/all-certifications
2	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	Autodesk	Commercial

2	ANSYS-Workbench	ANSYS	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	10	30
	Case Study - Analysis	10	
	Skill Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	15	30
	Skill In-Sem	15	
End-Sem Summative	Lab End-Sem Exam	20	40
	Skill End-Sem Exam	20	

3D MODELLING AND DIGITAL PROTOTYPING (3DMDP)

COURSE CODE	23SDME05P	MODE	P	LTPS	0-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Perform 3D modelling of engineering components	4	PO2
CO2	Perform analysis and simulation of a finite element model	4	PO2
CO3	Design and execute a fully functional prototype	5	PO2
CO4	Analysis of Engineering problems using Hypermesh optistruct solver	4	PO2

Syllabus

Module 1	3D modelling of engineering components
Module 2	Conversion of geometric model to finite element model, analysis and simulation of a finite element model
Module 3	To prepare a model from concept and analyse further to improve the design, Develop a functional prototype
Module 4	1D beam analysis and 2D plate with hole analysis in Hypermesh Optistruct solver

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	ANSYS Tutorial Release 2022	Kent L. Lawrence	SDC publications	2022
2	Design Workbook Using SOLIDWORKS 2021	Ronald E. Barr, Davor Juricic, Thomas J. Krueger, Alejandro Reyes	SDC publications	2021
3	Building better products with FEA	Vince Adams and Abraham	Onword press	1999
4	Finite Element Analysis	S S Bhavikatti	New Age International	2005

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/all-certifications
2	Ansys-structral analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Fusion 360	Autodesk	Commercial
2	ANSYS-Workbench	ANSYS	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study - Analysis	10	30
	MOOCs Review	20	
In-Sem Summative	MOOCs Exam	30	30
End-Sem Summative	Global Certification	40	40

GEOMETRIC DIMENSIONING AND TOLERANCING (GD&T)

COURSE CODE	22SDME06R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	MT

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the applications and advantages of GD&T, Definitions, Basic terminology	2	P03
CO2	Hands-on Practice of reading and creating industrial drawings	3	P03
CO3	Calculation of various tolerance values for generating industrial drawings	3	P03

Syllabus

Module 1	Calculation of limits and fits of the Tolerances given in the standards.
Module 2	Interpretation of GD&T symbols in the industrial drawings.
Module 3	Calculation of various tolerance values from GD&T drawings
Module 4	Creation of industrial drawing using GD&T symbols using software

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Geometric Dimensioning and Tolerancing: Applications, Analysis & Measurement	James D Meadows	ASME Press	2004
2	Dimensioning and Tolerancing Handbook	Paul J. Drake	New York: McGraw-Hill	1999
3	Geometric Dimensioning and Tolerancing: Workbook and Answer Book	Alex Krulikowski	Effective Training Inc	2017
4	GD&T: Application and Interpretation	Bruce A. Wilson	Delmar Cengage Learning	2011
5	Geometric Dimensioning and Tolerancing for Mechanical Design	Gene R. Cogorno	McGraw-Hill Education	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Technologist GDTP, Senior GDTP	ASME	Y	MCQ	ASME	https://www.asme.org/certification-accreditation/personnel-certification/gdtp-(y14-5)-geometric-dimensioning-and-tolerancing-professional-certification
2	Geometric Dimensioning	TUVSED	Y	MCQ	TUVSED	https://www.tuvsud.com/en-in/services/training/instructor-led-

	and Tolerancing (GD&T)					courses/geometric-dimensioning-and-tolerancing

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Auto CAD	Autodesk	Open Source (Student Version)
2	Fusion 360	Autodesk	Open Source (Student Version)

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab Continuous Evaluation	15	30
	Skill Continuous Evaluation	15	
In-Sem Summative	In Sem Lab Exam	10	30
	In Sem Skill Exam-I	10	
	In Sem Skill Exam-II	10	
End-Sem Summative	End Sem Lab Exam	25	40
	End Sem Skill Exam	15	

GEOMETRIC DIMENSIONING AND TOLERANCING (GD&T)

COURSE CODE	22SDME06A	MODE	A	LTPS	0-0-6-4	PRE-REQUISITE	MT

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the applications and advantages of GD&T, Definitions, Basic terminology	2	P03
CO2	Hands-on Practice of reading and creating industrial drawings	3	P03
CO3	Calculation of various tolerance values for generating industrial drawings	3	P03
CO4	Case studies on Industrial drawings using GD&T symbols	2	P03

Syllabus

Module 1	Calculation of limits and fits of the Tolerances given in the standards.
Module 2	Interpretation of GD&T symbols in the industrial drawings.
Module 3	Calculation of various tolerance values from GD&T drawings
Module 4	Creation of industrial drawing using GD&T symbols using software
Module 5	Study the interpretation and application of GD&T symbols in industrial drawings

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Geometric Dimensioning and Tolerancing: Applications, Analysis & Measurement	James D Meadows	ASME Press	2004
2	Dimensioning and Tolerancing Handbook	Paul J. Drake	New York: McGraw-Hill	1999
3	Geometric Dimensioning and Tolerancing: Workbook and Answer Book	Alex Krulikowski	Effective Training Inc	2017
4	GD&T: Application and Interpretation	Bruce A. Wilson	Delmar Cengage Learning	2011
5	Geometric Dimensioning and Tolerancing for Mechanical Design	Gene R. Cogorno	McGraw-Hill Education	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Technologist GDTP, Senior GDTP	ASME	Y	MCQ	ASME	https://www.asme.org/certification-accreditation/personnel-certification/gdtp-(y14-5)-geometric-

						dimensioning-and-tolerancing-professional-certification
2	Geometric Dimensioning and Tolerancing (GD&T)	TUVSED	Y	MCQ	TUVSED	https://www.tuvsud.com/en-in/services/training/instructor-led-courses/geometric-dimensioning-and-tolerancing

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Auto CAD	Autodesk	Open Source (Student Version)
2	Fusion 360	Autodesk	Open Source (Student Version)

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab Continuous Evaluation	15	30
	Skill Continuous Evaluation	15	
In-Sem Summative	In Sem Lab Exam	10	30
	In Sem Skill Exam-I	10	
	In Sem Skill Exam-II	10	
End-Sem Summative	End Sem Lab Exam	25	40
	End Sem Skill Exam	15	

GEOMETRIC DIMENSIONING AND TOLERANCING (GD&T)

COURSE CODE	22SDME06P	MODE	P	LTPS	0-0-6-4	PRE-REQUISITE	MT

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the applications and advantages of GD&T, Definitions, Basic terminology	2	P03
CO2	Hands-on Practice of reading and creating industrial drawings	3	P03
CO3	Calculation of various tolerance values for generating industrial drawings	3	P03
CO4	Case studies on Industrial drawings using GD&T symbols	2	P03

Syllabus

Module 1	Calculation of limits and fits of the Tolerances given in the standards.
Module 2	Interpretation of GD&T symbols in the industrial drawings.
Module 3	Calculation of various tolerance values from GD&T drawings
Module 4	Creation of industrial drawing using GD&T symbols using software
Module 5	Study the interpretation and application of GD&T symbols in industrial drawings

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Geometric Dimensioning and Tolerancing: Applications, Analysis & Measurement	James D Meadows	ASME Press	2004
2	Dimensioning and Tolerancing Handbook	Paul J. Drake	New York: McGraw-Hill	1999
3	Geometric Dimensioning and Tolerancing: Workbook and Answer Book	Alex Krulikowski	Effective Training Inc	2017
4	GD&T: Application and Interpretation	Bruce A. Wilson	Delmar Cengage Learning	2011
5	Geometric Dimensioning and Tolerancing for Mechanical Design	Gene R. Cogorno	McGraw-Hill Education	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Technologist GDTP, Senior GDTP	ASME	Y	MCQ	ASME	https://www.asme.org/certification-accreditation/personnel-certification/gdtp-(Y14-5)-geometric-

						dimensioning-and-tolerancing-professional-certification
2	Geometric Dimensioning and Tolerancing (GD&T)	TUVSED	Y	MCQ	TUVSED	https://www.tuvsud.com/en-in/services/training/instructor-led-courses/geometric-dimensioning-and-tolerancing

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Auto CAD	Autodesk	Open Source (Student Version)
2	Fusion 360	Autodesk	Open Source (Student Version)

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Case Study - Analysis	10	30
	MOOCs Review	20	
In-Sem Summative	MOOCs Exam	30	30
End-Sem Summative	Global Certification	40	40

EVT HARWARE PROTOTYPING (EVTHP)

COURSE CODE	22SDEE06R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	BEEC OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply PCB design tools	3	PO1,5, PSO1
CO2	Prototype Electric vehicle power circuits	3	PO1,5, PSO1
CO3	Prototype Electric vehicle control circuits	3	PO1,5, PSO1

Syllabus

Module 1	Ultiboard tool – design setup, part placement, traces and copper design, PCB calculators, auto-routing and auto-placement, preparing for assembly- gerber files-drill, cut, solder layers, PCB layout design for power circuits and control circuits.
Module 2	Prototyping Power circuits - Front-end converter, Power converter, Braking, Battery power converter - PCB design, assembling, testing and calibration.
Module 3	Prototping Control circuits - Driver boards, BMS controller, Protection circuits, Display units-PCB design, assembling, testing and calibration.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Embedded System Design with Arm Cortex-M Microcontrollers Applications with C, C++ and MicroPython	Cem Ünsalan, Hüseyin Deniz Gürhan, Mehmet Erkin Yücel	Springer	2022
2	From Machine- to-Machine to the Internet ofThings: Introduction to a New Age of Intelligence	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle	Academic Press	2015
3	Electric Vehicle Design and Prototyping	JJames E. Van Tassel,	CRC Press	2015
4	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussain	Pearson education	2nd edition
5	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	chris Mi	Springer	2 nd edition

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ULTI BOARD	NI	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	30
	Skill Continuous Evaluation	15	
In-Sem Summative	In-Sem 1	10	30
	In-Sem 2	10	
	Practical In Sem	10	
End-Sem Summative	Lab End-Sem Exam	25	40
	Skill End-Sem Exam	15	

EVT HARWARE PROTOTYPING (EVTHWP)

COURSE CODE	22SDEE06A	MODE	A	LTPS	0-0-6-4	PRE-REQUISITE	BEEC OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply PCB design tools	3	PO1,5, PSO1
CO2	Prototype Electric vehicle power circuits	3	PO1,5, PSO1
CO3	Prototype Electric vehicle control circuits	3	PO1,5, PSO1

Syllabus

Module 1	Ultiboard tool – design setup, part placement, traces and copper design, PCB calculators, auto-routing and auto-placement, preparing for assembly- gerber files-drill, cut, solder layers, PCB layout design for power circuits and control circuits.
Module 2	Prototyping Power circuits - Front-end converter, Power converter, Braking, Battery power converter - PCB design, assembling, testing and calibration.
Module 3	Prototping Control circuits - Driver boards, BMS controller, Protection circuits, Display units-PCB design, assembling, testing and calibration.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Embedded System Design with Arm Cortex-M Microcontrollers Applications with C, C++ and MicroPython	Cem Ünsalan, Hüseyin Deniz Gürhan, Mehmet Erkin Yücel	Springer	2022
2	From Machine- to-Machine to the Internet ofThings: Introduction to a New Age of Intelligence	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle	Academic Press	2015
3	Electric Vehicle Design and Prototyping	JJames E. Van Tassel,	CRC Press	2015
4	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussain	Pearson education	2nd edition
5	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	chris Mi	Springer	2 nd edition

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ULTI BOARD	NI	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	30
	Skill Continuous Evaluation	15	
In-Sem Summative	In-Sem 1	10	30
	In-Sem 2	10	
	Practical In sem	10	
End-Sem Summative	Lab End-Sem Exam	25	40
	Skill End-Sem Exam	15	

EVT HARWARE PROTOTYPING (EVTHP)

COURSE CODE	22SDEE06A	MODE	A	LTPS	0-0-6-4	PRE-REQUISITE	BEEC OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply PCB design tools	3	PO1,5, PSO1
CO2	Prototype Electric vehicle power circuits	3	PO1,5, PSO1
CO3	Prototype Electric vehicle control circuits	3	PO1,5, PSO1

Syllabus

Module 1	Ultiboard tool – design setup, part placement, traces and copper design, PCB calculators, auto-routing and auto-placement, preparing for assembly- gerber files-drill, cut, solder layers, PCB layout design for power circuits and control circuits.
Module 2	Prototyping Power circuits - Front-end converter, Power converter, Braking, Battery power converter - PCB design, assembling, testing and calibration.
Module 3	Prototping Control circuits - Driver boards, BMS controller, Protection circuits, Display units-PCB design, assembling, testing and calibration.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Embedded System Design with Arm Cortex-M Microcontrollers Applications with C, C++ and MicroPython	Cem Ünsalan, Hüseyin Deniz Gürhan, Mehmet Erkin Yücel	Springer	2022
2	From Machine- to-Machine to the Internet ofThings: Introduction to a New Age of Intelligence	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle	Academic Press	2015
3	Electric Vehicle Design and Prototyping	JJames E. Van Tassel,	CRC Press	2015
4	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussain	Pearson education	2nd edition
5	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	chris Mi	Springer	2 nd edition

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ULTI BOARD	NI	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	30
	Skill Continuous Evaluation	15	
In-Sem Summative	In-Sem 1	10	30
	In-Sem 2	10	
	Practical In sem	10	
End-Sem Summative	Lab End-Sem Exam	25	40
	Skill End-Sem Exam	15	

PROFESSIONAL ELECTIVES

ENERGY ENGINEERING & COMPUTATIONAL FLUID DYNAMICS (EECFD) SPECIALIZATION

. SOLAR ENERGY TECHNOLOGIES (SET)

COURSE CODE	22ECF3101R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply basics of solar radiation and heat transfer to analyze the performance of various solar collectors	3	PO1, PO2, PSO1
CO2	Analyze the performance of solar thermal systems	4	PO1, PO2, PSO1
CO3	Apply the principles of solar radiation to PV technology	3	PO2, PO6, PSO1
CO4	Apply the knowledge of thermodynamics and heat transfer to calculate the performance of solar PV systems	4	PO1, PO2, PSO1
CO5	Analyze various solar thermal and PV systems using Simulation (Trnsys) software	4	PO2, PO6, PSO1
CO6	Analyze various solar thermal and PV systems using energy plus software	4	PO2, PO6, PSO1

Syllabus

Module 1	Solar Radiation and collectors: Solar angles – Sun path diagrams – Radiation - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods- evacuated tubular collectors - concentrator collectors – classification - design and performance parameters- tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.
Module 2	Solar Thermal Systems: Principle of working, types, design and operation of - Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying
Module 3	Solar PV fundamentals – Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetero junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics
Module 4	Analysis of Solar PV Systems: Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPVsystems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems .

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Principles of Solar Engineering	Goswami, D.Y., Kreider, J. F. and & Francis	Principles of Solar Engineering	1978

2	Solar Photovoltatics – Fundamentals, Technologies and Applications	Chetan Singh Solanki	Solar Photovoltatics – Fundamentals, Technologies and Applications	2011
3	Solar Energy –Principle of Thermal Storage and collection	Sukhatme S P, J K Nayak,	Solar Energy –Principle of Thermal Storage and collection	2008
4	Photovoltaic Systems Engineering	Roger Messenger and Jerry Vnetre	Photovoltaic Systems Engineering	2000

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat transfer Modelling in Ansys Fluent	Ansys	Y	Online		Heat Transfer Modeling in Ansys Fluent | Ansys Courses
2	Certified Solar Energy professional	V Skills	Y	Online		https://www.vskills.in/certification/tutorial/certified-solar-energy-professional/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Trnsys	TRNSYS	Commercial
2	Energy Plus	OpenStudio	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	IN Sem-1	15	38
	In Sem-2	15	
	Practical In sem	8	
End-Sem Summative	End Sem Exam	24	40
	Practical End Sem	16	

SOLAR ENERGY TECHNOLOGIES (SET)

COURSE CODE	22ECF3101A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply basics of solar radiation and heat transfer to analyze the performance of various solar collectors	3	PO1, PO2, PSO1
CO2	Analyze the performance of solar thermal systems	4	PO1, PO2, PSO1
CO3	Apply the principles of solar radiation to PV technology	3	PO2, PO6, PSO1
CO4	Apply the knowledge of thermodynamics and heat transfer to calculate the performance of solar PV systems	4	PO1, PO2, PSO1
CO5	Analyze the performance of solar collectors using nanofluids	4	PO1, PO2, PSO1
CO6	Analyze various solar thermal and PV systems using Simulation (Trnsys) software	4	PO2, PO6, PSO1
CO7	Analyze various solar thermal and PV systems using energy plus software	4	PO2, PO6, PSO1

Syllabus

Module 1	Solar Radiation and collectors: Solar angles – Sun path diagrams – Radiation - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods- evacuated tubular collectors - concentrator collectors – classification - design and performance parameters- tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.
Module 2	Solar Thermal Systems: Principle of working, types, design and operation of - Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying
Module 3	Solar PV fundamentals – Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetero junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics
Module 4	Analysis of Solar PV Systems: Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPVsystems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems .
Module 5	Nanofluids preparation, characterization and applications, Application of nanofluids for solar heating and cooling systems, analysis of solar thermal systems using nanofluids

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Principles of Solar Engineering	Goswami, D.Y., Kreider, J. F. and & Francis	Principles of Solar Engineering	1978
2	Solar Photovoltatics – Fundamentals, Technologies and Applications	Chetan Singh Solanki	Solar Photovoltatics – Fundamentals, Technologies and Applications	2011
3	Solar Energy –Principle of Thermal Storage and collection	Sukhatme S P, J K Nayak,	Solar Energy –Principle of Thermal Storage and collection	2008
4	Photovoltaic Systems Engineering	Roger Messenger and Jerry Vnetre	Photovoltaic Systems Engineering	2000

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat transfer Modelling in Ansys Fluent	Ansys	Y	Online		Heat Transfer Modeling in Ansys Fluent | Ansys Courses
2	Certified Solar Energy professional	V Skills	Y	Online		https://www.vskills.in/certification/tutorial/certified-solar-energy-professional/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Trnsys	TRNSYS	Commercial
2	Energy Plus	OpenStudio	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	IN Sem-1	15	38
	In Sem-2	15	
	Practical In sem	8	
End-Sem Summative	End Sem Exam	24	40
	Practical End Sem	16	

SOLAR ENERGY TECHNOLOGIES (SET)

COURSE CODE	22ECF3101P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply basics of solar radiation and heat transfer to analyze the performance of various solar collectors	3	PO1, PO2, PSO1
CO2	Analyze the performance of solar thermal systems	4	PO1, PO2, PSO1
CO3	Apply the principles of solar radiation to PV technology	3	PO2, PO6, PSO1
CO4	Apply the knowledge of thermodynamics and heat transfer to calculate the performance of solar PV systems	4	PO1, PO2, PSO1
CO5	Analyze the performance of solar collectors using nanofluids	4	PO1, PO2, PSO1
CO6	Analyze various solar thermal and PV systems using Simulation (Trnsys) software	4	PO2, PO6, PSO1
CO7	Analyze various solar thermal and PV systems using energy plus software	4	PO2, PO6, PSO1

Syllabus

Module 1	Solar Radiation and collectors: Solar angles – Sun path diagrams – Radiation - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods- evacuated tubular collectors - concentrator collectors – classification - design and performance parameters- tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.
Module 2	Solar Thermal Systems: Principle of working, types, design and operation of - Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying
Module 3	Solar PV fundamentals – Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetero junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics
Module 4	Analysis of Solar PV Systems: Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPVsystems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems .
Module 5	Nanofluids preparation, characterization and applications, Application of nanofluids for solar heating and cooling systems, analysis of solar thermal systems using nanofluids

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Principles of Solar Engineering	Goswami, D.Y., Kreider, J. F. and & Francis	Principles of Solar Engineering	1978
2	Solar Photovoltatics – Fundamentals, Technologies and Applications	Chetan Singh Solanki	Solar Photovoltatics – Fundamentals, Technologies and Applications	2011
3	Solar Energy –Principle of Thermal Storage and collection	Sukhatme S P, J K Nayak,	Solar Energy –Principle of Thermal Storage and collection	2008
4	Photovoltaic Systems Engineering	Roger Messenger and Jerry Vnetre	Photovoltaic Systems Engineering	2000

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat transfer Modelling in Ansys Fluent	Ansys	Y	Online		Heat Transfer Modeling in Ansys Fluent | Ansys Courses
2	Certified Solar Energy professional	V Skills	Y	Online		https://www.vskills.in/certification/tutorial/certified-solar-energy-professional/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Trnsys	TRNSYS	Commercial
2	Energy Plus	OpenStudio	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Article Writing	14	24
	Project Continuous Evaluation	10	
In-Sem Summative	Practical In-Sem	18	36
	Skill In-sem	18	
End-Sem Summative	Project Demonstration	24	40
	End-Sem Exam (MCQ Based)	16	

ADVANCED ENERGY STORAGE SYSTEMS (AESS)

COURSE CODE	22ECF3202	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the basics of Energy storage systems and its applications	2	PO1
CO2	Modelling of various thermal energy storage systems	4	PO1, PO2
CO3	Understand the construction and working of various electrical storage systems and analyze their performance	4	PO1, PO2
CO4	Understand the principles of alternate energy storage technologies	2	PO1, PO2
CO5	Analyze various energy storage systems using a simulation tool	4	PO5, PO10

Syllabus

Module 1	**Introduction:** Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications **Applications of Energy Storage:** Renewable energy storage-Battery sizing and stand-alone applications, stationary (Power Grid application), Small scale application-Portable storage systems and medical devices, Mobile storage Applications.
Module 2	**Modelling of thermal energy storage systems:** Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach
Module 3	**Electrical Energy storage systems** – Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel –Cadmium, Zinc Manganese dioxide and modern batteries for example (i) zinc-Air (ii) Nickel Hydride, (iii) Lithium Battery. Application to EVs.
Module 4	**Alternate energy storage technologies:** Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Thermal Energy Storage Systems and Applications	Ibrahim Dincer and Mark A. Rosen	JohnWiley & Sons	
2	Fuel cell systems Explained	James Larminie and Andrew Dicks	Wiley	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys Associate certification	Ansys	Y	MCQs	Ansys	https://certifications.ansys.com/courses/basics-of-fluid-dynamics-associate-certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem -1	15	38
	In Sem-2	15	
	Lab In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Sem	16	

THERMAL MANAGEMENT OF ELECTRIC AND ELECTRONIC SYSTEM (TMEES)

COURSE CODE	23ME3236	MODE			LTPS	3-0-0-0	PRE-REQUISITE	Nill

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concepts of heat transfer to various electric and electronic systems requiring heat dissipation	3	PO1, PSO2
CO2	Apply different cooling techniques to microchannels, heat pipes and vapor chambers	3	PO1, PSO2
CO3	Apply various thermal management techniques in the fields of automobiles and electronics	3	PO1, PSO2
CO4	Analyze the Battery thermal management system and battery pack design	4	PO2, PSO2

Syllabus

Module 1	Thermal Management in Electronics -heat transfer modes, electronics packaging, contact and spreading resistances, heat sink design,
Module 2	Cooling Technologies thermal interface and phase change materials, active, passive, and novel air-cooling approaches, microchannels, jet impingement, immersion cooling, heat pipes, and vapor chambers, thermoelectric, Hybrid Thermal Management system, Air-cooled combine with Phase change material, Liquid cooled combine with phase change material, Heat pipe combines with phase change material.
Module 3	Applications of thermal management: avionics, data centres, mobile, internet of things, high-performance computing, automotive,
Module 4	Lithium-ion battery configuration and operation, Sources of heat in Lithium-ion battery, Lithium Ion- cell temperature ranges. Battery Thermal Management System (BTMS): Need of BTMS, Technologies of BTMS, Battery pack design, Lithium-ion chemistries, challenges of the battery pack,

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	THERMAL MANAGEMENT OF MICROELECTRONIC EQUIPMENT HEAT TRANSFER THEORY, ANALYSIS METHODS, AND DESIGN PRACTICES	L. T. Yeh, Ph.D., P.E. R. C.Chu	ASME PRESS NEW YORK	1997
2	The Handbook of Lithium-Ion Battery Pack Design Chemistry, Components, Types and Terminology	John Warner	Elsevier	2000
3	HANDBOOK ON BATTERY ENERGY STORAGE SYSTE	Yongping Zhai	ASIAN DEVELOPMENT BANK ASIAN DEVELOPMENT BANK	1996
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	

5	Thermal Management of Electric Vehicle Battery Systems	Ibrahim Dinçer, Halil S. Hamut and Nader Javani	7 John Wiley & Sons Ltd. Published	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Battery thermal management and safety	ISIE INDIA	Y	Online	ISIE INDIA	https://isieindia.com/courses/battery-thermal-management-and-safety/
2	Lithium-ion battery modules packaging	IATA	Y	Online	IATA	https://www.iata.org/en/training/courses/shipping-lithium-batteries/tcgp52/en/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Nill	Nill	Nill

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignments and Text book	10	
In-Sem Summative	Sem -1	20	40
	Sem -2	20	
End-Sem Summative	End Semester Exam	40	40

COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER (CFFHT)

COURSE CODE	22ECF3304R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concept of Taylor series to derive FD equations	3	PO1,PO2
CO2	Apply FDM to Steady one- and two-dimensional heat conduction equations	3	PO1,PO2
CO3	Apply FDM to Unsteady one- and two-dimensional heat conduction equations	3	PO1,PO2
CO4	Appy FDM to solve steady convection problems	3	PO1,PO2
CO5	Develop codes to analyze the basic fluid flow and heat transfer problems using FDM	4	PO5, PO10
CO6	Analyze, optimize various heat transfer/fluid flow systems	4	PO5, PO10

Syllabus

Module 1	Partial Differential equations, Taylor's series expansion and governing equations of fluid flow and heat transfer
Module 2	FDM discretization and application to steady diffusion problems
Module 3	Various time marching chemes and application to transient diffusion problems
Module 4	Advection schems and application to advection problems

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Essential Computational Fluid Dynamics	Zikanov.O	Wiley	2010
2	Computational Fluid Dynamics	Chung T. J	Cambridge University Press	2002
3	Numerical Heat Transfer and Fluid Flow	S. V. Patankar	Hemisphere	1980

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Matlab	Mathworks	Y	MCQs	Mathworks	https://www.mathworks.com/learn/training/certification.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial
2	Scilab	Dassault Systems	Opensource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem -1	15	38
	In Sem-2	15	
	Lab In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Sem	16	

COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER (CFFHT)

COURSE CODE	22ECF3304A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concept of Taylor series to derive FD equations	3	PO1,PO2
CO2	Apply FDM to Steady one- and two-dimensional heat conduction equations	3	PO1,PO2
CO3	Apply FDM to Unsteady one- and two-dimensional heat conduction equations	3	PO1,PO2
CO4	Apply FDM to solve steady convection problems	3	PO1,PO2
CO5	Apply FDM to solve transient convection - diffusion problems	3	PO1,PO2
CO5	Develop codes to analyze the basic fluid flow and heat transfer problems using FDM	4	PO5, PO10
CO6	Analyze, optimize various heat transfer/fluid flow systems	4	PO5, PO10

Syllabus

Module 1	Partial Differential equations, Taylor's series expansion and governing equations of fluid flow and heat transfer
Module 2	FDM discretization and application to steady diffusion problems
Module 3	Various time marching schemes and application to transient diffusion problems
Module 4	Advection schemes and application to advection problems

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Essential Computational Fluid Dynamics	Zikanov.O	Wiley	2010
2	Computational Fluid Dynamics	Chung T. J	Cambridge University Press	2002
3	Numerical Heat Transfer and Fluid Flow	S. V. Patankar	Hemisphere	1980

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored	Format of the Exam	Exam Provider	URL of the Certification

			(Y/N)			
1	Matlab	Mathworks	Y	MCQs	Mathworks	https://www.mathworks.com/learn/training/certification.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial
2	Scilab	Dassault Systems	Opensource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem -1	15	38
	In Sem-2	15	
	Lab In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Sem	16	

COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER (CFFHT)

COURSE CODE	22ECF3304P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concept of Taylor series to derive FD equations	3	PO1,PO2
CO2	Apply FDM to Steady one- and two-dimensional heat conduction equations	3	PO1,PO2
CO3	Apply FDM to Unsteady one- and two-dimensional heat conduction equations	3	PO1,PO2
CO4	Apply FDM to solve steady convection problems	3	PO1,PO2
CO5	Apply FDM to solve transient convection - diffusion problems	3	PO1,PO2
CO5	Develop codes to analyze the basic fluid flow and heat transfer problems using FDM	4	PO5, PO10
CO6	Analyze, optimize various heat transfer/fluid flow systems	4	PO5, PO10

Syllabus

Module 1	Partial Differential equations, Taylor's series expansion and governing equations of fluid flow and heat transfer
Module 2	FDM discretization and application to steady diffusion problems
Module 3	Various time marching schemes and application to transient diffusion problems
Module 4	Advection schemes and application to advection problems

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Essential Computational Fluid Dynamics	Zikanov.O	Wiley	2010
2	Computational Fluid Dynamics	Chung T. J	Cambridge University Press	2002
3	Numerical Heat Transfer and Fluid Flow	S. V. Patankar	Hemisphere	1980

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Matlab	Mathworks	Y	MCQs	Mathworks	

						https://www.mathworks.com/learn/training/certification.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial
2	Scilab	Dassault Systems	Opensource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Project Continuous Evaluation	15	22
	Home Assignments	7	
In-Sem Summative	Lab In Sem	38	38
End-Sem Summative	Sem End Project	40	40

ENERGY AUDIT AND MANAGEMENT (EA&M)

COURSE CODE	22ECF3405M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	Nill

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the fundamentals of Energy economics	2	PO1, PSO1
CO2	Apply the Engineering principles to estimate the energy conservation in steam generators and compressed air generators	3	PO2, PSO1
CO3	Apply the Engineering principles to estimate the energy conservation in rotary equipment	3	PO2, PSO1
CO4	Apply the Engineering principles to estimate the energy conservation in cooling towers and lighting systems	3	PO2, PSO1

Syllabus

Module 1	Energy Scenerio and Economics:Energy Conservation Act - Role of Energy Managers in Industries,- Simple Payback Period, Time Value of Money, IRR, NPV, Life Cycle Costing, Cost of Saved Energy
Module 2	Steam Generation and Compressed Air Generation:Boilers - types, losses and efficiency calculation , Cost of compressed air – No load test - Various Energy Conservation Measures in compressed air system
Module 3	Rotary Equipment & Refrigeration:Centrifugal pumps, Fans & Blowers,Definition of HVAC – Cooling load calculations (preliminary estimates only) – Introduction to Building Management System
Module 4	Energy Conservation in Cooling Towers:Analysis and Case studies.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Energy Efficiency for Engineers and Technologists	Eastop, T. D. and Croft, D. R	Longman Scientific & Technical	1990
2	Industrial Energy Conservation	Reay D.A	1stedition, Pergamon Press, 1977	1977
3	Energy Management Series	Bureau of Energy Efficiency	Bureau of Energy Efficiency	1990
4	Industrial Energy Management & Utilization	Larry C		2000

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat Transfer Methods	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/HEAT-TRANSFER

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In- Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

ENERGY AUDIT AND MANAGEMENT (EA&M)

COURSE CODE	22ECF3405MA	MODE	A	LTPS	4-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the fundamentals of Energy economics	2	PO1, PSO1
CO2	Apply the Engineering principles to estimate the energy conservation in steam generators and compressed air generators	3	PO2, PSO1
CO3	Apply the Engineering principles to estimate the energy conservation in rotary equipment	3	PO2, PSO1
CO4	Apply the Engineering principles to estimate the energy conservation in cooling towers and lighting systems	3	PO2, PSO1
CO5	Apply the Engineering principles to estimate the energy conservation in Refrigeration & Air conditioning systems	3	PO2, PSO1

Syllabus

Module 1	Energy Scenerio and Economics:Energy Conservation Act - Role of Energy Managers in Industries,- Simple Payback Period, Time Value of Money, IRR, NPV, Life Cycle Costing, Cost of Saved Energy
Module 2	Steam Generation and Compressed Air Generation:Boilers - types, losses and efficiency calculation , Cost of compressed air – No load test - Various Energy Conservation Measures in compressed air system
Module 3	Rotary Equipment & Refrigeration:Centrifugal pumps, Fans & Blowers,Definition of HVAC – Cooling load calculations (preliminary estimates only) – Introduction to Building Management System
Module 4	Energy Conservation in Cooling Towers:Analysis and Case studies.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Energy Efficiency for Engineers and Technologists	Eastop, T. D. and Croft, D. R	Longman Scientific & Technical	1990
2	Industrial Energy Conservation	Reay D.A	1stedition, Pergamon Press, 1977	1977
3	Energy Management Series	Bureau of Energy Efficiency	Bureau of Energy Efficiency	1990
4	Industrial Energy Management & Utilization	Larry C		2000

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Heat Transfer Methods	Tata Steel	Y	Online	Tata Steel	https://capabilitydevelopment.org/Coursedesc/HEAT-TRANSFER

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In- Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

MODERN REFRIGERATION & AIR CONDITIONING(MRAC)

COURSE CODE	22ECF3406M	MODE	M	LTPS	3-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of psychrometry and select appropriate refrigerant for a HVAC system	3	PO1, PO2, PSO1
CO2	Apply appropriate psychrometric processes and arrive at the heat load for a system	3	PO1, PO2, PSO1
CO3	Analyse types of air-conditioning system and air distribution configurations	4	PO1, PO2, PSO1
CO4	Analyse various non-conventional refrigeration systems, and adopt suitable instrumentation control, safety in HVAC systems	4	PO1, PO2, PSO1

Syllabus

Module 1	Applications of air-conditioning and refrigeration, vapour compression cycle,. Designation of refrigerants, Selection of refrigerants, Ozone Depletion Potential (ODP) and Global Warming (GW), alternative to existing CFC and HCFC refrigerants
Module 2	. P-h and T-s diagrams, thermodynamic analysis, effect of inter cooling, sub-cooling and super heating, Cascade refrigeration. Introduction to evaporative cooling and cooling towers.
Module 3	Thermodynamic analysis. Heating and Cooling Load Estimation : Components of cooling/heat load, Room sensible heat factor (RSHF), Grand sensible Heat factor (GSHF), Heating and cooling load estimation of a typical office / domestic building, Concept of diversity.
Module 4	Fundamentals of duct design, pressure loss and AHU calculations, types of terminal units, advanced air distribution: VAV, UFAD systems; concept of heat recovery systems. vapor absorption, vapor adsorption systems, reversed Brayton cycle - air based refrigeration. Introduction to Building Management System. safety in RAC systems.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Basic Refrigeration and Air Conditioning	Anantanarayanan P.N	Tata McGraw Hill.	1982
2	Refrigeration and Air Conditioning,	Arora R.C,	John Wiley and Sons.	2012
3	Fundamentals, Refrigeration, Systems and Equipments and HVAC Applications	P. K. Sarma and K. Ramakrishna	New Age International Publishers	1994
4	Modern Refrigeration and air Conditioning	Andrew D. Althouse, Carl H. Turnquist, A.F. Bracciano, D.C. Bracciano, and G.M. Bracciano	Goodheart-Wilkox Publisher	2019
5	Refrigeration and Air Conditioning technology	John Tomczyk , Eugene Silberstein, Bill Whitman , Bill Johnson	Cengage learning, 2016	2012

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	A Universal Certification System for India's refrigeration and Air-Conditioning Servicing Sector	COUNCIL ON ENERGY, ENVIRONMENT AND WATER	Y	Project		https://www.ceew.in/sites/default/files/ceew-study-on-universal-certification-for-indias-ac-sector-16Jul20.pdf
2	Certified HVAC Designer	ASHRAE	y	Design competition		https://www.ashrae.org/professional-development/ashrae-certification/certification-types/chd-certified-hvac-designer

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys	Ansys	Commercial
2			

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	10	20
	MOOC Review	10	
In-Sem Summative	MOOC's Exam	40	40
End-Sem Summative	End Sem Exam (MCQ Based)	20	40
	MOOC's Exam	20	

MODERN REFRIGERATION & AIR CONDITIONING(MRAC)

COURSE CODE	22ECF3406MA	MODE	MA	LTPS	4-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of psychrometry and select appropriate refrigerant for a HVAC system	3	PO1, PO2, PSO1
CO2	Apply appropriate psychrometric processes and arrive at the heat load for a system	3	PO1, PO2, PSO1
CO3	Analyse types of air-conditioning system and air distribution configurations	4	PO1, PO2, PSO1
CO4	Analyse various non-conventional refrigeration systems, and adopt suitable instrumentation control, safety in HVAC systems	4	PO1, PO2, PSO1
CO5	Analyze the concepts of thermodynamics, Pscychrometry to modern refrigeration systems	4	PO2, PO6, PSO1

Syllabus

Module 1	Applications of air-conditioning and refrigeration, vapour compression cycle,. Designation of refrigerants, Selection of refrigerants, Ozone Depletion Potential (ODP) and Global Warming (GW), alternative to existing CFC and HCFC refrigerants
Module 2	P-h and T-s diagrams, thermodynamic analysis, effect of inter cooling, sub-cooling and super heating, Cascade refrigeration. Introduction to evaporative cooling and cooling towers.
Module 3	Thermodynamic analysis. Heating and Cooling Load Estimation : Components of cooling/heat load, Room sensible heat factor (RSHF), Grand sensible Heat factor (GSHF), Heating and cooling load estimation of a typical office / domestic building, Concept of diversity.
Module 4	Fundamentals of duct design, pressure loss and AHU calculations, types of terminal units, advanced air distribution: VAV, UFAD systems; concept of heat recovery systems. vapor absorption, vapor adsorption systems, reversed Brayton cycle - air based refrigeration. Introduction to Building Management System. safety in RAC systems.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Basic Refrigeration and Air Conditioning	Anantanarayanan P.N	Tata McGraw Hill.	1982
2	Refrigeration and Air Conditioning,	Arora R.C,	John Wiley and Sons.	2012
3	Fundamentals, Refrigeration, Systems and Equipments and HVAC Applications	P. K. Sarma and K. Ramakrishna	New Age International Publishers	1994
4	Modern Refrigeration and air Conditioning	Andrew D. Althouse, Carl H. Turnquist, A.F. Bracciano, D.C.	Goodheart-Wilkox Publisher	2019

		Bracciano, and G.M. Bracciano		
5	Refrigeration and Air Conditioning technology	John Tomczyk , Eugene Silberstein, Bill Whitman , Bill Johnson	Cengage learning, 2016	2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	A Universal Certification System for India's refrigeration and Air-Conditioning Servicing Sector	COUNCIL ON ENERGY, ENVIRONMENT AND WATER	Y	Project		https://www.ceew.in/sites/default/files/ceew-study-on-universal-certification-for-indias-ac-sector-16Jul20.pdf
2	Certified HVAC Designer	ASHRAE	y	Design competition		https://www.ashrae.org/professional-development/ashrae-certification/certification-types/chd-certified-hvac-designer

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys-Fluent	Ansys	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	10	20
	MOOC Review	10	
In-Sem Summative	MOOC's Exam	40	40
End-Sem Summative	End Sem Exam (MCQ Based)	20	40
	MOOC's Exam	20	

CFD FOR COMPRESSIBLE AND INCOMPRESSIBLE FLOWS (CFDCIF)

COURSE CODE	22ECF3507	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the basics of various convective schemes, FVM discretization, application to disffusion problems	3	PO1, PO2
CO2	Solve N-S equations for incompressible flows using stream function – vorticity formulation and Pressure-velocity coupled algorithms	3	PO2, PO1
CO3	Solve N-S equations for compressible flows using MacCormack, Jameson algorithm	3	PO1,PO2
CO4	Modelling of turbulence	3	PO1, PO2
CO5	Analyze various fluid flow and heat transfer problems using Matlab programming/Ansys – Fluent following FVM	4	PO5, PO10

Syllabus

Module 1	Brief introduction of boundary layer flow, incompressible and compressible flows, finite volume method, example of parabolic and hyperbolic systems and time discretization technique, explicit and implicit methods, upwind and central difference schemes, stability, dissipation and dispersion errors. Higher order upwind schemes: second order convective schemes, QUICK.
Module 2	Stream function-vorticity approach: Derivation of stream function and vorticity equations; derivation pressure Poisson equation.
Module 3	Solution of N-S equations: MacCormack, Jameson algorithm in finite volume formulation and transformed coordinate system.
Module 4	Introduction to turbulence, scales of turbulence, Reynolds Averaged Navier Stokes (RANS) equation, closure problem, eddy viscosity model, k-ε and k-ω model, introduction to large eddy simulation (LES) and direct numerical simulation.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	*Numerical Heat Transfer and Fluid Flow*	S. V. Patankar	Hemisphere	2010
2	*Computational Fluid Flow and Heat Transfer*	K. Muralidhar,T. Sundararajan	Narosa	2002

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	Ansys Associate certification	Ansys	Y	MCQs	Ansys	https://certifications.ansys.com/courses/fundamentals-of-compressible-flows/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ansys Fluent	Ansys	Commercial
2	Any Programming language		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem -1	15	38
	In Sem-2	15	
	Lab In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Sem	16	

HYDROGEN & FUEL CELL TECHNOLOGIES (HFC)

COURSE CODE	22ECF3508	MODE	Regular	LTPS	2-0-2-0	PRE-REQUISITE	Thermodynamics

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand various properties of hydrogen and various production methods	2	PO1, PO2 & PSO2
CO2	Understand hydrogen storage methods and employing hydrogen as fuel for IC engine	2	PO1, PO2 & PSO2
CO3	Apply fuel cell basics and Fuel cell thermodynamics	3	PO1, PO2 & PSO2
CO4	Apply fuel cell reaction kinetics	3	PO1, PO2 & PSO2
CO5	Analyze various hydrogen systems and fuel cells using Simulation & Multiphysics software	4	PO5, PSO2

Syllabus

Module 1	Hydrogen basics and Production methods: Hydrogen – physical and chemical properties, salient characteristics. Production of hydrogen – steam reforming water electrolysis – gasification and woody biomass conversion – biological hydrogen production – photo dissociation – direct thermal or catalytic splitting of water
Module 2	Hydrogen storage methods: Hydrogen storage options – compressed gas – liquid hydrogen – Hydride – chemical Storage – comparisons. Safety and management of hydrogen, Transportation of hydrogen. Applications of Hydrogen. Hydrogen as a fuel for automobiles – Combustive properties of Hydrogen, Problems caused by hydrogen by employing fuel for automobiles, Design modifications required for the engine, Performance parameters of hydrogen fuelled IC engines
Module 3	Fuel cell: Overview of Fuel Cells, low and high temperature fuel cells. Fuel Cell performance, Polymer electrolyte fuel cells, Alkaline fuel cells, Phosphoric fuel cells, Molten carbonate fuel cells, Solid oxide fuel cells, Fuel cell systems and Sample calculations. Fuel cell thermodynamics - heat, work potentials, prediction of reversible voltage, fuel cell efficiency.
Module 4	Fuel cell reaction kinetics - electrode kinetics, over voltages, Tafel equation, charge transfer reaction, exchange currents, electro catalyses - design, activation kinetics, Fuel cell charge and mass transport - flow field, transport in electrode and electrolyte

Reference Books:

Sl No	Title	Author(s)	Year	Publisher
1	Hydrogen and Fuel Cells: A Comprehensive Guide	Rebecca L. and Busby	2005	Penn WellCorporation, Oklahoma
2	Fuel Cell Handbook	Mark C. Williams and H. Quedenfeld	2004	EG&GTechnical Services, Inc
3	Fuel Cells – Principles andApplications	Viswanathan, B and M Aulice Scibioh	2006	Universities Press

4	Non Conventional Energy Sources	G.D Rai	2017	Khanna Publishers
5				

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Improving Fuel Cell Designs for FCEVs Using Simulation	Ansys	Y	Online		https://www.ansys.com/en-in/resource-center/webinar/improving-fuel-cell-designs-for-fcevs-using-simulation
2						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	COMSOL multiphysics Software		Commercial
2	Ansys		Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

Engineering Design Specialization (ED)

MODELING, ANALYSIS AND DESIGN OF ROBOTIC SYSTEMS (MADRS)

COURSE CODE	22EGD3101R	MODE	R	LTPS	2-0-4-4	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify the anatomy of existing robotic systems and their performance specifications, end effectors, etc.	3	PO1, PO2
CO2	Identify the suitable sensors and actuators for a real time robotic system	3	PO1, PO2
CO3	Apply the Denavit Hartenberg procedure to solve forward and inverse kinematics of robots	3	PO1, PO2
CO4	Selection of appropriate robot control and arm configurations for specific applications	3	PO1, PO2
CO5	Kinematic modeling and analysis of ABB IRB 1600 industrial robot with the help of ABB RobotStudio software	4	PO3
CO6	Develop a robot system for a pick and place operation	4	PO3

Syllabus

Module 1	INTRODUCTION TO ROBOTICS: Major components of a Robot, Robotic-like devices, Classification of Robots – Classification by coordinate system and by control method. ROBOT END EFFECTORS: Introduction, End effectors, interfacing, types of End effectors, grippers and tools, Considerations in the selection and design of remote cantered devices.
Module 2	ROBOTIC SENSORY DEVICES: Non-Optical position sensors – Potentiometers, Synchros, inductosyn, optical position sensors – opto interrupters, Optical encoders (absolute & incremental). PROXIMITY SENSORS: Contact type, non-contact type – Reflected light, scanning laser sensors. TOUCH & SLIP SENSORS: Touch sensors – proximity Rod & Photo detector sensors, Slip sensors– Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.
Module 3	TRANSFORMATIONS AND KINEMATICS: Objectives, homogeneous coordinates, basic transformation operations, forward solution – Denavit Hartenberg procedure, Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques.
Module 4	INTRODUCTION TO ROBOT CONTROL: Introduction – Need and types of control schemes for robots – joint space control schemes with an example – task space control schemes with an example. ROBOT APPLICATIONS: Industrial Applications – Material Transfer, material handling, Loading and unloading, processing, spot and continuous arc welding, spray painting, grinding, Assembly and Inspection and Non-Industrial Applications.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Robotics Engineering: An Integrated Approach	Richard D. Klafter	Prentice-Hall	1989
2	INDUSTRIAL ROBOTICS	Mikell Groover	McGraw-Hill	1986
3	Robotics: Control, Sensing, Vision and Intelligence	K. S. Fu, C.S.G. Lee, Ralph Gonzalez	McGraw-Hill	1986
4	Robotics for Engineers	Yoram Koren	McGraw-Hill	1985
5	ROBOTICS AND CONTROL	R Mittle, I Nagrath	McGraw-Hill	2003

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	RobotStudio	ABB	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignment	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	In Semester Exam Lab	6	
	In Semester Exam Skill	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Exam	8	
	Skill End Exam	8	

MODELING, ANALYSIS AND DESIGN OF ROBOTIC SYSTEMS (MADRS)

COURSE CODE	22EGD3101A		MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	KDOM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify the anatomy of existing robotic systems and their performance specifications, end effectors, etc.	3	PO1, PO2
CO2	Identify the suitable sensors and actuators for a real time robotic system	3	PO1, PO2
CO3	Apply the Denavit Hartenberg procedure to solve forward and inverse kinematics of robots	3	PO1, PO2
CO4	Selection of appropriate robot control and arm configurations for specific applications	3	PO1, PO2
CO5	Analyse Forward and Inverse kinematics of spatial mechanism	4	PO1, PO2
CO6	Kinematic modeling and analysis of ABB IRB 1600 industrial robot with the help of ABB RobotStudio software	4	PO3
CO7	Develop a robot system for a pick and place operation	4	PO3

Syllabus

Module 1	INTRODUCTION TO ROBOTICS: Major components of a Robot, Robotic-like devices, Classification of Robots – Classification by coordinate system and by control method. ROBOT END EFFECTORS: Introduction, End effectors, interfacing, types of End effectors, grippers and tools, Considerations in the selection and design of remote cantered devices.
Module 2	ROBOTIC SENSORY DEVICES: Non-Optical position sensors – Potentiometers, Synchros, inductosyn, optical position sensors – opto interrupters, Optical encoders (absolute & incremental). PROXIMITY SENSORS: Contact type, non-contact type – Reflected light, scanning laser sensors. TOUCH & SLIP SENSORS: Touch sensors – proximity Rod & Photo detector sensors, Slip sensors– Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.
Module 3	TRANSFORMATIONS AND KINEMATICS: Objectives, homogeneous coordinates, basic transformation operations, forward solution – Denavit Hartenberg procedure, Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques.
Module 4	INTRODUCTION TO ROBOT CONTROL: Introduction – Need and types of control schemes for robots – joint space control schemes with an example – task space control schemes with an example. ROBOT APPLICATIONS: Industrial Applications – Material Transfer, material handling, Loading and unloading, processing, spot and continuous arc welding, spray painting, grinding, Assembly and Inspection and Non-Industrial Applications.
Module 5	Forward and Inverse kinematic analysis of spatial mechanism

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Robotics Engineering: An Integrated Approach	Richard D. Klafter	Prentice-Hall	1989
2	INDUSTRIAL ROBOTICS	Mikell Groover	McGraw-Hill	1986
3	Robotics: Control, Sensing, Vision and Intelligence	K. S. Fu, C.S.G. Lee, Ralph Gonzalez	McGraw-Hill	1986
4	Robotics for Engineers	Yoram Koren	McGraw-Hill	1985
5	ROBOTICS AND CONTROL	R Mittle, I Nagrath	McGraw-Hill	2003

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	RobotStudio	ABB	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignment	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	In Semester Exam Lab	6	
	In Semester Exam Skill	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Exam	8	
	Skill End Exam	8	

MODELING, ANALYSIS AND DESIGN OF ROBOTIC SYSTEMS (MADRS)

COURSE CODE	22EGD3101P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify the anatomy of existing robotic systems and their performance specifications, end effectors, etc.	3	PO1, PO2
CO2	Identify the suitable sensors and actuators for a real time robotic system	3	PO1, PO2
CO3	Apply the Denavit Hartenberg procedure to solve forward and inverse kinematics of robots	3	PO1, PO2
CO4	Selection of appropriate robot control and arm configurations for specific applications	3	PO1, PO2
CO5	Analyse Forward and Inverse kinematics of spatial mechanism	4	PO1, PO2
CO6	Kinematic modeling and analysis of ABB IRB 1600 industrial robot with the help of ABB RobotStudio software	4	PO3
CO7	Develop a robot system for a pick and place operation	4	PO3

Syllabus

Module 1	INTRODUCTION TO ROBOTICS: Major components of a Robot, Robotic-like devices, Classification of Robots – Classification by coordinate system and by control method. ROBOT END EFFECTORS: Introduction, End effectors, interfacing, types of End effectors, grippers and tools, Considerations in the selection and design of remote cantered devices.
Module 2	ROBOTIC SENSORY DEVICES: Non-Optical position sensors – Potentiometers, Synchros, inductosyn, optical position sensors – opto interrupters, Optical encoders (absolute & incremental). PROXIMITY SENSORS: Contact type, non-contact type – Reflected light, scanning laser sensors. TOUCH & SLIP SENSORS: Touch sensors – proximity Rod & Photo detector sensors, Slip sensors– Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.
Module 3	TRANSFORMATIONS AND KINEMATICS: Objectives, homogeneous coordinates, basic transformation operations, forward solution – Denavit Hartenberg procedure, Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques.
Module 4	INTRODUCTION TO ROBOT CONTROL: Introduction – Need and types of control schemes for robots – joint space control schemes with an example – task space control schemes with an example. ROBOT APPLICATIONS: Industrial Applications – Material Transfer, material handling, Loading and unloading, processing, spot and continuous arc welding, spray painting, grinding, Assembly and Inspection and Non-Industrial Applications.
Module 5	Forward and Inverse kinematic analysis of spatial mechanism

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Robotics Engineering: An Integrated Approach	Richard D. Klafter	Prentice-Hall	1989
2	INDUSTRIAL ROBOTICS	Mikell Groover	McGraw-Hill	1986
3	Robotics: Control, Sensing, Vision and Intelligence	K. S. Fu, C.S.G. Lee, Ralph Gonzalez	McGraw-Hill	1986

4	Robotics for Engineers	Yoram Koren	McGraw-Hill	1985
5	ROBOTICS AND CONTROL	R Mittle, I Nagrath	McGraw-Hill	2003

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	RobotStudio	ABB	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCS Review	14	14
In-Sem Summative	Global Challenges - Leaderboard	46	46
End-Sem Summative	Project Demonstration	40	40

CREEP, FATIGUE AND FRACTURE MECHANICS (CFFM)

COURSE CODE	22EGD3202	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Assess the failure of unflawed structural components	4	PSO2,PSO4
CO2	Assess the fatigue life of structural components under the specified load spectrum	4	PSO2,PSO4
CO3	Evaluate the fracture toughness and assess the life of flawed structural components	4	PSO2,PSO4
CO4	Assess the life of structural components under creep	4	PSO2,PSO4

Syllabus

Module 1	Analysis of stresses and strains in three-dimensions: Principal stresses and strains. Stress / strain invariants, Octahedral stresses, Theories of failure, various yield criteria
Module 2	Repeated Stresses and fatigue in metals: Fatigue tests, endurance limit, Fatigue under combined loadings. Fatigue design theory: Goodman, Gerber and Soderberg criteria. Factors influencing fatigue behavior of metals: Frequency, temperature, size, form, surface conditions, residual stress, etc. influence of stress concentration, notch sensitivity. Various mechanical and metallurgical methods used for improving fatigue strength of metals.
Module 3	Fracture Mechanics: Basic modes offracture; Griffith theory of brittle fracture and Orwan modifications; Linear Elastic Fracture Mechanics (LEFM): Stress field ahead of crack-tip; stress intensity factors; critical SIF; Fracture toughness testing and evaluation of KIC. Elasto-plastic fracture mechanics: Plane stress and plane strain plastic zone sizes; J-integral method; SERR computation and evaluation of structural integrity
Module 4	Creep behavior of metals: Creep-stress-time-temperature relations; creep testing methods; Mechanics of creep; creep in tension, bending and torsion; strain-hardening effects on creep; creep buckling; members subjected to combined stresses and creep

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanical Metallurgy	George E. Dieter	McGraw-Hill International	1986
2	Elementary Engineering Fracture Mechanics	David Broek	Springer	1982
3	Mechanical Behaviorof Materials	Norman E. Dowling	Prentice Hall	2013

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1			Y	MCQS		

	Fatigue & Fracture Mechanics Professional	NAFEMS			NAFEMS-Professional Simulation Engineer	https://www.nafems.org/professional-development/certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	**NOT APPLICABLE**		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
	Skill Continuous Evaluation	NA	
In-Sem Summative	In-sem-1	20	40
	In-sem-2	20	
	Skill in-sem	NA	
End-Sem Summative	End-sem exam (Paper based)	40	40
	Skill end sem exam	NA	

THEORY OF ELASTICITY AND PLASTICITY (TEP)

COURSE CODE	22EGD3203	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyze stresses and strains in planes in elastic or plastic region	4	PO1
CO2	Solve 2-D problems in rectangular Components	4	PO2,PO3
CO3	Analyze stresses and strains in 3-D problems	4	PO1,PO2,PO3
CO4	Analyze Beams and frames in plasticity applications	4	PO1,PO2,PO3

Syllabus

Module 1	Elasticity: Components of stress and strain: plane stress and plane strain; Plasticity: Foundations of plasticity, the criterions of yielding, stress-strain relationship, stress resolving postulates, rule of plastic flow.
Module 2	2-D Problems in rectangular co- ordinates: solution by polynomials; St.Venants principle; determination of displacements; Bending of a cantilever loaded at the end; Bending of a beam under uniform load.
Module 3	Stress and strain analysis in 3-D problems: Principle stresses and their determination; Stress invariants; strains at a point. Principal axis of strain; Elementary problems.
Module 4	Plastic analysis of beams and frames: Limit analysis of beams and frames; Minimum weight design, influence of axial force.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Theory of Elasticity	S.P. Timoshenko; J.N. Goodier	McGraw-Hill Book Company	1970
2	Theory of Plasticity	J. Chakrabarty	Elsevier Butterworth-Heinemann	2006
3	Engineering Plasticity: Theory and Application to Metal Forming Processes	R A C Slater	Macmillan	1977

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Understanding Solid Mechanics: Stress analysis	NAFEMS	Y	MCQS	NAFEMS-Professional Simulation Engineer	https://www.nafems.org/professional-development/certification/

	approach Stress Analysis Approaches					
2	Nonlinear FEA	NAFEMS	Y	MCQS	NAFEMS-Professional Simulation Engineer	https://www.nafems.org/professional-development/certification/

Tools used in Practical / Skill: NOT APPLICABLE

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NOT APPLICABLE		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
	Skill Continuous Evaluation	NA	
In-Sem Summative	In-sem-1	20	40
	In-sem-2	20	
	Skill in-sem	NA	
End-Sem Summative	End-sem exam (Paper based)	40	40
	Skill end sem exam	NA	

SUSTAINABLE DESIGN & SOCIAL INNOVATION IN ENGINEERING DESIGN(SDSIED)

COURSE CODE	22EGD3304R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	MED (22ME3111R)

Course Outcomes

CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Understand principles and frameworks of sustainable design and social innovation.	2	PO1
CO2	Apply Dieter's engineering design process incorporating sustainable design and develop a solution concept	3	PO2
CO3	identify the product architecture and configure the product components	3	PO2
CO4	Analyze and evaluate sustainable design methodologies for product development.	4	PO6, PSO2
CO5	Demonstrate creative thinking and problem-solving skills in social innovation through Design and execution of a fully functional prototype	6	PO6, PSO2
CO6	Develop skills in prototyping, testing, and refining designs for sustainable products.	4	PO6, PSO2

Syllabus

Module 1	Introduction to sustainable design and social innovation, Dieter's engineering design process, Sustainable design methodologies
Module 2	Social innovation and design thinking, Problem identification and needs analysis, Concept generation and selection
Module 3	Product Architecture & Systems Design, Product Configuration design, Detailed design and prototyping
Module 4	Developing a manufacturing plan for the prototype
Module 5	Analyse and refine the prototype for sustainability and innovation

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Sustainability in Engineering Design	Anthony Johnson & Andy Gibson	Elsevier publications	2014
2	Design for sustainability: a practical approach	Tracy Bhamra and Vicky Lofthouse	Gower Publishing Limited	2007
3	Engineering Design	George Dieter, Linda Schmidt	McGraw Hill	2013
4	PRODUCT DESIGN AND MANUFACTURING	R. C. Gupta and A. K. Chitale	PHI Learning Pvt. Ltd.	2023
5	Sustainable Product Design and Development	Anoop Desai, Anil Mital	CRC Press	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	Sustainability Excellence Associate*	International Society of Sustainability Professionals	Y	75 objective questions	International Society of Sustainability Professionals - online	https://sustainability-excellence.gbci.org/sea

- Global certification is only optional for this course

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Any modelling tool like- Solidworks, Fusion 360	Dassault Systemes, Autodesk	Commercial
2	Any stress Analysis tool – Ansys, Hyperworks, Nastran	Ansys, Altair, MSC-Hexagon	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1 (Presentation)	12	36
	In-Sem 2 (Presentation)	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	Project Demonstration	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

SUSTAINABLE DESIGN & SOCIAL INNOVATION IN ENGINEERING DESIGN(SDSIED)

COURSE CODE	22EGD3304A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	MED (22ME3111A)

Course Outcomes

CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Understand principles and frameworks of sustainable design and social innovation.	2	PO1
CO2	Apply Dieter's engineering design process incorporating sustainable design and develop a solution concept	3	PO2
CO3	identify the product architecture and configure the product components	3	PO2
CO4	Analyze and evaluate sustainable design methodologies for product development.	4	PO6, PSO2
CO5	Apply sustainable materials and manufacturing practices in practical settings.	4	PO6, PSO2
CO6	Demonstrate creative thinking and problem-solving skills in social innovation through Design and execution of a fully functional prototype	6	PO6, PSO2
CO7	Develop skills in prototyping, testing, and refining designs for sustainable products.	4	PO6, PSO2

Syllabus

Module 1	Introduction to sustainable design and social innovation, Dieter's engineering design process, Sustainable design methodologies
Module 2	Social innovation and design thinking, Problem identification and needs analysis, Concept generation and selection
Module 3	Product Architecture & Systems Design, Product Configuration design, Detailed design and prototyping
Module 4	Developing a manufacturing plan for the prototype
Module 5	Analyse and refine the prototype for sustainability and innovation

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Sustainability in Engineering Design	Anthony Johnson & Andy Gibson	Elsevier publications	2014
2	Design for sustainability: a practical approach	Tracy Bhamra and Vicky Lofthouse	Gower Publishing Limited	2007
3	Engineering Design	George Dieter, Linda Schmidt	McGraw Hill	2013
4	PRODUCT DESIGN AND MANUFACTURING	R. C. Gupta and A. K. Chitale	PHI Learning Pvt. Ltd.	2023
5	Sustainable Product Design and Development	Anoop Desai, Anil Mital	CRC Press	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Sustainability Excellence Associate*	International Society of Sustainability Professionals	Y	75 objective questions	International Society of Sustainability Professionals - online	https://sustainability-excellence.gbci.org/sea

- Global certification is only optional for this course

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Any modelling tool like- Solidworks, Fusion 360	Dassault Systemes, Autodesk	Commercial
2	Any stress Analysis tool – Ansys, Hyperworks, Nastran	Ansys, Altair, MSC-Hexagon	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1 (Presentation)	12	36
	In-Sem 2 (Presentation)	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	Project Demonstration	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

SUSTAINABLE DESIGN & SOCIAL INNOVATION IN ENGINEERING DESIGN (SDSIED)

COURSE CODE	22EGD3304P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	MED (22ME3111P)

Course Outcomes

CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Understand principles and frameworks of sustainable design and social innovation.	2	PO1
CO2	Apply Dieter's engineering design process incorporating sustainable design and develop a solution concept	3	PO2
CO3	identify the product architecture and configure the product components	3	PO2
CO4	Analyze and evaluate sustainable design methodologies for product development.	4	PO6, PSO2
CO5	Apply sustainable materials and manufacturing practices in practical settings.	4	PO6, PSO2
CO6	Demonstrate creative thinking and problem-solving skills in social innovation through Design and execution of a fully functional prototype	6	PO6, PSO2
CO7	Develop skills in prototyping, testing, and refining designs for sustainable products.	4	PO6, PSO2

Syllabus

Module 1	Introduction to sustainable design and social innovation, Dieter's engineering design process, Sustainable design methodologies
Module 2	Social innovation and design thinking, Problem identification and needs analysis, Concept generation and selection
Module 3	Product Architecture & Systems Design, Product Configuration design, Detailed design and prototyping
Module 4	Developing a manufacturing plan for the prototype
Module 5	Analyse and refine the prototype for sustainability and innovation

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Sustainability in Engineering Design	Anthony Johnson & Andy Gibson	Elsevier publications	2014
2	Design for sustainability: a practical approach	Tracy Bhamra and Vicky Lofthouse	Gower Publishing Limited	2007
3	Engineering Design	George Dieter, Linda Schmidt	McGraw Hill	2013
4	PRODUCT DESIGN AND MANUFACTURING	R. C. Gupta and A. K. Chitale	PHI Learning Pvt. Ltd.	2023
5	Sustainable Product Design and Development	Anoop Desai, Anil Mital	CRC Press	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Sustainability Excellence Associate*	International Society of Sustainability Professionals	Y	75 objective questions	International Society of Sustainability Professionals - online	https://sustainability-excellence.gbci.org/sea

- Global certification is only optional for this course

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Any modelling tool like- Solidworks, Fusion 360	Dassault Systemes, Autodesk	Commercial
2	Any stress Analysis tool – Ansys, Hyperworks, Nastran	Ansys, Altair, MSC-Hexagon	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1 (Presentation)	12	36
	In-Sem 2 (Presentation)	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	Project Demonstration	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

ADVANCED VIBRATIONS (AV)

COURSE CODE	22EGD3405M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	22ME2213

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic concepts of vibrations and the types of systems	2	PO1,PSO1
CO2	Model vibrating systems and analyze their behavior under harmonic and transient excitations.	3	PO1,PSO1
CO3	Analyze vibrations of continuous systems and apply vibration control techniques.	4	PO2,PSO1
CO4	Apply vibration analysis techniques to real-world problems in engineering.	3	PO1,PSO1

Syllabus

Module 1	Introduction to Vibrations: Single-degree-of-freedom systems, Multi-degree-of-freedom, systems, Free and forced vibrations
Module 2	Modeling of Vibrating Systems: Harmonic Excitation, Transient Excitation
Module 3	Continuous systems, Vibrations of plates and beams
Module 4	Vibration Control and applications

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanical Vibrations: Theory and Applications	S. Graham Kelly	Cengage Learning,	2011
2	Mechanical Vibrations	Singiresu S. Rao	Pearson Education India	2019
3	Fundamentals of Mechanical Vibrations	S. Graham Kelly	McGraw-Hill Education,	2000
4	Vibration Analysis and Control - New Trends and Developments	Francisco Beltran-Carbajal,	InTechOpen,	2018
5	Random Vibrations: Theory and Practice	Paul H. Wirsching, Thomas L. Paez, and James P. Noone,	John Wiley & Sons,	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Vibration Analyst	Vibration Institute	Y	Multiple Choice	Vibration Institute	Certified Vibration

						Analyst - Category II
2	Certified Vibration Analyst - Category II	Association of Asset...	Y	Multiple Choice	AMP	Certified Reliability Leader (CRL) - Vibration Analysis Track

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ACTIVE LEARNING	10	20
	HOME ASSIGNMENT	10	
In-Sem Summative	SEM IN EXAMINATION-1	20	40
	SEM IN EXAMINATION-II	20	
End-Sem Summative	END SEMESTER EXAM	40	40

ADVANCED VIBRATIONS (AV)

COURSE CODE	22EGD3405MA	MODE	A	LTPS	3-0-0-0	PRE-REQUISITE	22ME2213

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic concepts of vibrations and the types of systems	2	PO1,PSO1
CO2	Model vibrating systems and analyze their behavior under harmonic and transient excitations.	3	PO1,PSO1
CO3	Analyze vibrations of continuous systems and apply vibration control techniques.	4	PO2,PSO1
CO4	Apply vibration analysis techniques to real-world problems in engineering.	3	PO1,PSO1
CO5	Analyze the errors in the measurement of vibrations	4	PO2,PSO1

Syllabus

Module 1	Introduction to Vibrations: Single-degree-of-freedom systems, Multi-degree-of-freedom, systems, Free and forced vibrations
Module 2	Modelling of Vibrating Systems: Harmonic Excitation, Transient Excitation
Module 3	Continuous systems, Vibrations of plates and beams
Module 4	Vibration Control and applications
Module 5	Analyze the errors in the measurement of vibrations

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanical Vibrations: Theory and Applications	S. Graham Kelly	Cengage Learning,	2011
2	Mechanical Vibrations	Singiresu S. Rao	Pearson Education India	2019
3	Fundamentals of Mechanical Vibrations	S. Graham Kelly	McGraw-Hill Education,	2000
4	Vibration Analysis and Control - New Trends and Developments	Francisco Beltran-Carbajal,	InTechOpen,	2018
5	Random Vibrations: Theory and Practice	Paul H. Wirsching, Thomas L. Paez, and James P. Noone,	John Wiley & Sons,	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Vibration Analyst	Vibration Institute	Y	Multiple Choice	Vibration Institute	Certified Vibration

						Analyst - Category II
2	Certified Vibration Analyst - Category II	Association of Asset...	Y	Multiple Choice	AMP	Certified Reliability Leader (CRL) - Vibration Analysis Track

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ACTIVE LEARNING	10	20
	HOME ASSIGNMENT	10	
In-Sem Summative	SEM IN EXAMINATION-1	20	40
	SEM IN EXAMINATION-II	20	
End-Sem Summative	END SEMESTER EXAM	40	40

MECHANICS OF COMPOSITE MATERIALS (MCM)

COURSE CODE	22EGD3406M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	22ME3111R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Know the composite materials and manufacturing methods	3	PO1, PSO1
CO2	Identify the behavior of composite Lamina at micro level	3	PO1, PSO1
CO3	Identify the behavior of composite Lamina at macro level	3	PO1, PSO1
CO4	Apply Failure theories to calculate stresses in composite materials	3	PO1, PSO1

Syllabus

Module 1	Introduction to composite materials, Geometric definitions, Classification of composites, Types of fibers, Types of the matrix, Hybrid composite, Scale of analysis- micro and macro mechanics approaches, Degree of Anisotropy. Manufacturing methods of the composites, Autoclave molding, Filament winding, and Resin transfer molding.
Module 2	Elastic behavior of composite lamina (Micro-mechanics), Micro-mechanics methods, Geometric aspects and elastic symmetry, Longitudinal elastic properties (Continuous fibers), Transverse elastic properties, In-plane shear properties (Continuous fibers), Longitudinal properties (short fibers)
Module 3	Elastic behavior of composite lamina (Macro mechanics approach), Stress-Strain relations: General anisotropic material, Specially orthotropic material, Transversely isotropic material, Orthotropic material under plane stress, Isotropic material.
Module 4	Standard sizes of the specimen for tensile and compressive, Fatigue tests, and Impact tests of uni-directional composites. Experimental methods for characterization and testing of composite materials. Failure of the composite materials: fiber failures, matrix failure, interface failure. Failure Theories: Tsai-Wu, Tsai-Hill, Puck criterion, Maximum stress, maximum strain.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Mechanics of Composite Materials	Issac Daniel & Ori Ishai	OUPublisher, USA	2005
2	Mechanics of Composite Materials	Autar K. Kaw	Taylor & Francis	2005
3	Mechanics of Composite Materials	R.M.Jones	Taylor & Francis	1998
4	Composite Materials	N. Chawla and K.K. Chawla	Springer	2006
5	Mechanics of Composite Materials & Structures	Madhujit Mukhopadhyay	University Press	2022

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	Ansys-Structral Analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignments and text book	10	
In-Sem Summative	In sem-1	20	20
	In Sem-2	20	
End-Sem Summative	End Sem Exam	40	40

MECHANICS OF COMPOSITE MATERIALS (MCM)

COURSE CODE	22EGD3406MA	MODE	A	LTPS	4-0-0-0	PRE-REQUISITE	22ME3111R

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Know the composite materials and manufacturing methods	3	PO1, PSO1
CO2	Identify the behavior of composite Lamina at micro level	3	PO1, PSO1
CO3	Identify the behavior of composite Lamina at macro level	3	PO1, PSO1
CO4	Apply Failure theories to calculate stresses in composite materials	3	PO1, PSO1
CO5	Mechanical, Physical Characterization of composites, Wear Effects	4	PO1, PSO1

Syllabus

Module 1	Introduction to composite materials, Geometric definitions, Classification of composites, Types of fibers, Types of the matrix, Hybrid composite, Scale of analysis- micro and macro mechanics approaches, Degree of Anisotropy. Manufacturing methods of the composites, Autoclave molding, Filament winding, and Resin transfer molding.
Module 2	Elastic behavior of composite lamina (Micro-mechanics), Micro-mechanics methods, Geometric aspects and elastic symmetry, Longitudinal elastic properties (Continuous fibers), Transverse elastic properties, In-plane shear properties (Continuous fibers), Longitudinal properties (short fibers)
Module 3	Elastic behavior of composite lamina (Macro mechanics approach), Stress-Strain relations: General anisotropic material, Specially orthotropic material, Transversely isotropic material, Orthotropic material under plane stress, Isotropic material.
Module 4	Standard sizes of the specimen for tensile and compressive, Fatigue tests, and Impact tests of uni-directional composites. Experimental methods for characterization and testing of composite materials. Failure of the composite materials: fiber failures, matrix failure, interface failure. Failure Theories: Tsai-Wu, Tsai-Hill, Puck criterion, Maximum stress, maximum strain.
Module 5	Standard sizes of the specimen for tensile and compressive, Fatigue tests, and Impact tests of uni-directional composites. Experimental methods for characterization and testing of composite materials. Wear and friction behavior of the composite material.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Mechanics of Composite Materials	Issac Daniel & Ori Ishai	OUPublisher, USA	2005
2	Mechanics of Composite Materials	Autar K. Kaw	Taylor & Francis	2005
3	Mechanics of Composite Materials	R.M.Jones	Taylor & Francis	1998
4	Composite Materials	N. Chawla and K.K. Chawla	Springer	2006
5	Mechanics of Composite Materials & Structures	Madhujit Mukhopadhyay	University Press	2022

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-Structral Analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/
2	Fusion 360	Autodesk	Y	MCQs	Autodesk	https://www.autodesk.com/certification/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignments and text book	10	
In-Sem Summative	In sem-1	20	20
	In Sem-2	20	
End-Sem Summative	End Sem Exam	40	40

ADVANCED STRENGTH OF MATERIALS (ASM)

COURSE CODE	22EGD3507	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Analyze the behaviour of statically indeterminate beams for different loading conditions	4	PO1, PO2, PSO1
CO2	Analyze the behaviour of curved beams and determine the shear centre for various cross sections of beams	4	PO1, PO2, PSO1
CO3	Apply unit load method to find deflections in beams and structures	3	PO1, PO2, PSO1
CO4	Analyze the various stresses in rotating members and thick cylinders	4	PO1, PO2, PSO1
CO5	Simulate the structural members using ANSYS software and validate the results with analytical methods	4	PO5, PSO1

Syllabus

Module 1	Statically Indeterminate Beams: Introduction to Statically indeterminate Beams, apply the Moment Area Method to analyze the fixed beams. Introduction to Continuous beams, apply Clapeyron's theorem of three moments to analyze continuous beams.
Module 2	Curved Beams: Stresses in Beams of small and large initial curvature, Winkler-Bach theory, Stresses in Crane Hook and C-Clamp with Rectangular, Circular and Trapezoidal cross-sections. Shear Center: Importance of Shear Centre, Locate the shear center for different cross-sections.
Module 3	Energy Methods: Introduction, Principles of virtual work, Apply Unit load Method to determine displacements and slope in Beams and to analyze simple structures and trusses.
Module 4	Centrifugal Stresses: Introduction, Stresses in Rotating Ring, Disc of uniform thickness. Thick Cylinders: Stresses in Thick cylinders, Apply Lame's theory to determine radial and circumferential stresses in thick cylinders. Stresses in Compound Cylinders.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanics of Materials	Gere and Timoshenko	CBS publishers	2004
2	Mechanics of Materials	Beer P F and Johston (Jr) E R	McGraw Hill	2008
3	Strength of Materials	Dr. Sadhu Singh	Khanna Publishers	2013
4	Engineering Mechanics of Solids	Popov E P	Prentice Hall	1998
5	Advanced Mechanics of Solids	L. S. Srinath	Tata McGraw-Hill	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Ansys-Structural analysis	ANSYS	Y	MCQs	Mindbox-ARK Info solutions	https://certifications.ansys.com/associate-certifications/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	ANSYS	ANSYS Inc.	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

HYBRID AND ELECTRIC VEHICLE DESIGN(HEVD)

COURSE CODE	22EGD3508	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand Hybrid /EV Vehicles and study of vehicle dynamics	3	PSO1, PO1, PO2,
CO2	Apply Architecture of Hybrid/EV Vehicles, components and Battery EV	3	PSO1, PO1, PO2, PO3
CO3	Apply and analyse Fuel Cell, DC/AC Drives and SRM	3	PSO1, PO1, PO3, PO4
CO4	Apply EV Controls, Controller, and control strategies	4	PSO2, PO1. PO2, PO4
CO5	Analyze and apply theoetical concepts to develop mathematical models and simulate	5	PSO2, PO2, PO3, PO5

Syllabus

Module 1	Understand the history and need for Hybrid/EV Vehicle. Developments in hybrid and EV vehicle. Basic of Vehicle Dynamics
Module 2	Vehicle Dynamics, Hybrid/EV Vehicle Architecture, Solar EV Vehicle
Module 3	AC/DC/SRM Drives
Module 4	Vehicle control, controller design and Control Strategies

Reference Books:

Sl No	Title	Author(s)	Publisher	Year/Edition
1	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussein	CRC Press	2015
2	Modern Electric Hybrid Electric and Fuel Vehicles	Mehrdad Ehsani	Springer	2018
3	Vehicle Dynamics	Reza N. Jazar	Springer	2nd
4	Hybrid/EV Vehicle Architecture	Chris Mi	Wiley	1st
5	Solar Electric Vehicle Technology	Stefan E. Nahorski	CRC Press	1st
6	Electric Drives: Concepts and Applications	Vedam Subrahmanyam	Tata McGraw-Hill	1st

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Electric Vehicle	Society of Automotive	Yes	Online	SAE International	CEVE Certification

	Engineer (CEVE)	Engineers (SAE)				
2	Certified Renewable Energy Professional (CREP)	Association of Energy Engineers (AEE)	Yes	Online	Association of Energy Engineers	CREP Certification

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB/Simulink	Engineering	Commercial
2	ANSYS Maxwell	Engineering	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

E-Mobility Specialization

POWER TRAIN DESIGN FOR ELECTRIC VEHICLE(PTDEV)

COURSE CODE	22EME3101R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	ELM OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply principle of Power train components and fuel sources for EV design	3	PSO1 ,PO5, PO2
CO2	Modelling of dynamics for EV	3	PSO1,PO4, PO2
CO3	Modelling of Electric Vehicle Acceleration & Range	3	PSO2, PO1, PO4
CO4	Analyse The Regenerative Braking in EV	4	PSO2, PO1, PO4
CO5	Analyze to test the Power train components	4	PO1, PO4 & PSO1
CO6	Obtain the skill to test the Power train components	4	PO1, PO4 & PSO1

Syllabus

Module 1	HISTORY, ECONOMIC & ENVIRONMENTAL IMPACT OF ELECTRIC VEHICLE: History of EV, Case studies on Economic and Environment aspects of EV, Classification of electric vehicle, Modern electric drive train, Power train components: BEV, HEV, PHEV and FCEV, including working of Fuel cell, Super capacitor, energy management, Hybrid sources.
Module 2	ELECTRIC VEHICLE DYNAMICS: Laws of Motion, General description of vehicle movement, Tractive Effort, Vehicle resistance: Rolling Resistance, Aerodynamic Drag, Grading Resistance, Acceleration resistance, Dynamic equation, Tire Ground Adhesion and maximum tractive effort, Vehicle Power Plant and Transmission Characteristics.
Module 3	MODELING VEHICLE ACCELERATION & ELECTRIC VEHICLE RANGE: Acceleration performance parameters, Modeling the acceleration of an electric scooter, Modeling the acceleration of a small car, Driving cycles, Range modeling of battery electric vehicles, Constant velocity range modeling, Range modeling of fuel cell vehicles, Range modeling of hybrid electric vehicles.
Module 4	Fundamentals of Regenerative Braking: Energy Consumption in Braking, Braking Power and Energy on Front and Rear Wheels, Brake System of EVs and HEVs, Series Brake — Optimal Feel, Series Brake — Optimal Energy Recovery, Parallel Brake, Antilock Brake System (ABS).

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A History of Electric Vehicles	Nigel Burton	Crowood Publisher.	2013
2	Electric Cars: The Ultimate Guide for Understanding the Electric Car And What You Need to Know	Brad Durant.	CreateSpace Independent	2014
3	Electric Vehicle Technology Explained	James Larminie and John Lowry	Jhon Wiley-Blackwell	2012
4	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles- Fundamentals, Theory, and Design	Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi	CRC PRESS	2018
5	ELECTRIC and HYBRID VEHICLES, Design Fundamentals	Iqbal Husain	CRC PRESS	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Electro mobility	Bosch	Y	OBJECTIVE AND DESCRIPTIVE	Bosch	https://www.bosch-engineering.com/portfolio/trainings/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Electric Vehicle Development	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

POWER TRAIN DESIGN FOR ELECTRIC VEHICLE(PTDEV)

COURSE CODE	22EME3101A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	ELM OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply principle of Power train components and fuel sources for EV design	3	PSO1,PO5, PO2
CO2	Modeling of dynamics for EV	3	PSO1,PO4, PO2
CO3	Modeling of Electric Vehicle Acceleration & Range	3	PSO2,PO1, PO4
CO4	Analyse The Regenerative Braking in EV	4	PSO2,PO1, PO4
CO5	Test the Power train components	4	PO-1, PO-4 & PSO1
CO6	Obtain the skill to test the Power train components	4	PO1, PO4 & PSO1

Syllabus

Module 1	HISTORY, ECONOMIC & ENVIRONMENTAL IMPACT OF ELECTRIC VEHICLE: History of EV, Case studies on Economic and Environment aspects of EV, Classification of electric vehicle, Modern electric drive train, Power train components: BEV, HEV, PHEV and FCEV, including working of Fuel cell, Super capacitor, energy management, Hybrid sources.
Module 2	ELECTRIC VEHICLE DYNAMICS: Laws of Motion, General description of vehicle movement, Tractive Effort, Vehicle resistance: Rolling Resistance, Aerodynamic Drag, Grading Resistance, Acceleration resistance, Dynamic equation, Tire Ground Adhesion and maximum tractive effort, Vehicle Power Plant and Transmission Characteristics.
Module 3	MODELING VEHICLE ACCELERATION & ELECTRIC VEHICLE RANGE: Acceleration performance parameters, Modeling the acceleration of an electric scooter, Modeling the acceleration of a small car, Driving cycles, Range modeling of battery electric vehicles, Constant velocity range modeling, Range modeling of fuel cell vehicles, Range modeling of hybrid electric vehicles.
Module 4	Fundamentals of Regenerative Braking: Energy Consumption in Braking, Braking Power and Energy on Front and Rear Wheels, Brake System of EVs and HEVs, Series Brake — Optimal Feel, Series Brake — Optimal Energy Recovery, Parallel Brake, Antilock Brake System (ABS).
Module 5	Testing of the Power train components of EV, Test the Range of vehicle for different Driving cycles.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A History of Electric Vehicles	Nigel Burton	Crowood Publisher.	2013
2	Electric Cars: The Ultimate Guide for Understanding the Electric Car And What You Need to Know	Brad Durant.	CreateSpace Independent	2014
3	Electric Vehicle Technology Explained	James Larminie and John Lowry	Jhon Wiley-Blackwell	2012
4	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles-Fundamentals, Theory, and Design	Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi	CRC PRESS	2018
5	ELECTRIC and HYBRID VEHICLES, Design Fundamentals	Iqbal Husain	CRC PRESS	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Electro mobility	Bosch	Y	OBJECTIVE AND DESCRIPTIVE	Bosch	https://www.bosch-engineering.com/portfolio/trainings/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Electric Vehicle Development	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

POWER TRAIN DESIGN FOR ELECTRIC VEHICLE(PTDEV)

COURSE CODE	22EME3101P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	ELM OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply principle of Power train components and fuel sources for EV design	3	PSO1,PO5, PO2
CO2	Modeling of dynamics for EV	3	PSO1,PO4, PO2
CO3	Modeling of Electric Vehicle Acceleration & Range	3	PSO2,PO1, PO4
CO4	Analyse The Regenerative Braking in EV	4	PSO2,PO1, PO4
CO5	Test the Power train components	4	PO-1, PO-4 & PSO1
CO6	Obtain the skill to test the Power train components	4	PO1, PO4 & PSO1

Syllabus

Module 1	HISTORY, ECONOMIC & ENVIRONMENTAL IMPACT OF ELECTRIC VEHICLE: History of EV, Case studies on Economic and Environment aspects of EV, Classification of electric vehicle, Modern electric drive train, Power train components: BEV, HEV, PHEV and FCEV, including working of Fuel cell, Super capacitor, energy management, Hybrid sources.
Module 2	ELECTRIC VEHICLE DYNAMICS: Laws of Motion, General description of vehicle movement, Tractive Effort, Vehicle resistance: Rolling Resistance, Aerodynamic Drag, Grading Resistance, Acceleration resistance, Dynamic equation, Tire Ground Adhesion and maximum tractive effort, Vehicle Power Plant and Transmission Characteristics.
Module 3	MODELING VEHICLE ACCELERATION & ELECTRIC VEHICLE RANGE: Acceleration performance parameters, Modeling the acceleration of an electric scooter, Modeling the acceleration of a small car, Driving cycles, Range modeling of battery electric vehicles, Constant velocity range modeling, Range modeling of fuel cell vehicles, Range modeling of hybrid electric vehicles.
Module 4	Fundamentals of Regenerative Braking: Energy Consumption in Braking, Braking Power and Energy on Front and Rear Wheels, Brake System of EVs and HEVs, Series Brake — Optimal Feel, Series Brake — Optimal Energy Recovery, Parallel Brake, Antilock Brake System (ABS).
Module 5	Testing of the Power train components of EV, Test the Range of vehicle for different Driving cycles.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A History of Electric Vehicles	Nigel Burton	Crowood Publisher.	2013
2	Electric Cars: The Ultimate Guide for Understanding the Electric Car And What You Need to Know	Brad Durant.	CreateSpace Independent	2014
3	Electric Vehicle Technology Explained	James Larminie and John Lowry	Jhon Wiley-Blackwell	2012

4	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles- Fundamentals, Theory, and Design	Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi	CRC PRESS	2018
5	ELECTRIC and HYBRID VEHICLES, Design Fundamentals	Iqbal Husain	CRC PRESS	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Electro mobility	Bosch	Y	OBJECTIVE AND DESCRIPTIVE	Bosch	https://www.bosch-engineering.com/portfolio/trainings/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Electric Vehicle Development	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	6	24
	Skill Continuous Evaluation	6	
	MOOCs Review	12	
In-Sem Summative	MOOCs Exam	16	36
	Practical In-Sem	10	
	Skill In-Sem	10	
End-Sem Summative	End-Sem Exam (MCQ based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

COMMUNICATION PROTOCOLS & TESTING OF ELECTRIC VEHICLE (CPTEV)

COURSE CODE	22EME3202	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	ELM OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the communication protocols used in ElectricVehicles	2	PO1,PO5, PSO1
CO2	Apply the communication protocols and sensors for fault diagnostics of Electric Vehicle	3	PO1,PO3, PSO1
CO3	Analyze the intricacies of integrating HV and LV components of vehicle	4	PO1,PO6, PSO1
CO4	Analyze the system engineering/system validation	4	PO1,PO3, PSO1
CO5	Test electric vehicle fault	4	PO1, PO3, PO5, PSO2

Syllabus

Module 1	Introduction to serial communication protocols: SPI I2C CAN, LIN bus, MOST bus, Bluetooth, Flexi Ray, CAN message: Arbitration, message types, valid frame, error checking, CAN Transceiver features, CAN physical layer, CAN connectors, Bit Timing, Error Handling, CAN Interface with Sensor Modules.
Module 2	High Layer Protocols: IEC 61851, SAE J2601, Vehicle to Vehicle communication protocols, Fault Diagnosis On-Board diagnostics, Off-Board diagnostics. Common Sensors used in EV: Air Bag, ABS, Window Mirror, Cruise Control, Transmission control.
Module 3	Components like HVDC Relays connections, Insulation Monitoring Devices, Fuses, BTMS, Driveline Cooling, Coolant tanks, Level Sensors, Vehicle Wiring, Terminals, Temperature Considerations for wiring, Cable selection, Instrument Panel, HVIL,24V converters, derating of the components. EMI and EMC.
Module 4	V cycle, reliability calculations, Design for manufacturing, servicing & data analytics, supply chain management, Passenger safety and convenience, Antitheft systems.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Advanced Automotive Fault Diagnosis-Automotive Technology: Vehicle Maintenance and Repair	Tom Denton.	Routledge	2016
2	Electric Cars: The Ultimate Guide for Understanding the Electric Car and What You Need to Know	Brad Durant.	CreateSpace Independent	2014
3	Electric Vehicle Technology Explained	James Larminie and John Lowry	Jhon Wiley-Blackwell	2012
4	Automotive Electronics handbook	RONALD JURGEN	McGraw-Hill.	1999
5	Bosch Automotive Electrics and Automotive Electronics	Robert Bosch GmbH	Springer Publishers	2007

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Electric Vehicle Sensors	Coursera	Y	MCQ	Coursera	https://www.coursera.org/learn/electric-vehicle-sensors#syllabus
2	Vehicle networking	Bosch	Y	MCQ	Bosch	https://www.bosch-engineering.com/portfolio/trainings/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Electric Vehicle Development	MathWorks	Commercial
2	Vehicle networking	AUTOSAR	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

Autonomous Vehicles & Automotive Electronics (AVAE)

COURSE CODE	22EME3203	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	ELM OR ET

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the functional elements of robotics to build simple robot.	3	PO1, PSO1
CO2	Apply Denavit -Hattenberg parameters to position the manipulators	3	PO1, PSO1
CO3	Apply the differential motion through Jacobian to control the manipulator	3	PO1, PSO1
CO4	Analyse the force control techniques using Lagrange dynamic model	4	PO1, PO2, PSO1
CO6	Design and analyze the Effect of uncertainty in the mobile robots.	4	PO1, PO2, PO12, PSO1

Course Syllabus	
Module	Syllabus
Module 1:	Introduction to Autonomous Vehicles: Technological overview concepts of Autonomous Vehicles (AVs); History of Autonomous Vehicles; Vehicle Electronics Architecture; Functional Block Diagram of typical Autonomous Vehicle System (AVS); Basic control system applied to Drive Assisted and Driverless Vehicles; Overview of the operation of Electronic Control Unit (ECUs).
Module 2:	Automotive Sensors and Actuators (ASA): Role of sensors and actuators in autonomous vehicles; Accelerometers, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Steering wheel angle, Vehicle speed, Throttle position, Turbine speed, Temperature, Mass air flow (MAF) rate, Automotive Engine Control Actuators, Fuel Injection, Exhaust Gas Recirculation Actuator, Variable Valve Timing, VVP Mechanism Model, Electric Motor Actuators.
Module 3:	Automotive Electronics (AE): Fundamentals of Automotive Electronics (FAE)- Principles of automotive systems, Advanced driver-assistance systems (ADAS)- Evolution of ABS configurations, Basics of Theory of Operation, Integration of ADAS Technology into Vehicle Electronics, Auto pilot, Advanced parking system, ADAS in Toyota and Tesla.
Module 4:	Automotive Wireless (AW): Wireless Networking and Applications to Vehicle Autonomy; Integration of Wireless Networking and On-Board Vehicle Networks; Automotive GPRS Vehicle Tracking (AGPRS-VT)- Vehicle Tracking System; Principle of Vehicle Tracking system, GPS and GPRS tracking system. Controlled Area Network (CAN):Basic, Block diagram of the CAN bus architecture, Types of CAN Physical Layers, Frame Format of CAN protocol, Working principle of CAN communication.

Reference Books:				
Sl No	Title	Author(s)	Publisher	Year
Book 1	Automotive Computers and Control System	Tom Weather Jr and Cland C. Hunter	Prentice Hall Inc., New Jersey	1998

Book 2	On-Road Intelligent Vehicles: Motion Planning for Intelligent Transportation Systems	Rahul Kala	Butterworth-Heinemann	2016
Book 3	Autonomous Vehicles Volume 1: Using Machine Intelligence	Romil Rawat	Wiley	2022
Book 4	Understanding Automotive Electronics: An Engineering Perspective	William Ribbens	Butterworth-Heinemann	2017

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Multi-Object Tracking for Automotive Systems	Chalmers University via edx	N	Online	Chalmers University via edx	https://www.classcentral.com/course/edx-decision-making-for-autonomous-systems-10305

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MathWorks	Commercial

Evaluation Components

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	8	**22**
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	**38**
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	End Semester Exam	24	**40**
	Lab End Exam	16	

CHARGING STATION FOR ELECTRIC VEHICLE (CSEV)

COURSE CODE	22EME3304R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	ELM OR ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To identify the charger topology of various electric vehicle and charging modes	3	2,1
CO2	To Analyze Power electronic converters for electric vehicle charging applications	4	2,5
CO3	To Analyze control of Fast charging station for EV	4	3
CO4	To Demonstrate installation of charging station	2	6,7
CO6	To Analyze the converters and control algorithms using Matlab	4	3,5
CO7	To develop and test the EVSE and layouts using MATLAB & Pspice	4	5

Syllabus

Module 1	Charger Topologies Charging time and charging speed, Defining power levels- Normal charging, Semi-fast charging, Overview of power levels ,DC conductive charging, AC conductive charging, Low power Charger, Automotive standard charger, High power topologies, Multi-port Charger. Charging Modes
Module 2	Power Electronics for EV Battery Charging Forward/ Flyback Converters, Half-Bridge DC–DC Converter, Full-Bridge DC–DC Converter, Power Factor Correction, Bidirectional Battery Chargers, Dual active bridge dc-dc converter, Solar charging station.
Module 3	Charging Infrastructure Charger - Existing National & International Charger Architecture Standards - SAE J1773, VDE-AR-E 2623-2-2, JEVS G105-1993 (CHAdeMO), CCS, Type-1 AC, Type-2 AC, Bharat DC-001, Bharat AC-001. Cords and Cables, Earthing, Fault Protection, Testing, Charging Safety, Protection against electric shock, Digital Communication between EV and Charging Station.
Module 4	Installation: Govt. of India guideline on Public Charging Stations, IEC Standards- 60068-2(1, 2, 14, 30), 61683, 60227, 60502, 60947 part I,II, III and 61215. Site assessment, EVSE Typical Site Plans, Design Guidelines and Site Drawings, Planning Considerations, Station Configuration, Selection and erection of electrical equipment - Isolation, switching and control.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Power Electronics	Daniel W. Hart	McGrawHill	2010
2	Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications	Haitham Abu-Rub (editor), Mariusz Malinowski (editor), Kamal Al-Haddad (editor)	Wiley	2014

3	Electric Vehicle Integration via Smart Charging: Technology, Standards, Implementation, and Applications	Vahid Vahidinasab, Behnam Mohammadi-Ivatloo	Springer	2022
4	Battery Management Systems for Large Lithium Battery Packs	Davide Andrea	Artech House Publishers; Unabridged edition	2010
5	Developing Charging Infrastructure and Technologies for Electric Vehicles	Mohammad Saad Alam, Reji Kumar Pillai, N. Murugesan.	Business Science Reference	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MathWorks Certified MATLAB Associate	MATLAB	Y	ONLINE	MATHWORKS	https://www.mathworks.com/services/training/certification/matlab-associate.html
2	Cadence EDA tools	Cadence	Y	ONLINE	Cadence	https://www.cadence.com/en/training

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MATHWORKS	Commercial
2	PSPIC	ORCAD/Cadence	Both

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments and Book (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise + Continuous Skill evaluation	5+5	
In-Sem Summative	In-Sem Exam I	12	36
	In-Sem Exam II	12	
	In Semester Exam (Lab + Skilling)	6+6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab + Skill End Exam	8+8	

CHARGING STATION FOR ELECTRIC VEHICLE (CSEV)

COURSE CODE	22EME3304A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	ELM or ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To identify the charger topology of various electric vehicle and charging modes	3	2,1
CO2	To Analyze Power electronic converters for electric vehicle charging applications	4	2,5
CO3	To Analyze control of Fast charging station for EV	4	3
CO4	To Demonstrate installation of charging station	2	6,7
CO5	To Test power converters used for electric vehicle charging	4	4,5
CO6	To Analyze the converters and control algorithms using Matlab	4	3,5
CO7	To develop and test the EVSE and layouts using MATLAB & Pspice	4	5

Syllabus

Module 1	Charger Topologies Charging time and charging speed, Defining power levels- Normal charging, Semi-fast charging, Overview of power levels ,DC conductive charging, AC conductive charging, Low power Charger, Automotive standard charger, High power topologies, Multi-port
Module 2	Charger. Charging Modes Constant-current charging, Constant-voltage charging, Pulse Charging, Reflex charging, Float charge, Trickle Charge, Load management at charging station and peak load management.
Module 3	Power Electronics for EV Battery Charging Forward/ Flyback Converters, Half-Bridge DC–DC Converter, Full-Bridge DC–DC Converter, Power Factor Correction, Bidirectional Battery Chargers, Dual active bridge dc-dc converter, Solar charging station.
Module 4	Charging Infrastructure Charger - Existing National & International Charger Architecture Standards - SAE J1773, VDE-AR-E 2623-2-2, JEVS G105-1993 (CHAdeMO), CCS, Type-1 AC, Type-2 AC, Bharat DC-001, Bharat AC-001. Cords and Cables, Earthing, Fault Protection, Testing, Charging Safety, Protection against electric shock, Digital Communication between EV and Charging Station.
Module 5	Installation: Govt. of India guideline on Public Charging Stations, IEC Standards- 60068-2(1, 2, 14, 30), 61683, 60227, 60502, 60947 part I,II, III and 61215. Site assessment, EVSE Typical Site Plans, Design Guidelines and Site Drawings, Planning Considerations, Station Configuration, Selection and erection of electrical equipment - Isolation, switching and control.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Power Electronics	Daniel W. Hart	McGrawHill	2010

2	Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications	Haitham Abu-Rub (editor), Mariusz Malinowski (editor), Kamal Al-Haddad (editor)	Wiley	2014
3	Electric Vehicle Integration via Smart Charging: Technology, Standards, Implementation, and Applications	Vahid Vahidinasab, Behnam Mohammadi-Ivatloo	Springer	2022
4	Battery Management Systems for Large Lithium Battery Packs	Davide Andrea	Artech House Publishers; Unabridged edition	2010
5	Developing Charging Infrastructure and Technologies for Electric Vehicles	Mohammad Saad Alam, Reji Kumar Pillai, N. Murugesan.	Business Science Reference	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MathWorks Certified MATLAB Associate	MATLAB	Y	ONLINE	MATH WORKS	https://www.mathworks.com/services/training/certification/matlab-associate.html
2	Cadence EDA tools	Cadence	Y	ONLINE	Cadence	https://www.cadence.com/en/training

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MATHWORKS	Commercial
2	PSPICE	ORCAD/Cadence	Both

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments and Book (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise / Continuous Skill evaluation	5+5	
In-Sem Summative	In-Sem Exam I	12	36
	In-Sem Exam II	12	
	In Semester Exam (Lab + Skilling)	6+6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab + Skill End Exam	8+8	

CHARGING STATION FOR ELECTRIC VEHICLE (CSEV)

COURSE CODE	22EME3304P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	ELM or ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To identify the charger topology of various electric vehicle and charging modes	3	2,1
CO2	To Analyze Power electronic converters for electric vehicle charging applications	4	2,5
CO3	To Analyze control of Fast charging station for EV	4	3
CO4	To Demonstrate installation of charging station	2	6,7
CO5	To Test power converters used for electric vehicle charging	4	4,5
CO6	To Analyze the converters and control algorithms using Matlab	4	3,5
CO7	To develop and test the EVSE and layouts using MATLAB & Pspice	4	5

Syllabus

Module 1	Charger Topologies Charging time and charging speed, Defining power levels- Normal charging, Semi-fast charging, Overview of power levels ,DC conductive charging, AC conductive charging, Low power Charger, Automotive standard charger, High power topologies, Multi-port
Module 2	Charger. Charging Modes Constant-current charging, Constant-voltage charging, Pulse Charging, Reflex charging, Float charge, Trickle Charge, Load management at charging station and peak load management.
Module 3	Power Electronics for EV Battery Charging Forward/ Flyback Converters, Half-Bridge DC–DC Converter, Full-Bridge DC–DC Converter, Power Factor Correction, Bidirectional Battery Chargers, Dual active bridge dc-dc converter, Solar charging station.
Module 4	Charging Infrastructure Charger - Existing National & International Charger Architecture Standards - SAE J1773, VDE-AR-E 2623-2-2, JEVS G105-1993 (CHAdeMO), CCS, Type-1 AC, Type-2 AC, Bharat DC-001, Bharat AC-001. Cords and Cables, Earthing, Fault Protection, Testing, Charging Safety, Protection against electric shock, Digital Communication between EV and Charging Station.
Module 5	Installation: Govt. of India guideline on Public Charging Stations, IEC Standards- 60068-2(1, 2, 14, 30), 61683, 60227, 60502, 60947 part I,II, III and 61215. Site assessment, EVSE Typical Site Plans, Design Guidelines and Site Drawings, Planning Considerations, Station Configuration, Selection and erection of electrical equipment - Isolation, switching and control.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Power Electronics	Daniel W. Hart	McGrawHill	2010

2	Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications	Haitham Abu-Rub (editor), Mariusz Malinowski (editor), Kamal Al-Haddad (editor)	Wiley	2014
3	Electric Vehicle Integration via Smart Charging: Technology, Standards, Implementation, and Applications	Vahid Vahidinasab, Behnam Mohammadi-Ivatloo	Springer	2022
4	Battery Management Systems for Large Lithium Battery Packs	Davide Andrea	Artech House Publishers; Unabridged edition	2010
5	Developing Charging Infrastructure and Technologies for Electric Vehicles	Mohammad Saad Alam, Reji Kumar Pillai, N. Murugesan.	Business Science Reference	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MathWorks Certified MATLAB Associate	MATLAB	Y	ONLINE	MATH WORKS	https://www.mathworks.com/services/training/certification/matlab-associate.html
2	Cadence EDA tools	Cadence	Y	ONLINE	Cadence	https://www.cadence.com/en/training

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MATHWORKS	Commercial
2	PSPICE	ORCAD/Cadence	Both

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	6	24
	Skill Continuous Evaluation	6	
	MOOCs Review	12	
In-Sem Summative	MOOCs Exam	16	36
	Practical In-Sem	10	
	Skill In-Sem	10	
End-Sem Summative	End-Sem Exam (MCQ based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

INTRODUCTION TO BATTERY MANAGEMENT SYSTEMS (IBMS)

COURSE CODE	23EME3405M	MODE	M	LTPS	3-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concepts of heat transfer to various electric and electronic systems requiring heat dissipation	3	PO1, PSO2
CO2	Apply different cooling techniques to microchannels, heat pipes and vapor chambers	3	PO1, PSO2
CO3	Apply various thermal management techniques in the fields of automobiles and electronics	3	PO1, PSO2
CO4	Analyze the Battery thermal management system and battery pack design	4	PO2, PSO2

Syllabus

Module 1	Thermal Management in Electronics -heat transfer modes, electronics packaging, contact and spreading resistances, heat sink design,
Module 2	Cooling Technologies thermal interface and phase change materials, active, passive, and novel air-cooling approaches, microchannels, jet impingement, immersion cooling, heat pipes, and vapor chambers, thermoelectric, Hybrid Thermal Management system, Air-cooled combine with Phase change material, Liquid cooled combine with phase change material, Heat pipe combines with phase change material.
Module 3	Applications of thermal management: avionics, data centres, mobile, internet of things, high-performance computing, automotive,
Module 4	Lithium-ion battery configuration and operation, Sources of heat in Lithium-ion battery, Lithium Ion- cell temperature ranges. Battery Thermal Management System (BTMS): Need of BTMS, Technologies of BTMS, Battery pack design, Lithium-ion chemistries, challenges of the battery pack,

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	THERMAL MANAGEMENT OF MICROELECTRONIC EQUIPMENT HEAT TRANSFER THEORY, ANALYSIS METHODS, AND DESIGN PRACTICES	L. T. Yeh, Ph.D., P.E. R. C.Chu	ASME PRESS NEW YORK	1997
2	The Handbook of Lithium-Ion Battery Pack Design Chemistry, Components, Types and Terminology	John Warner	Elsevier	2000
3	HANDBOOK ON BATTERY ENERGY STORAGE SYSTE	Yongping Zhai	ASIAN DEVELOPMENT BANK ASIAN	1996

			DEVELOPMENT BANK	
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	
5	Thermal Management of Electric Vehicle Battery Systems	Ibrahim Dinçer, Halil S. Hamut and Nader Javani	7 John Wiley & Sons Ltd. Published	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Battery thermal management and safety	ISIE INDIA	Y	Online	ISIE INDIA	https://isieindia.com/courses/battery-thermal-management-and-safety/
2	Lithium-ion battery modules packaging	IATA	Y	Online	IATA	https://www.iata.org/en/training/courses/shipping-lithium-batteries/tcgp52/en/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		
2	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	20	20
In-Sem Summative	MOOCs Exam	40	40
End-Sem Summative	End-Sem Exam (MCQ based)	40	40

INTRODUCTION TO BATTERY MANAGEMENT SYSTEMS (IBMS)

COURSE CODE	23EME3405MA	MODE	M	LTPS	4-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concepts of heat transfer to various electric and electronic systems requiring heat dissipation	3	PO1, PSO2
CO2	Apply different cooling techniques to microchannels, heat pipes and vapor chambers	3	PO1, PSO2
CO3	Apply various thermal management techniques in the fields of automobiles and electronics	3	PO1, PSO2
CO4	Analyze the Battery thermal management system and battery pack design	4	PO2, PSO2
CO5			

Syllabus

Module 1	Thermal Management in Electronics -heat transfer modes, electronics packaging, contact and spreading resistances, heat sink design,
Module 2	Cooling Technologies thermal interface and phase change materials, active, passive, and novel air-cooling approaches, microchannels, jet impingement, immersion cooling, heat pipes, and vapor chambers, thermoelectric, Hybrid Thermal Management system, Air-cooled combine with Phase change material, Liquid cooled combine with phase change material, Heat pipe combines with phase change material.
Module 3	Applications of thermal management: avionics, data centres, mobile, internet of things, high-performance computing, automotive,
Module 4	Lithium-ion battery configuration and operation, Sources of heat in Lithium-ion battery, Lithium Ion- cell temperature ranges. Battery Thermal Management System (BTMS): Need of BTMS, Technologies of BTMS, Battery pack design, Lithium-ion chemistries, challenges of the battery pack,
Module 5	

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	THERMAL MANAGEMENT OF MICROELECTRONIC EQUIPMENT HEAT TRANSFER THEORY, ANALYSIS METHODS, AND DESIGN PRACTICES	L. T. Yeh, Ph.D., P.E. R. C.Chu	ASME PRESS NEW YORK	1997

2	The Handbook of Lithium-Ion Battery Pack Design Chemistry, Components, Types and Terminology	John Warner	Elsevier	2000
3	HANDBOOK ON BATTERY ENERGY STORAGE SYSTE	Yongping Zhai	ASIAN DEVELOPMENT BANK	1996
4	Heat Transfer	Holman, J. P	McGraw-Hill Book Co	
5	Thermal Management of Electric Vehicle Battery Systems	Ibrahim Dinçer, Halil S. Hamut and Nader Javani	7 John Wiley & Sons Ltd. Published	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Battery thermal management and safety	ISIE INDIA	Y	Online	ISIE INDIA	https://isieindia.com/courses/battery-thermal-management-and-safety/
2	Lithium-ion battery modules packaging	IATA	Y	Online	IATA	https://www.iata.org/en/training/courses/shipping-lithium-batteries/tcgp52/en/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		
2	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	20	20
In-Sem Summative	MOOCs Exam	40	40
End-Sem Summative	End-Sem Exam (MCQ based)	40	40

BATTERY STATE ESTIMATION PENDING MOOCS

BATTERY STATE ESTIMATION PENDING MOOCSA

AI AND IOT FOR ELECTRICAL VEHICLES (AIEV)

COURSE CODE	22EME3507	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	ELM OR ET

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Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	understand the IoT devices and tools	2	-/2
CO2	Operate the cloud system Environment	3	1/2
CO3	Applying ML Techniques for Electric Vehicles	2	-/2
CO4	Applying AI techniques for EV Applications	3	3/2
CO5	Apply sensors and embedded programming for cloud data monitoring for electrical vehicle parameters	3	1/2

Syllabus

Module 1	IoT Devices and Enabling Technologies: Sensor Devices- temperature, vibration, irradiance, wind speed, PIR, proximity, current, voltage Controllers, Actuators, Networking and Communication Protocols, Data analytics using AI and ML for – smart cities, smart grid, smart building, electrical vehicles
Module 2	Cloud Computing: Basics-Cloud systems, Cloud computing protocols, Role of Web services, Deployment Models- Public, Community, Hybrid, Private Clouds, Cloud Analytics over Thingspeak, Google Firebase, AWS-console, Functions. Database Services-Relational DBMS, RDS Services
Module 3	AI and ML on Cloud: Data Pre-processing techniques in Machine Learning, Data-handling, importing libraries, Data pre-processing using python, Missing data, Categorical Data. Regression and Classification algorithms in ML. Cloud based Real-time Monitoring systems, M2M communications
Module 4	Case Studies Applications: Electric Vehicle Battery state estimation, health monitoring, SOL determination, Power management, Charging optimization and Electric Drive applications, Online vehicle Assistance

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligent Techniques for Electric and Hybrid Electric Vehicles	Chitra A., P. Sanjeevikumar	(Apress)	2020
2	Internet of Things An Application Based approach Using Arduino Platform and Firebase	SOURAV KUMAR BHOI	Independently published	May 31, 2018
3	Hybrid Electric Vehicles-Principles and Applications with practical perspectives	Chris Mi, M. Abdul Masrur and David Wenzhong Gao	(Apress)	2018

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		Global Industrial Cyber Security Professional Certification (GICSP)	Y	online		https://www.giac.org/certifications/global-industrial-cyber-security-professional-gicsp/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	TINKERCAD	AutoDESK	OPENSOURCE
2	NI Multisim	National Instruments	FREE STUDENT VERSION

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	lab weekly exercise	7	
In-Sem Summative	In Sem 1	15	38
	In Sem 2	15	
	Lab IN semester	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab end sem	16	

EV SYSTEMS AND WIRING DESIGN - EVWD

COURSE CODE	22EME3508	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	ELM or ET

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply CATIA and AutoCAD tools for EV system wiring.	3	1,7
CO2	Understand the wiring routing and optimal weights of wiring.	2	3,4
CO3	Understand the electrical connections and safety consideration for EV	2	3,4
CO4	Apply the concept of BMS and thermal management of EV	3	7 & 1
CO5	Demonstrate AutoCAD and CATIA tools for EV wiring, routing and connections.	4	7 & 1

Syllabus

Module 1	Catia V5 and Electrical AutoCAD: 3D model of a wiring harness - 2D harness drawing using Electrical AutoCAD - different wires and cables, connectors, splices, and other components, wire colors, labels, installation, and maintenance
Module 2	Wire routing and optimization: Routing methods and strategies, shortest path, most direct path, and optimal path methods, Electromagnetic compatibility, wire routing affects the electromagnetic compatibility (EMC), routing optimization, reduce weight and space
Module 3	Electrical connections: and splices- Types of electrical connections, Crimping tools, and techniques, Soldering techniques, Wire splicing methods. Safety considerations: insulation, grounding, and protection against electrical shock and fire.
Module 4	High-Voltage Wiring, special wiring and connectors, Battery Management System (BMS), Power Electronics circuit connections, Thermal Management, safe temperature range.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	AutoCAD Electrical Essential Training	Shaun Bryant	linkedin	2015
2	Introduction to CATIA V6	Kirstie Plantenburg	SDC Publications	2014
3	AutoCAD Electrical 16 Black Book	Gaurav Verma, Matt Weber	CADCAMCAE Works, USA	2015
4	Bosch Professional Automotive Information	Robert Bosch GmbH-Editors	Robert Bosch GmbH	2007
5	AUTOMOTIVE HANDBOOK	R Bosch GmbH Editors	R Bosch GmbH	2022

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Autodesk Certified Professional: AutoCAD Electrical (ACP-AE)	AUTODESK	Y	ONLINE	AUTODESK	https://www.autodesk.com/certification/overview
2	CATIA	Dassault Systèmes Certification	Y	ONLINE	Dassault Systèmes	

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	AutoCAD Electrical	AUTODESK	Commercial
2	CATIA	Dassault Systèmes	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning (LTC, in-class Quiz, etc.)	8	2
	Home Assignments and Book (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam I	15	38
	In-Sem Exam II	15	
	In Semester Exam Lab	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Exam	16	

SMART MANUFACTURING SPECIALIZATION (SMF)

MACHINE TO MACHINE COMMUNICATIONS (MMC)

COURSE CODE	23SMF3101R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	Data Communications

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Identify the main challenges associated with M2M and sensors	3	PO1, PO2
CO2	Understand main standards, protocols, algorithms, and research activities for machine to machine communication with sensors	3	PO1, PO3
CO3	Apply standards/protocols to develop machine to machine communication and to understand Hardware interfaces in a sensor network	4	PO1, PO4

Syllabus

Module 1	Introduction to M2M; M2M Current Landscape; Early implementations and deployment of M2M communications. M2M Architecture and Protocols –M2M Requirements and High Level Architectural Principles.
Module 2	High Level Architecture Principles for M2M Communications. M2M Service Architectures – High Level Service Architecture; ETSI TC M2M Service Capabilities Framework, M2M service Capabilities, M2M Resource based M2M Commuication and Procedures.
Module 3	M2M Terminals and Modules – Hardware Interfaces – Power, USB, UART, Antenna, UICC, GPIO, SPI, I2C, ADC, PCM, PWM

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	M2M Communications - A System Approach	D. Boswarthick, O. Elloumi, and O. Hersent	Wiley	2012
2	Machine-to-Machine (M2M) Communications- Architecture, Performance and Applications	C. Anton-Haro, M. Dohler	Woodhead Publishing ISBN 978-1-78242-102-3	2015
3	Building the Internet of Things with IPv6 and MIPv6 The Evolving World of M2M Communications	D. Minoliauth	Wiley	2013
4	Machine-to-Machine CommunicationsArchitectures, Technology, Standards, and Applications	Vojislav B. Misic, Jelena Misic	CRC Press	2015
5	M2M Communications: A SYSTEMS APPROACH	David Boswarthick, Omar Elloumi, Olivier Hersent	John Wiley & Sons, Ltd	2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		Telcoma			Telcoma	https://telcomaglobal.com/p/5g-machine-to-machine-communications-training-course-certification-m2m
2		Tonex			Tonex	https://www.tonex.com/training-courses/m2m/
3	LoRa Alliance			Multiple choice questions		https://accredited-professional.lora-alliance.org/courses/exam
4	ISA/IEC 62443	SIEMENS				https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity/fields-of-application.html?gclid=Cj0KCQjw7uSkBhDGARIsAMCZNJuGGjiJ-pGVPQ8VZPSIlSBhzhXZrbJ_bD8NGYQmV2obJp_sOem4YkUaAqlZEALw_wcB&acz=1
4		CC-Link Partner Association				https://www.cc-link.org/en/
5	CCNA IOT	Cisco				https://developer.cisco.com/certification/devnet-iot/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	5	22
	Home Assignments	5	
	Practical Continuous Evaluation	6	
	Skill Continuous Evaluation	6	
In-Sem Summative	In Sem 1	10	38
	In Sem 2	10	
	Practical In sem	8	
	Skill in Sem	10	
End-Sem Summative	Lab End Sem	16	
	End Sem Exam (MCQ Based)	24	

MACHINE TO MACHINE COMMUNICATIONS (MMC)

COURSE CODE	23SMF3101A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	Data Communications

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Identify the main challenges associated with M2M and sensors	3	PO1, PO2
CO2	Understand main standards, protocols, algorithms, and research activities for machine to machine communication with sensors	3	PO1, PO3
CO3	Apply standards/protocols to develop machine to machine communication and to understand Hardware interfaces in a sensor network	4	PO1, PO4
CO4	Anlyze the protocols and standards for their implementation	4	PO1, PO5
CO5	Establish the communication between machine to machine using protocols and standards of communication	5	PO1, PO
CO6	Deployment and analyse the communication protocols using software	5	PO1, PO5

Syllabus

Module 1	Introduction to M2M; M2M Current Landscape; Early implementations and deployment of M2M communications
Module 2	M2M Architecture and Protocols –M2M Requirements and High Level Architectural Principles. High Level Architecture Principles for M2M Communications
Module 3	M2M Service Architectures – High Level Service Architecture; ETSI TC M2M Service Capabilities Framework, M2M service Capabilities, M2M Resource based M2M Commuication and Procedures.
Module 4	M2M Terminals and Modules – Hardware Interfaces – Power, USB, UART, Antenna, UICC, GPIO, SPI, I2C, ADC, PCM, PWM and Analog Audio, Service, Software Interface. Smart Cards in M2M Communication
Module 5	Smart Cards in M2M Communication Security and Privacy issues in M2M communication, hardware based security solutions, Smart Card Properties for M2M environments

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	M2M Communications - A System Approach	D. Boswarthick, O. Elloumi, and O. Hersent	Wiley	2012
2	Machine-to-Machine (M2M) Communications- Architecture, Performance and Applications	C. Anton-Haro, M. Dohler	Woodhead Publishing ISBN 978-1-78242-102-3	2015
3	Building the Internet of Things with IPv6 and MIPv6 The Evolving World of M2M Communications	D. Minoliauth	Wiley	2013

4	Machine-to-Machine CommunicationsArchitectures, Technology, Standards, and Applications	Vojislav B. Misic, Jelena Misic	CRC Press	2015
5	M2M Communications: A SYSTEMS APPROACH	David Boswarthick, Omar Elloumi, Olivier Hersent	John Wiley & Sons, Ltd	2012
6	Smart Card Handbook	Wolfgang Rankl, Wolfgang Effing	John Wiley & Sons,	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		Telcoma			Telcoma	https://telcomaglobal.com/p/5g-machine-to-machine-communications-training-course-certification-m2m
2		Tonex			Tonex	https://www.tonex.com/training-courses/m2m/
3	LoRa Alliance			Multiple choice questions		https://accredited-professional.lora-alliance.org/courses/exam
4	ISA/IEC 62443	SIEMENS				https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity/fields-of-application.html?gclid=Cj0KCQjw7uSkBhDGARIsAMCZNJuGGjiJ-pGVPQ8VZPSIlSBhzhXZrbJ_bD8NGYQmV2obJp_sOem4YkUaAqlZEALw_wcB&acz=1
4		CC-Link Partner Association				https://www.cc-link.org/en/
5	CCNA IOT	Cisco				https://developer.cisco.com/certification/devnet-iot/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Arduino, Raspberry Pi, and BeagleBone. These boards often have built-in connectivity options like Wi-Fi, Bluetooth, or cellular modules		

2	Simulator tool like COOja (Contiki Network Simulator) OMNeT++ (Discete Event Simulation Framework) Cisco Packet Tracer	Open Source, OpenSim Ltd, Cisco	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	5	22
	Home Assignments	5	
	Practical Continuous Evaluation	6	
	Skill Continuous Evaluation	6	
In-Sem Summative	In Sem 1	10	38
	In Sem 2	10	
	Practical In sem	8	
	Skill in Sem	10	
End-Sem Summative	End sem Lab exam	16	40
	End Sem Exam (MCQ Based)	24	

MACHINE TO MACHINE COMMUNICATIONS (MMC)

COURSE CODE	23SMF3101P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	Data Communications

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Identify the main challenges associated with M2M and sensors	3	PO1, PO2
CO2	Understand main standards, protocols, algorithms, and research activities for machine to machine communication with sensors	3	PO1, PO3
CO3	Apply standards/protocols to develop machine to machine communication and to understand Hardware interfaces in a sensor network	4	PO1, PO4
CO4	Anlyze the protocols and standards for their implementation	4	PO1, PO5
CO5	Establish the communication between machine to machine using protocols and standards of communication	5	PO1, PO
CO6	Deployment and analyse the communication protocols using software	5	PO1, PO5

Syllabus

Module 1	Introduction to M2M; M2M Current Landscape; Early implementations and deployment of M2M communications
Module 2	M2M Architecture and Protocols –M2M Requirements and High Level Architectural Principles. High Level Architecture Principles for M2M Communications
Module 3	M2M Service Architectures – High Level Service Architecture; ETSI TC M2M Service Capabilities Framework, M2M service Capabilities, M2M Resource based M2M Commuication and Procedures.
Module 4	M2M Terminals and Modules – Hardware Interfaces – Power, USB, UART, Antenna, UICC, GPIO, SPI, I2C, ADC, PCM, PWM and Analog Audio, Service, Software Interface. Smart Cards in M2M Communication
Module 5	Smart Cards in M2M Communication Security and Privacy issues in M2M communication, hardware based security solutions, Smart Card Properties for M2M environments

Reference Books:

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2	Machine-to-Machine (M2M) Communications- Architecture, Performance and Applications	C. Anton-Haro, M. Dohler	Woodhead Publishing ISBN 978-1-78242-102-3	2015
3	Building the Internet of Things with IPv6 and MIPv6 The Evolving World of M2M Communications	D. Minoliauth	Wiley	2013

4	Machine-to-Machine CommunicationsArchitectures, Technology, Standards, and Applications	Vojislav B. Misic, Jelena Misic	CRC Press	2015
5	M2M Communications: A SYSTEMS APPROACH	David Boswarthick, Omar Elloumi, Olivier Hersent	John Wiley & Sons, Ltd	2012
6	Smart Card Handbook	Wolfgang Rankl, Wolfgang Effing	John Wiley & Sons,	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		Telcoma			Telcoma	https://telcomaglobal.com/p/5g-machine-to-machine-communications-training-course-certification-m2m
2		Tonex			Tonex	https://www.tonex.com/training-courses/m2m/
3	LoRa Alliance			Multiple choice questions		https://accredited-professional.lora-alliance.org/courses/exam
4	ISA/IEC 62443	SIEMENS				https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity/fields-of-application.html?gclid=Cj0KCQjw7uSkBhDGARIsAMCZNJuGGjiJ-pGVPQ8VZPSIlSBhzhXZrbJ_bD8NGYQmV2obJp_sOem4YkUaAqlZEALw_wcB&acz=1
4		CC-Link Partner Association				https://www.cc-link.org/en/
5	CCNA IOT	Cisco				https://developer.cisco.com/certification/devnet-iot/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Arduino, Raspberry Pi, and BeagleBone. These boards often have built-in connectivity options like Wi-Fi, Bluetooth, or cellular modules		

2	Simulator tool like COOja (Contiki Network Simulator) OMNeT++ (Discete Event Simulation Framework) Cisco Packet Tracer	Open Source, OpenSim Ltd, Cisco	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	10	20
	MOOC Review	10	
In-Sem Summative	MOOC’s Exam	40	40
End-Sem Summative	End Sem Exam (MCQ Based)	20	40
	MOOC’s Exam	20	

ADVANCED MATERIALS MANUFACTURING & TESTING (AMMT)

COURSE CODE	23ME3272	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand various types of materials involved in manufacturing Composites.	2	PO1, PSO1
CO2	Apply the principles of Bio, Smart and microelectronic materials to societal needs	2	PO1, PSO1
CO3	Analyze the properties of various functionally graded materials and their applications.	3	PO1, PSO1
CO4	Synthesis and fabrication methods of nanomaterial and study of characterisation techniques.	3	PO1, PSO1

Syllabus

Module 1	ENGINEERING MATERIALS: Introduction INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: Polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber- reinforced composites and nature-made composites, and applications. MANUFACTURING & TESTING METHODS: Hand layup, spray-up, filament winding, pultrusion, moulding method, RTM, Rule of mixtures
Module 2	BIO MATERIALS: Introduction, properties, applications, Biocompatibility, classification. SMART MATERIALS: Introduction-shape memory effect- classification of shape memory alloys-composition-properties and applications of shape memory alloys. MICROELECTRONIC MATERIALS: Introduction, properties of Silicon, silicon wafer production, Lithography technique.
Module 3	FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification-different systems-preparation-properties and applications of functionally graded materials. NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (nano – structure, wires, tubes, composites).
Module 4	Elements of Nanoscience and Nanotechnology: Synthesis of nanomaterials, fabrication and characterization of nanostructures, applications. Material processing by chemical vapor deposition and physical vapor deposition–Principle of SEM, TEM, AFM. Materials Characterisation: X-ray diffraction, Neutron diffraction and Electron diffraction–X-ray fluorescence spectroscopy–Fourier transform Infrared spectroscopy (FTIR)–Ultraviolet and visible spectroscopy (UV-Vis)–Thermogravimetric Analysis (TGA)–Differential Thermal Analysis (DTA)–Differential Scanning Calorimetry (DSC).

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechanics of Composite Materials	R. M. Jones	Prentice-Hall of India	2015

2	Analysis of Laminated Composite Structures	AutarK.Kaw	Butterworth-Heinemann	2016
3	Analysis and performance of fibre Composites	B. D. Agarwal and L. J. Broutman	Univ Pr of the Pacific	2020
4	Mechanics of Composite Materials	Autar K.Kaw	Prentice-Hall of India	2021
5				

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Materials Scientist (CMS)	American Association of Materials Engineers (AAME)	Y	Online proctored examination	AAME	https://www.aame.org/certifications/certified-materials-scientist-cms/
2	Advanced Materials Manufacturing & Testing Professional (AMMTP)	International Association of Advanced Materials (IAAM) Proctored (Y/N): Yes	Y	Online proctored examination	IAAM	https://www.iaamonline.org/certification/advanced-materials-manufacturing-testing-professional-ammtp/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Scanning Electron Microscope (SEM)	Materials Science and Engineering	Commercial
2	Universal Testing Machine (UTM)	Materials Testing and Quality Control	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignments and text book	10	
In-Sem Summative	In sem-1	20	20
	In Sem-2	20	
End-Sem Summative	End Sem Exam	40	40

MODERN MANUFACTURING PROCESSES (MMP)

COURSE CODE	22SMF3203	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	22MR2208 (MP)

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the fundamental concepts of modern manufacturing processes based on sources of energy.	2	PO1 PO2 + PSO1
CO2	Identify and analyse mechanical energy-based machining processes, and evaluate their advantages, limitations and applications.	4	PO1 PO2 + PSO1
CO3	Describe chemical energy-based machining processes and evaluate their advantages, limitations, and applications.	3	PO1 PO2 + PSO1
CO4	Explain and analyse the principles and applications of thermoelectric energy-based machining processes.	4	PO1 PO2 + PSO1

Syllabus

Module 1	Modern Manufacturing Processes: Introduction, Need for modern manufacturing processes. Classification of modern machining processes based on sources of energy. Mechanical energy-based machining processes: Principle, Equipment, Process parameters, Advantages, limitations and applications of Abrasive jet machining, water jet machining, ultrasonic machining.
Module 2	Chemical energy-based machining processes: Principle, Equipment, Process parameters, Advantages, limitations and applications of Chemical machining, Electro-chemical machining, Electro-chemical deburring and Electro chemical honing. Thermoelectric energy-based machining processes: Principle, Equipment, Process parameters, Advantages, limitations and applications of Electric discharge machining, Wire-electric discharge machining, electric discharge grinding, laser beam machining, plasma arc machining, electron beam Machining.
Module 3	Non-traditional welding processes: Principle, Equipment, Process parameters, Advantages, limitations and applications of Laser beam welding, Plasma arc welding, Electron beam welding, Ultrasonic welding, Friction welding, Explosive welding and Under water welding.
Module 4	Non-traditional Forming processes: Methods, advantages, limitations and applications of Explosion Forming Process, Electro Hydraulic Forming, Magnetic Pulse Forming, Petro-Forge Hammer.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modern Machining Processes: Advanced Manufacturing	J. Paulo Davim	Springer	
2	Nontraditional Manufacturing Processes: Manufacturing Engineering and Materials Processing	Bradley L. Prevost, George W. Woodruff	CRC Press	

3	Machining and Machine-tools: Research and Development	J. Paulo Davim	Springer	
4	Nontraditional Machining Handbook	E. Paul DeGarmo, J. Temple Black, Ronald A. Kohser	CRC Press	
5	Welding and Other Joining Processes	Steven R. Schmid	Pearson	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Modern Manufacturing Processes	SME	Yes	Online	Prometric	https://www.sme.org/certification/mfgtech/
2	Manufacturing Technology	AWS	Yes	Online	PSI	https://www.aws.org/certification/CW

Tools used in Practical / Skill: N A

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

SUSTAINABLE DESIGN & SOCIAL INNOVATION IN SMART MANUFACTURING (SDSISM)

COURSE CODE	22SMF3304R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the principles of Design Thinking and apply them to foster sustainable design and social innovation in smart manufacturing.	2	PO1, PO2, PSO1
CO2	Conduct user research and stakeholder analysis to identify sustainability challenges and user needs in smart manufacturing environments.	3	PO1, PO2, PSO1
CO3	Generate creative ideas and develop sustainable design solutions that address social and environmental issues in smart manufacturing.	3	PO1, PO2, PSO1
CO4	Prototype and test design concepts using rapid prototyping methods and iterate based on user feedback.	4	PO1, PO6, PSO1
CO5	Evaluate the social impact and sustainability aspects of design solutions in smart manufacturing.	6	PO1, PO6, PSO1
CO6	Gain hands on experience on 3D Modelling software as Fusion 360 and hardware such as 3D modelling	6	PO1, PO6, PSO1

Syllabus

Module 1	Introduction to Design Thinking in Sustainable Design and Social Innovation • Understanding the principles and methodology of Design Thinking • Exploring the role of Design Thinking in fostering sustainable design and social innovation in smart manufacturing Case studies highlighting successful applications of Design Thinking in sustainability-driven projects
Module 2	Empathizing and Defining for Sustainable Design • Conducting user research and stakeholder analysis to understand sustainability challenges and user needs • Defining problem statements and identifying design opportunities for sustainable design solutions Applying human-centered design approaches to address social and environmental issues in smart manufacturing
Module 3	Ideation and Prototyping for Social Innovation • Generating creative ideas through brainstorming and ideation techniques • Rapid prototyping methods for testing and validating sustainable design concepts Integrating social innovation principles to address community needs and enhance social impact
Module 4	Testing and Iterating Sustainable Design Solutions • User-centered testing methods for evaluating the effectiveness of sustainable design solutions • Iterative design process and feedback-driven improvement of prototypes

	Assessing the social, environmental, and economic impact of sustainable design interventions
Module 5	Implementation of Sustainable Design Solutions • Strategies for successful implementation of sustainable design solutions in smart manufacturing settings
Module 6	Gain hands on experience on various software and hardware tools for conceptual prototyping

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Sustainability in engineering design	Johnson, A., & Gibson, A.	Prentice-Hall of India	2015
2	Smart Manufacturing: When Artificial Intelligence Meets the Internet of Things	Kheng, T. Y. (Ed.).	Butterworth-Heinemann	2016
3	Social innovation: combining profits and progress. In Social Innovation and Sustainable Entrepreneurship	Tietz, M. A., Abdelgawad, S. G. S., & Pasquini, M.	Univ Pr of the Pacific	2020
4	Industry 4.0—from Smart Factory to Cognitive Cyber-physical Production System and Cloud Manufacturing	Mladineo, M.	MDPI Energies	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Sustainable Design and Social Innovation Professional in Smart Manufacturing (CSDSI-PM)	Global Association of Sustainable Design and Innovation (GASDI)	Y	Online proctored examination	GASDI	https://www.gasdi.org/certification/certified-sustainable-design-and-social-innovation-professional-in-smart-manufacturing-csdsi-pm/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Life Cycle Assessment (LCA)	Sustainability and Environmental Management	Open source software like OpenLCA and commercial tools like SimaPro are commonly used for conducting LCA

2	Smart Manufacturing Systems	Manufacturing and Industrial Automation	Commercial. Various software systems and platforms, such as Manufacturing Execution Systems (MES) and Industrial Internet of Things (IIoT) platforms, are used for implementing smart manufacturing practices.

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1 (Presentation)	12	36
	In-Sem 2 (Presentation)	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	Project Demonstration	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

SUSTAINABLE DESIGN & SOCIAL INNOVATION IN SMART MANUFACTURING (SDSISM)

COURSE CODE	22SMF3304A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the principles of Design Thinking and apply them to foster sustainable design and social innovation in smart manufacturing.	2	PO1, PO2, PSO1
CO2	Conduct user research and stakeholder analysis to identify sustainability challenges and user needs in smart manufacturing environments.	3	PO1, PO2, PSO1
CO3	Generate creative ideas and develop sustainable design solutions that address social and environmental issues in smart manufacturing.	3	PO1, PO2, PSO1
CO4	Prototype and test design concepts using rapid prototyping methods and iterate based on user feedback.	4	PO1, PO6, PSO1
CO5	Evaluate the social impact and sustainability aspects of design solutions in smart manufacturing.	6	PO1, PO6, PSO1
CO6	Gain hands on experience on 3D Modelling software as Fusion 360 and hardware such as 3D modelling	6	PO1, PO6, PSO1
CO7	Communicate and present design concepts effectively, showcasing the value of sustainable design and social innovation in smart manufacturing.	6	PO1, PO7, PSO1

Syllabus

Module 1	Introduction to Design Thinking in Sustainable Design and Social Innovation • Understanding the principles and methodology of Design Thinking • Exploring the role of Design Thinking in fostering sustainable design and social innovation in smart manufacturing • Case studies highlighting successful applications of Design Thinking in sustainability-driven projects
Module 2	Empathizing and Defining for Sustainable Design • Conducting user research and stakeholder analysis to understand sustainability challenges and user needs • Defining problem statements and identifying design opportunities for sustainable design solutions • Applying human-centered design approaches to address social and environmental issues in smart manufacturing
Module 3	Ideation and Prototyping for Social Innovation • Generating creative ideas through brainstorming and ideation techniques • Rapid prototyping methods for testing and validating sustainable design concepts • Integrating social innovation principles to address community needs and enhance social impact

Module 4	Testing and Iterating Sustainable Design Solutions • User-centered testing methods for evaluating the effectiveness of sustainable design solutions • Iterative design process and feedback-driven improvement of prototypes • Assessing the social, environmental, and economic impact of sustainable design interventions
Module 5	Implementation of Sustainable Design Solutions • Strategies for successful implementation of sustainable design solutions in smart manufacturing settings
Module 6	Gain hands on experience on various software and hardware tools for conceptual prototyping
Module 7	Scaling of Sustainable Design Solutions • Scaling up solutions to achieve broader social and environmental impact • Considerations for stakeholder engagement, collaboration, and system-level thinking in sustainable design initiatives

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Sustainability in engineering design	Johnson, A., & Gibson, A.	Prentice-Hall of India	2015
2	Smart Manufacturing: When Artificial Intelligence Meets the Internet of Things	Kheng, T. Y. (Ed.).	Butterworth-Heinemann	2016
3	Social innovation: combining profits and progress. In Social Innovation and Sustainable Entrepreneurship	Tietz, M. A., Abdelgawad, S. G. S., & Pasquini, M.	Univ Pr of the Pacific	2020
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Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Sustainable Design and Social Innovation Professional in Smart Manufacturing (CSDSI-PM)	Global Association of Sustainable Design and Innovation (GASDI)	Y	Online proctored examination	GASDI	https://www.gasdi.org/certification/certified-sustainable-design-and-social-innovation-professional-in-smart-manufacturing-csdsi-pm/
2						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Life Cycle Assessment (LCA)	Sustainability and Environmental Management	Open source software like OpenLCA and commercial tools like SimaPro are commonly used for conducting LCA
2	Smart Manufacturing Systems	Manufacturing and Industrial Automation	Commercial. Various software systems and platforms, such as Manufacturing Execution Systems (MES) and Industrial Internet of Things (IIoT) platforms, are used for implementing smart manufacturing practices.

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1 (Presentation)	12	36
	In-Sem 2 (Presentation)	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	Project Demonstration	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

SUSTAINABLE DESIGN & SOCIAL INNOVATION IN SMART MANUFACTURING (SDSISM)

COURSE CODE	22SMF3304P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the principles of Design Thinking and apply them to foster sustainable design and social innovation in smart manufacturing.	2	PO1, PO2, PSO1
CO2	Conduct user research and stakeholder analysis to identify sustainability challenges and user needs in smart manufacturing environments.	3	PO1, PO2, PSO1
CO3	Generate creative ideas and develop sustainable design solutions that address social and environmental issues in smart manufacturing.	3	PO1, PO2, PSO1
CO4	Prototype and test design concepts using rapid prototyping methods and iterate based on user feedback.	4	PO1, PO6, PSO1
CO5	Evaluate the social impact and sustainability aspects of design solutions in smart manufacturing.	6	PO1, PO6, PSO1
CO6	Gain hands on experience on 3D Modelling software as Fusion 360 and hardware such as 3D modelling	6	PO1, PO6, PSO1
CO7	Communicate and present design concepts effectively, showcasing the value of sustainable design and social innovation in smart manufacturing.	6	PO1, PO7, PSO1

Syllabus

Module 1	Introduction to Design Thinking in Sustainable Design and Social Innovation • Understanding the principles and methodology of Design Thinking • Exploring the role of Design Thinking in fostering sustainable design and social innovation in smart manufacturing • Case studies highlighting successful applications of Design Thinking in sustainability-driven projects
Module 2	Empathizing and Defining for Sustainable Design • Conducting user research and stakeholder analysis to understand sustainability challenges and user needs • Defining problem statements and identifying design opportunities for sustainable design solutions • Applying human-centered design approaches to address social and environmental issues in smart manufacturing
Module 3	Ideation and Prototyping for Social Innovation • Generating creative ideas through brainstorming and ideation techniques • Rapid prototyping methods for testing and validating sustainable design concepts • Integrating social innovation principles to address community needs and enhance social impact
Module 4	Testing and Iterating Sustainable Design Solutions • User-centered testing methods for evaluating the effectiveness of sustainable design solutions

	• Iterative design process and feedback-driven improvement of prototypes • Assessing the social, environmental, and economic impact of sustainable design interventions
Module 5	Implementation of Sustainable Design Solutions • Strategies for successful implementation of sustainable design solutions in smart manufacturing settings
Module 6	Gain hands on experience on various software and hardware tools for conceptual prototyping
Module 7	Scaling of Sustainable Design Solutions • Scaling up solutions to achieve broader social and environmental impact • Considerations for stakeholder engagement, collaboration, and system-level thinking in sustainable design initiatives

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Sustainability in engineering design	Johnson, A., & Gibson, A.	Prentice-Hall of India	2015
2	Smart Manufacturing: When Artificial Intelligence Meets the Internet of Things	Kheng, T. Y. (Ed.).	Butterworth-Heinemann	2016
3	Social innovation: combining profits and progress. In Social Innovation and Sustainable Entrepreneurship	Tietz, M. A., Abdelgawad, S. G. S., & Pasquini, M.	Univ Pr of the Pacific	2020
4	Industry 4.0—from Smart Factory to Cognitive Cyber-physical Production System and Cloud Manufacturing	Mladineo, M.	MDPI Energies	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Sustainable Design and Social Innovation Professional in Smart Manufacturing (CSDSI-PM)	Global Association of Sustainable Design and Innovation (GASDI)	Y	Online proctored examination	GASDI	https://www.gasdi.org/certification/certified-sustainable-design-and-social-innovation-professional-in-smart-manufacturing-csdsi-pm/
2						

Tools used in Practical / Skill:

Sl	Tool Name	Parent Industry	Open Source/ Commercial

No			
1	Life Cycle Assessment (LCA)	Sustainability and Environmental Management	Open source software like OpenLCA and commercial tools like SimaPro are commonly used for conducting LCA
2	Smart Manufacturing Systems	Manufacturing and Industrial Automation	Commercial. Various software systems and platforms, such as Manufacturing Execution Systems (MES) and Industrial Internet of Things (IIoT) platforms, are used for implementing smart manufacturing practices.

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignments	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1 (Presentation)	12	36
	In-Sem 2 (Presentation)	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	Project Demonstration	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

ROBOTICS & INDUSTRIAL AUTOMATION (R & IA)

COURSE CODE	22SMF3405M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	Manufacturing Processes

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the role of robotics in Industrial Automation	2	PO1, PO3+PSO1
CO2	Apply the concepts of real time sensors used in Industrial automation	3	PO2, PO3+PSO1
CO3	Apply the concepts of Control strategies used in Industrial automation	3	PO2, PO3+PSO1
CO4	Apply the concept of PLC used in Industrial automation	3	PO2, PO3+PSO1

Syllabus

Module 1	Robotics in science fiction, industrial revolution, history and need of robotics, definition of a robot, robot terminology, types and applications of robot, overview of present status and future trends, Introduction to Industrial Automation and Control, Architecture of Industrial Automation Systems
Module 2	Measurement Systems Specifications, Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques, Measurement of Level, Humidity
Module 3	Introduction to Process Control, P-I-D Control, Controller Tuning, Implementation of P-I-D Controllers, Special Control Structures: Feedforward and Ratio Control, Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Split Range Control.
Module 4	Introduction to PLC, Need of PLC in Designing, Architecture of PLC, Application and Advantage of PLC, Automation Concept and Basic Design, PLC Programming.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Industrial Instrumentation, Control and Automation	S. Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House,	2013
2	Automation, Production Systems and Computer Integrated Manufacturing	Mikell Groover	Pearson Education	2009
3	Programmable Logic Controllers: Principles and Applications	John W. Webb and Ronald A. Rei	Prentice Hall Inc.	2003
4	Industrial Control Electronics Devices, Systems, & Applications	Terry Bartlet,	Delmar Publisher.	3rd Edition
5	Chemical Process Control, An Introduction to Theory and Practice	George Stephanopoulos	Prentice Hall India	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	PLC Automation systems	Siemens	Y	Objective	CCUBE	https://www.ccube.asia/plc_siemens_certification_centre.php
2	Industrial Automation with PLC & SCADA	National Institute of Electronics & Information Technology, Calicut	Y	Objective	NIELIT Calicut	https://www.nielit.gov.in/calicut/calicut/content/online-course-industrial-automation-plc-scada

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	Na

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem-1 (Test-1)	20	40
	In-Sem-2 (Test-2)	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40
	Total	100	100

ROBOTICS & INDUSTRIAL AUTOMATION (R & IA)

COURSE CODE	22SMF3405MA	MODE	A	LTPS	3-0-0-0	PRE-REQUISITE	Manufacturing Processes

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the role of robotics in Industrial Automation	2	PO1, PO3+PSO1
CO2	Apply the concepts of real time sensors used in Industrial automation	3	PO2, PO3+PSO1
CO3	Apply the concepts of Control strategies used in Industrial automation	3	PO2, PO3+PSO1
CO4	Apply the concept of PLC used in Industrial automation	3	PO2, PO3+PSO1

Syllabus

Module 1	Robotics in science fiction, industrial revolution, history and need of robotics, definition of a robot, robot terminology, types and applications of robot, overview of present status and future trends, Introduction to Industrial Automation and Control, Architecture of Industrial Automation Systems
Module 2	Measurement Systems Specifications, Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques, Measurement of Level, Humidity
Module 3	Introduction to Process Control, P-I-D Control, Controller Tuning, Implementation of P-I-D Controllers, Special Control Structures: Feedforward and Ratio Control, Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Split Range Control.
Module 4	Introduction to PLC, Need of PLC in Designing, Architecture of PLC, Application and Advantage of PLC, Automation Concept and Basic Design, PLC Programming.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Industrial Instrumentation, Control and Automation	S. Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House,	2013
2	Automation, Production Systems and Computer Integrated Manufacturing	Mikell Groover	Pearson Education	2009
3	Programmable Logic Controllers: Principles and Applications	John W. Webb and Ronald A. Rei	Prentice Hall Inc.	2003
4	Industrial Control Electronics Devices, Systems, & Applications	Terry Bartlet,	Delmar Publisher.	3rd Edition
5	Chemical Process Control, An Introduction to Theory and Practice	George Stephanopoulos	Prentice Hall India	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

1	PLC Automation systems	Siemens	Y	Objective	CCUBE	https://www.ccube.asia/plc_siemens_certification_centre.php
2	Industrial Automation with PLC & SCADA	National Institute of Electronics & Information Technology, Calicut	Y	Objective	NIELIT Calicut	https://www.nielit.gov.in/calicut/calicut/content/online-course-industrial-automation-plc-scada

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	Na

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem-1 (Test-1)	20	40
	In-Sem-2 (Test-2)	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40
	Total	100	100

MEASUREMENTS & INSTRUMENTATION (MI)

COURSE CODE	22SMF3406M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Explain the basics of standards of measurement, limits, fits & tolerances industrial applications. Identify the uses of gauges and comparators	2	PO1
CO2	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices	3	PO1
CO3	Interpret measurement of field variables like force, torque and pressure	2	PO1
CO4	Comprehend the fundamentals of thermocouple and strain measurement	4	PO1

Syllabus

Module 1	Definition – Introduction to measurements, Precision and accuracy, generalized configuration and functional descriptions of measuring instruments – examples. Errors in measurements – sources of error, Classification and elimination of error. Measurement of Displacement: Theory and construction of various transducers to measure displacement– Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures
Module 2	Measurement of Temperature: Classification – Ranges – Various Principles of measurement– Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers–Temperature Indicators. Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.
Module 3	Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators –Bubler level indicators. Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer(LDA). Measurement of Speed : Mechanical Tachometers – Electrical tachometers – Stroboscope, Non contact type of tachometer. Measurement of Acceleration and Vibration : Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle
Module 4	Stress Strain Measurements : Various types of stress and strain measurements – electricalstrain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive andtensile strains – usage for measuring torque, Strain gauge Rosettes. Measurement of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.Computer assisted data acquisition, data manipulation, data presentation.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Measurement systems: Application and design	Ernest O Doebelin, Dhanesh N Manik	Tata McGraw Hill Education	2006

2	Instrumentation and Control systems	S.Bhaskar	Anuradha Agencies	2013
3	Mechanical and Industrial Measurements	R.K. Jain	Khanna Publishers	2013
4	Instrumentation & mech. Measurements	A.K. Tayal	Galgotia Publications	2013
5	Instrumentation, measurement & analysis	B.C.Nakra & K.K.Choudhary	TMH	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Metrology and Measurement	ASQ	Y	MCQ	ASQ	https://asq.org/certification/quality-engineer
2	Certified Calibration Technician (CCT) Certification	American Society of Certified Technicians (ASCT)	Y	MCQ	ASCT	https://asct-education.org/certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	10	20
	MOOCs Review	10	
In-Sem Summative	MOOCs Exam	40	40
End-Sem Summative	End-Sem Exam (MCQ based)	20	40
	MOOCs Exam	20	

MEASUREMENTS & INSTRUMENTATION (MI)

COURSE CODE	22SMF3406M	MODE	A	LTPS	4-0-0-0	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Explain the basics of standards of measurement, limits, fits & tolerances industrial applications. Identify the uses of gauges and comparators	2	PO1
CO2	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices	3	PO1
CO3	Interpret measurement of field variables like force, torque and pressure	2	PO1
CO4	Comprehend the fundamentals of thermocouple and strain measurement	4	PO1
CO5	Understand the concepts of Data Acquisition systems	2	PO1

Syllabus

Module 1	Definition – Introduction to measurements, Precision and accuracy ,generalized configuration and functional descriptions of measuring instruments – examples. Errors in measurements – sources of error, Classification and elimination of error. Measurement of Displacement: Theory and construction of various transducers to measure displacement– Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures
Module 2	Measurement of Temperature: Classification – Ranges – Various Principles of measurement– Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers–Temperature Indicators. Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.
Module 3	Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators –Bubler level indicators. Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer(LDA). Measurement of Speed : Mechanical Tachometers – Electrical tachometers – Stroboscope, Non contact type of tachometer. Measurement of Acceleration and Vibration : Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle
Module 4	Stress Strain Measurements : Various types of stress and strain measurements – electricalstrain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive andtensile strains – usage for measuring torque, Strain gauge Rosettes. Measurement of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.Computer assisted data acquisition, data manipulation, data presentation.

Module 5	Data Acquisition Systems: Overview of Data Acquisition Systems, Sensors and Signal Conditioning, Data Acquisition Hardware, Data Acquisition Software, Data Manipulation and Presentation

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Measurement systems: Application and design	Ernest O Doebelin, Dhanesh N Manik	Tata McGraw Hill Education	2006
2	Instrumentation and Control systems	S.Bhaskar	Anuradha Agencies	2013
3	Mechanical and Industrial Measurements	R.K. Jain	Khanna Publishers	2013
4	Instrumentation & mech. Measurements	A.K. Tayal	Galgotia Publications	2013
5	Instrumentation, measurement & analysis	B.C.Nakra & K.K.Choudhary	TMH	2009

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Metrology and Measurement	ASQ	Y	MCQ	ASQ	https://asq.org/certification/quality-engineer
2	Certified Calibration Technician (CCT) Certification	American Society of Certified Technicians (ASCT)	Y	MCQ	ASCT	https://asct-education.org/certification/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	10	20
	MOOCs Review	10	
In-Sem Summative	MOOCs Exam	40	40
End-Sem Summative	End-Sem Exam (MCQ based)	20	40
	MOOCs Exam	20	

REVERSE ENGINEERING & RAPID PROTOTYPING (RERP)

COURSE CODE	22SMF3507	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the principles of Reverse Engineering process and its methodology	2	PO1,PSO1
CO2	Understand Rapid prototyping and its classification. Know the various Liquid based RP techniques and their process details, applications.	2	PO1,PSO1
CO3	Understand different Solid and Powder based techniques of Rapid prototyping process and their applications.	2	PO1,PSO1
CO4	Understand Rapid tooling techniques with their industrial applications.	2	PO1,PSO1

Syllabus

Module 1	Reverse Engineering: Introduction, benefits, and applications of reverse engineering. Steps involved in the reverse engineering process, including contact and non-contact techniques. Overview of the 3D scanning process and hardware used in the reverse engineering process.
Module 2	Rapid Prototyping: Definition and types of prototypes, the role of prototypes in product development, evaluation of rapid prototyping methods. The three phases of development lead to rapid prototyping. Classification of rapid prototyping systems. Fundamentals of rapid prototyping, including the advantages and disadvantages. Outline the fundamental fabrication processes and the process chain of rapid prototyping. Liquid-based RP techniques: Principles of operation, machine details, materials, and process details of SLA, SGC, SCS, SOUP, two-laser beams, as well as their applications
Module 3	Solid-based rapid prototyping techniques: Principles of operation, machine details, materials, and process details of LOM, FDM, PLT, MJM, MEM, along with their applications. Powder-based RP techniques: Principles of operation, machine details, materials, and process details of SLS, 3DP, LENS, DSPC, MJS, EBM, and their applications
Module 4	Rapid tooling and RP case studies: Introduction, types of rapid tooling, direct and indirect tooling techniques used in aerospace industries, automotive industries, and biomedical applications Case Studies: Wind Tunnel Testing with Rapid Prototyped Models, RP applied to investment casting, Integration of Reverse Engineering and Rapid Prototyping

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Rapid Prototyping: Principles and Applications	Chua, C. K., K. F. Leong and C. S. Lim	World Scientific	2010
2	Reverse Engineering – Technology of Reinvention	Wego Wang	Taylor & Francis	2011
3	Rapid Prototyping: Theory and Practical	Ali K Kamrani	Springer	2006
4	Rapid Manufacturing	Pham D T and Dimov S S	Verlag	2001

5	Stereo lithography and other RP&M Technologies	Paul F Jacobs	SME	1996

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Additive Manufacturing Certification	SME	Y	MCQ	SME	https://www.sme.org/training/additive-manufacturing-certification/additive-manufacturing-certification-process/
2	Additive Manufacturing (AM) Certificate Program	Purdue University and The Barnes Global Advisors	Y	MCQ	Purdue University and The Barnes Global Advisors	https://www.barnesglobaladvisors.com/additive-manufacturing-certificate

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Ultimaker Cura	Ultimaker	Open Source
2	Fusion 360	Autodesk	Open Source(student version)

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

FLEXIBLE MANUFACTURING SYSTEMS (FMS)

COURSE CODE	22SMF3508	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	MP

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Schedule machines in plant layouts	3	PO1,PO2, PSO2
CO2	Apply the concept of group technology to the development of FMS	3	PO1,PO2, PSO2
CO3	Assess performance of Flexible Manufacturing Systems	3	PO1,PO2, PSO2
CO4	Illustrate Manufacturing cells and hardware components of FMS	3	PO2, PO9,PSO2
CO5	Implement NC part programming in part production (Practical)	3	PO4, PO5,PSO2

Syllabus

Module 1	Production systems: Types of production-Job Shop, Batch and Mass production-Functions in manufacturing - Organization and information processing in manufacturing - Plant layout - Work in progress inventory - Scheduling, problems.
Module 2	Group technology: Formation of part families - Part classification - Coding system - Opitz, Multi Class, Production flow analysis - Machine cell design - Clustering methods - Modern algorithms - Benefits - System planning - Objective, guide line, system definition and sizing - Human resources - Objective, staffing, supervisor role.
Module 3	Flexible manufacturing systems: FMS - Introduction - Evolution - Definition - Need - Economic Justification, Application - Machine tool Selection and Layout - Computer control system - Data files - Reports - Planning the FMS - Analysis Methods for FMS - Benefits and limitations.
Module 4	Flexible manufacturing cells: Introduction - Cell description and classifications - Unattended machining – Component handling and storage system - Cellular versus FMS - System - Simulation, Hardware configuration - Controllers - Communication networks - Lean production and agile manufacturing.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Flexible Manufacturing Cells and Systems	William W. Luggen	Prentice Hall, New Jersey	1991
2	Automation Production Systems & Computer Integrated manufacturing	Mikell P. Groover	Prentice Hall of India, New Delhi	2007
3	Flexible Manufacturing	David J. Parrish	Butterworth-Heinemann, Newton, MA, USA	1990
4	Flexible Manufacturing Systems: Recent Developments	Raouf.A and Ben-Daya.M	Elsevier	1995
5	Flexible Manufacturing System	H. K. Shivanand	New Age International (P) Limited	2006

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	CNC Train Simulation Software	MTAB	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

ROBOTICS AND AUTOMATION SPECIALIZATION(RAN)

ROBOT MOTION PLANNING, DYNAMICS AND CONTROL (RMPDC)

COURSE CODE	22RAN3101R	MODE	R	LTPS	2-0-4-4	PRE-REQUISITE	KDOM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic principles of robot trajectory planning	2	PO1, PSO1
CO2	Apply motion planning principles to a robot in the presence of obstacles	3	PO2, PSO1
CO3	Analyse motion planning and robot control	4	PO3, PSO1
CO4	Perform basic motion, force, and hybrid motion-force control to mobile robotics.	3	PO2, PSO1
CO5	Perform lab experiments using Robostudio software for motion planning.	4	PO5
CO6	Develop a Robot system for a pick and place operation	4	PO5

Syllabus

Module 1	Robot trajectory Control: key concepts of robot motion generation: planning a motion for a robot in the presence of obstacles, and real-time feedback control to track the planned motion, Trajectory generation, Path planning algorithms
Module 2	Motion Planning: foundational material like C-space obstacles, graphs and trees, and graph search, as well as classical and modern motion planning techniques, such as grid-based motion planning, randomized sampling-based planners, and virtual potential fields.
Module 3	Robot Control: PID control, motion control, force control, and hybrid motion-force control, adaptive control
Module 4	Mobile Robotics: Localization and mapping, SLAM, Path planning, Control of mobile robots

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Robot Modeling and Control	Mark W. Spong	Wiley	2005
2	Introduction to Autonomous Robots	Nikolaus Correll, Bradley Hayes, and Jur van den Berg.	The MIT Press	2022
3	Robotics, Vision and Control	Peter Corke	Springer	2017
4	Planning Algorithms	Steven M. LaValle	Cambridge University Press	2021
5	Dynamic Simulations of Multibody Systems	Murilo G. Coutinho	Springer	2001

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	RobotStudio	ABB	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignment	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	In Semester Exam Lab	6	
	In Semester Exam Skill	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Exam	8	
	Skill End Exam	8	

ROBOT MOTION PLANNING, DYNAMICS AND CONTROL (RMPDC)

COURSE CODE	22RAN3101A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	KDOM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic principles of robot trajectory planning	2	PO1, PSO1
CO2	Apply motion planning principles to a robot in the presence of obstacles	3	PO2, PSO1
CO3	Analyse motion planning and robot control	4	PO3, PSO1
CO4	Perform basic motion, force, and hybrid motion-force control to mobile robotics.	3	PO2, PSO1
CO5	Apply optimization techniques for joint space trajectory	3	PO2, PSO1
CO6	Perform lab experiments using Robostudio software for motion planning.	4	PO5
CO7	Develop a Robot system for a pick and place operation	4	PO5

Syllabus

Module 1	Robot trajectory Control: key concepts of robot motion generation: planning a motion for a robot in the presence of obstacles, and real-time feedback control to track the planned motion, Trajectory generation, Path planning algorithms
Module 2	Motion Planning: foundational material like C-space obstacles, graphs and trees, and graph search, as well as classical and modern motion planning techniques, such as grid-based motion planning, randomized sampling-based planners, and virtual potential fields.
Module 3	Robot Control: PID control, motion control, force control, and hybrid motion-force control, adaptive control
Module 4	Mobile Robotics: Localization and mapping, SLAM, Path planning, Control of mobile robots
Module 5	Joint Space Optimization: Optimizing joint trajectories to achieve desired end-effector motions while considering joint limits, velocity, and torque constraints.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Robot Modeling and Control	Mark W. Spong	Wiley	2005
2	Introduction to Autonomous Robots	Nikolaus Correll, Bradley Hayes, and Jur van den Berg.	The MIT Press	2022
3	Robotics, Vision and Control	Peter Corke	Springer	2017
4	Planning Algorithms	Steven M. LaValle	Cambridge University Press	2021
5	Dynamic Simulations of Multibody Systems	Murilo G. Coutinho	Springer	2001

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	RobotStudio	ABB	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Home Assignment	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	In Semester Exam Lab	6	
	In Semester Exam Skill	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Exam	8	
	Skill End Exam	8	

ROBOT MOTION PLANNING, DYNAMICS AND CONTROL (RMPDC)

COURSE CODE	22RAN3101P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	KDOM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic principles of robot trajectory planning	2	PO1, PSO1
CO2	Apply motion planning principles to a robot in the presence of obstacles	3	PO2, PSO1
CO3	Analyse motion planning and robot control	4	PO3, PSO1
CO4	Perform basic motion, force, and hybrid motion-force control to mobile robotics.	3	PO2, PSO1
CO5	Apply optimization techniques for joint space trajectory	3	PO2, PSO1
CO6	Perform lab experiments using Robostudio software for motion planning.	4	PO5
CO7	Develop a Robot system for a pick and place operation	4	PO5

Syllabus

Module 1	Robot trajectory Control: key concepts of robot motion generation: planning a motion for a robot in the presence of obstacles, and real-time feedback control to track the planned motion, Trajectory generation, Path planning algorithms
Module 2	Motion Planning: foundational material like C-space obstacles, graphs and trees, and graph search, as well as classical and modern motion planning techniques, such as grid-based motion planning, randomized sampling-based planners, and virtual potential fields.
Module 3	Robot Control: PID control, motion control, force control, and hybrid motion-force control, adaptive control
Module 4	Mobile Robotics: Localization and mapping, SLAM, Path planning, Control of mobile robots
Module 5	Joint Space Optimization: Optimizing joint trajectories to achieve desired end-effector motions while considering joint limits, velocity, and torque constraints.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Robot Modeling and Control	Mark W. Spong	Wiley	2005
2	Introduction to Autonomous Robots	Nikolaus Correll, Bradley Hayes, and Jur van den Berg.	The MIT Press	2022
3	Robotics, Vision and Control	Peter Corke	Springer	2017
4	Planning Algorithms	Steven M. LaValle	Cambridge University Press	2021
5	Dynamic Simulations of Multibody Systems	Murilo G. Coutinho	Springer	2001

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	RobotStudio	ABB	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCS Review	14	14
In-Sem Summative	Global Challenges - Leaderboard	46	46
End-Sem Summative	Project Demonstration	40	40

AUTONOMOUS VEHICLES & AUTOMOTIVE ELECTRONICS (AVAE)

COURSE CODE	22RAN3202	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	EM

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the functional elements of robotics to build simple robot.	3	PO1, PSO1
CO2	Apply Denavit -Hattenberg parameters to position the manipulators	3	PO1, PSO1
CO3	Apply the differential motion through Jacobian to control the manipulator	3	PO1, PSO1
CO4	Analyse the force control techniques using Lagrange dynamic model	4	PO1, PO2, PSO1
CO6	Design and analyze the Effect of uncertainty in the mobile robots.	4	PO1, PO2, PO12, PSO1

Course Syllabus	
Module	Syllabus
Module 1:	Introduction to Autonomous Vehicles: Technological overview concepts of Autonomous Vehicles (AVs); History of Autonomous Vehicles; Vehicle Electronics Architecture; Functional Block Diagram of typical Autonomous Vehicle System (AVS); Basic control system applied to Drive Assisted and Driverless Vehicles; Overview of the operation of Electronic Control Unit (ECUs).
Module 2:	Automotive Sensors and Actuators (ASA): Role of sensors and actuators in autonomous vehicles; Accelerometers, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Steering wheel angle, Vehicle speed, Throttle position, Turbine speed, Temperature, Mass air flow (MAF) rate, Automotive Engine Control Actuators, Fuel Injection, Exhaust Gas Recirculation Actuator, Variable Valve Timing, VVP Mechanism Model, Electric Motor Actuators.
Module 3:	Automotive Electronics (AE): Fundamentals of Automotive Electronics (FAE)- Principles of automotive systems, Advanced driver-assistance systems (ADAS)- Evolution of ABS configurations, Basics of Theory of Operation, Integration of ADAS Technology into Vehicle Electronics, Auto pilot, Advanced parking system, ADAS in Toyota and Tesla.
Module 4:	Automotive Wireless (AW): Wireless Networking and Applications to Vehicle Autonomy; Integration of Wireless Networking and On-Board Vehicle Networks; Automotive GPRS Vehicle Tracking (AGPRS-VT)- Vehicle Tracking System; Principle of Vehicle Tracking system, GPS and GPRS tracking system. Controlled Area Network (CAN):Basic, Block diagram of the CAN bus architecture, Types of CAN Physical Layers, Frame Format of CAN protocol, Working principle of CAN communication.

Reference Books:				
Sl No	Title	Author(s)	Publisher	Year
Book 1	Automotive Computers and Control System	Tom Weather Jr and Cland C. Hunter	Prentice Hall Inc., New Jersey	1998

Book 2	On-Road Intelligent Vehicles: Motion Planning for Intelligent Transportation Systems	Rahul Kala	Butterworth-Heinemann	2016
Book 3	Autonomous Vehicles Volume 1: Using Machine Intelligence	Romil Rawat	Wiley	2022
Book 4	Understanding Automotive Electronics: An Engineering Perspective	William Ribbens	Butterworth-Heinemann	2017

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Multi-Object Tracking for Automotive Systems	Chalmers University via edx	N	Online	Chalmers University via edx	https://www.classcentral.com/course/edx-decision-making-for-autonomous-systems-10305

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MathWorks	Commercial

Evaluation Components

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	8	**22**
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	**38**
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	End Semester Exam	24	**40**
	Lab End Exam	16	

ROBOT MANIPULATION & WHEELED MOBILE ROBOTS (RMWM)

COURSE CODE	22RAN3203	MODE		LTPS	2-0-2-0	PRE-REQUISITE	FIT or SM

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the various contacts elements required for robot's manipulator	2	PO1 PSO1
CO2	Apply the concept of forces/ friction to find out the performance of the manipulator	3	PO2, PO3, PSO1
CO3	Apply the basic concepts used to check the performance of mobile robots	3	PO3, PO7, PSO1
CO4	Apply the concept of feedback control and odometry for Mobile robots	3	PO3, PO4 PSO1
Co-6	Apply the basic concepts used to design a capstone model of mobile robots	3	PO5, PSO 1

Syllabus

Module 1	Contact Kinematics: First-Order analysis of a Single contact, contact types: Rolling, Sliding, and Breaking free, Multiple contacts, Collection of Bodies, Other types of contacts, Planar Graphical Methods, Form Closure
Module 2	Contact Forces and Friction: Friction, planar graphical methods, force closure, Duality of force and motion freedoms, manipulation.
Module 3	Types of wheeled mobile robots, Omnidirectional wheeled mobile robots, modelling, classification of mobile robots etc.
Module 4	Motion planning, feedback control, non-holonomic wheeled mobile robots, modelling, Controllability, motion planning, and feedback control of odometry for wheeled mobile robots; and mobile manipulation.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	MODERN ROBOTICS MECHANICS, PLANNING, AND CONTROL	Kevin M. Lynch and Frank C. Park	Camebridge	2017
2	Introduction to Autonomous Mobile Robots	Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza	MIT Press	2011
3	Planning Algorithms	S. M. LaValle	Cambridge University Press,	2006
4	Principles of Robot Motion Theory, Algorithms and Implementations	H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun	PHI	2005

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Matlab	Mathworks	Y	yes	Mathworks	https://www.mathworks.com/learn/training/certification.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Robot Operating System		Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem-1	15	38
	In-Sem 2	15	
	Practical In Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab Sem End Exam	16	
	Total	100	100

ADVANCED ROBOTICS (AR)

COURSE CODE	22RAN3303R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	DMR

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the control techniques for path planning.	3	PO1, PSO2
CO2	Apply the basics of DH parameters for developing the models of Advanced Robotic Manipulator.	3	PO1, PO5, PSO1, PSO2
CO3	Apply the functional and critical operational Robotics methods for preparing advanced level of Robotics.	3	PO1, PSO2
CO4	Analyze the concepts of Advanced Robotics Systems and Real-time environment for various applications.	4	PO1, PO2, PSO2
CO6	Analyze the kinematics and dynamics requirements using VREP robotic simulation tool	4	PO1, PO2, PO5, PSO2

Course Syllabus	
Module	Syllabus
Module 1:	Introduction to Robotic Systems: Introduction to Robotic Operating System (ROS), Degrees of Freedom (DoF), Six Degrees of Freedom (6DOF), Mobility formula, Three Laws of Robotics; Asimov's Laws (AL), Robotics Foundation: Dynamic Stabilization (DS), Advanced Robotics Sensors (ARS), Power Sources (PS), Force Control(FC), Ring LASER, Application of Gyro Sensor (GS), Inertial Navigation (IN), Terrain a Mapping (TaM), Direct and inverse kinematics problems, Motions and dimensions; Robotics Components.
Module 2:	Advanced Robotic Manipulator & Actuator (ARM & ARS): Industrial Robot Manipulator: Manipulator Structures, Kinematics of Serial and Parallel Manipulators, Velocity Analysis and Statics of Manipulators, Dynamic of Manipulators, Trajectory Planning and Generation (P&G), position and Force control of Manipulators, Modelling and Control of Flexible Manipulators, Joint Actuating System; Grippers, AR in Path Planning Algorithm, Hill-Climbing, Design Consideration Macrobiotics.
Module 3:	Varieties of Robots & Advanced Robotics Heterogeneity (ARH): Design Studies (Modelling and analysis) on Boston Dynamics Products: Cheetah, Atlas, Spot Mini, Legged Robots, Wheeled Robots, Tele robots, Service Robots; Design considerations on Large Robots, Miniature Robot (Swarm robotics), Auto-bots, bipeds, KUKA Collaborative Robot Series, autonomous Underwater Vehicle, Unmanned Aerial Vehicle; Reactor Pressure Vessel (RPV) Measuring Robots.
Module 4:	Case Studies (Applications of Advanced Robotic Systems): Robot Assembling: Assembly of robots using Lego, Vex and Tetrix Kits – Five-minute bot, Wall following robot; Coordinated Multi-Robot Exploration; Mapping and Localization in Non-Static Environments. Programming: Programming of robots using NXT software, Robot C and python programming advanced path planning robots. Case Study of Multiple Robots, medical robots: image guided surgical robots, radiotherapy, painting robots and cancer treatment, Industrial /Home/Defense Applications.

Reference Books:				
Sl No	Title	Author(s)	Publisher	Year
1	Industrial Robotics Technology, Programming and Applications	M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey	McGraw Hill Education	2017
2	Robotics-Fundamental Concepts and Analysis	Ashitava Ghoshal	Oxford University Press	2006
3	Automation, Production Systems, and computer integrated Manufacturing	Mikell P Groover	Prentice Hall	2016
4	Digital Image Processing	Gonzalez and Woods	Pearson	2017
5	Automation and Robotics	Khushdeep Goyal	S.K. Kataria & Sons	2013
6	Image Guided Interventions – Technology and Applications	Terry peters, Kevin clearly	Peters	2008

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Modern Robotics Mechanics, Planning and Control Specialization	Northwest University, Evanstan via Coursera	Y	Online	Northwest University, Evanstan via Coursera	https://www.careers360.com/university/northwestern-university-evanston/modern-robotics-mechanics-planning-and-control-specialization-certification-course

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MathWorks	Commercial
2	VREP robotics	RoboLab, Aston University	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	7	**24**
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem Exam-I	12	**36**
	In-Sem Exam-II	12	
	In Semester Exam (Lab)	6	
	In Semester Exam (Skilling)	6	
End-Sem Summative	End Semester Exam	24	**40**
	Lab Skill End Exam	8	
	Skill End Exam	8	

ADVANCED ROBOTICS (AR)

COURSE CODE	22RAN3304A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	DMR

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the control techniques for path planning.	3	PO1, PSO2
CO2	Apply the basics of DH parameters for developing the models of Advanced Robotic Manipulator.	3	PO1, PO5, PSO1, PSO2
CO3	Apply the functional and critical operational Robotics methods for preparing advanced level of Robotics.	3	PO1, PSO2
CO4	Analyze the concepts of Advanced Robotics Systems and Real-time environment for various applications.	4	PO1, PO2, PSO2
CO5	Analyze the fetch and frieght robots with various co-ordinate frames and joint angles	4	PO2, PO3, PSO2
CO6	Analyze the kinematics and dynamics requirements using VREP robotic simulation tool	4	PO1, PO2, PO5, PSO2
CO7	Analyze the construction and various parameters of a robot using the Studica Robotic System kit	4	PO1, PO2, PSO2

Course Syllabus	
Module	Syllabus
Module 1:	Introduction to Robotic Systems: Introduction to Robotic Operating System (ROS), Degrees of Freedom (DoF), Six Degrees of Freedom (6DOF), Mobility formula, Three Laws of Robotics; Asimov's Laws (AL), Robotics Foundation: Dynamic Stabilization (DS), Advanced Robotics Sensors (ARS), Power Sources (PS), Force Control(FC), Ring LASER, Application of Gyro Sensor (GS), Inertial Navigation (IN), Terrain a Mapping (TaM), Direct and inverse kinematics problems, Motions and dimensions; Robotics Components.
Module 2:	Advanced Robotic Manipulator & Actuator (ARM & ARS): Industrial Robot Manipulator: Manipulator Structures, Kinematics of Serial and Parallel Manipulators, Velocity Analysis and Statics of Manipulators, Dynamic of Manipulators, Trajectory Planning and Generation (P&G), position and Force control of Manipulators, Modelling and Control of Flexible Manipulators, Joint Actuating System; Grippers, AR in Path Planning Algorithm, Hill-Climbing, Design Consideration Macrobiotics.
Module 3:	Varieties of Robots & Advanced Robotics Heterogeneity (ARH): Design Studies (Modelling and analysis) on Boston Dynamics Products: Cheetah, Atlas, Spot Mini, Legged Robots, Wheeled Robots, Tele robots, Service Robots; Design considerations on Large Robots, Miniature Robot (Swarm robotics), Auto-bots, bipeds, KUKA Collaborative Robot Series, autonomous Underwater Vehicle, Unmanned Aerial Vehicle; Reactor Pressure Vessel (RPV) Measuring Robots.
Module 4:	Case Studies (Applications of Advanced Robotic Systems): Robot Assembling: Assembly of robots using Lego, Vex and Tetrix Kits – Five-minute bot, Wall following robot; Coordinated Multi-Robot Exploration; Mapping and Localization in Non-Static Environments. Programming: Programming of robots using NXT software, Robot C and python programming advanced path planning robots. Case Study of Multiple Robots, medical

	robots: image guided surgical robots, radiotherapy, painting robots and cancer treatment, Industrial /Home/Defense Applications.
Module 5:	Collaborative and Adversarial Learning: A Case Study in Robotic Soccer, Fetch and Freight Robots, service robots

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Industrial Robotics Technology, Programming and Applications	M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey	McGraw Hill Education	2017
2	Robotics-Fundamental Concepts and Analysis	Ashitava Ghoshal	Oxford University Press	2006
3	Automation, Production Systems, and computer integrated Manufacturing	Mikell P Groover	Prentice Hall	2016
4	Digital Image Processing	Gonzalez and Woods	Pearson	2017
5	Automation and Robotics	Khushdeep Goyal	S.K. Kataria & Sons	2013
6	Image Guided Interventions – Technology and Applications	Terry peters, Kevin clearly	Peters	2008

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Modern Robotics Mechanics, Planning and Control Specialization	Northwest University, Evanstan via Coursera	Y	Online	Northwest University, Evanstan via Coursera	https://www.careers360.com/university/northwestern-university-evanston/modern-robotics-mechanics-planning-and-control-specialization-certification-course

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MathWorks	Commercial
2	VREP robotics	RoboLab, Aston University	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	7	**24**
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	5	

	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem Exam-I	12	**36**
	In-Sem Exam-II	12	
	In Semester Exam (Lab)	6	
	In Semester Exam (Skilling)	6	
End-Sem Summative	End Semester Exam	24	**40**
	Lab Skill End Exam	8	
	Skill End Exam	8	

ADVANCED ROBOTICS (AR)

COURSE CODE	22RAN3304P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	DMR

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the control techniques for path planning.	3	PO1, PSO2
CO2	Apply the basics of DH parameters for developing the models of Advanced Robotic Manipulator.	3	PO1, PO5, PSO1, PSO2
CO3	Apply the functional and critical operational Robotics methods for preparing advanced level of Robotics.	3	PO1, PSO2
CO4	Analyze the concepts of Advanced Robotics Systems and Real-time environment for various applications.	4	PO1, PO2, PSO2
CO5	Analyze the fetch and frieght robots with various coordinate frames and joint angles	4	PO2, PO3, PSO2
CO6	Analyze the kinematics and dynamics requirements using VREP robotic simulation tool	4	PO1, PO2, PO5, PSO2
CO7	Analyze the construction and various parameters of a robot using the Studica Robotic System kit	4	PO1, PO2, PSO2

Course Syllabus	
Module	Syllabus
Module 1:	Introduction to Robotic Systems: Introduction to Robotic Operating System (ROS), Degrees of Freedom (DoF), Six Degrees of Freedom (6DOF), Mobility formula, Three Laws of Robotics; Asimov's Laws (AL), Robotics Foundation: Dynamic Stabilization (DS), Advanced Robotics Sensors (ARS), Power Sources (PS), Force Control(FC), Ring LASER, Application of Gyro Sensor (GS), Inertial Navigation (IN), Terrain a Mapping (TaM), Direct and inverse kinematics problems, Motions and dimensions; Robotics Components.
Module 2:	Advanced Robotic Manipulator & Actuator (ARM & ARS): Industrial Robot Manipulator: Manipulator Structures, Kinematics of Serial and Parallel Manipulators, Velocity Analysis and Statics of Manipulators, Dynamic of Manipulators, Trajectory Planning and Generation (P&G), position and Force control of Manipulators, Modelling and Control of Flexible Manipulators, Joint Actuating System; Grippers, AR in Path Planning Algorithm, Hill-Climbing, Design Consideration Macrobiotics.
Module 3:	Varieties of Robots & Advanced Robotics Heterogeneity (ARH): Design Studies (Modelling and analysis) on Boston Dynamics Products: Cheetah, Atlas, Spot Mini, Legged Robots, Wheeled Robots, Tele robots, Service Robots; Design considerations on Large Robots, Miniature Robot (Swarm robotics), Auto-bots, bipeds, KUKA Collaborative Robot Series, autonomous Underwater Vehicle, Unmanned Aerial Vehicle; Reactor Pressure Vessel (RPV) Measuring Robots.
Module 4:	Case Studies (Applications of Advanced Robotic Systems): Robot Assembling: Assembly of robots using Lego, Vex and Tetrix Kits – Five-minute bot, Wall following robot; Coordinated Multi-Robot Exploration; Mapping and Localization in Non-Static Environments. Programming: Programming of robots using NXT software, Robot C and python programming advanced path planning robots. Case Study of Multiple Robots, medical

	robots: image guided surgical robots, radiotherapy, painting robots and cancer treatment, Industrial /Home/Defense Applications.
Module 5:	Collaborative and Adversarial Learning: A Case Study in Robotic Soccer, Fetch and Freight Robots, service robots

Reference Books:				
Sl No	Title	Author(s)	Publisher	Year
1	Industrial Robotics Technology, Programming and Applications	M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey	McGraw Hill Education	2017
2	Robotics-Fundamental Concepts and Analysis	Ashitava Ghoshal	Oxford University Press	2006
3	Automation, Production Systems, and computer integrated Manufacturing	Mikell P Groover	Prentice Hall	2016
4	Digital Image Processing	Gonzalez and Woods	Pearson	2017
5	Automation and Robotics	Khushdeep Goyal	S.K. Kataria & Sons	2013
6	Image Guided Interventions – Technology and Applications	Terry peters, Kevin clearly	Peters	2008

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Modern Robotics Mechanics, Planning and Control Specialization	Northwest University, Evanstan via Coursera	Y	Online	Northwest University, Evanstan via Coursera	https://www.careers360.com/university/northwestern-university-evanston/modern-robotics-mechanics-planning-and-control-specialization-certification-course

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MathWorks	Commercial
2	VREP robotics	RoboLab, Aston University	Open source

EVALUATION COMPONENT

Evaluation	Component	Weightage	Total
	ALM (LTC, in-class Quiz, etc.)	7	

In-Sem Formative	Home Assignment and Book. (Min. 4 Assignments etc.)	7	**24**
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem Exam-I	12	**36**
	In-Sem Exam-II	12	
	In Semester Exam (Lab)	6	
	In Semester Exam (Skilling)	6	
End-Sem Summative	End Semester Exam	24	**40**
	Lab Skill End Exam	8	
	Skill End Exam	8	

ARTIFICIAL INTELLIGENCE FOR ROBOTICS (AIR)

COURSE CODE	22RAN3405M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the Fundamentals of Artificial Intelligence, Applications and need of AI in robotics	2	PO1, PO2, PSO1
CO2	Applying various AI search techniques to solve real world problems	3	PO1, PO2, PSO1
CO3	Apply principles of AI in solutions that require process, planning and Reasoning	3	PO1, PO2, PSO1
CO4	Apply various forms of learning and knowledge representation techniques for communication, perceiving and acting for robots.	3	PO1, PO2, PSO1

Syllabus

Module 1	AI Introduction: History, features, Need for AI in Robotics, Thinking and acting humanly, Intelligent agents, structure of agents.
Module 2	Problem Solving: Solving problems by searching – Informed search and exploration, Constraint satisfaction problem – Adversarial search, Knowledge and reasoning – Knowledge representation – First order logic and semantic nets and frames
Module 3	Planning: Planning with forward and backward State space search – Partial order planning – Planning graphs – Planning with propositional logic – Planning and acting in real world. Reasoning: Uncertainty – Probabilistic reasoning- Filtering and prediction – Hidden Markov models – Kalman Filters – Dynamic Bayesian Networks, Speech Recognition, Making Decisions.
Module 4	Learning: Forms of learning – Knowledge in Learning – Statistical learning methods – reinforcement learning, communication, perceiving and acing, Probabilistic language processing, perception.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence: A modern approach	Stuart Russell, Peter Norvig	2010	Pearson Education
2	Artificial Intelligence: A guide to Intelligent Systems	Negnevitsky, M	2011	Harlow: Addison-Wesley
3	Artificial Intelligence: Robotics and Machine Evolution	David Jefferis	1999	Crabtree Publishing Company
4	Artificial Intelligence for Robotics	Francis X. Govers	2018	Packt Publishing
5	Robot Programming: A Practical Guide to Behaviour-Based Robotics	Joe Jones, Daniel Roth, and Tucker Balch	2004	McGraw Hill

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NPTEL : Search Methods for Problem Solving	IIT Madras	y	MCQ	IIT Madras	https://nptel.ac.in/courses/106106126

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python software with libraries	Python Software Foundation	Open Source
2	Robo Studio	ABB	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Certification	10	

ARTIFICIAL INTELLIGENCE FOR ROBOTICS (AIR)

COURSE CODE	22RAN3405MA	MODE	A	LTPS	4-0-0-0	PRE-REQUISITE	SM

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the Fundamentals of Artificial Intelligence, Applications and need of AI in robotics	2	PO1, PO2, PSO1
CO2	Applying various AI search techniques to solve real world problems	3	PO1, PO2, PSO1
CO3	Apply principles of AI in solutions that require process, planning and Reasoning	3	PO1, PO2, PSO1
CO4	Apply various forms of learning and knowledge representation techniques for communication, perceiving and acting for robots.	3	PO1, PO2, PSO1
CO5	Analyze the role of Artificial Intelligence in operations and control of Robots, Ethics and risk of AI in robotics.	4	PO2, PO5, PSO2

Syllabus

Module 1	AI Introduction: History, features, Need for AI in Robotics, Thinking and acting humanly, Intelligent agents, structure of agents.
Module 2	Problem Solving: Solving problems by searching – Informed search and exploration, Constraint satisfaction problem – Adversarial search, Knowledge and reasoning – Knowledge representation – First order logic and semantic nets and frames
Module 3	Planning: Planning with forward and backward State space search – Partial order planning – Planning graphs – Planning with propositional logic – Planning and acting in real world. Reasoning: Uncertainty – Probabilistic reasoning- Filtering and prediction – Hidden Markov models – Kalman Filters – Dynamic Bayesian Networks, Speech Recognition, Making Decisions.
Module 4	Learning: Forms of learning – Knowledge in Learning – Statistical learning methods – reinforcement learning, communication, perceiving and acing, Probabilistic language processing, perception.
Module 5	AI in Robotics: Robotic perception, localization, mapping – configuring space, planning uncertain movements, dynamics and control of movements, Ethics and risk of AI in robotics.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence: A modern approach	Stuart Russell, Peter Norvig	2010	Pearson Education
2	Artificial Intelligence: A guide to Intelligent Systems	Negnevitsky, M	2011	Harlow: Addison-Wesley
3	Artificial Intelligence: Robotics and Machine Evolution	David Jefferis	1999	Crabtree Publishing Company
4	Artificial Intelligence for Robotics	Francis X. Govers	2018	Packt Publishing

5	Robot Programming: A Practical Guide to Behaviour-Based Robotics	Joe Jones, Daniel Roth, and Tucker Balch	2004	McGraw Hill

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NPTEL : Search Methods for Problem Solving	IIT Madras	y	MCQ	IIT Madras	https://nptel.ac.in/courses/106106126

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python software with libraries	Python Software Foundation	Open Source
2	Robo Studio	ABB	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE (HMI&BMI)

COURSE CODE	22RAN3406M	MODE	M	LTPS	3-0-0-0	PRE-REQUISITE	AMRB

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply Norman's model to HMI	3	PO1, PSO1
CO2	Apply different GOMS models, Fitts Laws for improving the Human Machine Interaction	3	PO1, PSO1
CO3	Apply the concepts of Brainwaves for Bain Machine Interface	3	PO1, PO12, PSO1
CO4	Analyze different methodologies for HMI/BMI Applications	4	PO1, PO2, PO12, PSO1

Course Syllabus	
Module	Syllabus
Module 1:	Introduction, history and relation to Ergonomics and Human Factors Problems and challenges, Recurrent HMI Themes, Concept of usability - definition and elaboration, Human Machine Interface and software engineering, GUI design and aesthetics, Prototyping techniques, **Guidelines in HMI: Norman's seven principles, Norman's model of interaction.**
Module 2:	Fitts Laws, Hick-Hyman Laws, Norman's 7 Principles. Design rules Authority vs. generality Principles, introduction to different types of models, GOMS family of models, KLM and CMN-GOMS, Guidelines in HMI: Norman's seven principles, Norman's model of interaction, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.
Module 3:	Alpha, Beta, Theta, Gamma wave, Brain-Control Interface, ARMA Model. Introduction to Brain Control Interface **Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI Brain signal acquisition, Experiment design and data analysis (with explanation of one-way ANOVA), ARMA Model**.
Module 4:	Hierarchical Task Analysis, Dialog Design, Use of FSM, Task modelling and analysis through Hierarchical task analysis (HTA), Dialog Design using FSM (finite state machines), Cognitive architecture, Object Oriented Modelling of User Interface Design, Applications of HMI/BMIs: rover, robotic camera, environmental control.

Reference Books:				
Sl No	Title	Author(s)	Publisher	Year
Book 1:	Designing the User Interface	B. Schneiderman	Addison Wesley	2009
Book 2:	Brain Computer Interfaces: Principles and practice	Jonathan Wolpaw,Elizabeth Winter Wolpaw	Oxford University Press, USA	2012
Book 3	Human Computer Interaction	Dix A., Finlay J., Abowd G. D. and Beale R.	Pearson Education	2003
Book 4	Human-Machine Interface: Concepts and Design Principles	Sridharan Devarajan and S. Srinivasan	Tata McGraw-Hill Education	2019

Book 5	Brain-Computer Interfaces: Principles and Practice	Rajesh P. N. Rao	Oxford University Press	2013

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	CERTIFICATE IN BIOMEDICAL MANUFACTURING	Indian Biomedical Skill Consortium	y	online	Yes	https://ibsc-amtz.in/certificatemanufacturing
2	CERTIFICATE IN BIOMEDICAL QUALITY ASSURANCE	Indian Biomedical Skill Consortium	y	online	Yes	https://ibsc-amtz.in/certificateassurance

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

EVALUATION COMPONENTS

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	10	20
	Home Assignment and Book. (Min. 4 Assignments etc.)	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE (HMI&BMI)

COURSE CODE	22RAN3406MA	MODE	MA	LTPS	4-0-0-0	PRE-REQUISITE	AMRB

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply Norman's model to HMI	3	PO1, PSO1
CO2	Apply different GOMS models, Fitts Laws for improving the Human Machine Interaction	3	PO1, PSO1
CO3	Apply the concepts of Brainwaves for Bain Machine Interface	3	PO1, PO12, PSO1
CO4	Analyze different methodologies for HMI/BMI Applications	4	PO1, PO2, PO12, PSO1
CO5	Analysis of EEG Signal with BCI application	4	PO1, PO2, PO3, PO12, PSO2

Course Syllabus	
Module	Syllabus
Module 1:	Introduction, history and relation to Ergonomics and Human Factors Problems and challenges, Recurrent HMI Themes, Concept of usability - definition and elaboration, Human Machine Interface and software engineering, GUI design and aesthetics, Prototyping techniques, **Guidelines in HMI: Norman's seven principles, Norman's model of interaction.**
Module 2:	Fitts Laws, Hick-Hyman Laws, Norman's 7 Principles. Design rules Authority vs. generality Principles, introduction to different types of models, GOMS family of models, KLM and CMN-GOMS, Guidelines in HMI: Norman's seven principles, Norman's model of interaction, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.
Module 3:	Alpha, Beta, Theta, Gamma wave, Brain-Control Interface, ARMA Model. Introduction to Brain Control Interface **Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI Brain signal acquisition, Experiment design and data analysis (with explanation of one-way ANOVA), ARMA Model**.
Module 4:	Hierarchical Task Analysis, Dialog Design, Use of FSM, Task modelling and analysis through Hierarchical task analysis (HTA), Dialog Design using FSM (finite state machines), Cognitive architecture, Object Oriented Modelling of User Interface Design, Applications of HMI/BMIs: rover, robotic camera, environmental control.
Module 5:	Case studies of BCIs based on multi-neuronal activity, electrocorticography (ECoG), and electroencephalography (EEG) as well as BCI applications, pervasive computing, CSCW, virtual reality, tangible user interface, multimedia

Reference Books:				
Sl No	Title	Author(s)	Publisher	Year
Book 1:	Designing the User Interface	B. Schneiderman	Addison Wesley	2009

Book 2:	Brain Computer Interfaces: Principles and practice	Jonathan Wolpaw,Elizabeth Winter Wolpaw	Oxford University Press, USA	2012
Book 3	Human Computer Interaction	Dix A., Finlay J., Abowd G. D. and Beale R.	Pearson Education	2003
Book 4	Human-Machine Interface: Concepts and Design Principles	Sridharan Devarajan and S. Srinivasan	Tata McGraw-Hill Education	2019
Book 5	Brain-Computer Interfaces: Principles and Practice	Rajesh P. N. Rao	Oxford University Press	2013

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	CERTIFICATE IN BIOMEDICAL MANUFACTURING	Indian Biomedical Skill Consortium	y	online	Yes	https://ibsc-amtz.in/certificatemanufacturing
2	CERTIFICATE IN BIOMEDICAL QUALITY ASSURANCE	Indian Biomedical Skill Consortium	y	online	Yes	https://ibsc-amtz.in/certificateassurance

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

EVALUATION COMPONENTS

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	10	20
	Home Assignment and Book. (Min. 4 Assignments etc.)	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

COMPUTER VISION & APPLICATIONS (CVA)

COURSE CODE	22RAN3507	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	AMRB

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the fundamental concepts of signal processing to computer vision	3	PO1, PSO1
CO2	Apply different methodologies of feature extraction, pattern analysis and visual geometric modelling to stochastic optimization problems	3	PO1, PO5, PSO1
CO3	Apply various Boundary and Edge Detection techniques in 3D signal (Video).	3	PO1, PO5, PSO1
CO4	Analyze the classifiers in different applications such as Biometrics, Medical diagnosis, document processing, mining of visual content, surveillance, and advanced rendering.	4	PO1, PO2, PO5, PSO1
CO6	Analyse the histogram and texture of image and Classification Model LDA in Python / MATLAB for Computer Vision applications	4	PO1, PO2, PO3, PO5, PO12, PSO1, PSO2

Course Syllabus	
Module	Syllabus
Module 1:	Basic Block Diagram Computer Vision; Principle of Computer Vision; Perception of 2 Dimensional & 3Dimensional Transformation (2DCVT &3DCT); 3D Rotation; Histogram, Texture Analysis; Image formation, Geometric Primitives and transformations, 3D to 2D Projections, Lens distortions, Colour, Compositing and matting, Point, Pixel transforms, Histogram equalization, Application: Tonal adjustment, 4D to 11D Transformation on CV.
Module 2:	Overview of Feature Extraction on Computer Vision; Edges, HOG, SIFT, SURF, DTW, Gabor Filter, Scale Space Analysis; Edge detection, Edge linking, Application: Edge editing and enhancement, A comparative study of CFs, LBP, HOG, SIFT, SURF, and BRIEF for security and face recognition, Gabor filter for image processing and computer vision.
Module 3:	Optical Flow-Rate, Optical Flow Estimation, Elastic Band, Boundary Detection, Selection of Terminal Point of the Line, Texture Segmentation, Edge Flow and Anisotropic Diffusion, Edge Flow Intensity, Edge Flow Texture, Edge Flow Based on Gabor Phase, Edge Flow Integration, Edge Flow Propagation and Boundary Detection.
Module 4:	VQ, ICA, KNN, PCA, LDA, Classifiers: GMM, SVM, CNN, DNN Gaussian Mixture Model and Deep Neural Network Recognizing faces with PCA and ICA, K-nearest Neighbours (KNN) ,Classification Model LDA in Python for Computer Vision applications, Deep Learning for Computer Vision, Support Vector Machines (SVM), Image Processing with the Computer Vision API vision field, Robust Principal Component Analysis for Computer Vision, Diagnosis and Treatment of Computer Vision Syndrome, Image Classifier using CNN for various applications.

Reference Books:				
Book Sl No	Title	Author(s)	Publisher	Year

Book 1:	Advanced Secure Optical Image Processing for Communications	Ayman Al Falou	Institute of Physics Publishing	2018
Book 2:	Computer Vision: Algorithms and Applications	Richard Szeliski	Springer	2022
Book 3	Introduction to Computer Vision	Noah Snavely	Springer	2022
Book 4	Computer Vision & Applications	Vipul Sharma	Springer	2021
Book 5	Image Analysis Applications	Rangachar Kasturi	CRC Press	2020

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NVIDIA Deep Learning Institute (DLI) Certifications	NVIDIA	Y	Online	NVIDIA	https://www.nvidia.com/en-in/training/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MATLAB	MathWorks	Commercial
2	Python	Python Software Foundation	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	8	**22**
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	**38**
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	End Semester Exam	24	**40**
	Lab End Exam	16	

AUTOMOTIVE ELECTRONICS & AUTOSAR SPECIALIZATION (AEA)

AUTOMOTIVE SENSORS AND APPLICATION

COURSE CODE	22AEA3101R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of basic electronics for engines	3	PO1,PSO1
CO2	Apply the concept for designing ECU for automotive requirements	3	PO1, PSO1
CO3	Apply the concept for selection and designing transducers	3	PO1, PSO1
CO4	Analyze the Vehicle requirements for motion sensors	4	PO2, PSO1
CO5	Analyze the sensors of vehicle systems physically	4	PO2, PSO1
CO6	Analyze the sensors of vehicle systems numerically	4	PO2, PSO1

Syllabus

Module 1	Electronic ignition, multi-point fuel injection, direct injection; electronic fuel injection; Automobile emissions control, tests, standards (Indian). The concepts of ECU design for automotive applications,
Module 2	Need for ECUs, advances in ECUs for automotive, design complexities of ECUs, V-Model for Automotive ECU's Architecture, analog and digital interfaces
Module 3	Transducers classification and basic principles, General Input-output configuration, static characteristics and dynamic characteristics of instruments, Variable resistance transducers, Metal and semiconductor strain gages and their signal conditioning, Inductive transducers, Electromagnetic sensors, Hall effect sensors, Capacitive transducers, Piezo electric transducers and their signal conditioning, Ultrasonic sensors.
Module 4	Vehicle Body:- Torque sensors/ Force sensors, Sensors Flap air flow sensors, Temperature sensor, Ultrasonic sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Fundamentals of Internal Combustion Engines	H.N. Gupta	PHI publisher	2013
2	Internal Combustion Engines	V Ganesan	Tata McGraw Hill	2012
3	Automotive Sensors (Sensors Technology)	John Turner & Joe Watson		2009
4	Fundamentals of Automotive Electronics Book	Alma Hillier		2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Nil					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

EVALUATION COMPONENT

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	7	**24**
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem Exam-I	12	**36**
	In-Sem Exam-II	12	
	In Semester Exam (Lab)	6	
	In Semester Exam (Skilling)	6	
End-Sem Summative	End Semester Exam	24	**40**
	Lab Skill End Exam	8	
	Skill End Exam	8	

AUTOMOTIVE SENSORS AND APPLICATION

COURSE CODE	22AEA3101A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of basic electronics for engines	3	PO1,PSO1
CO2	Apply the concept for designing ECU for automotive requirements	3	PO1, PSO1
CO3	Apply the concept for selection and designing transducers	3	PO1, PSO1
CO4	Analyze the Vehicle requirements for motion sensors	4	PO2, PSO1
CO5	Analyze the sensors for autonomous vehicles	4	PO2, PSO1
CO5	Analyze the sensors of vehicle systems physically	4	PO2, PSO1
CO6	Analyze the sensors of vehicle systems numerically	4	PO2, PSO1

Syllabus

Module 1	Electronic ignition, multi-point fuel injection, direct injection; electronic fuel injection; Automobile emissions control, tests, standards (Indian). The concepts of ECU design for automotive applications,
Module 2	Need for ECUs, advances in ECUs for automotive, design complexities of ECUs, V-Model for Automotive ECU's Architecture, analog and digital interfaces
Module 3	Transducers classification and basic principles, General Input-output configuration, static characteristics and dynamic characteristics of instruments, Variable resistance transducers, Metal and semiconductor strain gages and their signal conditioning, Inductive transducers, Electromagnetic sensors, Hall effect sensors, Capacitive transducers, Piezo electric transducers and their signal conditioning, Ultrasonic sensors.
Module 4	Vehicle Body:- Torque sensors/ Force sensors, Sensors Flap air flow sensors, Temperature sensor, Ultrasonic sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Fundamentals of Internal Combustion Engines	H.N. Gupta	PHI publisher	2013
2	Internal Combustion Engines	V Ganesan	Tata McGraw Hill	2012
3	Automotive Sensors (Sensors Technology)	John Turner & Joe Watson		2009
4	Fundamentals of Automotive Electronics Book	Alma Hillier		2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Nil					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

AUTOMOTIVE SENSORS AND APPLICATION

COURSE CODE	22AEA3101P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of basic electronics for engines	3	PO1,PSO1
CO2	Apply the concept for designing ECU for automotive requirements	3	PO1, PSO1
CO3	Apply the concept for selection and designing transducers	3	PO1, PSO1
CO4	Analyze the Vehicle requirements for motion sensors	4	PO2, PSO1
CO5	Analyze the sensors for autonomous vehicles	4	PO2, PSO1
CO5	Analyze the sensors of vehicle systems physically	4	PO2, PSO1
CO6	Analyze the sensors of vehicle systems numerically	4	PO2, PSO1

Syllabus

Module 1	Electronic ignition, multi-point fuel injection, direct injection; electronic fuel injection; Automobile emissions control, tests, standards (Indian). The concepts of ECU design for automotive applications,
Module 2	Need for ECUs, advances in ECUs for automotive, design complexities of ECUs, V-Model for Automotive ECU's Architecture, analog and digital interfaces
Module 3	Transducers classification and basic principles, General Input-output configuration, static characteristics and dynamic characteristics of instruments, Variable resistance transducers, Metal and semiconductor strain gages and their signal conditioning, Inductive transducers, Electromagnetic sensors, Hall effect sensors, Capacitive transducers, Piezo electric transducers and their signal conditioning, Ultrasonic sensors.
Module 4	Vehicle Body:- Torque sensors/ Force sensors, Sensors Flap air flow sensors, Temperature sensor, Ultrasonic sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Fundamentals of Internal Combustion Engines	H.N. Gupta	PHI publisher	2013
2	Internal Combustion Engines	V Ganesan	Tata McGraw Hill	2012
3	Automotive Sensors (Sensors Technology)	John Turner & Joe Watson		2009
4	Fundamentals of Automotive Electronics Book	Alma Hillier		2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Nil					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

EVALUATION COMPONENT

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	7	**24**
	Home Assignment and Book.	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem Exam-I	12	**36**
	In-Sem Exam-II	12	
	In Semester Exam (Lab)	6	
	In Semester Exam (Skilling)	6	
End-Sem Summative	End Semester Exam	24	**40**
	Lab Skill End Exam	8	
	Skill End Exam	8	

AUTOTRONICS (AT)

COURSE CODE	22AEA3202	MODE		LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of sensors for engine management	3	PO1,PO2,PSO1
CO2	Apply the concept of control of fuel systems	3	PSO1, PO1, PO2, PO3
CO3	Apply the concept for Electronically controlled Injection and actuators	3	PSO1, PO1, PO3, PO4
CO4	Analyze and design OBD tools	4	PSO2, PO1. PO2, PO4
CO5	Analyze and apply theoetical concepts to develop mathematical models and simulate	5	PSO2, PO2, PO3, PO7

Syllabus

Module 1	Understand the concept of sensor and control functions
Module 2	Apply the concept of sensors for fuel injection systems, metering and timing controls.
Module 3	Electronic control management of high pressure fuel injection systems.
Module 4	Analysis of OBD 1 and OBD2 control and strategies.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Autotronics	P.N.Sankar	Geometric publishers	2015
2	Automotive Electronics	Bosch	Bosch	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Nil					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

AUTOMOTIVE POLLUTION AND ITS CONTROL (APS)

COURSE CODE	22AEA3203	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution	3	PO1, PO2, PO6, PSO1
CO2	Pollutant formation in SI Engine, mechanism of HC , CO and NO in SI engine, exhaust emission and factors affecting the emission, evaporative emission, crankcase emission, lead emission	3	PO1, PO2, PO6, PSO1
CO3	Pollutant formation in SI Engine, mechanism of HC , CO and NO in SI engine, exhaust emission and factors affecting the emission, evaporative emission, crankcase emission, lead emission	3	PO1, PO2, PO6, PSO1
CO4	Noise, Vibration And Harshness, Sources of Noise, Measurement of Noise -Engine combustion noise, - control of noise, control devices and noise proof materials	4	PO1, PO2, PO6, PSO1
CO5	NDIR,FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards	5	PO1, PO2, PO6, PSO1

Syllabus

Module 1	Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution
Module 2	Pollutant formation in SI Engine, mechanism of HC , CO and NO in SI engine, exhaust emission and factors affecting the emission, evaporative emission, crankcase emission, lead emission
Module 3	Design strategies to control emission from engines, effect of design and operating parameters on emission concentrations, modification in the engine design.
Module 4	Noise, Vibration And Harshness, Sources of Noise, Measurement of Noise -Engine combustion noise, - control of noise, control devices and noise proof materials

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Internal Combustion Engines	V Ganesan	McGraw Hill.	1996
2	Internal Combustion Engines	Obert,E.F.,	New Age International Publishers	1968
3	I.C Engines Fundamentals	John B Heywood	McGraw Hill.	1988
4	Internal Combustion Engines	Mathur and sharma	Dhanpat rai New delhi	1996

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Diesel – R-K	Ashok Leyland	Open Source
2	Chem-Kin	ANSYS	Licensed

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In Sem -I	15	38
	In Sem -II	15	
	Lab In Sem -	8	
End-Sem Summative	End Sem Exam	24	40
	Lab End Sem	16	

ALTERNATE DRIVES TRACTION AND CONTROL

COURSE CODE	22AEA3202R	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of alternate technologies	3	PO1,PO2,PSO1
CO2	Apply the concept of speed and torque for automotive requirements	3	PSO1, PO1, PO2, PO7
CO3	Apply the concept for Hybrid architecture design	3	PSO1, PO1, PO3, PO4
CO4	Analyze the Concept of fuel cells	4	PSO2, PO1. PO2, PO4
CO5	Analyze power electronics dynamics and control	4	PSO2, PO1. PO2, PO5

Syllabus

Module 1	Understand the concept of alternate technology for Vehicle drives
Module 2	Apply the concept of alternate drive controls and traction requirements
Module 3	Apply the concept of hybrid vehicles and design drive layouts
Module 4	Analysis of fuel cell vehicles and their drive trains

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	Mehrdad Ehsani	CRC publisher	2015
2	Electric & Hybrid Vehicles	Iqbal hussein	CRC publisher	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Nil	Nil	Nil	Nil	Nil	Nil

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	
	Home Assignments	7	
	Practical Continuous Evaluation	7	22
In-Sem Summative	In-Sem 1	15	
	In-Sem 2	15	
	Practical In-Sem	8	38
End-Sem Summative	End-Sem Exam (Paper Based)	24	
	Lab End-Sem Exam	16	40

ALTERNATE DRIVES, TRACTION AND CONTROL

COURSE CODE	22AEA3202A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of alternate technologies	3	PO1,PO2,PSO1
CO2	Apply the concept of speed and torque for automotive requirements	3	PSO1, PO1, PO2, PO7
CO3	Apply the concept for Hybrid architecture design	3	PSO1, PO1, PO3, PO4
CO4	Analyze the Concept of fuel cells	4	PSO2, PO1. PO2, PO4
CO5	Analyze power electronics dynamics and control	4	PSO2, PO1. PO2, PO5
CO6	Analyze the traction control in vehicles	4	PSO2, PO1. PO2, PO5
CO7	Analyze and apply theoetical concepts to develop mathematical models and simulate	5	PSO2, PO2, PO3, PO7

Syllabus

Module 1	Understand the concept of alternate technology for Vehicle drives
Module 2	Apply the concept of alternate drive controls and traction requirements
Module 3	Apply the concept of hybrid vehicles and design drive layouts
Module 4	Analysis of fuel cell vehicles and their drive trains

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	Mehrdad Ehsani	CRC publisher	2015
2	Electric & Hybrid Vehicles	Iqbal hussein	CRC publisher	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	
	Home Assignments	7	
	Practical Continuous Evaluation	7	22
In-Sem Summative	In-Sem 1	15	
	In-Sem 2	15	
	Practical In-Sem	8	38
End-Sem Summative	End-Sem Exam (Paper Based)	24	
	Lab End-Sem Exam	16	40

ALTERNATE DRIVES, TRACTION AND CONTROL

COURSE CODE	22AEA3202P	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of alternate technologies	3	PO1,PO2,PSO1
CO2	Apply the concept of speed and torque for automotive requirements	3	PSO1, PO1, PO2, PO7
CO3	Apply the concept for Hybrid architecture design	3	PSO1, PO1, PO3, PO4
CO4	Analyze the Concept of fuel cells	4	PSO2, PO1. PO2, PO4
CO5	Analyze power electronics dynamics and control	4	PSO2, PO1. PO2, PO5
CO6	Analyze the traction control in vehicles	4	PSO2, PO1. PO2, PO5
CO7	Analyze and apply theoetical concepts to develop mathematical models and simulate	5	PSO2, PO2, PO3, PO7

Syllabus

Module 1	Understand the concept of alternate technology for Vehicle drives
Module 2	Apply the concept of alternate drive controls and traction requirements
Module 3	Apply the concept of hybrid vehicles and design drive layouts
Module 4	Analysis of fuel cell vehicles and their drive trains

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	Mehrdad Ehsani	CRC publisher	2015
2	Electric & Hybrid Vehicles	Iqbal hussein	CRC publisher	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

VEHICLE CONTROL SYSTEMS

COURSE CODE	22AEA3405M	MODE	M	LTPS	3-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of transfer function	3	PO1,PO2,PSO1
CO2	Apply the concept of first and second order systems	3	PO1,PO2,PSO1, PO7
CO3	Apply the concept for stability criteria	3	PO1,PO2,PSO1, PSO2
CO4	Analyze the PID controllers and application	4	PO2,PO3, PO7, PSO2

Syllabus

Module 1	Fundamentals of modelling -transfer function approach. Introduction to block diagrams & signal flow graphs. -stability analysis- Routh Hurwitz stability criteria -Root Locus -. Importance and interpretations of results.
Module 2	First order, Second order control system response for step, ramp and impulse inputs. Error Analysis - Type number -characteristic equation -Poles and Zeroes concept -Error Analysis and performance indices Frequency response plots -frequency domain specifications
Module 3	stability in the frequency domain -gain and phase margins - Nyquist stability criterion Proportional, Integral, Derivative controllers, P, PI, and PID control actions and mathematical models. Using Simulink to build 'P', 'PI', 'PID' controller modules and carry out experiments
Module 4	State space design methods : SISO,MIMO systems, Various forms of representation of the system (Bush form, etc), controllability and observability, state observer

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modem Control Engineering	Katsuhiko Ogata	Prentice Hall	2001
2	Discrete-Time Control Systems	K. Ogata	Prentice-Hall	1994

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

VEHICLE CONTROL SYSTEMS

COURSE CODE	22AEA3405MA	MODE	MA	LTPS	4-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of transfer function	3	PO1,PO2,PSO1
CO2	Apply the concept of first and second order systems	3	PO1,PO2,PSO1, PO7
CO3	Apply the concept for stability criteria	3	PO1,PO2,PSO1, PSO2
CO4	Analyze the PID controllers and application	4	PO2,PO3, PO7, PSO2
CO5	Analyze the state space design methods	4	PO2,PO3, PO7, PSO2

Syllabus

Module 1	Fundamentals of modelling -transfer function approach. Introduction to block diagrams & signal flow graphs. -stability analysis- Routh Hurwitz stability criteria - Root Locus -. Importance and interpretations of results.
Module 2	First order, Second order control system response for step, ramp and impulse inputs. Error Analysis - Type number -characteristic equation -Poles and Zeroes concept - Error Analysis and performance indices Frequency response plots -frequency domain specifications
Module 3	stability in the frequency domain -gain and phase margins - Nyquist stability criterion Proportional, Integral, Derivative controllers, P, PI, and PID control actions and mathematical models. Using Simulink to build 'P', 'PI', 'PID' controller modules and carry out experiments
Module 4	State space design methods : SISO,MIMO systems, Various forms of representation of the system (Bush form, etc), controllability and observability, state observer

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modem Control Engineering	Katsuhiko Ogata	Prentice Hall	2001
2	Discrete-Time Control Systems	K. Ogata	Prentice-Hall	1994

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Matlab	Mathworks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS

COURSE CODE	22AEA3406M	MODE	M	LTPS	3-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of Automotive Electronics	3	PO1,PO2,PSO1
CO2	Apply the concept of Fuel Ignition Electronics	3	PSO1, PO1, PO2, PO7
CO3	Apply the concept for Fuel Injection Electronics	3	PSO1, PO1, PO3, PO4
CO4	Analyze the Concept of Electronics Accessories	4	PSO2, PO1. PO2, PO4

Syllabus

Module 1	Understand the concept of Electronics for Vehicles
Module 2	Apply the concept of Electronic controls for fuel ignition systems
Module 3	Apply the concept of Electronic controls for Fuel systems and steering
Module 4	Analysis of electronic controls for Automotive accessories

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Understanding Automotive Electronics: An Engineering Perspective	William Ribbens	Butterworth	2013
2	Automobile Electrical and Electronics Systems	Tom Denton	Butterworth	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	Nil		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS

COURSE CODE	22AEA3406MA	MODE	MA	LTPS	3-0-0-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of Automotive Electronics	3	PO1,PO2,PSO1
CO2	Apply the concept of Fuel Ignition Electronics	3	PSO1, PO1, PO2, PO7
CO3	Apply the concept for Fuel Injection Electronics	3	PSO1, PO1, PO3, PO4
CO4	Analyze the Concept of Electronics Accessories	4	PSO2, PO1. PO2, PO4
CO5	Analyze the electronic controls for automotive accessories	4	PSO2, PO1. PO2, PO4

Syllabus

Module 1	Understand the concept of Electronics for Vehicles
Module 2	Apply the concept of Electronic controls for fuel ignition systems
Module 3	Apply the concept of Electronic controls for Fuel systems and steering
Module 4	Analysis of electronic controls for Automotive accessories

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Understanding Automotive Electronics: An Engineering Perspective	William Ribbens	Butterworth	2013
2	Automobile Electrical and Electronics Systems	Tom Denton	Butterworth	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	Nil		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	MOOCs Review	15	20
	Global Challenges Participation	5	
In-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges – Leader board	10	
End-Sem Summative	MOOCs Exam (LMS / Paper Based)	30	40
	Global Challenges - Rating/Points	5	
	Global Certification	5	

SOFT COMPUTING TECHNIQUES FOR AUTOMOTIVE APPLICATIONS

COURSE CODE	22AEA3507	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of artificial neural networks	3	PO1,PO2,PSO1
CO2	Apply the concept of neural network for pattern classification	3	PO1,PO2,PSO1, PO7
CO3	Apply the concept for pattern association	3	PO1,PO2,PSO1, PSO2
CO4	Analyze the fuzzy logic functions	4	PO2,PO3, PO7, PSO2

Syllabus

Module 1	Artificial neural networks - Applications of neural networks – signal processing - control - Pattern recognition - speech production - speech recognition - Architecture - setting of weights - activation functions - McCulloch Pitt Neuron- application to simulation of fundamental logic gates. Biases and thresholds.
Module 2	Linear separability - HebbNet - Algorithm - Application - Perceptron - Application - Leaming rule convergence theorem - Adaline - Architecture - application - Madaline- automatic identification of number plates, milestones.
Module 3	Hebb and Delta rule for pattern Association - Heteroassociative memory neural network -Associative Net - Storage capacity - Iterative Autoassociative Net - Discrete Hopfield Net - Bidirectional Associative memory - algorithm - application- classification of vehicles
Module 4	Classical sets - operations on classical sets - properties of classical sets - Fuzzy set operations - Properties of fuzzy sets - Classical relations - Operations and properties of Crisp relations - Fuzzy relations - operations and properties - Tolerance and equivalence relations -applications- identification of automatic right gear engagement

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Fundamentals of Neural Networks Architectures, Algorithms and Applications	LaureneFausett	Pearson Education	2012
2	Fuzzy Logic with Engineering Application.,	Timothy J. Ross	Wiley India Edition, New Delhi	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	Nil		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

AUTOMOTIVE NETWORKING AND PROTOCOLS

COURSE CODE	22AEA3508	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	TD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concept of Automotive networking	3	PO1,PO2,PSO1
CO2	Apply the concept of LIN Standard	3	PO1,PO2,PSO1, PO7
CO3	Apply the concept for CAN	3	PO1,PO2,PSO1, PSO2
CO4	Analyze the protocols for critical safety	4	PO2,PO3, PO7, PSO2

Syllabus

Module 1	Overview of Data communication and networking -need for In-Vehicle networking -layers of OSI reference model -multiplexing and de-multiplexing concepts -vehicle buses.
Module 2	Overview of general-purpose networks and protocols - Ethernet, TCP, UDP, IP. LIN standard overview -workflow concept-applications -LIN protocol specification -signals
Module 3	Frame transfer -Frame types -Schedule tables -Task behaviour model -Network management - status management. Overview of CAN -fundamentals -Message transfer -frame types-Error handling -fault confinement-Bit time requirements. Introduction to CAN open -TT CAN
Module 4	Device net -SAE JI 939 Flexray-Introduction -network topology -ECUs and bus interfaces --controller host interface and protocol operation controls -media access control and frame and symbol processing - coding /decoding unit.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Fundamentals of Neural Networks Architectures, Algorithms and Applications	LaureneFausett	Pearson Education	2012
2	Fuzzy Logic with Engineering Application.,	Timothy J. Ross	Wiley India Edition, New Delhi	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	Nil		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

MANAGEMENT ELECTIVES

BASICS OF MARKETING FOR ENGINEERS (BME)

COURSE CODE	22MB0001	MODE	Regular	LTPS	2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic concepts of marketing management	2	PO11
CO2	Understand the concepts of Marketing environment, consumer behaviour and Segmentation, Targeting and Positioning (STP)	2	PO11
CO3	Apply the marketing mix strtegies with special focus on technology products	3	PO11
CO4	Apply appropriate strategy for the marketing of high tech products and services	3	PO11

Syllabus

Module 1	Introduction and Nature of Marketing: Evolution of Marketing Concept - Core concepts of marketing - Scope and Importance of Marketing. -Difference between Selling and Marketing - Marketing Myopia - Consumer Marketing Vs. Industrial Marketing.
Module 2	Marketing Environment and factors of marketing environment -Understanding Consumer Behaviour: nature, scope and importance of consumer behavior – Factors influencing Consumer Behavior - Buying decision making process - Market Segmentation, Targeting and Positioning (STP).
Module 3	Marketing mix - Product definition, levels of product, product classification, difference between goods and services, Product Life Cycle, New Product Development – Technology and Product Management - Concept of Pricing – Factors influencing the pricing policy – Pricing strategies - Pricing Considerations in High-Tech Markets.
Module 4	Promotion mix - Marketing Communication Tools for High-Tech Markets - Channels of distribution - Supply Chain Management in High-Tech Markets - Technology Marketing, Green Marketing, and Concept of market study.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Marketing Management	V. S. Ramaswamy and S. Namakumari	Prentice Hall	2018
2	Marketing Management	Kotler and Keller	PHI New Delhi	2019
3	Marketing Management	Philip Kotler & Gary Armstrong	Prentice Hall	2017
4	Marketing Management	RajanSaxena	TataMcGrahill	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	HubSpot Content Marketing Certification	HubSpot	N		HubSpot	https://academy.hubspot.com/

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

PARADIGMS IN MANAGEMENT THOUGHT (PIMT)

COURSE CODE	22MB0002	MODE	Regular	LTPS	2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic management concepts along with an insight into levels of management.	2	PO11
CO2	Understand the key contributions of classical approach to Management	2	PO11
CO3	Understand and apply Quantitative methods to improve Management performance.	2	PO11
CO4	Understand the key contributions of Behavioural and contemporary approaches to Management.	2	PO9

Syllabus

Module 1	Management Introduction - Early management thought - Management Concept – Nature - Management as art, science, profession - Scope and functions of Management - Levels of Management - Importance of management.
Module 2	Classical Approach to Management: (a) Scientific Management- The advent of Scientific Management – Frederick W Taylor's contributions, - Contribution by Henry L Gantt - Contribution by Frank, Lillian Gilberth. General Administrative Approach: Henry Fayol's contributions towards general management – Max Weber's Bureaucracy Approach.
Module 3	Quantitative Approach: Important contributions – TQM – implications in today's management – Six sigma,
Module 4	Behavioral Approach: Organizational Behaviour – Contributions of Elton Mayo's – Hawthorne studies – contributions of Mary Parker Follett – Chester Bernard. Contemporary Approach: Systems Theory – Contingency Theory – Chao's Theory -Peter F Drucker Contributions – C K Prahlad's Contribution – Porter's theory – Worker Management – Employee Engagement – People Capability Maturity Model.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Management	Stephen P Robbins, Mary Coulter, Neeharika Vohra	Pearson	2008
2	Management	Stoner, Freeman, Gilbert	PHI	2018
3	The evolution of management thought	Daniel A Wren, Arther G Bedeian	John wiley& sons	2020
4	"Essentials of Management", 11th Edition	Harold Koontz, Heinz Weihrich, Mark V. Cannice,	Mc Graw Hill	2020

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Leadership Skills	IIMA	Yes	Online	Coursera	https://shorturl.at/dhJO8

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

ORGANIZATION MANAGEMENT (OMG)

COURSE CODE	22MB0004	MODE	Regular	LTPS	: 2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Remember and understand the various management theories and management approaches.	2	PO1, PO9
CO2	Remember and understand organization theories, structures and organization principles.	2	PO1, PO9
CO3	Have basic knowledge and understanding of motivation, motivational theories, leadership theories, moral and behavioral sciences and also understand the management concept, administration and management objectives.	2	PO1, PO9
CO4	Understand the various issues in industrialrelations, trade unions and college bargaining and industrialsafety.	2	PO1, PO9

Syllabus

Module 1	Development of Management thought – Introduction, Various theories; Functional approach, scientific management approach, human relations approach, latest management thoughts, organisationtheory-classicalorganisation,neo-classicalorganisationtheory,modernorganisationtheory.
Module 2	Organization Structure--Principles of organisation, organizational theories, departmentalism, authority, power, organizing, organizational effectiveness, structuring the organisation, organizational change, organisation charts; types of organisations—line , functional and line and staff relations, Organisational manuals
Module 3	Motivation, Morale and behavioral science—Motivation: Characteristics, importance, Kinds of motivation. Thoughts of motivational philosophy: Douglass McGregore—X and Y theory; Herzberg's theory. Human needs, Incentive as motivators, Managing dissatisfaction and frustration. Morale, Absenteeism, Behavioral science, Group dynamics, Group behavior. Leadership— Meaning, importance, styles, theories, leaders Vs managers. Management concept—Management, Administration, Organisation, Difference and Relationship between Management, Administration and Organisation, Importance of Management, Characteristics of management, Managerial Skills, Managerial Objectives, Harmonization of Objectives, Hierarchy of Objectives
Module 4	Industrial Relations, Trade Union And Collective Bargaining—Industrial relations, Industrial Psychology, Industrial disputes, Conflict management, Views about conflict, Labor Policy. Workers grievances, Suggestion system. Trade Unions. Collective Bargaining, Negotiations, Industrial Safety—working conditions, Accidents, Preventive measures, Safety training

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Organizational behavior,	Stephen P.Robins	Pearson education	2008
2	Essentials of Management	Koontz & Wehrich	Tata Mc Grawhill	2007

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Organisation & people effectiveness	University of Cambridge business school	yes	online	University of Cambridge business school	https://shorturl.at/pACJU
2	Certificate in Global Management	Insead	Yes	online	INSEAD	https://www.insead.edu/executive-education/certificate-global-management

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

FINANCIAL MANAGEMENT FOR ENGINEERS (FME)

COURSE CODE	22MB0003	MODE	Regular	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To enable the students to understand the finance functions and types of businesses.	2	PO2
CO2	To evaluate the investment decisions - Capital Budgeting Decisions (Long-Term)	3	PO4
CO3	To evaluate the investment decisions - Working Capital Decisions (Short-Term)	3	PO4
CO4	To be able to understand the uses of various sources of finance as well as the dividend policies in practice.	3	PO4

Syllabus

Module 1	Introduction to Finance: Financial Management, Definitions, Investment Decision, Finance Decision, Dividend Decision, Types of Business, Proprietary company, Partnership Company, Company, Features, Merits and Demerits, Private Limited Company Vs. Public Limited Company, Classification of companies, Franchisee, Cooperative Society. How to start a limited company, Public Issue
Module 2	Capital Budgeting Meaning, Features, Techniques of Capital Budgeting, Traditional methods- Payback Period, ARR and Modern Methods- NPV, IRR & Profitability Index, Case studies on Capital Budgeting
Module 3	Working Capital Management- Gross working capital, Net working Capital, operating cycle, computation of working capital Requirement, determinants of working capital requirements in a company, Cash Management, Receivables Management, and Inventory Management. Case studies on Working Capital.
Module 4	Sources of Finance and Dividend: Short-term sources - Cash credit limit, Overdraft, Bill Discounting, Short term loans, long-term sources Equity, Preference, Bond/ Debenture, Term loans, Venture capital financing. Dividends, Meaning, Types of Dividends, Dividend Policies in Practice

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Financial Management	I M Pandey	Vikas	
2	Financial Management: Theory & Practice	Prasanna Chandra	Tata McGraw Hill	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		NA				

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

FOREIGN LANGUAGE ELECTIVES

FRENCH LANGUAGE (FLG)

COURSE CODE	22FL3054	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Acquire a working knowledge of the basic elements of the French language viz. letters, vowels, accents, articles, useful expressions, etc.	2	PO10
CO2	Frame questions and respond in the affirmative or negative with être and avoir and form plurals	3	PO10
CO3	Understand and apply the adjectives and essential verbs.	3	PO10
CO4	Comprehend and use in speech, vocabulary, reading, questions and answers on passages pertaining to monuments of France	3	PO10

Syllabus

Module 1	L'Alphabet et les Voyelles, Les Accents, Les Noms, Le Pluriel, Les Articles Indéfinis, Les Articles Définis, Les Expressions Utiles, Les Nombres Cardinaux, Les Nombres Ordinaux, Les Jours de la Semaine, Les Mois de l'Année,
Module 2	Le temps (Quelle heure est-il ?) Les Pronoms Personnels (Sujets), L'Interrogatif, Le Négatif, Le Verbe Être – Forme Affirmatif, Forme Interrogatif, Le Verbe Avoir – Forme Affirmatif, Forme Interrogatif, Les Prépositions.
Module 3	Les Articles Contractés, Les Adjectifs Qualificatifs, Les Adjectifs Possessifs, Les Adjectifs Démonstratifs, Les Verbes de Premier Groupe, Deuxième groupe, Troisième groupe Les Verbes Irréguliers.
Module 4	Les animaux Les pays et les nationalités Les parties du corps Le Futur proche. Le passe recent La famille Présentez-vous ?

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Le Nouvel Esprit, Méthode de Français,	Meenal Tiwari	Langers international private limited	2016
2	Cours de Langue et de Civilisation Françaises, Tome Un	G.Mauger Blue	publié par Hachette.	2011
3	Dondo Modern French Course écrit par Mathurin Dondo, Publié par OUP.	Mathurin marius Dondo	Oxford	1997
4	Grammaire progressive du Francais	Maia Gregoire	CLE international	2020

Global Certifications: NA

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and text book	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End semester Exam	40	40

GERMAN LANGAUGE (GLG)

COURSE CODE	22FL3055	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the German language Basic Proficiency: Students will develop and apply a solid foundation in German, allowing them to introduce themselves, engage in basic conversations, and understand everyday expressions.	3	PO10
CO2	Determine the German Vocabulary and Grammar: Students will learn essential vocabulary and grasp German grammar rules, enabling them to construct simple sentences accurately.	3	PO10
CO3	Comprehesive Reading and Listening practices: Students will comprehend basic written and spoken German, understanding short texts, signs, and following straightforward conversations.	3	PO10
CO4	Examining and interpreting the German Cultural Awareness: Students will gain insights into German-speaking countries' culture, enhancing their ability to communicate respectfully and appreciate the customs and traditions.	3	PO10

Syllabus

Module 1	Begrüssing – Alfabets-die Zahlen- die Addition-die Subtraktion-die Division-dieMultiplikation - Personal Pronomen - sein form - haben form - der Infinitiv - konjugationimPräsens
Module 2	DieArtekel– bestimmter Artikel – unbestimmter Artikel – Verneinung – KonjugationimPerfekt..Partizip II -Future
Module 3	Präpositionen – W-Frage - possessivPronomen - deutsche 4 Fälle – wohnen – die Familie
Module 4	Orientierung - Farben – Wochen,Monaten, Jahren, Jahreszeiten, - Einkaufen, Urlaub machen, sport, Gesundheit

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Studio d A1, Deutsch als Fremdsprache	Cornelsen/Goyal SaaB	GoylPublishers and Distributors(P) Ltd. New Delhi 110007	2004
2	Netzwerk for A1,	Stefanie Dengler Paul Rusch Helen Schmitz Tamka Siener	GoylPublishers and Distributors(P) Ltd. New Delhi 110007	2018
3	Deutsch ganz leicht A1, A German selfstudy course for beginners	Huebner	GoylPublishers and Distributors(P) Ltd. New Delhi 110007	2018
4	Collins, easy learning German Grammar & Practice	collins	Collins	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

		NA				

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and text book	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End semester Exam	40	40

JAPANESE LANGUAGE (JLG)

COURSE CODE	22FL3058	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the Japanese language Basic Proficiency	2	PO10
CO2	Determine the Japanese Vocabulary and Grammar	3	PO10
CO3	Examine and interpret Japan Cultural Awareness	3	PO10
CO4	Comprehensive Reading and Listening practice and apply the language skills	3	PO10

Syllabus

Module 1	1.1 Introduce about Japanese and its alphabets writing system (hiragana, katakana, kanji). (日本語について) 1.2 Greeting あいさつ. 1.3 Vocabulary　ごい 1.4 numbers 数字. 1.5 Weekdays, Months, dates. （平日、月、） 1.6 Time.　(時間）
Module 2	2.1 Tenses- Past tense, Present, Future Tense. (過去形、現在形) 2.2 Verbs – first form, second form and third form. （同士） 2.3 daily based Conversation. （会話） 2.4 name of transportation (vehicles). （乗り物） 2.5 feelings. （気持ち） 2.6 Japanese culture. （日本文化）
Module 3	3.1 Family relationships (家族） 3.2 Healthcare Body parts. 3.3 countries name, and nationalities. 国の名前 3.4 National holidays.国の休み 3.5 Foods and vegetables. 3.6 classroom instructions.
Module 4	4.1 Animals.　動物の名前. 4.2 Shopping. 買い物 4.3 Colours.色の名前 4.4 Hobbies　趣味 4.5 listening practice skills.　ちょかい 4.6 Passage reading ability.　どっかい 4.7 Self-Introduction.　じこうしょじゃい

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Minna No Nihongo- N5 Level	Japan Foundation	Goyal Publisher	2018

Global Certifications: NA

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

		NA				

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and text book	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End semester Exam	40	40

AUDIT COURSES

GENDER AND SOCIAL EQUALITY (GSE)

COURSE CODE	22UC0011	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Students will have developed a better understanding of important issues related to gender in contemporary India	2	PO2
CO2	Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through group discussions.	3	PO4
CO3	Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.	4	PO6
CO4	Students will acquire insight into the gendered division of labour and its relation to politics and economics.	4	PO10

Syllabus

Module 1	UNDERSTANDING GENDER: Socialization: Making Women, Making Men, Preparing for Womanhood, Growing up Male, First lessons in Caste, Different Masculinities. GENDER AND BIOLOGY: Missing Women: Sex Selection and Its Consequences, Declining Sex Ratio. Demographic Consequences. Gender Spectrum: Beyond the Binary Two or Many? Struggles with Discrimination.
Module 2	GENDER AND LABOUR: Housework: The Invisible Labor, Women's work: Its politics and Economics, Fact and Fiction. Unrecognized and Unaccounted work.Additional Reading:Wages and Conditions of Work.
Module 3	ISSUES OF VIOLENCE: Sexual Harassment: Say No! Sexual Harassment, not Eve-teasing-Coping with Everyday Harassment, Domestic Violence: Speaking Out, Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forumsfor Justice. Thinking about Sexual Violence.
Module 4	GENDER: CO - EXISTENCE : Just Relationships: Being Together as Equals Mary Kom andOnler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A World of Equals: A Textbook on Gender	*Edited by: Susie Tharu; A. Suneetha; Uma Maheswari Bhrugubanda*	Orient BlackSwan	
2	Seeing Like A Feminist	Menon Nivedita, Nivedita Menon	Penguin Zubaan	
3	Gender Sensitization: Issues and Challenges	Dr Raj Pal Singh, Dr Anupama Sihag	Raj Publications	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Global Gender Policy Certificate	The George Washington University				https://elliott.gwu.edu/global-gender-policy

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NIL		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	HOME ASSIGNMENTS	10	
In-Sem Summative	IN SEM-1	20	40
	IN SEM-2	20	
End-Sem Summative	END SEMESTER	40	40

ESSENCE OF INDIAN KNOWLEDGE TRADITION (EIKT)

COURSE CODE	23UC0019	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To understand the concepts of Indian traditional knowledge	2	PO1
CO2	To develop the outstanding knowledge on Indian administration	2	PO1
CO3	To understand the importance of traditional culture and knowledge	2	PO1
CO4	To know the impact of western culture on Indian society	2	PO1

Syllabus

Module 1	Indian Knowledge System – An Introduction Number System and Units of Measurements Mathematics, Astronomy Concept of Culture- Culture and Civilization- General Characteristics of Indian culture Importance of Culture-Unity in Diversity
Module 2	Evolution of Indian Administration Arthashastra and Kautilya Sapthanga theory Traditions and Culture through the Ages
Module 3	Fundamental Unity of Harappa and Vedic Culture Jainism and Buddhism Mauryan Period Gupta Period-Pallavas and Cholas, Vijayanagar Period-Art Architecture and Literature
Module 4	Rise of the West and its impact on India- Social and Religious reformers in the 18th and 19th centuries- Press and growth of modern Indian literature- Rise of Indian Cinema-Indian Independence

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Indian heritage, culture, Art and Culture	Madhukumar Bhagat	GKP Publishers	2019
2	Traditional Knowledge System in India,	Amit Jha,	Springer	2009.

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		SWAYAM	Y		NPTEL	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	HA	10	
In-Sem Summative	TEST 1-MCQ	20	40
	TEST 2-MCQ	20	
End-Sem Summative	END SEM-MCQ	40	40

INDIAN CONSTITUTION (IC)

COURSE CODE	22UC0008	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To acquire knowledge of the historical developments thatculminated in the drafting of the Indian Constitution	2	PO6
CO2	To understand the basic features of the Indian Constitution	2	PO6
CO3	To understand the structure of the Federal Government as definedby the Indian Constitution	2	PO6
CO4	To understand the Indian Judicial System and Election System of India.	2	PO6

Syllabus

Module 1	Making of the Constitution: A brief analysis of National Movement, Constitutional Development with reference to Government of India Act 1909, 1919, 1935 and Indian Independence Act 1947
Module 2	The Constituent Assembly of India. Basic features of the Indian Constitution and the Preamble, Fundamental Rights, Directive Principles of State Policy Fundamental Duties Government of the Union:
Module 3	The Union Executive – the President and the Vice-President – The Council of Ministers and the Prime Minister – Powers and functions The Union legislature – The Parliament – The Lok Sabha and the Rajya Sabha, Composition, powers and functions – the role of the Speaker. Government of the State: The Governor – the Council of Ministers and the Chief Minister Powers and Functions, The State Legislature – composition, powers and functions
Module 4	The Indian Judicial System: the Supreme Court and the High Court's – composition, Jurisdiction and functions. judicial review, Judicial activism, Independence of Judiciary In India. Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Indian Polity	Laxmikanth	McGraw Hill Edge	7th Edition
2	Indian Administration	Subhash Kashyap	NATIONAL BOOKS TRUST	2017
3	Constitution of India	Shukla V.N.	Eastern Book Company	2019
4	The Indian Constitution:	Granville Austiin	Oxford	1999
5	Indian Constitutional Law'	M.P. Jain	Lexi Nexis	2018

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment	10	
In-Sem Summative	Sem-in 1 (Online MCQ)	20	40
	Sem-in 2 (Online MCQ)	20	
End-Sem Summative	End Sem Exam (Online MCQ)	40	40

ECOLOGY & ENVIRONMENT (E&E)

COURSE CODE	22UC0009	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Define to articulate basic understanding of the importance of Environmental education and conservation of natural resources. conservation of natural resources and Energy resources.	2	PO 7
CO2	Understand concepts of ecosystems and learn methods for conservation of habitats and biodiversity.	2	PO 7
CO3	Identify critically about individual roles in prevention of pollution. An Environmental Studies will be enabled to do independent research on human interactions with the environment.	2	PO 7
CO4	Recognize the knowledge on environmental legislation, disaster management and EIA process.	2	PO 6

Syllabus

Module 1	The Multidisciplinary nature of Environmental Studies: Introduction to Environment: Definition – scope – importance –Multidisciplinary nature of Environmental Studies, Need for public awareness. Institutions and people in Environment. Natural Resources: Renewable and Non-Renewable Resources: Forest resources: Uses –Deforestation– causes, effects and impacts, Afforestation Programmes-Socio-forestry, Agro-forestry, Vanasamrakshana programmes, Mining its impact on environment: mining, dams and their effects on forests and tribal people. . Water resources: Distribution of surface and ground water, Aquifers, – floods – drought – conflicts over water, dams - benefits and problems, Water conservation – rainwater harvesting – watershed management,Cloud seeding Mineral resources: Use – exploitation – environmental effects –. Food resources: Changes in agricultural methodologies, comparison between old and new methods of farming, Green Revolution, Environmental Impact Assessment of conversion of agricultural lands– effects of modern agriculture, Drip Irrigation – fertilizer-pesticide problems, Eutrophication, Vermicompost – waterlogging, Bluebaby syndrome – Energy resources: Growing energy needs – renewable and non- renewable energy sources – Solar, wind, geothermal, tidal, bio energies . Land resources: Land as a resource – land degradation-. Soil erosion: Importance of soil, Types of soil erosion, Causes and effects of soil erosion. How to control soil erosion. Role of an individual in conservation of natural resources
Module 2	Ecosystems: Concept of an ecosystem: Structure and function of an ecosystem - Producers – consumers – decomposers with examples, Energy flow in the ecosystem – Ecological succession– Food chains – food webs and ecological pyramids. Types of ecosystems. characteristic features, structure and function of the following ecosystema Forest ecosystem b. Grassland ecosystem c. Desert ecosystem e. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its Conservation: Introduction – Introduction — Definition: genetic, species and ecosystem diversity. • Biogeographical classification of India • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values Biodiversity at global, National, and local levels • India as a mega-diversity nation • Hotspots of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts. •

	Endangered and endemic species of India • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Module 3	Environmental Pollution: Definition •Causes, effects and control measures of - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution. e. Noise pollution f. Thermal pollution g. Nuclear hazards • Solid waste Management Causes, effects and control measures of urban and industrial wastes. • Role of an individual in preventionof pollution. Pollution case studies. • Diaster management floods, earthquake, cycloneand landslides. Social Issues and the Environment • From Unsustainable to Sustainable development • Urban problems related to energy • Water conservation. rainwater harvesting, watershed management Resettlement and rehabilitation of people its problems and concerns. Case studies.
Module 4	Environmental ethics issues and possiblesolutions. Climate change. global warm acid rain, ozone laver depiction. nuclear accidents and holocaust. Case studies. Wasteland reclamation. •Environmental Protection Act, Air (Prevention and Control of Pollution) Act Water (Prevention and control of Pollution) Act • Wildlife Protection Act• Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Public awareness. : Human Population and the Environment• Population growth, • Population explosion Family Welfare Programme. • Environment and human health. • Human Rights. Value Education. • HIV /AIDS. • Case Studies.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Textbook of Environmental Studies	Erach Bharucha	Universities Press (India) Pvt Ltd	2010
2	Environmental Studies	Benny Joseph	Tata McGraw Hill	2009
3	Textbook of Environmental Studies	Deeksha Deve and S.S. Kateswa	Cengage learning India pvt ltd	2009
4	Environmental Studies	Anubha Kaushik, C.P. Kaushik	New Age International	2007

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	25
	Home Assignment & Textbook	10	
	Attendance	5	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

INDIAN KNOWLEGDE SYSTEM-DESIGN FOR SUSTAINABILITY (IKS-DFS)

COURSE CODE	22UC0020	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Develop a comprehensive understanding of the foundations, significance, and concept of "Indianness" in Indian knowledge systems.	2	PO1, PO2,
CO2	Gain an in-depth knowledge of ancient Indian contributions to science, mathematics, philosophy, and their impact on global knowledge systems.	2	PO1, PO2,
CO3	Explore and appreciate the richness of Indian art, literature, aesthetics, and their interplay with spirituality and cultural expression.	2	PO1, PO2,
CO4	Recognize the contemporary relevance of Indian knowledge systems, their integration with other fields, and foster interdisciplinary perspectives.	2	PO1, PO2,

Syllabus

Module 1	Foundations of Indian Knowledge Systems • Overview of Indian civilization and its intellectual heritage • Significance and relevance of Indian knowledge systems in various domains • Exploration of the concept of "Indianness" and its implications
Module 2	Ancient Indian Contributions to Science, Mathematics, and Philosophy • Study of ancient Indian scientific treatises and their contributions • Exploration of Indian advancements in mathematics, astronomy, metallurgy, and medicine • Analysis of major philosophical schools in India and their key concepts
Module 3	Indian Art, Literature, and Aesthetics • Study of Indian classical arts, including music, dance, painting, and sculpture • Exploration of aesthetic theories such as Rasa, Bhava, and Natyashastra • Understanding the relationship between art, spirituality, and cultural expression
Module 4	Contemporary Relevance and Integration of Indian Knowledge Systems • Examination of modern Indian contributions to science, technology, and innovation • Exploration of the global impact and recognition of Indian knowledge systems • Integration of Indian knowledge with other fields and interdisciplinary perspectives

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The Cultural Heritage of India	Kapila Vatsyayan	National Book Trust	2007
2	India: A History	John Keay	Grove Press	2010
3	The Lost River: On the Trail of the Sarasvati	Michel Danino	Penguin Books	2010
4	India: A Sacred Geography	Diana L. Eck	Harmony	2012

5	Indian Philosophy: A Very Short Introduction	Sue Hamilton	Oxford University Press	2001
6	The Arts and Crafts of India and Ceylon	Ananda K. Coomaraswamy	Dover Publications	2013

Global Certifications:

Mapped Global Certifications:						
Sl. No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1			
2			

Evaluation Components:

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	HOME ASSIGNMENTS	10	
In-Sem Summative	IN SEM-1	20	40
	IN SEM-2	20	
End-Sem Summative	END SEMESTER	40	40

OPEN ELECTIVES

i.<Robotics > <(RBT)>

COURSE CODE	OEME00015	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the anatomy of existing robotic systems and their performance specifications, end effectors, etc	2	PO3,PO5
CO2	Apply appropriate sensors, actuators for real time applications of Robotic Systems	3	PO3
CO3	Apply the Denavit Hartenberg procedure to solve forward and inverse kinematics of robots	3	PO3
CO4	Classification of Robot Languages, Comprehensive identification of suitable Robotic systems for various applications.	4	PO5

Syllabus

Module 1	Introduction to Robotics, Major components of a Robot, Robotic-like devices, Classification of Robots – Classification by coordinate system and by control method, Specifications of Robots, Fixed versus flexible automation, economic analysis. ROBOTEND EFFECTORS: Introduction, End effectors, interfacing, types of End effectors, grippers and tools, considerations in the selection and design of remote cantered devices.
Module 2	ROBOTIC SENSORY DEVICES: Objective, Non-Optical position sensors – Potentiometers, Synchros, inductosyn, optical position sensors – opto interrupters, Optical encoders (absolute & incremental). PROXIMITYSENSORS: Contact type, non-contact type – Reflected light, scanning laser sensors. TOUCH & SLIP SENSORS: Touch sensors – proximity Rod & Photo detector sensors, Slip sensors– Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.
Module 3	TRANSFORMATIONS AND KINEMATICS: Objectives, homogeneous coordinates, basic transformation operations, forward solution – Denavit Hartenberg procedure, Simple problems involving planar manipulators, inverse or backward solution –problems involved, techniques. Introduction to Trajectory Planning, the manipulator jacobian.
Module 4	ROBOT APPLICATIONS: IndustrialApplications – Material Transfer, material handling, Loading and unloading, processing, spot and continuous arc welding, spraypainting, grinding, Assembly and Inspection and Non-Industrial Applications. ROBOT LANGUAGES: Introduction, AL, AML,VAL, RAIL

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Robotics Engineering: An Integrated Approach	Richard D. Klafter	Prentice-Hall	1989
2	INDUSTRIAL ROBOTICS	Mikell Groover	McGraw-Hill	1986

3	Robotics: Control, Sensing, Vision and Intelligence	K. S. Fu, C.S.G. Lee, Ralph Gonzalez	McGraw-Hill	1986
4	Robotics for Engineers	Yoram Koren	McGraw-Hill	1987
5	ROBOTICS AND CONTROL	R Mittle, I Nagrath	McGraw-Hill	2017

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	20
	Home Assignments	10	
In-Sem Summative	In-Sem 1	20	40
	In-Sem 2	20	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

Mechatronics > <(MCT)>

COURSE CODE	OEME00016	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply appropriate sensor, and actuators to system for a given application.	3	PO2, PSO1
CO2	Apply appropriate micro controller for a given application and to build a mathematical Model of system for evaluating open loop system performance and behaviour.	3	PO2, PSO1
CO3	Apply an appropriate closed loop control strategy to attain the desired system behaviour.	3	PO2, PSO1
CO4	Apply a Mechatronic product design for a given application and evaluate its performance. applications.	3	PO3, PSO1

Syllabus

Module 1	Introduction, Elements of Mechatronic system, Applications. SENSORS AND TRASDUCERS: Introduction, Classification of Sensors, selection of sensors. Classification of transducers - strain gauges, displacement transducers, capacitive and inductive transducers, LVDT, oscillation transducer, piezoelectric, potentiometric, velocity transducers, temperature transducers, optical transducers.
Module 2	Modelling of one and two degrees of freedom Mechanical, Electrical, fluid and thermal systems. Block diagram representations for these systems. SYSTEM RESPONSE: Introduction, Transfer function, Time response and Frequency response analysis mechanical systems and electrical systems.
Module 3	Continuous and discrete processes, control modes, Two-step, proportional, Derivative, integral, PID controllers. PLC
Module 4	Mechatronics system Design, possible design solutions. CASE STUDY: pick and place Robot, CNC Machine. Introduction, data acquisition – Quantizing theory, Analog to Digital conversion, Digital to Analog conversion.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering	W Bolton	Pearson education	2015
2	Introduction to mechatronics and measurement systems	David G. Alciatore, MichaelB	McGraw-Hill	2019
3	A course in Electrical and Electronic Measurement and Instrumentation	A.K.Sawhney,	DhanpatRai& Sons - 1991	2008
4	Mechatronics	Nitaigour Premchand Mahalik	Tata McGraw-Hill,	2008
5	Mechanical Measurements	T.G. Beckwith &N.L.Buck	Addison-Wesley	2020

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Mechatronics Certification Test	PMMI	Y	Programming	PMMI	www.pmmi.org/workforce-development/mechatronics/certification-tests
2	Siemens Mechatronic Systems Certification Program	Siemens	Y	Programming	Siemens	https://www.siemens.com/my/en/products/services/digital-enterprise-services/sitrain/smscp.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Na	Na	Na

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active learning	10	20
	Home assignment	10	
In-Sem Summative	Test-1	20	40
	Test-2	20	
End-Sem Summative	Sem End	40	40

OPERATIONS RESEARCH (OR) – OEME0017

COURSE CODE	OEME0017	MODE	Offline	LTPS	4-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply various methods to find optimum solutions to Linear Programming Problems	3	PO5
CO2	Apply various methods to find optimal solutions for the problems in the field of Transportation and Assignment Problems	3	PO5
CO3	Apply various methods to find solutions to Game theory, Queuing Theory, Inventory Control & simulation.	3	PO5
CO4	Applying the concept of PERT/CPM for solving various projects	3	PO5

Syllabus

Module 1	Introduction to Operations Research: Introduction, Modeling in Operations Research, Phases of OR study, Scope and application of OR. Linear Programming and its Applications: Linear Programming Problem – Graphical solution of LP Problem. Simplex method, Big M method, two-phase method, multiplesolution, infeasible solution, unbounded solution, degeneracy, Dual Simplex method.
Module 2	Transportation: Introduction – Methods of basic feasible solution, Optimality test, Degeneracy in transportation problem, unbalanced transportation Problem, Assignment Problems: Hungarian method for assignment problem, Traveling salesman problem.
Module 3	Theory of Games: Introduction, to solve the rectangular two-person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, solution of a two person zero sum 2Xn game, Graphical method for 2Xn and nX2 games. Inventory Control: Introduction – EOQ with uniform rate of demand, Economic lot size with finite rate of replenishment, Quantity discounts. Queuing Theory: Introduction, single channel, Poisson arrival, exponential service time with finite population and infinite population, And Application to Inventory Control.
Module 4	Project Management by PERT/CPM: Introduction, simple network techniques, construction rules of drawing, Fulkerson's rule,Critical path method (CPM)- floats, critical path, project duration, PERT: Introduction, different Timeestimates, expected time, variance, expected project duration and probability of completion. Crashing:Introduction, crashing of network problem

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Operations Research – An Introduction	Hamdy.A.Taha	Pearson Education	2017
2	Introduction to Operations Research	F.S.Hiller, G.J.Liberman	Tata McGraw Hill Education (India) Pvt. Ltd.	2017
3	Operations Research-Theory, Methods & Applications	S.D. Sharma	Kedar Nath Ram Nath.	2017
4	Operations Research	R. Paneerselvam	PHI	2006

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	10	20
	Home Assignment	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	
End-Sem Summative	Semester End Exam	40	40

TOOL BASED LEARNING COURSES

Tool Based learning (Python) (TBL-1)

COURSE CODE	22TBME01	MODE	R	LTPS	0-0-0-4	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Implement Python Operators, Conditional statements, Data Types, Functions, Files and Data Visualization through Matplotlib and Numerical Methods	3	PO1,PO5, PSO1
CO2	Apply SciPy, Scikit-Learn, Pandas Libraries to Unsupervised and Supervised machine learning algorithms using python programming to Analyse various machine learning algorithms to solve real world problems in Mechanical Engineering domain	4	PO1,PO5, PSO1

Syllabus

Module 1	Introduction to Python programming, Data Types, Operators, Conditional statements and loops, Functions, File handling and Data visualization techniques using Matplotlib and python libraries
Module 2	Application of Machine Learning algorithms (Supervised, unsupervised and reinforcement Techniques), Analyze linear and non- linear equations, curve fitting & interpolation, classification, Regression and clustering using python Program for better decision making on Industrial, Automation and Manufacturing problems in Mechanical Engineering.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Numerical Python: Scientific Computing and Data Science Applications with Numpy, SciPy and Matplotlib	Robert Johansson	A press	2019
2	Python Machine Learning	Wei-Meng Lee	Wiley Publisher	2019
3	Core Python Programming	R. Nageswara Rao	Dreamtech Press	2018
4	Learning Python	Mark Lutz	O'Reilly Media	2003
5	Python for Data Analysis	Wes McKinney	Open Access	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	PCAP	Open EDG Python Institute	Y	MCQ	Python Institute	https://pythoninstitute.org/pcap
2	Programming using Python	Microsoft	Y	MCQ	Microsoft	e-Train India Pvt. Ltd Delhi

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Language with Libraries	Python Software Foundation	Open Source
2	Tableau software	Salesforce Inc	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	12.5	25
	Continuous Evaluation Project	12.5	
In-Sem Summative	In Sem Exam-1	17.5	35
	In Sem Exam-2	17.5	
End-Sem Formative	Exercise - Tool base	05	10
	Questions &Answers	05	
End-Sem Summative	Review for Project	15	30
	Report	10	
	Presentation	5	

Tool Based Learning-2 , Programming using JAVA (JAVA)

COURSE CODE	22TBME02	MODE	R	LTPS	0-0-0-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	To understand basic concepts of oops , fundamentals of java	2	PO1,PO3,PSO1
CO2	Apply concepts of class &object	3	PO2,PO5,PSO2,
CO3	Analyze and Implement interfaces, Packages	4	PO3,PO5,PSO2
CO4	Analyze Multi-Threading and Exceptions& Assertions and Solve problems related Mechanical Engineering using OOPs Techniques	4	PO2,PO5,PSO2

Syllabus

Module 1	**Introduction:** Object-Oriented Programming, OOP Principles, Encapsulation, Inheritance and Polymorphism Java as a OOP, Internet Enabled language, The Byte code, Data types, Variables, Dynamic initialization, scope and life time of variables, Arrays, Operators, Control statements, Type Conversion and Casting, Compiling and running of simple Java program
Module 2	**Classes and Objects:** Concepts of classes and objects, Declaring objects, Assigning Object Reference Variables, Methods, Constructors, Access Control, Garbage Collection, Usage of static with data and methods, usage of final with data, Overloading methods and constructors, parameter passing - call by value, recursion, Nested classes
Module 3	**Inheritance:** Inheritance Basics, member access rules, Usage of super key word, forms of inheritance, Method Overriding, Abstract classes, Dynamic method dispatch, Using final with inheritance, String handling functions. Packages and Interfaces: Packages, Class path, Importing packages, differences between classes and interfaces, Implementing ,Applying interface.
Module 4	**Exception Handling:** Exception Handling fundamentals, multi threaded programming, java input/output, collection framework and swing package based event driven programming.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"The Complete Reference Java"	Herbert Schildt	McGraw Hill Education	2017
2	"An Introduction to Object-Oriented Programming"	Timothy A. Budd	Pearson India	2008
3	"JAVA for Beginners"	Joyce Farrell, Ankit R. Bhavsar	Course Technology	2011
4	"Core Java: An Integrated Approach"	R. Nageswara Rao	Dreamtech Press	2008
5	"Java in a Nutshell"	Benjamin	O'Reilly Media, Inc.Inc.	2011

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	JAVA	**Oracle Certified Professional, Java EE 7 Application Developer**	Y	MCQ's	ORACL	https://education.oracle.com/oracle-certification-path/pFamily_48
2	JAVA	**Spring Professional Certification**	Y	MCQ's	SPRIN	https://d1fto35gcfffzn.cloudfront.net/academy/Core-Spring-5.0-Certification-Study-Guide.pd

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Java Development Kit(JDK)	Oracle	Open Source
2	Ope nJDK	Sun Microsystems	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	12.5	25
	Continuous Evaluation Project	12.5	
In-Sem Summative	In Sem Exam-1	17.5	35
	In Sem Exam-2	17.5	
End-Sem Formative	Exercise - Tool base	05	10
	Questions &Answers	05	
End-Sem Summative	Review for Project	15	30
	Report	10	
	Presentation	5	