NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamil Nadu, India, Phone: 04294-225585

Curriculum and Syllabus
for
B.E - MECHANICAL ENGINEERING [R15]
(5th to 8th Semesters)

(This Curriculum and Syllabi are applicable to Students admitted from the academic year [2015-2016] to [2016-2017])

DECEMBER 2018

Approved by Seventh Academic Council

Mechanical Department PEOs and POs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS) :

- **PEO1:** Graduates will be successful practitioners in solving industry's technological problems
- **PEO2:** Graduates will be entrepreneurs and contribute to the economic growth of the country
- **PEO3:** Graduates will pursue higher studies in engineering or management successfully
- **PEO4:** Graduates will prefer career paths in teaching or research
- **PEO5:** Graduates will function in their career with professional and ethical responsibilities

PROGRAM OUTCOMES:

At the end of a programme a students will be able to demonstrate ability to

GRADUATE ATTRIBUTEs	PO No.	PROGRAMME OUTCOMEs
Engineering Knowledge	PO1	an ability to apply knowledge of mathematics, science and engineering
Problem Analysis	PO2	an ability to design and conduct experiments, as well as to analyze and interpret data
Design and Development of Solutions	PO3	an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, safety, manufacturability and sustainability
Investigation of Complex Problems	PO4	an ability to function on multidisciplinary teams to solve complex problems
Modern Tool Usage	PO5	an ability to use the techniques, skills and modern engineering tools necessary for engineering practice
The Engineer and Society	PO6	an ability to infer societal, health, safety, legal & cultural issues and consequent responsibilities relevant to the professional engineering practice
Environment and Sustainability	PO7	an ability to explain, compare and summarize the impact of engineering solutions for sustainable development with societal and environmental perspective
Ethics	PO8	an understanding of professional and ethical responsibility
Individual and Team Work	PO9	an ability to function effectively as an individual / team in different environments
Communication	PO10	an ability to communicate effectively
Project Management and Finance	PO11	an ability to apply knowledge of engineering and management principles to the projects
Lifelong Learning	PO12	an ability to recognize the need for life-long learning

Approved by Seventh Academic Council

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE - 638 052

REGULATIONS - 2015 (R15) **CHOICE BASED CREDIT SYSTEM (CBCS)**

B.E. MECHANICAL ENGINEERING

CURRICULA : I - VIII SEMESTERS **SYLLABI : V - VIII SEMESTERS**

SEMESTER : I								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15EY101	Communicative English	HS	3	1	0	2	2
2	15MY101	Linear Algebra, Analytical Geometry and Calculus	BS	5	3	2	0	4
3	15PY101	Engineering Physics	BS	3	3	0	0	3
4	15CY101	Engineering Chemistry	BS	3	3	0	0	3
5	15ME101	Fundamentals of Mechanical Engineering	ES	3	3	0	0	3
6	15EEC01	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
PRACTICALS								
7	15GY111	Physics and Chemistry Laboratory - I	BS	4	0	0	4	2
8	15GY112	Soft Skills - I	EEC	2	0	0	2	1
9	15GYC11	Engineering Practices Laboratory	ES	4	0	0	4	2
10	15ME111	Engineering Graphics Laboratory	ES	3	1	0	2	2
			TOTAL	**33**	**17**	**2**	**14**	**25**

SEMESTER : II								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15EY201	Professional English	HS	3	1	0	2	2
2	15MY201	Multivariable Calculus and Laplace Transform	BS	5	3	2	0	4
3	15PY201	Materials Physics	BS	3	3	0	0	3
4	15CY201	Environmental Science and Engineering	HS	3	3	0	0	3
5	15ME201	Engineering Mechanics	ES	4	2	2	0	3
6	15CSC01	Problem solving and C programming	ES	3	3	0	0	3
PRACTICALS								
7	15GY211	Physics and Chemistry Laboratory - II	BS	4	0	0	4	2
8	15GY212	Soft Skills - II	EEC	2	0	0	2	1
9	15CSC11	Computer Programming Laboratory	ES	2	0	0	2	1
10	15ME211	Computer Aided Modeling and Drafting Laboratory	ES	4	0	0	4	2
			TOTAL	**33**	**15**	**4**	**14**	**24**

SEMESTER : III								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15MY301	Fourier Series, Partial Differential Equations and Probability	BS	5	3	2	0	4
2	15ME301	Materials Engineering and Technology	ES	3	3	0	0	3
3	15ME302	Engineering Thermodynamics	ES	4	2	2	0	3
4	15ME303	Fluid Mechanics and Machinery	PC	4	2	2	0	3
5	15ME304	Manufacturing Processes	ES	3	3	0	0	3
6	15EE306	Electrical Machines and Drives	ES	3	3	0	0	3
PRACTICALS								
7	15ME311	Fluid Mechanics and Machinery Laboratory	PC	4	0	0	4	2
8	15ME312	Manufacturing Processes Laboratory	ES	4	0	0	4	2
9	15ME313	Computer Aided Machine Drawing	PC	4	0	0	4	2
10	15GYC12	Soft Skills - Listening & Speaking	EEC	2	0	0	2	0
			TOTAL	**36**	**16**	**6**	**14**	**25**

SEMESTER : IV								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15MY401	Statistics and Numerical Methods	BS	5	3	2	0	4
2	15ME401	Kinematics of Machinery	PC	4	2	2	0	3
3	15ME402	Thermal Engineering Systems	PC	4	2	2	0	3
4	15ME403	Strength of Materials	PC	4	2	2	0	3
5	15ME404	Material Removal Processes	PC	3	3	0	0	3
6	15ME405	Fluid Power Systems	PC	3	3	0	0	3
PRACTICALS								
7	15ME411	Thermal Engineering Systems Laboratory	PC	4	0	0	4	2
8	15ME412	Strength of Materials Laboratory	PC	2	0	0	2	1
9	15ME413	Material Removal Processes Laboratory	PC	4	0	0	4	2
10	15GYC13	Soft Skills - Reading & Writing	EEC	2	0	0	2	0
			TOTAL	**35**	**15**	**8**	**12**	**24**

SEMESTER : V								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15ME501	Mechatronics	PC	3	3	0	0	3
2	15ME502	Design of Machine Elements	PC	4	2	2	0	3
3	15ME503	Heat and Mass Transfer (Theory + Lab)	PC	6	2	2	2	4
4	15ME504	Dynamics of Machinery	PC	4	2	2	0	3
5	E-1	Elective - I (PE)	PE	3	3	0	0	3
PRACTICALS								
6	15ME511	Mechatronics Laboratory	PC	4	0	0	4	2
7	15ME512	Kinematics and Dynamics Laboratory	PC	4	0	0	4	2
8	15GY511	Soft Skills Aptitude and Reasoning - I	EEC	2	0	0	2	0
			TOTAL	**30**	**12**	**6**	**12**	**20**

SEMESTER : VI								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15ME601	Power Plant Technology	PC	3	3	0	0	3
2	15ME602	Design of Transmission Systems	PC	4	2	2	0	3
3	15ME603	Finite Element Analysis	PC	4	2	2	0	3
4	15ME604	Metrology and Measurements (Theory + Lab)	PC	5	3	0	2	4
5	E-2	Elective - II (PE)	PE	3	3	0	0	3
6	E-3	Elective - III (PE)	PE	3	3	0	0	3
PRACTICALS								
7	15ME611	Computer Aided Analysis Laboratory	PC	4	0	0	4	2
8	15GE611	Comprehension	EEC	2	0	0	2	1
9	15GY611	Soft Skills Aptitude and Reasoning – II	EEC	2	0	0	2	0
	15ME612	Employability Enhancement Skills						
	15ME613	Entrepreneurship						
			TOTAL	**30**	**16**	**4**	**10**	**22**

SEMESTER : VII								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	15ME701	CAD / CAM / CIM	PC	3	3	0	0	3
2	E-4	Elective - IV (PE)	PE	3	3	0	0	3
3	E-5	Elective - V (PE)	PE	3	3	0	0	3
4	E-6	Elective - VI (PE/OE)	PE/OE	3	3	0	0	3
5	E-7	Elective - VII (OE)	OE	3	3	0	0	3
PRACTICALS								
6	15ME711	CAD / CAM Laboratory	PC	4	0	0	4	2
7	15GE711	Personality and Character Development	EEC	1	0	0	1	0
8	15ME731	Project - I	EEC	8	0	0	8	4
			TOTAL	**28**	**15**	**0**	**13**	**21**

SEMESTER : VIII								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY								
1	E-8	Elective - VIII (PE/OE)	PE/OE	3	3	0	0	3
2	E-9	Elective - IX (OE)	OE	3	3	0	0	3
PRACTICALS								
3	15ME831	Project - II	EEC	16	0	0	16	8
			TOTAL	**22**	**6**	**0**	**16**	**14**

Total Credits: 25 + 24 + 25 + 24 + 20 + 22 + 21 + 14 = 175

HUMANITIES AND SOCIAL SCIENCES (HS)								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	15EY101	Communicative English	HS	3	1	0	2	2
2	15EY201	Professional English	HS	3	1	0	2	2
3	15CY201	Environmental Science and Engineering	HS	3	3	0	0	3

BASIC SCIENCES (BS)								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	15MY101	Linear Algebra, Analytical Geometry and Calculus	BS	5	3	2	0	4
2	15PY101	Engineering Physics	BS	3	3	0	0	3
3	15CY101	Engineering Chemistry	BS	3	3	0	0	3
4	15GY111	Physics and Chemistry Laboratory - I	BS	4	0	0	4	2
5	15MY201	Multivariable Calculus and Laplace Transform	BS	5	3	2	0	4
6	15PY201	Materials Physics	BS	3	3	0	0	3
7	15GY211	Physics and Chemistry Laboratory - II	BS	4	0	0	4	2
8	15MY301	Fourier Series, Partial Differential Equations and Probability	BS	5	3	2	0	4
9	15MY401	Statistics and Numerical Methods	BS	5	3	2	0	4

ENGINEERING SCIENCES (ES)								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	15ME101	Fundamentals of Mechanical Engineering	ES	3	3	0	0	3
2	15EEC01	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
3	15GYC11	Engineering Practices Laboratory	ES	4	0	0	4	2
4	15ME111	Engineering Graphics Laboratory	ES	3	1	0	2	2
5	15ME201	Engineering Mechanics	ES	4	2	2	0	3
6	15CSC01	Problem solving and C programming	ES	3	3	0	0	3
7	15CSC11	Computer Programming Laboratory	ES	2	0	0	2	1
8	15ME211	Computer Aided Modeling and Drafting Laboratory	ES	4	0	0	4	2
9	15ME301	Materials Engineering and Technology	ES	3	3	0	0	3
10	15ME302	Engineering Thermodynamics	ES	4	2	2	0	3
11	15ME304	Manufacturing Processes	ES	3	3	0	0	3
12	15EE306	Electrical Machines and Drives	ES	3	3	0	0	3
13	15ME312	Manufacturing Processes Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	15ME303	Fluid Mechanics and Machinery	PC	4	2	2	0	3
2	15ME311	Fluid Mechanics and Machinery Laboratory	PC	4	0	0	4	2
3	15ME313	Computer Aided Machine Drawing	PC	4	0	0	4	2
4	15ME401	Kinematics of Machinery	PC	4	2	2	0	3
5	15ME402	Thermal Engineering Systems	PC	4	2	2	0	3
6	15ME403	Strength of Materials	PC	4	2	2	0	3
7	15ME404	Material Removal Processes	PC	3	3	0	0	3
8	15ME405	Fluid Power Systems	PC	3	3	0	0	3
9	15ME411	Thermal Engineering Systems Laboratory	PC	4	0	0	4	2
10	15ME412	Strength of Materials Laboratory	PC	2	0	0	2	1
11	15ME413	Material Removal Processes Laboratory	PC	4	0	0	4	2
12	15ME501	Mechatronics	PC	3	3	0	0	3
13	15ME502	Design of Machine Elements	PC	4	2	2	0	3
14	15ME503	Heat and Mass Transfer (Theory + Lab)	PC	6	2	2	2	4
15	15ME504	Dynamics of Machinery	PC	4	2	2	0	3
16	15ME511	Mechatronics Laboratory	PC	4	0	0	4	2
17	15ME512	Kinematics and Dynamics Laboratory	PC	4	0	0	4	2
18	15ME601	Power Plant Technology	PC	3	3	0	0	3
19	15ME602	Design of Transmission Systems	PC	4	2	2	0	3
20	15ME603	Finite Element Analysis	PC	4	2	2	0	3
21	15ME604	Metrology and Measurements (Theory + Lab)	PC	5	3	0	2	4
22	15ME611	Computer Aided Analysis Laboratory	PC	4	0	0	4	2
23	15ME701	CAD / CAM / CIM	PC	3	3	0	0	3
24	15ME711	CAD / CAM Laboratory	PC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	15GY112	Soft Skills - I	EEC	2	0	0	2	1
2	15GY212	Soft Skills - II	EEC	2	0	0	2	1
3	15GE611	Comprehension	EEC	2	0	0	2	1
4	15ME731	Project - I	EEC	8	0	0	8	4
5	15ME831	Project - II	EEC	16	0	0	16	8
6	15GYC12	Soft Skills - Listening & Speaking	EEC	2	0	0	2	0
7	15GYC13	Soft Skills - Reading & Writing	EEC	2	0	0	2	0
8	15GY511	Soft Skills Aptitude and Reasoning - I	EEC	2	0	0	2	0
9	15GY611	Soft Skills Aptitude and Reasoning - II	EEC	2	0	0	2	0
	15ME612	Employability Enhancement Skills						
	15ME613	Entrepreneurship						
10	15GE711	Personality and Character Development	EEC	1	0	0	1	0

LIST OF PROFESSIONAL ELECTIVES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
Design Engineering								
1	15MEX01	Composite Materials and Mechanics	PE	3	3	0	0	3
2	15MEX02	Design for Manufacturing	PE	3	3	0	0	3
3	15MEX03	Engineering Failure Analysis	PE	3	3	0	0	3
4	15MEX04	Mechanical Vibrations	PE	3	3	0	0	3
5	15MEX05	Micro Electro Mechanical Systems	PE	3	3	0	0	3
6	15MEX06	Product Design	PE	3	3	0	0	3
7	15MEX07	Tool Design	PE	3	3	0	0	3
8	15MEX08	Tribology	PE	3	3	0	0	3
9	15MEX31	New Product Development	PE	3	3	0	0	3
Thermal Engineering								
1	15MEX09	Advanced Automobile Engineering	PE	3	3	0	0	3
2	15MEX10	Computational Fluid Dynamics	PE	3	3	0	0	3
3	15MEX11	Cryogenic Engineering	PE	3	3	0	0	3
4	15MEX12	Fuels and Combustion	PE	3	3	0	0	3
5	15MEX13	Gas Dynamics and Jet Propulsion	PE	3	3	0	0	3
6	15MEX14	Internal Combustion Engines	PE	3	3	0	0	3
7	15MEX15	Refrigeration and Air Conditioning	PE	3	3	0	0	3
8	15MEX16	Solar Thermal Systems	PE	3	3	0	0	3
Manufacturing, Industrial Engineering and Management								
1	15MEX17	Nanotechnology	PE	3	3	0	0	3
2	15MEX18	Nondestructive Evaluation and Testing	PE	3	3	0	0	3
3	15MEX19	Additive Manufacturing Processes	PE	3	3	0	0	3
4	15GEC05	Engineering Economics and Cost Analysis	PE	3	3	0	0	3
5	15MEX21	Industrial Engineering and Management	PE	3	3	0	0	3
6	15MEX22	Lean and Agile Manufacturing	PE	3	3	0	0	3
7	15MEX23	Metal Casting Technology	PE	3	3	0	0	3
8	15MEX24	Metal Forming Technology	PE	3	3	0	0	3
9	15MEX25	New Venture Planning and Management	PE	3	3	0	0	3
10	15MEX26	Industrial Robotics	PE	3	3	0	0	3
11	15MEX27	Process Planning and Cost Estimation	PE	3	3	0	0	3
12	15MEX28	Surface Engineering	PE	3	3	0	0	3
13	15GEC04	Total Quality Management	PE	3	3	0	0	3
14	15MEX30	Welding Engineering	PE	3	3	0	0	3

NB: Minimum One course from each stream of Professional Electives to be opted.

LIST OF OPEN ELECTIVES

OPEN ELECTIVES (OE)								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	15CEZ01	Energy conservation in buildings	OE	3	3	0	0	3
2.	15CEZ02	Waste Management	OE	3	3	0	0	3
3.	15CEZ03	Air Pollution Management	OE	3	3	0	0	3
4.	15CEZ04	Building Services	OE	3	3	0	0	3
5.	15CSZ01	Software Engineering Methodologies	OE	3	3	0	0	3
6.	15CSZ02	Design Thinking	OE	3	3	0	0	3
7.	15CSZ03	Open Source Software	OE	3	3	0	0	3
8.	15CSZ04	Information Security	OE	3	3	0	0	3
9.	15ECZ01	Avionics	OE	3	3	0	0	3
10.	15ECZ02	Consumer Electronics	OE	3	3	0	0	3
11.	15ECZ03	Modern wireless communication system	OE	3	3	0	0	3
12.	15ECZ04	Electronic Testing	OE	3	3	0	0	3
13.	15EEZ01	Renewable Energy Technology	OE	3	3	0	0	3
14.	15EEZ02	Energy Conservation and Auditing	OE	3	3	0	0	3
15.	15EEZ03	Electrical Machines	OE	3	3	0	0	3
16.	15EEZ04	Wind and Solar Electrical Systems	OE	3	3	0	0	3
17.	15EIZ01	Autotronix	OE	3	3	0	0	3
18.	15EIZ02	Fiber Optic Sensors	OE	3	3	0	0	3
19.	15EIZ03	Industrial Automation	OE	3	3	0	0	3
20.	15EIZ04	Ultrasonic Instrumentation	OE	3	3	0	0	3
21.	15ITZ01	PC Hardware and Trouble Shooting	OE	3	3	0	0	3
22.	15ITZ02	Cyber Crime Investigations and Digital Forensics	OE	3	3	0	0	3
23.	15ITZ03	Developing Mobile Apps	OE	3	3	0	0	3
24.	15ITZ04	Software Project Management	OE	3	3	0	0	3
25.	15MEZ01	Six Sigma	OE	3	3	0	0	3
26.	15MEZ02	Project Management	OE	3	3	0	0	3
27.	15MEZ03	Electric Vehicle Technology	OE	3	3	0	0	3
28.	15MEZ04	Value Engineering	OE	3	3	0	0	3
29.	15MYZ01	Mathematical Structure	OE	3	3	0	0	3
30.	15MYZ02	Optimization Techniques	OE	3	3	0	0	3
31.	15MYZ03	Statics for Engineers	OE	3	3	0	0	3
32.	15MYZ04	Statistics for Engineers	OE	3	3	0	0	3
33.	15PYZ01	Nanomaterials	OE	3	3	0	0	3
34.	15PYZ02	Nuclear physics and reactors	OE	3	3	0	0	3
35.	15PYZ03	Space science and technology	OE	3	3	0	0	3

36.	15CYZ01	Chemistry for engineers	OE	3	3	0	0	3
37.	15CYZ02	Soil chemistry	OE	3	3	0	0	3
38.	15CYZ03	Organic chemistry	OE	3	3	0	0	3

LIST OF OPEN ELECTIVES

VALUE ADDED COURSE								
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	15GEY01	Hindi Language	OE	2	2	0	0	2
2	15GEY02	German Language	OE	2	2	0	0	2
3	15GEY03	Japanese Language	OE	2	2	0	0	2

SUMMARY

SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HS	2	5							7
2	BS	12	9	4	4					29
3	ES	10	9	14						33
4	PC			7	20	17	15	5		64
5	PE					3	6	9	3	21
6	OE							3	3	6
7	EEC	1	1				1	4	8	15
	TOTAL	25	24	25	24	20	22	21	14	175

15EY101 COMMUNICATIVE ENGLISH
(Common to All Branches)

L	T	P	C
1	0	2	2

OBJECTIVES:

- To improve their lexical, grammatical and communicative competence
- To enhance their communicative skills in real life situations
- To assist students understand the role of thinking in all forms of communication
- To equip students with oral and appropriate written communication skills
- To assist students with employability and job search skills

COURSE OUTCOMES:

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

CO1: Express their opinions clearly, speak convincingly, initiate a discussion, negotiate, and argue using appropriate communicative strategies

CO2: Explain effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing

CO3: Relate different genres of texts infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation

CO4: Infer unspoken and implied meanings and comprehend different spoken excerpts critically

CO5: Develop their professional communication skills

UNIT I : GRAMMAR **(9)**

Parts of Speech - Basic sentence structures - Types of sentences - Auxiliary verbs - Modal Auxiliaries - Articles - Prepositions - Tenses - Voices - Subject - Verb Agreement - Different Grammatical forms of the same word

UNIT II : VOCABULARY **(9)**

Synonyms - Antonyms - One Word Substitution - Words often Confused - Compound nouns - Countable and Uncountable Nouns - Spelling rules - Homophones and Homonyms

UNIT III : CONVERSATIONAL SKILLS **(9)**

Strategies for Good Conversation - Improving fluency and Self Expression - Articulation - Voice quality - Role play - One minute talk

UNIT IV : COMPREHENSIVE LISTENING AND READING **(9)**

Effective listening Strategies - Listening to Speeches and Lectures - Listening to Announcements - Listening and Gap Filling - Listening to Interviews - Reading Comprehension (Extensive Reading)

UNIT V : TECHNICAL WRITING **(9)**

Interpretation of Data - Highlighting problems & suggesting solution - Apology Letter - Inviting Dignitaries - Permission to undergo Industrial visit - Jumbled Sentences.

TOTAL (L:15+P:30) : 45 PERIODS

TEXT/ REFERENCES BOOKS:

1. Rizvi, Ashraf.M, “Effective Technical Communication”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
2. Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006
3. Hewings. M, “Advanced English Grammar”, Cambridge University Press, Chennai, 2000
4. Raman M & Sangeetha Sharma, “Technical Communication”, Oxford University Press, USA, 2005

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x	x	x	x		x
2								x		x		x
3				x		x	x	x	x	x		x
4				x		x	x	x	x	x		x
5				x				x	x	x		x

15MY101 LINEAR ALGEBRA, ANALYTICAL GEOMETRY AND CALCULUS

(Common to B.E - MECH. & CIVIL Engineering Branches)

L	T	P	C
3	2	0	4

OBJECTIVES:

- To identify, formulate and solve Engineering problems
- To use the techniques, Skills and Engineering tools necessary for Engineering practice
- To learn further topics of Mathematics in higher semesters in a graded manner
- To appreciate the important role of Mathematical concepts in Engineering applications

COURSE OUTCOMES:

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

CO1: Be capable of identifying algebraic Eigen value problems from practical areas and obtain the Eigen solutions in certain cases and to have acquired the technique of diagonalizing a matrix which would render the Eigen solution procedure very simple

CO2: Have a sound knowledge of Three dimensional Cartesian co-ordinates, straight lines, plane and sphere, essential concepts for an engineer which would be encountered by them in their engineering subjects in the same or higher semesters

CO3: To make the student knowledgeable in the area of infinite sequences and series and their convergence geometrical aspects of curvature, essential concepts for an engineer, as elegant applications of differential calculus.

CO4: Have grasped the basis of complex integration and the concept of contour integration which is an important tool for evaluation of certain integrals encountered in practice

CO5: Have learnt the method of solving differential equations of certain types, including systems of differential equations that they might encounter in their studies of other subjects in the same or higher semesters

UNIT I : MATRICES **(9)**

Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values and Eigen vectors (without proof) - Cayley Hamilton Theorem (statement only) and its applications - Orthogonal transformation of a symmetric matrix to diagonal form - Quadratic form - Nature of Quadratic form

UNIT II : THREE DIMENSIONAL ANALYTICAL GEOMETRY **(9)**

Direction cosines and ratios - Angle between two lines - Equation of a plane - Equation of a straight line - Coplanar lines - Shortest distance between skew lines - Sphere - Tangent plane - Plane section of a sphere - Orthogonal spheres

UNIT III : SERIES AND DIFFERENTIAL CALCULUS **(9)**

Sequences - Definition and Examples - Series - Types and convergence - Series of positive terms - Test of convergence - Comparison test, Cauchy's condensation test (without proof) - simple problem - Curvature in Cartesian coordinates - Centre and radius of curvature - Circle of curvature (Simple and Standard Questions be asked)

UNIT IV : COMPLEX INTEGRATION **(9)**

Cauchy's integral theorem and Integral formula - Taylor's and Laurent's series - Singularities - Residues - Residue theorem (Statement only) - Application of Residue theorem to evaluate real integrals - Evaluation of contour integrals of the type (i) Around unit circle $\int_0^{2\pi} f(\cos\vartheta, \sin\theta)d\theta$ (ii) $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)}dx$ with no pole on real axis

UNIT V : ORDINARY DIFFERENTIAL EQUATIONS **(9)**

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogeneous equation of Euler's type and Legendre's type

TOTAL(L:45+T:30) : 75 PERIODS

TEXT BOOKS

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & sons, 2013
3. Veerarajan.T, "Engineering Mathematics for first year", 3rd Edition, Tata McGraw Hill, 2011

REFERENCES

1. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics: Sem-II", 5th Edition, Laxmi Publications.2011
2. P.Kandasamy, K.Thilagavathy,K.Gunavathy,"Engineering Mathematics for first Year", 9th Rev. Ed., S.Chand & Co Ltd, 2013
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007)
4. N.K.Venkatasubramanian,"Engineering Mathematics", Vikas Publishing House Private Ltd,(2000)
5. T.K.Manicavachagom Pillai, T.Natarajan, K.S.Ganapathy, "Algebra", Viswananthan Publishers

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x	x		x		x		x	x
2	x			x							x	x
3	x			x	x		x		x		x	x
4	x			x							x	x
5	x			x	x		x		x		x	x

15PY101 ENGINEERING PHYSICS
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide the basic ideas in large number of engineering subjects
- To develop the skills of the students in physics under various applications
- To provide knowledge in wave and particle physics

COURSE OUTCOMES:

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

CO1: Acquire knowledge regarding Acoustics and ultrasonic
CO2: Applying knowledge in the areas of laser and fiber optic technique
CO3: Design the sensors using the knowledge of fiber optics
CO4: Gaining knowledge about wave, particle nature and matter waves
CO5: Analyze the different kind of crystal structures and gain knowledge about crystal growth

UNIT I : ACOUSTICS & ULTRASONCIS **(9)**

Classification of sound - characteristics of musical sound - loudness - Weber - Fechner law - absorption coefficient- reverberation - reverberation time - Sabine's formula (growth & decay) - Factors affecting acoustics of buildings and their remedies.

Ultrasonics - Introduction - properties of ultrasonics - magnetostriction - piezo electric methods - Medical application - Sonogram - Engineering Application - Ultrasonic A B C scan methods

UNIT II : OPTICS & LASER TECHNOLOGY **(9)**

Interference: Air wedge - theory - uses - testing of flat surfaces - determination of thickness of a thin wire - Types of lasers - Nd YAG laser - CO_2 laser - semiconductor laser (homo junction & hetro junction) - Applications - Determination of particle size using laser - Holography - construction - reconstruction - Lasers in industry (Material Processing) and Medical field (Surgery)

UNIT III : FIBER OPTICS AND SENSORS **(9)**

Principle of light transmission through fiber - expression for acceptance angle and numerical aperture - Fabrication of optical fibers - Double crucible method - types of optical fibers (material, refractive Index profile and mode) fiber optic communication system - Splicing - Applications of optical fiber - Sensors - temperature - pressure sensor and displacement sensor Medical Endoscope

UNIT IV : WAVE AND PARTICLE PHYSICS **(9)**

Development of quantum theory - de Broglie wavelength - properties of matter waves - G.P Thomson experiment- Schrödinger's wave equation - time dependent - time independent wave equations - physical significance - applications - particle in a one dimensional potential box - Compton Effect - theory and experimental verification

UNIT V : CRYSTALOGRAPHY **(9)**

Lattice - unit cell - Bravais lattices - lattice planes - Miller indices - 'd' spacing in cubic lattice - calculation of number of atoms per unit cell - atomic radius - coordination number - packing factor for SC, BCC, FCC and HCP structures - Crystal growth techniques - solution, melt (Czochralski) and vapour growth techniques(qualitative)

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Rajendran.V, "Engineering Physics", Tata McGraw-Hill, New Delhi, 2011.
2. Tamilarasan.K, Prabu.K, "Engineering Physics I", 2nd ed., Tata McGraw-Hill, New Delhi, 2011
3. Senthilkumar.G, "Engineering Physics I", VRB Publishers, 2011

REFERENCES:

1. Palanisami.P.K, "Physics for Engineers", Vol. 1, Sci Tech Pub. (India) Pvt. Ltd., Chennai, 2002.
2. Avadhanulu.M.N and Kshirsagar.P.G, "A Textbook of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2005
3. Rajendran.V and A. Marikani.A, "Physics I", Tata McGraw-Hill, New Delhi, 2004.
4. Gaur.R.K and Gupta.S.L, "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2006.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1			x			x				x		X
2	x	x							x		x	X
3			x			x					x	
4	x		x									
5		x							x		x	X

15CY101 ENGINEERING CHEMISTRY
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- The students should be conversant with the principles of water characterization and treatment of potable and industrial purposes
- The students are able to study about the principles of electrochemistry, energy storage devices, principles of corrosion control and chemical kinetics
- Principles of polymer chemistry and Engineering applications of polymers and adsorption
- Have gained a well founded knowledge of chemistry of fuels and lubricants

COURSE OUTCOMES:

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

CO1: Apply knowledge of fundamental principles of chemistry
CO2: Define and solve engineering problems, including the utilization of creative and innovative skills
CO3: Gain practical experience with chemical process equipment as well as to analyze and interpret data
CO4: Understand the impact of engineering solutions in a global, economic, environmental and societal context
CO5: Gain the knowledge about fuels and lubricants

UNIT I : WATER TECHNOLOGY (9)

Hardness - types - estimation by EDTA method - domestic water treatment - disinfection methods (chlorination, ozonation and UV treatment) - boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) - external conditioning - demineralization process - desalination - reverse osmosis method - Determination of Fe in water by colorimetry - determination of sodium in water by flame photometry

UNIT II : ELECTROCHEMISTRY AND CORROSION (9)

Electrochemistry - electrode potential - - reference electrode - standard hydrogen electrode (SHE) and calomel electrode - Nernst equation and problems, potentiometric titration (redox). Conductance measurements - conductometric titration (acid-base). Batteries - types,- lead acid battery - Corrosion - Chemical corrosion - electrochemical corrosion - corrosion control - sacrificial anode method

UNIT III : POLYMERS AND NANOMATERIALS (9)

Polymers - classification, addition, condensation and co polymerization - plastics - thermoplastics and thermosetting plastics - preparation , properties and uses of PVC, PET, teflon and nylon - Polymer processing - compression and injection moulding techniques - Nanomaterials - Carbon nanotubes - synthesis and their applications

UNIT IV : CHEMICAL KINETICS AND SURFACE CHEMISTRY (9)

Order of a reaction (definition) - kinetics of first order reaction - acid catalysed hydrolysis of ester - kinetics of second order reaction - base catalysed hydrolysis of ester - Arrhenius equation - effect of temperature on reaction rate - Surface chemistry - Adsorption - types of adsorption - Langmuir adsorption isotherm - role of adsorption in catalytic reactions

UNIT V : FUELS AND LUBRICANTS (9)

Fuels - Coal - proximate analysis - metallurgical coke - manufacture by Otto-Hoffmann method - Liquid fuels - knocking - octane number and cetane number - synthetic petrol - Fischer Tropsch and Bergius processes - Lubricants - properties - viscosity index, flash and fire points, cloud and pour points and oiliness - Flue gas analysis - Orsat apparatus

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Jain.P.C and Monica Jain, "Engineering Chemistry", Vol I & II, Dhanpat Rai Pub.Co., New Delhi,15th ed., 2013
2. Dara.S.S, "A Text book of Engineering Chemistry", S.Chand & Co.Ltd ., New Delhi, 2014
3. Dr.Ravikrishnan.A, "Engineering chemistry I & Engineering chemistry II", Sri Krishna Hitech Publishing co. Pvt .Ltd., 13th ed., Chennai, 2012

REFERENCES:

1. Krishnamurthy.N, Vallinayagam.P and Madhavan.D, “Engineering Chemistry”, PHI learning private Ltd, New Delhi, 2009
2. Sivashankar.B, “Engineering Chemistry”, Tata McGraw-Hill, Pub. Co. Ltd., New Delhi, 2008
3. Sivakumar.R and Sivakumar.N, “Engineering Chemistry”, Tata McGraw-Hill publishing company limited, New Delhi, 2009

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x		x					x	x
2	x	x	x	x	x						x	x
3	x	x	x	x	x	x	x				x	x
4			x	x	x	x	x				x	x
5	x	x			x	x					x	x

15ME101 FUNDAMENTALS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Mechanical Engineering
- To acquire knowledge on the design procedure, materials, fluid properties and energy systems
- To introduce the fundamentals of mechanics

COURSE OUTCOMES:

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

CO1: Summarize the elements of Mechanical Engineering, steps involved technical problem solving and unit systems
CO2: List the stages in Mechanical Design and types of transmission systems
CO3: Explain the types of engineering materials and their mechanical behavior
CO4: Describe the types of fluids, properties and working principles flow measurement devices
CO5: Demonstrate the knowledge of thermodynamics and thermal energy conversion systems

UNIT I : ENGINEERING BASICS (9)

Introduction to Mechanical engineering - Elements of Mechanical Engineering - Design, Professional Practices, Forces, Materials, Fluids, Energy, Motion - Technical problem solving approach - Unit systems and conversions, Base and Derived Units, C.G.S, F.P.S, M.K.S, International System of Units

UNIT II : MECHANICAL DESIGN AND TRANSMISSION SYSTEMS (9)

Design Process - Manufacturing Processes - Motion and power transmission, Rotational Motion, Gears - Function, Application, advantages, disadvantages, Spur Gears, Rack and Pinion, Bevel Gears, Helical Gears, Worm Gear sets - Speed, Torque, and Power in Gear sets - Simple and Compound Gear trains, Planetary Gear trains- Belt and Chain Drives

UNIT III : MECHANICS OF MATERIALS (9)

Forces in structures and machines - Forces in Rectangular and Polar Forms - Resultant of Several Forces - Moment of a Force - Materials and stresses - Tensile, Compression, Shear - Material Properties - Deformation, Strength, Ductility, Plasticity, Elasticity, Stress - strain curve, Simple Problem - Engineering Materials, Metals and their alloys, Ceramics, Polymers, Composite materials

UNIT IV : FLUID MECHANICS (9)

Fluid - Characteristics of Fluids, Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Surface Tension, Capillarity - Simple Problems - Fluid Statics - Pressure at a Point, Pascal's Law, Absolute Pressure, Gauge Pressure, Vacuum Pressure, Atmospheric Pressure, Measurement of pressure, Manometer (simple Manometer), Mechanical Gauge (Bourdon Tube) - Types of fluid flows

UNIT V : THERMAL AND ENERGY SYSTEMS (9)

Basics of Thermodynamics - Thermodynamic system, Classification, properties of system, Work, Heat, Temperature, Properties of perfect gas, enthalpy, entropy, internal energy - Heat Engines - External Combustion Engines, Boiler - Internal Combustion Engine - Two Stroke Engine, Four Stroke Engine

TOTAL (L:45) : 45 PERIODS

TEXT BOOK:

1. Wickert Jonathan, Kemper Lewis, "An Introduction to Mechanical Engineering", 1st ed., Cengage Learning India, 2009

REFERENCES:

1. Devendra Vashist, "Mechanical Engineering - Fundamentals", I.K.International Publishing House, 2010.
2. Sadhu Singh, "Principles of Mechanical Engineering", 1st ed., S.Chand Publisher, 2010

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x							x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x		x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x			x	x	x					x	x

15EEC01 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to Mech. & Civil Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquaint the students pursuing engineering disciplines other than electrical engineering
- To give the basic knowledge about AC, DC circuits and various types of measuring instruments and Electrical Machines

COURSE OUTCOMES:

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

CO1: Analyze and synthesis of electrical circuits
CO2: Acquire knowledge about the working of measuring instruments
CO3: Acquire knowledge about the working of electron devices
CO4: Know the fundamentals of electrical machines and digital electronics
CO5: Know the fundamentals of communication engineering

UNIT I : ELECTRICAL CIRCUITS & MEASUREMENTS (9)

Ohms Law - Kirchoff's Laws - Steady State Solution of DC Circuits - Introduction to AC Circuits - Operating Principles of Moving Coil and Moving Iron Instruments, Dynamometer type Wattmeter and Induction type energy meter

UNIT II : ELECTRICAL MACHINES (9)

DC Generator - DC Motor-Single Phase Transformer - single phase induction Motor - Construction, Principle of Operation, EMF Equation and Applications

UNIT III : SEMICONDUCTOR DEVICES AND APPLICATIONS (9)

Characteristics of PN Junction Diode and Zener Diode - Half wave and Full wave Rectifier - Bipolar Junction Transistor: CB, CE, CC Configurations and Characteristics

UNIT IV : DIGITAL ELECTRONICS (9)

Binary Number System - Logic Gates - Half and Full Adders - Flip-Flops - RS,D,T and JK - Registers and Counters

UNIT V : FUNDAMENTALS OF COMMUNICATION ENGINEERING (9)

Types of Signals: Analog and Digital Signals - Modulation - Amplitude and Frequency Modulation – Demodulation - Communication Systems - Radio, TV, Microwave, Satellite (Block Diagram Approach only)

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Muthusubramanian.R, Salivahanan.S and Muraleedharan.K.A, "Basic Electrical, Electronics and Computer Engineering", 2nd ed., Tata McGraw Hill, 2012.
2. Sedha.R.S, "Applied Electronics", S. Chand & Co., 2008.

REFERENCES:

1. Mittle and V. N. Mittle, "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 2005.
2. T K Nagsarkar and M S Sukhija, "Basics of Electrical Engineering", Oxford press 2005.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x				x	x
2	x	x	x	x	x						x	x
3	x		x	x							x	x
4	x		x	x			x				x	x
5	x		x	x							x	x

15GY111 PHYSICS AND CHEMISTRY LABORATORY - I

(Common to All Branches)

L	T	P	C
0	0	4	2

OBJECTIVES:

- To provide the basic practical exposure to all the engineering and technological streams in the field of physics.
- The students are able to know about the water containing impurities and some physical parameters

COURSE OUTCOMES:

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

CO1: Acquire the fundamental knowledge in optics such as interference, diffraction etc.
CO2: Gain the basic knowledge about handling the laser light and the spectral instruments.
CO3: Analyze the properties of matter with sound waves and the basic parameters of an optical fibre
CO4: Apply knowledge of measurement of hardness producing ions, chloride, alkalinity and Do and Understand the impact of water quality parameters
CO5: Gain practical experience with chemical process like conductance, EMF, pH and engineering problems related to all the measurements

LIST OF EXPERIMENTS:

PHYSICS LABORATORY- I

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
2. Determination of thickness of a thin wire – Air wedge method.
3. Determination of laser parameters - wavelength, particle size and angle of divergence ofa Laser.
4. Determination of acceptance angle and numerical aperture of an optical fiber.
5. Determination of wavelength of mercury spectrum – spectrometer grating.
6. Determination of Hysteresis loss in a ferromagnetic material.

CHEMISTRY LABORATORY- I

1. Estimation of hardness of Water by EDTA
2. Conductometric titration of strong acid Vs strong base
3. Determination of DO in water (Winkler's method)
4. Estimation of Chloride in a Water sample (Argentometric)
5. Conductometric precipitation titration using barium chloride and sodium sulphate
6. Determination of molecular weight and degree of polymerization using viscometry.

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x					x			x
2	x	x		x					x			x
3	x	x		x			x		x			x
4	x	x		x			x		x			x
5	x	x		x					x			x

15GY112- SOFT SKILLS – I
(Common to All Branches)

L	T	P	C
0	0	2	1

OBJECTIVES:

- To develop inter personal skills and be an affective goal oriented team player
- To develop professionals with idealistic, practical and moral values
- To develop communication in writing techniques
- To re-engineer attitude and understand its influence on behaviour

COURSE OUTCOMES:

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

CO1: Analyze their strength and weakness
CO2: Understand the importance of non verbal communication
CO3: Get exposure about the fundamentals of GDs and Interviews
CO4: Communicate and present their ideas
CO5: Know how to prepare Resume and write Report efficiently

UNIT I **(6)**

Self Analysis - Self Introduction - Ice breaking - Identify strength and weakness - Self esteem and Confidence

UNIT II **(6)**

Non Verbal - Body Language of self and others
Presentation Skills - Stages involved in an effective presentation - Selection of topic, content, aids - Engaging the audience - Time management

UNIT III **(6)**

Group Discussion - Understanding the objective and skills tested in GD - Types of GD - Roles in a GD - Do's & Don'ts - Video Modules, fundamentals of placement techniques
Interview Skills - Self preparation checklist - Grooming tips (Do's& Don'ts) - Video Modules

UNIT IV **(6)**

Out of box thinking and General behaviours

UNIT V **(6)**

Preparing Resume and Report

TOTAL (P:30) : 30 PERIODS

REFERENCE:

1. Andrews Sudhir, "How to Succeed at Interviews", 21st Reprint, Tata McGraw-Hill. New Delhi, 1988

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x		x	x		x	x		x
2							x		x	x		x
3				x			x		x	x		x
4				x		x	x		x	x		x
5				x						x		x

15GYC11 ENGINEERING PRACTICES LABORATORY

(Common to All Branches)

L	T	P	C
0	0	4	2

OBJECTIVES:

- To provide hands on training on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering
- To understand the basic working principle of electric components
- To understand and operate multimeter for current, voltage and resistance measurements
- Have and technical skills required to remain productive in the field of Electrical Engineering

COURSE OUTCOMES:

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

CO1: Understand various civil engineering practices like plumbing, carpentry and relevant tools

CO2: Understand various manufacturing processes

CO3: Get familiarity with the instruments such as CRO, Function generator, single and dual power supply, multi-meter, bread board, IC's, and components such as diodes, transistors, resistors, capacitors, inductors, etc.,

CO4: Get familiarity with the testing of capacitors, diodes, transistors with Analog multimeter or Digital multimeter and Understand the principles of electrical circuits and electronics, and analysis, synthesis, and experimental techniques for both analog and digital electronic circuits

CO5: Do residential house wiring and Measure energy and resistance to earth of an electrical equipment

GROUP-A (MECHANICAL AND CIVIL ENGINEERING)

I - CIVIL ENGINEERING PRACTICE **(15)**

Buildings:

a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects

Plumbing Works:

a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings
b. Study of pipe connections requirements for pumps and turbines
c. Preparation of plumbing line sketches for water supply and sewage works
d. Hands-on-exercise:

   Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components
e. Demonstration of plumbing requirements of high-rise buildings

Carpentry using Power Tools only:

a. Study of the joints in roofs, doors, windows and furniture
b. Hands-on-exercise: Planning, Tee joints

II - MECHANICAL ENGINEERING PRACTICE **(15)**

Welding:

a. Preparation of edges for welding and study of welding symbols
b. Arc welding- butt joints, lap joints and tee joints
c. Gas welding
d. Study of standard size of bars, rods, sections, sheet metals
e. Study of work piece types and parameters of welding such as welding current, air gap, filler metal

Basic Machining:

a. Facing & Plain turning
b. Drilling Practice
c. Study of different types of screw drivers, screws, bolts and nuts

Sheet Metal Work:

a. Model making using bending and forming - Trays, cone
b. Study of thickness gauges, wire gauges

GROUP - B (ELECTRICAL AND ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICE **(15)**

a. Residential house wiring using switches, fuse, indicator, lamp and energy meter
b. Fluorescent lamp wiring
c. Stair case wiring
d. Measurement of electrical quantities - voltage, current, power & power factor in RLC circuit
e. Measurement of energy using single phase energy meter
f. Measurement of resistance to earth of electrical equipment

ELECTRONICS ENGINEERING PRACTICE **(15)**

a. Study of Electronic components and equipment - Resistor (Colour coding), Inductor, Capacitor
b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO
c. Study of logic gates AND, OR, XOR and NOT
d. Study of Clock Signal
e. Soldering practice -Components Devices and Circuits - Using general purpose PCB
f. Study of HWR and FWR
g. Study of Telephone, FM Radio and Cell Phone

TOTAL (P:60): 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x		x			x		x	x
2	x			x		x			x		x	x
3	x	x		x		x			x		x	x
4	x	x		x		x			x		x	x
5	x	x		x		x			x		x	x

15ME111 ENGINEERING GRAPHICS LABORATORY

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn to take data and transform it into graphic drawings
- To learn basic engineering drawing and standards related to technical drawing
- To understand and practice the engineering drawings

COURSE OUTCOMES:

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

CO1: Construct conic sections and special curves of required specifications
CO2: Apply the concept of first angle projection to create project of straight lines, planes, solids and section of solids
CO3: Develop a surface drawing of a solid model with given dimensions
CO4: Build orthographic, isometric projections of a three dimensional object
CO5: Make use of the knowledge of engineering drawing to Create physical models

LIST OF THE EXPERIMENTS

1. Construction of conic sections and special curves
2. Projection of straight lines
3. Projection of planes
4. Projection of solids
5. Section of solids
6. Development of surfaces
7. Orthographic projection
8. Isometric projections
9. Creation of Three Dimensional objects

TOTAL (L:15+P:30) : 45 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x	x				x		x	x
2	x		x	x					x		x	x
3	x		x	x	x				x		x	x
4	x		x	x					x		x	x
5	x		x	x					x		x	x

15EY201 PROFESSIONAL ENGLISH
(Common to All Branches)

L	T	P	C
1	0	2	2

OBJECTIVES:

- To articulate and enunciate words and sentences clearly and efficiently
- To demonstrate ability to gather information and apply it to persuade or articulate one's own point of view
- To understand different writing techniques and contents based on the communication medium being used
- To apply appropriate skills for preparation and performance for effective oral communication
- To enable learners of Engineering and Technology develop their basic communication skills in English

COURSE OUTCOME:

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

CO1: Construct clear, grammatically correct sentences using a variety of sentence structures and appropriate academic vocabulary
CO2: Utilize advanced vocabulary in different circumstances
CO3: Acquire listening and speaking skills in both formal and informal contexts
CO4: Distinguish main ideas and supporting details and employ active reading strategies to understand texts at the critical level
CO5: Equip them with writing skills needed for academic as well as workplace contexts

UNIT I : GRAMMAR **(9)**

Degrees of Comparison - Transformation of Sentences - Correction of errors - Reported Speech - Word Formation - Proximity of Concord - Connectives - Phrasal Verbs

UNIT II : VOCABULARY **(9)**

Building Vocabulary using Thesaurus - Cloze Test - Idioms and Phrases - Analogy - Collocation - Modifiers - Redundancy

UNIT III : LISTENING AND SPEAKING **(9)**

Introduction to articulation skills (Speech Pattern) - Activity based Listening and Speaking Practice (Listening to News, practicing Short Speeches and Debate)

UNIT IV : READING **(9)**

Reading Practice using General and Technical Articles from Newspapers and Science magazines - Reading short notices, Advertisements and passages - Levels of Reading Comprehension

UNIT V : WRITING **(9)**

Interpretation of pictures and cartoons - Slogan writing - Dialogue writing - Theme building exercises - Paragraph Completion - Instructions - Exercise on accuracy, brevity and correctness

TOTAL (L:15+P:30) : 45 PERIODS

TEXT/ REFERENCES BOOKS

1. Rizvi, Ashraf M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
2. Norman Whitby, "Business Benchmark - Pre Intermediate to Intermediate, Students Book", Cambridge University Press, 2006
3. Hewings. M, "Advanced English Grammar", Cambridge University Press, Chennai, 2000
4. Raman M &Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 2005

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1						x	x	x		x		x
2						x	x	x	x	x		x
3				x			x	x	x	x		x
4				x			x	x		x		x
5				x			x	x	x	x		x

15MY201 MULTIVARIABLE CALCULUS AND LAPLACE TRANSFORM
(*Common to Civil and MECH. Branches)*

L	T	P	C
3	2	0	4

OBJECTIVES:

To enable students

- Apply knowledge of Mathematics in Engineering
- Communicate problem solutions using correct Mathematical terminology
- Apply rigorous and analytic approach to analyse and solve differential equations

COURSE OUTCOMES:

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

CO1: Understand and handle functions of more than one variable, from the points of view of their differentiation, expansions and extreme values, along with differentiation under integral sign which are encountered in engineering studies

CO2: Have learnt the methods of double and triple integration, which are needed in their studies in other areas and gained confidence to handle integrals of higher orders

CO3: Have a good grasp of analytic functions and their interesting properties which could be exploited in a few engineering areas and be introduced to the host of conformal mappings with a few standard examples that have direct application

CO4: Have studied the basics of vector calculus comprising of gradient, divergence and curl and line, surface and volume integrals and the classical theorems involving them, which would be encountered by them in their engineering subjects in the same or higher semesters

CO5: Have a sound knowledge of Laplace transform and its properties and sufficient exposure to solution of certain linear differential equations using the Laplace transform techniques which have applications in other subjects of the current and higher semesters

UNIT I : FUNCTIONS OF SEVERAL VARIABLES **(9)**

Partial derivatives - Total differential - Differentiation of implicit functions - Taylor's expansion - Maxima and Minima- Constrained Maxima and Minima by Lagrange's Multiplier method - Jacobians

UNIT II : MULTIPLE INTEGRALS **(9)**

Double integration in Cartesian Co-ordinates-Change of order of integration - Area as double integral - Triple integration in Cartesian Co-ordinates - Volume as triple integrals

UNIT III : ANALYTIC FUNCTIONS **(9)**

Functions of a complex variable - Analytic functions - Necessary and sufficient conditions for analyticity (Statement only) - Properties - Harmonic conjugate - Construction of analytic function - Conformal mapping - Mapping by functions: w = z + c, cz, 1/z, and bilinear transformation

UNIT IV : VECTOR CALCULUS **(9)**

Gradient and Directional derivative - Divergence and Curl - Irrotational and solenoidal vector fields - Line integral over a plane curve - Surface integral and volume integral - Green's ,Gauss divergence, Stokes Theorem(Statement only) - Verification and Evaluation

UNIT V : LAPLACE TRANSFORM **(9)**

Definition - Laplace Transform of Standard functions: $e^{at}, \sin at, \sinh at, t^n, f'(t), f''(t)$ - First Shifting Theorem (Statement only) - Initial and Final value Theorems - Inverse Laplace transforms -Convolution theorem (Statement only) - Applications of Laplace transform for differential equations of 2nd order with constant coefficients

TOTAL (L:45+T:30) : 75 PERIODS

TEXT BOOKS:

1. Dr.Grewal.B.S, "Higher Engineering Mathematics", 42nd ed., Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th ed., John Wiley & sons, 2013
3. Veerarajan.T, "Engineering Mathematics for first year", 3rd ed., Tata McGraw Hill, 2011

REFERENCES:

1. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics: Sem-II", 5th edition., Laxmi Publications, 2011
2. Kandasamy.P, Thilagavathy.K,Gunavathy.K, "Engineering Mathematics for first Year", 9th Revised Edition, S.Chand & Co Ltd, 2013
3. Glyn James, "Advanced Engineering Mathematics", 7th ed., Wiley India, 2007

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x							x	x
2	x			x							x	x
3	x			x	x		x				x	x
4	x			x							x	x
5	x			x	x		x		x		x	x

15PY201 MATERIALS PHYSICS

(Common to Civil and Mechanical Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide the basic ideas in electrical conduction, conductors, semiconductors and nano technology
- To understand the fundamental concepts on solid state physics
- To gain fundamental knowledge about thermal physics and that will help students to study further subjects like thermodynamics, heat and mass transfer etc.,
- To update the recent development about modern engineering materials

COURSE OUTCOMES:

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

CO1: Analyze different conducting materials and their behavior
CO2: Know the basics about thermal conductivity of various materials
CO3: Examine the materials using different methods during the manufacturing process
CO4: Acquire information regarding new engineering materials and using them to create new Products
CO5: Gain knowledge about nanotechnology and its various applications

UNIT I : CONDUCTING MATERIALS (9)

Electron theories of conductivity - postulates of classical free electron theory- derivation of electrical conductivity of metals (Drude- Lorentz theory) - merits and demerits. Derivation of thermal conductivity - Wiedeman-Franz law-verification. Fermi energy - Importance of fermi energy - Fermi-Dirac distribution function and its variation with temperature - density of energy states- calculation of density of electrons

UNIT II : SEMICONDUCTING MATERIALS & SUPERCONDUCTING MATERIALS (9)

SEMICONDUCTORS: Elemental and compound semiconductors - Intrinsic semiconductor - carrier concentration derivation - variation of Fermi level with temperature - electrical conductivity - band gap determination - extrinsic semiconductors (qualitative) - variation of Fermi level with temperature and impurity concentration - Hall effect - determination of Hall coefficient - Applications

SUPERCONDUCTIVITY: Properties - Types of super conductors - BCS theory of superconductivity - Applications of superconductors - SQUID, cryotron, magnetic levitation

UNIT III : THERMAL PHYSICS (9)

Mode of heat transfer - thermal conductivity - Newton's law of cooling - thermal conduction through compound media (bodies in series and parallel) - thermal conductivity of a good conductor - Forbe's method - thermal conductivity of bad conductor - Lee's disc - radial flow of heat - expression for thermal conductivity of rubber - experimental determination - practical applications of conduction

UNIT IV : MATERIAL TESTING MECHANISMS (9)

Testing of materials - classification of tests - destructive tests - tensile test on a metal - hardness test - Non Destructive Testing - Various steps involved in NDT process - X-ray radiographic technique - displacement method - merits, demerits and applications of X-ray radiography - X-ray fluoroscopy - liquid penetrant method - advantages, disadvantages and applications

UNIT V : MODERN ENGINEERING MATERIALS & NANOTECHNOLOGY (9)

Metallic glasses: preparation, properties and applications - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy, applications, advantages and disadvantages of SMA - Nano materials - synthesis - plasma arcing - chemical vapour deposition - sol gel - electrodeposition - ball milling - properties of nanoparticles and applications - Carbon nanotubes - fabrication - arc method - pulsed laser deposition - structure - properties and applications

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Rajendran.V, “Engineering Physics”, Tata McGraw-Hill.New Delhi, 2011
2. Gaur.R.K, Gupta.S.L, “Engineering Physics”, Dhanpat Rai Publications, 2007
3. Avadhanulu.M.N, Kshirsagar.P.G, “A Text book of Engineering Physics”, S.Chand, 2011

REFERENCES:

1. SenthilKumar.G, N.Iyandurai, “Physics-II”, VRB Publishers, Revised Edition, 2005-2006
2. Pillai.S.O, “Solid State Physics”, New Age International Publications, New Delhi, 2010

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x						x			
2		x				x						
3	x	x							x			
4	x	x	x			x						
5	x	x	x	x								

15CY201 ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the constitutes of the environment
- The students should be conversant with valuable resources
- To know about the role of a human being in maintaining a clean environment
- To maintain ecological balance and preserve bio-diversity
- To get knowledge about the conservation of environment for the future generation

COURSE OUTCOMES:

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

CO1: Design a system, component or process to meet desired needs
CO2: Identify, formulate and solve environmental engineering problems
CO3: Understand the professional and ethical responsibility as related to the practice of environmental engineering and the impact of engineering solutions in global context
CO4: Use the techniques, skills and modern engineering tools necessary for environmental engineering practice
CO5: Acquire the knowledge of information technology in environmental science

UNIT I : INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES (9)

Environment: Scope - importance - need for public awareness. Forest resources: Use-over exploitation-deforestation. Water resources: Use-over utilization of surface and ground water - conflicts over water. Mineral resources: Use-exploitation-environmental effects of extracting and using mineral resources. Food resources: World food problems changes caused by agriculture. Effects of modern agriculture - fertilizer- pesticide problems. Energy resources: Renewable energy sources - solar energy - wind energy. Land resources: land degradation - soil erosion. Role of an individual in conservation of natural resources

UNIT II : ECOSYSTEMS AND BIODIVERSITY (9)

Concepts of an ecosystem: Structure and function of an ecosystem - Producers, consumers and decomposers. Food chains- food webs. Types of ecosystem: Structure and functions of forest ecosystem and river ecosystem. Biodiversity: Value of biodiversity: consumptive use-productive use - social values - ethical values - aesthetic values. Hotspots of biodiversity -Threats to biodiversity: Habitat loss - poaching of wildlife and man wildlife conflicts- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

UNIT III : ENVIRONMENTAL POLLUTION (9)

Pollution: Causes, effects and control measures of Air pollution, Water pollution, Soil pollution and Noise pollution. Solid waste management: Causes - effects -control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Disaster managements: Floods - cyclone- landslides

UNIT IV : SOCIAL ISSUES AND THE ENVIRONMENT (9)

Water conservation - rain water harvesting. Climate change - global warming - acid rain - ozone layer depletion. Environment protection act: Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Wildlife protection Act - Forest conservation Act

UNIT V : HUMAN POPULATION AND THE ENVIRONMENT (9)

Population growth - variation among nations - Population explosion - Family welfare programme - Human rights - HIV/AIDS - women and child welfare - Role of information technology in environment and human health

TOTAL (L:45) : 45 PERIODS

TEXTBOOKS:

1. AnubhaKaushik and Kaushik.C.P, Environmental Science and Engineering, New Age International Publishers, New Delhi, 2006.
2. Meenakshi.P, "Elements of Environmental Science and Engineering", Prentice-Hall of India, New Delhi 2005.
3. Dr.A.Ravikrishnan, "Environmental Science and Engineering", Sri Krishna Hitech Publishing co. Pvt .Ltd., Chennai,13th ed., 2012.

REFERENCES:

1. Masters Gilbert M, "Introduction to Environmental Engineering and Science", 2nd ed., Pearson Education, New Delhi, 2004.
2. Santosh Kumar Garg, Rajeshwari Garg, Ranjni Garg "Ecological and Environmental Studies", Khanna Publishers, Nai Sarak, New Delhi, 2006.
3. Miller T.G. Jr., "Environmental Science", 10th ed., Wadsworth Publishing Co., 2004.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x		x			x		x	x
2	x		x	x		x			x		x	x
3	x		x	x		x	x		x		x	x
4	x		x	x		x	x		x		x	x
5	x		x	x		x	x		x		x	x

15ME201 ENGINEERING MECHANICS

L	T	P	C
2	2	0	3

OBJECTIVES:

- To study the behaviour of a particle and rigid body under the action of forces
- To analyse the structures subjected to various forces
- To know the geometric properties of the different shapes
- To teach energy and momentum methods

COURSE OUTCOMES:

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

CO1: Solve the engineering problems in case of equilibrium conditions.
CO2: Calculate the reaction forces of various supports of different structures.
CO3: Solve the problems involving dry friction.
CO4: Determine the centroid, centre of gravity and moment of inertia of various surfaces and solids.
CO5: Solve the problems involving dynamics of particles and rigid bodies

UNIT I : STATICS OF PARTICLE (6+6)

Introduction to Mechanics - Units and Dimensions - Fundamental Principles - Laws of Mechanics, Lame's theorem, Parallelogram and triangular Law of forces, Principle of Transmissibility - Coplanar forces - Equilibrium of particles under coplanar forces - Equilibrium of particle in space Single equivalent force

UNIT II : STATICS OF RIGID BODY (6+6)

Equilibrium of Rigid Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions

UNIT III : FRICTION (6+6)

Frictional force - Laws of Coulomb friction - Angle of friction - cone of friction - Simple contact friction - Ladder friction - Belt friction - Transmission of power through belts - Wedge Friction - Screw Jack - Self locking - Rolling Resistance - Problems involving the equilibrium of a rigid bodies with frictional forces

UNIT IV : PROPERTIES OF SECTIONS (6+6)

Centroid - First moment of area - Theorems of Pappus and Guldinus - Second moment of area - Moment and Product of inertia of plane areas - Transfer Theorems - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principal axes - Mass moment of inertia - Derivation of mass moment of inertia for rectangular section prism, sphere from first principle - relation to area moments of inertia

UNIT V : DYNAMICS OF PARTICLES AND RIGID BODIES (6+6)

Displacements, Velocity and acceleration, their relationship - Absolute and Relative motion method-Linear motion - Curvilinear motion - Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies - Impact - direct and central impact - coefficient of restitution - Translation and Rotation of Rigid Bodies - Velocity and Acceleration - General plane motion

TOTAL (L:30+T:30) : 60 PERIODS

TEXT BOOK:

1. Ferdinand P. Beer, E. Russell Johnston, "Vector Mechanics for Engineers: Statics and Dynamics", 9th ed., Tata McGraw-Hill International Edition, 2010
2. Meriam.J.L and Kraige.L.G, "Engineering Mechanics: Statics and Dynamics", 6th Edition, Wiley Publishers, 2006

REFERENCES:

1. Irving H. Shames, "Engineering Mechanics : Statics and Dynamics", Prentice Hall of India Private limited, 2003
2. Russell C Hibbeler, "Engineering Mechanics: Statics and Dynamics", 12th ed., Prentice Hall, 2009
3. Anthony M. Bedford and Wallace Fowler, "Engineering Mechanics: Statics and Dynamics", 5th ed., Prentice Hall, 2007
4. Palanichamy, M.S and Nagan,S, "Engineering Mechanics - Statics and Dynamics", 3rd ed., TataMcGraw-Hill,NewDelhi,2005
5. Rajasekaran.S,Sankara subramanian,G, "Fundamentals of Engineering Mechanics", 3rd ed., Vikas Publishing House Pvt.Ltd., New Delhi, 2005

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x	x	x		x		x	x	x
2	x		x		x	x					x	x
3	x		x		x	x					x	x
4	x		x		x	x		x			x	x
5	x	x	x	x	x	x		x		x	x	x

15CSC01 PROBLEM SOLVING AND C PROGRAMMING

(Common to All B.E Programmes except CSE & IT)

L	T	P	C
3	0	0	3

OBJECTIVES :

- To know the correct and efficient ways of solving problems
- To learn the basics of C declarations, operators and expressions
- To work on all the elementary statements (Loop, Branch) and arrays
- To learn on the manipulation of strings, functions and pointers

COURSE OUTCOMES:

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

CO1: Understand the basic terminology used in computer programming
CO2: Use different data types in a computer program
CO3: Design programs involving decision structures, loops and functions
CO4: Explain the difference between call by value and call by reference
CO5: Understand the dynamics of memory by the use of pointers

UNIT I : INTRODUCTION TO COMPUTERS **(9)**

Computer Basics - Applications and characteristics of Computer - Computer organization - Number systems - Computer Software - Types of software - Software Development steps

UNIT II : PROBLEM SOLVING & PROGRAMMING **(9)**

Algorithms - Flowchart - Pseudo code - Overview of C - Writing the first C Program - Constants, Variables, Data Types, Storage Classes - Operators and Expressions - Managing Input and Output operations

UNIT III : CONTROL STRUCTURES AND ARRAYS **(9)**

Selection structures, Iteration Structures - Control Transfer Statements- Array concepts - One dimensional array - Two dimensional arrays – Multidimensional arrays - Strings

UNIT IV : POINTERS & FUNCTIONS **(9)**

Pointer - Declaration - Initialization - Accessing the values - Dynamic Memory Allocation- Functions - Elements of User defined Functions, Function types, Parameter Passing Techniques, Passing Array to Functions, Recursive Function

UNIT V: STRUCTURES, UNIONS AND FILES **(9)**

Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union **-** File Management in C - The Preprocessor

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Ashok.N.Kamthane, “Programming in C”, 2nded.,Pearson EducationIndia, 2013
2. Balagurusamy.E, “Fundamentals of computing and programming”, 2nd ed., Tata McGraw-Hill Publishing Company Limited, 2012

REFERENCES:

1. YashavantKanetkar, “Let us C”, BPB publications, New Delhi, 3rd ed., 2011
2. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Tata McGraw-Hill, 2nd ed., 2006
3. Dromey R.G., “How to Solve it by Computer”, Pearson Education, 4th Reprint, 2007
4. Kernighan B.W and Ritchie D.M, “The C Programming language”, 2nd ed., Pearson Education, 2006

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x										x	x
2	x		x				x		x		x	x
3	x		x				x		x		x	x
4	x										x	x
5	x										x	x

15GY211 PHYSICS AND CHEMISTRY LABORATORY- II
(Common to All Branches)

L	T	P	C
0	0	4	2

OBJECTIVES:

- To provide the basic practical exposure to all the engineering and technological streams in the field of physics
- The students are able to know about the water containing impurities and some physical parameters

COURSE OUTCOMES:

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

CO1: Acquire the practical knowledge in various modules
CO2: Gain the practical knowledge about band gap of a semiconductor, optoelectronic devices and understand about the spectral instruments
CO3: Analyze the properties of matter and the thermal conductivity of a material
CO4: Apply knowledge of measurement of conductance, hardness producing ions, alkalinity, conductance, EMF and pH
CO5: Understand the impact of water quality parameters

LIST OF EXPERIMENTS:

PHYSICS LABORATORY- II

1. Determination of Young's modulus of the material - non uniform bending
2. Determination of Band Gap of a semiconductor material
3. Determination of viscosity of liquid - Poiseuille's method
4. Spectrometer dispersive power of a prism
5. Determination of Young's modulus of the material - uniform bending
6. Torsional pendulum - Determination of rigidity modulus
7. Solar cell - VI characteristics
8. V-I characteristics of PN junction diode
9. Determination of thermal conductivity of a bad conductor - Lee's Disc method

CHEMISTRY LABORATORY- II

1. Estimation of alkalinity of Water sample
2. Estimation of Copper in brass by EDTA
3. Conductometric titration of mixture of acids
4. Estimation of iron by potentiometry
5. Estimation of hydrochloric acid by pH metry
6. Estimation of water of crystallization of copper sulphate
7. Estimation of iron by spectrophotometer

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x		x	x	x	x		x	x	x
2	x	x	x			x		x	x	x	x	x
3	x		x	x	x					x	x	x
4											x	x
5	x	x									x	x

15GY212 SOFT SKILLS – II

(Common to All Branches)

L	T	P	C
0	0	2	1

OBJECTIVES:

- To re-engineer attitude and understand its influence on behaviour
- To recognize stress symptoms & develop stress deflecting strategies
- To improve time management, organizational skills and goal setting
- To develop leadership skills to improve teamwork, creativity, efficiency & productivity

COURSE OUTCOME:

At the end of this course, student will be able to

CO1: Narrate stories by their own

CO2: Develop their leadership qualities for the betterment of the team.

CO3: Demonstrate the ability to evaluate an event or situation, identify the problem and alternate solutions, and make a recommendation

CO4: Acquire strategic knowledge about how to manage time

CO5: Overcome stress making factors in society

UNIT I **(6)**

Effective presentation strategies - Story telling - Visual communication

UNIT II **(6)**

Team work - Importance of team work - Leadership skills - attributes of a successful team - barriers involved - dealing with people - Group decision making

UNIT III **(6)**

Life and Managerial skills - Effective ways of dealing with people - Emotional intelligence - Types of conflicts (Inter and Intra group conflicts)

UNIT IV **(6)**

Time Management - Tips and strategies - Time wasters - Procrastination - Advantages of time management

UNIT V **(6)**

Stress management - Management of various forms of fear (examination fear, stage fear and public speaking fear)

TOTAL (P:30) : 30 PERIODS

TEXT BOOK :

1. Swaminathan. V.D & Kaliappan.K.V, “Psychology for Effective Living”, The Madras Psychology Society, Chennai, 2001

REFERENCES:

1. Robbins, S.B, “Organizational Behavior”,Prentice Hall of India, New Delhi, 2005
2. Smith, B, “Body Language”, Rohan Book Company, Delhi, 2004
3. Hurlock, E.B,“Personality Development”, 28th Reprint. Tata Mc-Graw Hill, New Delhi, 2006

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1										x		
2						x	x	x	x	x		
3						x	x	x	x	x		
4						x	x	x	x	x		
5						x	x	x	x	x		

15CSC11 COMPUTER PROGRAMMING LABORATORY
(*Common to All Branches Except CSE & IT*)

L	T	P	C
0	0	2	1

OBJECTIVES:

- Learn about Office tools like MS Word and MS Excel
- Gain knowledge about open source tool to draw flowchart
- Acquire the basics of C declarations, operators and expressions
- Work on all the elementary statements (Loop, Branch), functions and arrays
- Learn on the manipulation of structures, pointers and files

COURSE OUTCOMES:

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

CO1: Use MS Word and MS Excel for document preparation
CO2: Draw flowchart using open source tool
CO3: Develop program using basic C constructs
CO4: Write program using arrays and functions
CO5: Create program using pointer, structure and files

Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation

Spread Sheet

4. Chart - Line, XY, Bar and Pie.
5. Formula - formula editor

RAPTOR - Tool

6. Drawing - flow Chart

C- Programming

7. Program Using Operators, Expressions and IO formatting
8. Program Using Decision Making and Looping
9. Program Using Arrays and Strings
10. Program Using Functions and Recursion
11. Program Using Pointers.
12. Program Using Structure, Union.
13. Program Using Files.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
- Printers – 3 Nos.

Software

- OS - Windows / UNIX Clone
- Application Package - Office suite
- RAPTOR - Tool
- Compiler - C

TOTAL (P:30) : 30 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x				x					
2	x	x					x		x		x	
3	x	x	x				x		x			
4	x	x	x				x					
5	x		x				x					

15ME211 COMPUTER AIDED MODELING AND DRAFTING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To understand fundamentals of modeling and drafting
- To model 2D & 3D drawings of mechanical components using modeling software

COURSE OUTCOMES:

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

CO1: Create orthogonal views of given three dimensional object using modeling software
CO2: Develop sectional view of various solids
CO3: Construct three dimensional model of simple objects
CO4: Make use of two dimensional model to represent three dimensional models
CO5: Create 2D & 3D models of machine components

LIST OF THE EXPERIMENTS

1. Drawing of front view and top view of given solid models
2. Drawing of front view and top view of simple solids of cylinder, cone, and dimensioning the objects.
3. Drawing sectional views of prism and pyramid
4. Drawing sectional views of cylinder, cone
5. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model
6. Creation of 2 D drawing of assembly Flanged Coupling- protected type
7. Creation of 2 D drawing of Knuckle Joint
8. Creation of 2 D drawing of Cotter Joint with sleeve
9. Creation of 3 D drawing of Nut & Bolt
10. Creation of 3D drawing of Geneva Gear

Modeling and drafting software may be used for conducting the laboratory

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x	x				x		x	x
2	x		x	x	x				x		x	x
3	x		x	x	x				x		x	x
4	x		x	x	x				x		x	x
5	x		x	x	x				x		x	x

15MY301 FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND PROBABILITY

(Use of Normal Distribution table is permitted)

(Common to BE - Mechanical & Civil Engineering)

L	T	P	C
3	2	0	4

OBJECTIVES:

- To acquire knowledge on formation of Fourier series for the periodic functions
- To introduce the solution methods of given partial differential equations and their applications
- To understand the theory of probability and types of statistical distributions

COURSE OUTCOMES:

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

CO1: Develop the Fourier series for the functions of given period
CO2: Determine the solution for numerical problems in first order partial differential equations
CO3: Solve the given types of problems on the partial differential equations
CO4: Construct the Fourier series for the vibrating string and heat transfer problems
CO5: Demonstrate the theory of probability and the parameters of statistical distributions

UNIT I : FOURIER SERIES **(9)**

Dirichlet's conditions - Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Parseval's identity - Root -Mean square value of a function - Harmonic Analysis.

UNIT II : FIRST ORDER NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS **(9)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations: (i) f(p,q)=0, (ii) Clairaut's type, (iii) f(z,p,q) = 0, (iv) f(x,p) = g(y,q).

UNIT III : LINEAR PARTIAL DIFFERENTIAL EQUATIONS **(9)**

General solution of Lagrange's linear equation Pp+Qq = R - Solutions of simultaneous equations dx/P=dy/Q =dz/R by the method of grouping & method of multipliers-.Linear partial differential equations of second and higher order with constant coefficients (R.H.S = 0, e^{ax+by}, cos(ax+by), sin(ax+by), $x^r y^s$)(only homogeneous types.)

UNIT IV : APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **(9)**

Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation (zero and Non-zero Boundary conditions) - One dimensional heat equation(Reduced to zero & non zero temperature) - Steady state solution of two dimensional heat equation (Finite and infinite plate).

UNIT V : PROBABILITY THEORY AND DISTRIBUTIONS **(9)**

Random Experiment - Definition of Probability - Axioms of probability - conditional probability - independent of events, Discrete distributions: Binomial and Poisson - Continuous distributions: Exponential and Normal distributions

TOTAL (L:45 + T:30) : 75 PERIODS

TEXT BOOKS:

1. Veerarajan.T, "Transforms and Partial Differential Equations", 2nd ed., Tata McGraw Hill, New Delhi, Second reprint, 2015
2. Veerarajan.T., "Probability, Statistics and Random Processes with Queueing theory and Queueing Networks, Tata McGraw-Hill, 4th ed., second reprint 2016, New Delhi

REFERENCES:

1. Goyal. Manish and Bali, N.P, "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012
2. Grewal, B.S. "Higher Engineering Mathematics", 43nd ed., Khanna publishers, New Delhi, 2014
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006
4. Kandasamy.P, Thilagavathy.K and Gunavathy.K, "Engineering Mathematics: Volume III", S. Chand & Co Ltd., 2006.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x								x
2	x	x		x				x			x	x
3	x	x	x	x			x	x			x	x
4	x	x		x	x		x	x			x	x
5	x	x						x			x	x

Approved by Fourth Academic Council

15ME301 MATERIALS ENGINEERING AND TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire basic knowledge in the discipline of materials science and engineering
- To introduce the heat treatment methods and the process parameters for various materials
- To explore the types of non ferrous alloys and advanced materials

COURSE OUTCOMES:

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

CO1: Classify the materials and the types of defects
CO2: Identify the different forms of phases with respect to temperature and composition
CO3: Recommend suitable heat treatment method to enhance the surface characteristics of particular material
CO4: Measure the mechanical properties of materials using various equipment
CO5: Categorize the engineering applications of non ferrous and advanced materials

UNIT I : BASIC CONCEPTS (9)

Materials Science - Simple Crystal Structures - BCC, FCC, HCP Structures - Unit Cell - Defects - Point, Line, Surface, Volume - Slip planes and slip systems - Schmid's rule - Polymorphism

UNIT II : PHASE DIAGRAMS AND PHASE TRANSFORMATION (9)

Gibbs's Phase rule - Solidification and Solid Solutions - Equilibrium Diagrams - Classification of Equilibrium Diagrams - Isomorphous System - Eutectoid and Peritectic system - Iron-Iron carbide phase diagram - Phase, Time - Temperature - Transformation (TTT) and Martensitic Transformation - Types and applications of Steels - and Cast Irons.

UNIT III : HEAT TREATMENT PROCESS (9)

Heat Treatment - Annealing and its types, Normalizing, Hardening and its types - Quench Cracks, Tempering, Hardenability - Surface hardening processes - Casehardening, Flame Hardening and induction hardening, Cyaniding and Nitriding

UNIT IV : MECHANICAL PROPERTIES OF MATERIALS (9)

Testing of Materials - Classification of tests, Tensile test, Impact test, Hardness test Tension and Torsion test - Stress-strain Curve - Fractures in metals - Ductile Fracture, Brittle Fracture - Methods of protection against fracture - Creep test - stages of creep - Prevention of Creep Fracture

UNIT V : NON FERROUS METALS AND ALLOYS (9)

Non Ferrous Metals - Aluminium, Copper, Nickel, Magnesium, Zinc, Lead, Non Ferrous Alloys - Copper alloys, Aluminium alloys, Magnesium alloys and Nickel alloys. Non Metallic Materials - Polymers, Ceramics and Composites.

TOTAL (L:45): 45 PERIODS

TEXT BOOKS:

1. Rajput.R.K, "Engineering Materials and Metallurgy", 6th ed., S.Chand & Company Pvt.Ltd, 2013
2. Balasubramaniam.R, "Callister's Materials Science and Engineering (With CD)", 2nd ed., Wiley India Pvt Ltd 2014

REFERENCES:

1. Anderson.C, Leaver.K.D, Leavers.P and Rawlings.R.D, "Materials Science for Engineers", 5th ed., CRC Press, 2003
2. William F. Smith and Javad Hashemi, "Foundations of Materials Science and Engineering", 5th ed., McGraw Hill, 2009
3. Sidney H Avner, "Introduction to Physical Metallurgy", 2nd ed., Tata McGraw Hill Publishing Company Limited, 2008
4. Raghavan.V, "Material Science and Engineering", 5th ed., PHI Learning Private Limited, 2011
5. Kenneth G. Budinski, "Engineering Materials Properties and Selection", 9th ed., PHL Learning Private Limited, 2013

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x	x	x					x
2	x	x	x		x		x	x			x	x
3	x	x	x	x	x	x	x	x			x	x
4		x			x			x			x	x
5	x	x	x	x	x	x	x	x			x	x

Approved by Fourth Academic Council

15ME302 ENGINEERING THERMODYNAMICS
(Use of Psychrometric charts is permitted)

L	T	P	C
2	2	0	3

OBJECTIVES:

- To introduce the basic principles of classical thermodynamics and basic conversion principles of mass and energy to closed and open systems
- To introduce the second law of thermodynamics with applications and to know about exergy, entropy and second law efficiency
- To understand various gas laws, equations of state and apply them to solve problems of gas mixtures in estimating enthalpy, entropy, specific heat, internal energy and psychrometric processes

COURSE OUTCOMES:

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

CO1: Describe the concepts of conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics
CO2: Identify closed and open systems and analyze related problems
CO3: Apply the concept of second law to analyze thermal systems
CO4: Apply gas laws to mixtures
CO5: Explain the types of psychrometric processes

UNIT I : BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (6+6)

Basic concepts - thermodynamics system -closed, open and isolated systems - property, state and thermodynamic equilibrium - process and cycle - forms of energy - work and heat transfer - concept of heat and temperature, zeroth law and first law of thermodynamics – application to closed and open systems - first law applied to steady flow engineering devices

UNIT II : SECOND LAW OF THERMODYNAMICS (6+6)

Entropy - property of entropy - the inequality of Clausius - thermal energy reservoirs - second law of thermodynamics - Kelvin-Planck and Clausius statements - equivalence of Kelvin-Planck and Clausius statements - Clausius inequality - refrigerators, heat pump and air conditioners - COP - perpetual motion machines - reversible and irreversible process - Carnot cycle

UNIT III : EXERGY AND ANERGY (6+6)

Exergy - Available energy referred to a cycle - quality of energy Maximum work in a reversible process -reversible work by an open system useful work - dead state availability in chemical reactions - Anergy and Gouy-Stodola theorem, exergy balance - Second law efficiency comments on exergy

UNIT IV : IDEAL GAS MIXTURES (6+6)

Ideal and real gases - Vander Waals equation - principle of corresponding states - ideal gas equation of state - compressibility factor - compressibility charts - composition of gas mixtures - mass and mole fractions - relating pressure, volume and temperature of ideal gas mixtures - evaluating internal energy -enthalpy- entropy and specific heats

UNIT V : PSYCHROMETRY (6+6)

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

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Holman.J.P "Thermodynamics", 10th ed., McGraw Hill Education, 2011
2. Nag.P.K, "Engineering Thermodynamics", 5th ed., McGraw Hill Education, 2013

REFERENCES:

1. Arora.C.P, Thermodynamics, 1st ed., Tata McGraw - Hill Education, 2001
2. Moran, Shapiro, Boettner, Bailey "Principals of Engineering Thermodynamics", 7th ed., Wiley India Pvt Ltd-2013
3. Michael A. Boles, Yunus A. Cengel, "Thermodynamics: An Engineering Approach", 7th ed., Tata McGraw - Hill Education, 2011
4. Rajput.R.K, "Engineering Thermodynamics", 4th ed., Laxmi Publications, 2007
5. Rao.Y.V.C, "An Introduction to Thermodynamics", Revised Edition, Orient Longman, 2009

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											x
2	x	x			x		x	x	x		x	x
3	x	x			x							x
4	x											x
5	x	x					x	x			x	x

15ME303 FLUID MECHANICS AND MACHINERY

L	T	P	C
2	2	0	3

OBJECTIVES:

- To introduce the fundamentals of fluid mechanics in hydraulic machineries
- To know the fluid properties and understand the importance of flow measurement
- To acquire knowledge on the development of boundary layers

COURSE OUTCOMES:

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

CO1: Explain the fluid properties and flow parameters
CO2: Estimate major and minor losses in flow through circular conduits
CO3: Apply dimensional analysis to formulate the relationship between the dependent and independent variables
CO4: Analyze the performance of hydraulic pumps
CO5: Find out the performance of various hydraulic machines

UNIT I : FLUID PROPERTIES AND FLOW CHARACTERISTICS (6+6)

Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity - Flow characteristics - concept of control volume - application of continuity equation, energy equation and momentum equation

UNIT II : FLOW THROUGH CIRCULAR CONDUITS (6+6)

Laminar flow through circular conduits - boundary layer concepts - types of boundary layer thickness - Darcy Weisbach equation - friction factor- Moody diagram- losses in pipes-hydraulic and energy gradient - flow through pipes in series and parallel

UNIT III : DIMENSIONAL ANALYSIS (6+6)

Need for dimensional analysis -methods of dimensional analysis - similitude - types of similitude - dimensionless parameters- applications-model analysis.

UNIT IV : PUMPS (6+6)

Classification of pumps - centrifugal pumps - working principle and work done - velocity triangle- performance curves - reciprocating pump- working principle - work done

UNIT V : TURBINES (6+6)

Classification of turbines - heads and efficiencies - velocity triangles - Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done- performance curves for turbines - governing of turbines.

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Bansal.R.K,"A Textbook of Fluid Mechanics and Hydraulic Machines", Revised 9th ed., Laxmi Publications (P) Ltd., 2011
2. Yunus Cengel, John Cimbala , "Fluid Mechanics Fundamentals and Applications", 3rd ed., McGraw-Hill Higher Education, 2013

REFERENCES:

1. Kumar.D.S, "Fluid Mechanics and Fluid Power Engineering", S K Kataria & Sons, New Delhi, 2013
2. Modi.P.Nand Seth.S.M, "Hydraulics and Fluid Mechanics Including Hydraulics Machines", 20th Revised and Enlarged ed., Standard Publishers Distributors, 2013
3. Rajput.R.K, "Fluid Mechanics & Hydraulic Machines", 3rd Revised Edition, S.Chand (G/L) & Company Ltd, 2006
4. Vijay Gupta and Santosh Kumar Gupta, "Fluid Mechanics and Applications", 3rd ed., New Age International, 2015
5. Victor Streeter, Benjamin Wylie.E, Bedford.K.W, "Fluid Mechanics", 9th ed., Tata McGraw - Hill Education, 2010

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x							
2	x	x			x			x			x	x
3	x	x						x			x	x
4	x	x	x						x			x
5	x	x	x						x			x

Approved by Fourth Academic Council

15ME304 MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge on basic concepts of foundry and casting processes
- To introduce various methods of welding, cold and hot working and forming
- To understand forging, molding, powder metallurgy and composite materials

COURSE OUTCOMES:

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

CO1: Describe the principles of foundry and casting
CO2: Demonstrate the concept of metal forming processes for various applications
CO3: Select a metal joining process for various materials
CO4: Explain the manufacturing processes under powder metallurgy and plastics
CO5: Understand the manufacturing process for ceramics, glass and composite materials

UNIT I : CASTING PROCESSES (9)

Patterns- mould making - core- moulding sand -melting equipment- melting and pouring- gating system- cooling and solidification- casting- preparation, design- sand, shell mould, ceramic, vacuum, investment, die, centrifugal, continuous casting processes - casting defects, inspection and testing

UNIT II : METAL FORMING PROCESSES (9)

Cold and hot working - rolling - forging - extrusion -drawing - metal stamping and forming - bending, deep drawing, stretch forming, metal spinning, shear and flow forming, blanking, piercing, embossing and coining, roll forming - forming defects - shot peening - types of dies, presses - comparison of forming processes.

UNIT III : METAL JOINING PROCESSES (9)

Metal fusion welding processes - oxy-fuel gas welding – Electric arc welding processes - consumable electrode - SMAW- SAW - GMAW - FCAW -non-consumable electrode - GTAW- AHW- PAW – assembly of structures- solid state welding processes - ultrasonic welding - friction welding – explosive welding- diffusion welding - resistance welding - weld defects and testing

UNIT IV: POWDER METALLURGY AND PLASTICS (9)

Production of metal powders - compaction -sintering and finishing - design considerations for powder metallurgy – Plastics - types - types of Molding - injection molding, blow molding, compression molding, transfer molding, thermoforming

UNIT V : CERAMICS, GLASS AND COMPOSITE MATERIALS (9)

Processing of ceramics - shaping, drying and firing - finishing operations – Glass - fabrication, classification, uses and design considerations - composite materials – particle reinforced and fiber reinforced composites - design considerations

TOTAL(L:45) : 45 PERIODS

TEXT BOOKS:

1. Black.J.T and Ronald A Kohser, "Degarmo's Materials and Processes in Manufacturing", 11th ed., Willey India Pvt. Ltd, 2013
2. Rajput.R.K, "A Textbook of Manufacturing Technology", Laxmi Publications (P) Ltd, 2007

REFERENCES:

1. Hajra Choudhury S.K, Hajra Choundhury A.K and Nirjhar Roy, "Elements of Workshop Technology", Vol. 1, 2009
2. HMT, "Production Technology", "McGraw Hill Education", 1st ed., McGraw Hill Education, 1986
3. Rao.P.N, "Manufacturing Technology : Foundry, Forming and Welding - Volume 1", 4th ed., McGraw Hill Education, 2013
4. Serope Kalpakjian, Steven R. Schmid, "Manufacturing Engineering and Technology", 4th ed., Pearson Education, 2001
5. Sharma.P.C, "A Textbook of Production Technology", S. Chand Publications, 2006

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x									x
2	x	x	x		x	x		x			x	x
3	x	x	x		x	x		x			x	x
4	x		x		x	x		x			x	x
5	x		x									x

15EE306 ELECTRICAL MACHINES AND DRIVES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge on DC & AC machines, working principles and speed torque characteristics
- To introduce the fundamentals of electrical drives and special machines
- To know the starters for DC & AC motors and their conventional methods of speed control

COURSE OUTCOMES:

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

CO1: Describe the construction, working principle and characteristics of various types of DC machines
CO2: Summarize the construction, working principle and characteristics of different types of AC machines
CO3: Identify the types of drive systems and factors to be considered in selection of drives
CO4: Select DC motor starter and speed control method for an industrial application
CO5: Choose AC motor starter and speed control method for a particular equipment

UNIT I : DC MACHINES (9)

Construction - Generator Principle - EMF equation - Characteristics of different types of DC generators - Motor principle - Torque equation - Characteristics of different types DC motors - Starters - Electric braking.

UNIT II : AC MACHINES (9)

Alternator Construction, principle and EMF equation - Three phase induction motors - types - construction - speed torque characteristics - starters

UNIT III : ELECTRIC DRIVE FUNDAMENTALS AND SPECIAL MACHINES (9)

Drive systems - concept of electric drive - classification - AC and DC drives - principal factors affecting the choice of drive - selection of power rating of motor - drive system based on temperature and load variation factors - DC and AC servomotors - Stepper motors.

UNIT IV: DC MOTOR STARTERS AND SPEED CONTROL OF DC DRIVES (9)

DC Motor starters - speed control of DC series and shunt motors - armature and field control, Ward-Leonard control system - conventional speed control of DC Drives

UNIT V : AC MOTOR STARTERS AND SPEED CONTROL OF AC DRIVES (9)

AC Motor starters - speed control of three phase induction motor - voltage control, voltage / frequency control, slip power recovery scheme – conventional speed control of AC drives

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Theraja, B. L. and Theraja, A. K, "A Text Book of Electrical Technology", Volume - II, 23rd Revised edition edition, S. Chand and Co, New Delhi, 2006
2. Vedam Subramaniam, "Electric Drives - Concepts and applications", 2nd ed., McGraw Hill Education (India) Private Limited, 2010

REFERENCES:

1. Kothari.D.P, Nagrath.I.J, "Electric Machines", 4th ed., Mcgraw Hill Education, 2010
2. Ned Mohan, "Electric Machine and Drives", Wiley India Pvt Ltd, 2013
3. Partab.H, "Art and Science and Utilization of electrical energy", Dhanpat Rai and Sons, 2014
4. Pillai.S.K "A first course on Electric drives", 3rd ed., New Age International publications, Reprint 2015
5. Singh.M.D, Khanchandani.K.B, "Power Electronics", 2nd ed., Tata McGraw-Hill, 2006

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											x
2	x											x
3	x	x	x				x	x	x		x	x
4	x						x	x			x	x
5	x						x	x			x	

Approved by Fourth Academic Council

15ME311 FLUID MECHANICS AND MACHINERY LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To know the methodology of flow measurement using various devices
- To understand the losses in the pipes
- To estimate the performance of pumps and turbines

COURSE OUTCOMES:

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

CO1: Measure the flow parameter under given conditions
CO2: Determine the losses of flow through pipes
CO3: Estimate the performance of hydraulic pumps and turbines
CO4: Demonstrate Bernoulli's theorem with application
CO5: Find the meta-centric height from given ship model

LIST OF THE EXPERIMENTS

1. Determination of co-efficient of discharge of given orifice meter and Venturi meter
2. Calculation of rate of flow using Rota meter
3. Verification of Bernoulli's theorem
4. Determination of co-efficient of velocity of given Flow through Pitot tube
5. Determination of co-efficient of force Impact of jet
6. Determination of Meta-centric height of given ship model
7. Determination of co efficient of discharge of given Notch tank
8. Performance characteristics of Centrifugal Pump
9. Performance characteristics of Submergible pump
10. Performance characteristics of Reciprocating pump/Gear pump
11. Performance characteristics of Impulse Turbine
12. Performance characteristics of Reaction Turbine

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x				x			x			
2	x	x				x		x	x		x	
3	x	x				x		x	x		x	x
4	x	x				x			x			
5	x	x				x		x	x		x	

Approved by Fourth Academic Council

15ME312 MANUFACTURING PROCESSES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To provide hands on training in welding practices
- To understand the procedure to prepare the types of sand moulds and moulding properties
- To know the metal forming processes

COURSE OUTCOMES:

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

CO1: Develop a fabricated product using welding joints
CO2: Create types of moulds based on the given patterns and estimate the moulding properties
CO3: Apply forging to fabricate a part with given specifications
CO4: Estimate the sand mould strength
CO5: Create sheet metal models using metal forming methods

LIST OF THE EXPERIMENTS

WELDING EXERCISES

1. Fabrication of a welded frame using various joints from the given drawing
2. Preparation of metals joints using Gas welding and Gas cutting from the given workpiece
3. Preparation of joints using Soldering

PREPARATION OF SAND MOULD

4. Mould with solid pattern
5. Mould with split pattern
6. Mould with loose piece pattern
7. Mould with core and cavity
8. Determination of grain fineness number of moulding sand
9. Estimation of permeability of moulding sand
10. Determination of sand mould strength

METAL FORMING EXERCISES

11. Forging of cylindrical rod into hexagonal bar
12. Forging of metallic solid block into stepped block
13. Fabrication of Tapered Rectangular Tray

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x			x			x			
2	x	x	x		x	x		x	x		x	x
3	x		x			x			x			
4	x	x	x		x	x		x	x		x	x
5	x		x			x			x			

Approved by Fourth Academic Council

15ME313 COMPUTER AIDED MACHINE DRAWING

L	T	P	C
0	0	4	2

OBJECTIVES:

- To know the specifications and symbols of standard machine components
- To gain knowledge about the procedure for modelling and drafting
- To understand the drawings of machine components and simple assemblies

COURSE OUTCOMES:

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

CO1: Explain the standards in engineering drawing of machines and components
CO2: Develop a surface model of given product using a CAD package
CO3: Illustrate the steps involved in creating 3D drawings
CO4: Construct assembly drawing from the given part drawings
CO5: Interpret a drawing and identify the fit, form and functional aspects

LIST OF THE EXPERIMENTS

1. Surface modeling of a car body
2. Preparation of 3D Model and Assembly drawing of Screw Jack
3. Preparation of 3D Model and Assembly drawing of Universal Joint
4. Preparation of 3D Model and Assembly drawing of Safety Valves
5. Preparation of 3D Model and Assembly drawing of Non-return valves
6. Preparation of 3D Model and Assembly drawing of Piston & Cylinder head
7. Preparation of 3D Model and Assembly drawing of Connecting rod
8. Preparation of 3D Model and Assembly drawing of Crankshaft
9. Preparation of 3D Model and Assembly drawing of Fuel pump
10. Preparation of 3D Model and Assembly drawing of Fuel Injector

Prerequisite:

Code of Practice for Engineering Drawing - BIS specifications - Welding symbols - riveted joints - keys - fasteners - Reference to hand book for the selection of standard components like bolts - nuts - screws - keys
Limits - Fits and tolerances - Allocation of fits for various mating parts

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x		x			x	x		x	x
2	x		x		x			x	x		x	x
3	x		x		x			x	x		x	x
4	x		x		x			x	x		x	x
5	x		x		x			x	x		x	x

Approved by Fourth Academic Council

15GYC12- SOFT SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	0

OBJECTIVES:

- To recollect the functional understanding of basic grammar and its structure
- To acquire the listening skills through note completion, matching and multiple choice modes
- To develop speaking skills through self introduction, short talk and topic discussion

COURSE OUTCOMES:

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

CO1: Apply the knowledge of basic grammar to classify the types of verbs and questions and to construct the sentences

CO2: Develop the listening skills through note completion, matching and multiple choice modes

CO3: Organize a presentation on the given topic

UNIT I : Grammar **(10)**

Tenses - Verb (Auxiliary and Modal) - 'Yes/No' Type Questions - Reported Speech - Gerund - Phrasal Verbs

UNIT II : Listening **(10)**

Part I : Note completion
Part II : Matching
Part III : Multiple Choice

UNIT III : Speaking **(10)**

Part I : Self-Introduction
Part II : Short Talk on Business Topics
Part III : Topic Discussion in Pairs

TOTAL (P:30) : 30 PERIODS

REFERENCES:

1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007
2. Whitby, Norman ,"Business Benchmark Pre- Intermediate to Intermediate Preliminary, 2nd ed., Cambridge University Press, 2013

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1									x	x		x
2									x	x		x
3									x	x		x

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15MY401 STATISTICS AND NUMERICAL METHODS

(Use of Normal Distribution table, t-table, χ^2-table, F-table is permitted)

L	T	P	C
3	2	0	4

OBJECTIVES:

- To get knowledge on types of hypothesis tests and design of experiments
- To know the numerical methods for solving algebraic, transcendental equations, interpolation and integration
- To introduce the numerical solution methods for solving ordinary differential equations

COURSE OUTCOMES:

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

CO1: Select a hypothesis testing method for the given numerical set of data to analyze the significance
CO2: Apply Analysis of Variance for the data set of selected number of factors to test for significant parameter
CO3: Determine the solution of algebraic and transcendental equations numerically
CO4: Demonstrate the concept of interpolation and numerical integration with empirical data sets
CO5: Make use of numerical methods in the solution of ordinary differential equations in solving problems

UNIT I : TESTING OF HYPOTHESIS (9)

Introduction to Sampling distributions - Large Sample - Tests for single mean, Difference of means - Small sample- Students t-test - F-test - Chi-square test for goodness of fit - Independence of attributes.

UNIT II : DESIGN OF EXPERIMENTS (9)

Analysis of variance - One way classification - Completely randomized design - Two way classification- Randomized block design - Latin square design - 2^2 factorial design.

UNIT III : SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS (9)

Newton Raphson method - Direct methods - Gauss Elimination method - Gauss Jordan method - Iterative methods - Gauss Jacobi and Gauss Seidel method - Matrix Inversion by Gauss Jordan method.

UNIT IV : INTERPOLATION AND NUMERICAL INTEGRATION (9)

Lagrange's and Newton's divided difference interpolation - Newton's forward and backward difference interpolation- Numerical Integration using Trapezoidal rule and Simpson's 1/3 rule - Two and Three point Gaussian quadrature formulae.

UNIT V : NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (9)

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor & corrector methods for solving first order equations - Finite difference methods for solving second order equation.

TOTAL (L:45 + T:30) : 75 PERIODS

TEXT BOOKS:

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2006
2. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Numerical Methods", S.Chand & Co. Ltd. New Delhi, 2003

REFERENCES:

1. Walpole, Ronald. E, Myers, Sharon. L, and Ye. Keying, "Probability and Statistics for Engineers and Scientists", 8th ed., Pearson Education, 2007
2. Spiegel, M.R. J. Schiller and Srinivasan. R.A, "Schaum's Outlines Probability and Statistics", 3rd ed., Tata McGraw Hill, New Delhi, 2010
3. Chapra. C, Steven and Canale. P, Raymond, "Numerical Methods for Engineers", 5th ed., Tata McGraw Hill, New Delhi, 2007
4. T.Veerarajan and T.Ramachandran, "Numerical methods with Programming in C", 2nd ed., Tata McGraw Hill 2006, Eighth Reprint, 2011
5. Jay L.Devore, "Probability And Statistics for Engineering and the Sciences", 8th ed., Cengage learning, 2011

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Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x			x			x	x		x	x
2	x	x			x			x	x		x	x
3	x											x
4	x	x			x			x			x	
5	x	x			x			x	x		x	x

Approved by Fourth Academic Council

15ME401 KINEMATICS OF MACHINERY

L	T	P	C
2	2	0	3

OBJECTIVES:

- To introduce the basic types of mechanisms, joints and degrees of freedom
- To know the steps in position, velocity and acceleration analysis using graphical and analytical methods
- To acquire knowledge on different types of friction and its effects
- To introduce the concept of kinematic analysis of cam drives, gear drives and friction drives

COURSE OUTCOMES:

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

CO1: Demonstrate the working of various mechanisms
CO2: Analyze the velocity and acceleration of linkages in mechanism design
CO3: Apply the concept of friction in various engineering applications like belt, clutch, brake etc.,
CO4: Select a layout of cam for specified motion in power transmission of machine elements
CO5: Investigate the gear drives with their selection for transmission of mechanical power in machines

UNIT I : BASICS OF MECHANISMS (6+6)

Mechanisms and its terminologies - Degree of freedom - Mobility - Kutzbach criterion - Grubler's criterion for planar mechanisms - Grashof's law - Kinematic Inversions of Four bar chain - Single slider and Double slider crank chains - Quick return mechanisms - Mechanical advantage - Classification of mechanisms.

UNIT II : KINEMATIC ANALYSIS OF SIMPLE MECHANISMS (6+6)

Displacement, velocity and acceleration analysis in Four bar and Slider crank mechanisms with turning and sliding pairs - Relative velocity method and Instantaneous center method - Analytical method for slider crank mechanism.

UNIT III : FRICTION DRIVES (6+6)

Torque transmitted in plate clutches - calculation of torque and power - Selection of a belt drive, velocity ratio, limiting ratio of belt and rope tensions, centrifugal tensions - condition for maximum power transmission - working principle of shoe and band brakes

UNIT IV : KINEMATICS OF CAMS (6+6)

Classifications of Cams and Followers - definitions in cam profile - derivatives of follower motion - Displacement diagrams for uniform velocity, simple harmonic motion, constant acceleration and deceleration, cycloidal motions - Graphical layout of disc cam profile for knife edge, roller and flat faced followers - Undercutting. Basics of tangent cam and circular arc cam.

UNIT V : KINEMATICS OF GEARS AND GEAR TRAINS (6+6)

Spur gear terminology and definitions - law of gearing - comparison of involute tooth and cycloidal tooth forms - interchangeable gears - gear tooth action - interference and undercutting - basics of nonstandard gear teeth - helical, bevel, worm, rack and pinion gears - Gear trains - speed ratio, train value -parallel axis gear trains - epicyclic gear trains - Sun and planet gears.

TOTAL (L:30 +T:30) : 60 PERIODS

TEXT BOOKS:

1. John J. Uicker, Jr., Gordon R. Pennock and Joseph E. Shigly, "Theory of Machines and Mechanisms - SI Edition", 4th ed., Oxford University Press, 2014
2. Khurmi.R.S and Gupta.J.K, "Theory of Machines", 14th ed., S.Chand & Company Pvt. Ltd., 2005

REFERENCES:

1. Ambekar A.G, "Mechanism and Machine Theory",1st ed., Prentice Hall of India, 2013
2. Bansal.R.K and Brar.J.S, "Theory of Machines", 5th ed., Laxmi Publications, 5th ed., Revised 2016
3. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", East-West Publications, 2008
4. Kenneth J Waldron and Gary L Kinzel, "Kinematics, Dynamics, and Design of Machinery", 3nd ed., Wiley India Pvt Ltd, 2016
5. Rattan.S.S, "Theory of Machines", 4th ed., McGraw Hill Education India Private Limited, 2014

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x		x		x	x			x	x
2	x	x	x		x		x	x	x		x	x
3	x	x	x	x	x	x	x	x			x	x
4	x				x			x			x	x
5	x	x	x		x	x		x			x	x

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15ME402 THERMAL ENGINEERING SYSTEMS

(Use of Steam Tables, Mollier Chart and Refrigeration Tables & Chart is permitted)

L	T	P	C
2	2	0	3

OBJECTIVES:

- To acquire knowledge on the principles, working and performance of IC engines
- To know the gas power cycles and the stages in steam formation
- To introduce the working principle of steam nozzles, air compressors, refrigeration and air conditioning systems

COURSE OUTCOMES:

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

CO1: Identify the various components and working of IC engine
CO2: Analyze the different properties of gas power cycles
CO3: Demonstrate the formation of steam and parameters of steam nozzles and turbines
CO4: Determine the various flow parameters of air compressors
CO5: Describe the concepts of different Refrigeration cycles and Air Conditioning systems

UNIT I : INTERNAL COMBUSTION ENGINES (6+6)

Heat engines - IC engines -terminologies, classification, different parts, applications - four stroke and two stroke cycle engines - comparison - ignition and fuel injection systems - electronic fuel injection - cooling and lubrication systems - combustion phenomenon in SI & CI engines - pre-ignition, detonation, octane number, delay period, diesel knock, cetane number - supercharging

UNIT II : GAS POWER CYCLES (6+6)

Air standard efficiency - Carnot cycle - Otto cycle - Diesel cycle - dual combustion cycle - comparison of otto, diesel and dual combustion cycles -Brayton cycle -calculation of air standard efficiency - mean effective pressure

UNIT III : STEAM FORMATION, STEAM NOZZLES AND TURBINES (6+6)

Pure substance - definition, phase change, p-T and p-V-T diagram - formation of steam - important terms - thermodynamic properties & steam tables - work done during evaporation, internal energy, entropy of water, evaporation, wet & superheated steam - Mollier chart - steam nozzles - flow through nozzles and efficiency - steam turbines - compounding - analytical problems on single stage impulse and reaction turbines - working principles of Rankine Cycle, reheat and regenerative cycle

UNIT IV : AIR COMPRESSORS (6+6)

Classification of air compressors - reciprocating compressors, construction and working of single stage compressor, equation for work with and without clearance, volumetric efficiency, actual p-V diagram, multi stage compression, efficiency, effect of clearance volume, FAD and displacement - analytical problems

UNIT V : REFRIGERATION AND AIR CONDITIONING (6+6)

Refrigeration systems - COP - air refrigeration system, p-V and T-s diagrams of reversed Carnot and Brayton cycles - simple vapour compression system - p-h chart - volumetric efficiency - layout and working principle of vapour absorption system - refrigerants, classification, properties - air conditioning systems - cooling load calculations - summer, winter, year round air conditioning - central system

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Eastop.T.D and McConkey.A, "Applied Thermodynamics for Engineering Technologists", 5th ed., Pearson India, 2002
2. Rajput.R.K, "Thermal Engineering", 9th ed., Laxmi Publications Ltd, 2014.

REFERENCES:

1. Ganesan V." Internal Combustion Engines", 3rd ed., Tata Mcgraw-Hill 2007
2. Manohar Prasad, "Refrigeration and Air Conditioning", 3rd ed., New Age International publications, 2015
3. Mathur.M.L and Sharma.R.P, "Internal Combustion Engines", Dhanpat Rai Publications, 2010
4. Onkar Singh, "Applied Thermodynamics", New Age International (P) Ltd., Publishers, 2015
5. Rudramoorthy.R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											x
2	x	x			x	x	x	x			x	x
3	x				x	x	x	x			x	x
4	x	x			x	x	x	x			x	x
5	x	x			x	x	x	x			x	x

15ME403 STRENGTH OF MATERIALS

L	T	P	C
2	2	0	3

OBJECTIVES:

- To introduce the concept of stress, strain and biaxial stress under given loading condition for various materials
- To introduce the steps involved in construction of shear force and bending moment diagrams
- To acquire knowledge on deflection of beams, torsion and columns

COURSE OUTCOMES:

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

CO1: Apply concepts of strength of materials to obtain solutions to real time engineering problems
CO2: Determine the stresses and deformations of objects under external loadings
CO3: Develop shear force and bending moment diagrams for various types of beams with given loading conditions
CO4: Find the slope and deflection of beams using double integration method, Macaulay's method, area moment theorems, conjugate beam method
CO5: Estimate torsional rigidity of given materials numerically using torsion equation, buckling effect of columns

UNIT I : STRESSES AND STRAINS (6+6)

Definition - derivation of normal stress, shear stress, and normal strain and shear strain - Elastic constants - Poisson's ratio - relationship between elastic constants and Poisson's ratio - Generalized Hooks law - Strain energy - Deformation of simple and compound bars - thermal stresses

UNIT II : BI-AXIAL STRESS SYSTEM (6+6)

Biaxial state of stress - Stress at a point - stresses on inclined planes - principal stresses and Principal strains - Thin cylinders and shells - deformation of thin and thick cylinders and shells - Mohr's circle method

UNIT III : SIMPLE BENDING (6+6)

Types of beams: Cantilever, Simply supported, Overhanging: Shear Force and Bending Moment Diagrams- Theory of simple bending - bending stress and shear stress in beams

UNIT IV : DEFLECTION OF BEAMS (6+6)

Deflection of beams by Double integration method - Macaulay's method - Area moment theorems for computation of slopes and deflections in beams - Conjugate beam method

UNIT V : TORSION AND COLUMNS (6+6)

Torsion - derivation of shear strain - Torsion formula - stresses and deformations in circular and hollow shafts - Stepped shafts - shafts fixed at the both ends - Stresses in helical springs - Theory of columns - Long column and short column - Euler's formula - Rankine's formula - Secant formula - beam column

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Bansal.R.K, "A textbook of Strength of Materials : Mechanics of Solids (SI Units)", 5th ed., Laxmi Publications, 2007
2. Ferdinand Beer Jr., E. Russell Johnston " Mechanics of Materials", 7th ed., McGraw Hill, 2011

REFERENCES:

1. Andrew Pytel and Jaan Kiusalaas, "Mechanics of Materials", SI Edition, Cengage Learning, 2011
2. Ergor P. Popov, "Mechanics of Materials", 2nd ed., Pearson Education, 2015
3. James M Gere and Stephen P Timoshenko, "Mechanics of Materials", SI Edition, Nelson Thornes Ltd, 2011
4. Ramamrutham.S and Narayanan.R, "Strength of Materials", 14th ed., Dhanpat Rai Publications, 2014
5. Rajput R.K, "Strength of Materials", S.Chand & Company Ltd, 2007

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x	x			x	x
2	x	x			x			x			x	x
3	x	x	x	x	x			x			x	x
4	x	x			x			x			x	x
5	x	x		x	x		x	x			x	x

Approved by Fourth Academic Council

15ME404 MATERIAL REMOVAL PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge on the mechanism of chip formation in machining, cutting tool materials, tool life and cutting fluids
- To understand the working of machine tools namely lathe, shaping & allied machines, milling, drilling & allied machines, grinding & allied machines and broaching
- To understand the basic concepts of Non Traditional Machining Processes

COURSE OUTCOMES:

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

CO1: Describe the fundamentals of metal cutting in machining operations
CO2: Identify the components of lathe and milling machine
CO3: List various machining processes such as shaping, planing, slotting and different drilling operations
CO4: Choose the process parameters in grinding operations, finishing operations and gear generations for the given material
CO5: Explain the working principles and process parameters of various Non Traditional Machining processes

UNIT I : THEORY OF METAL CUTTING (9)

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

UNIT II : LATHE AND MILLING MACHINE (9)

Lathe machine - Centre lathe, tool nomenclature, operations, machining time and power estimation- Milling - specifications - types - cutter nomenclature - operations - milling processes - indexing - gear forming.

UNIT III : MACHINE TOOLS AND HOLE MAKING (9)

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

UNIT IV : GRINDING AND GEAR GENERATION (9)

Grinding - types of grinding -grinding wheel designation and selection - honing, lapping, super finishing, polishing and buffing- Gear generation - gear shaping and gear hobbing - specifications - cutting spur and helical gears.

UNIT V : NON-TRADITIONAL MACHINING (9)

Classification of Nontraditional Machining processes - Principle of operations - Process characteristics - applications - Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Chemical machining, Electro chemical machining, Electro chemical grinding, Laser beam machining, Electron beam machining.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Rajput R. K, "Manufacturing Technology", Laxmi Publications (P) Ltd, New Delhi, 2013
2. Richard R Kibbe, John E Neely, Roland O Merges and Warren T White, "Machine Tool Practices", Prentice Hall of India, New Delhi, 10th Revised edition, 2014

REFERENCES:

1. Hajra Choudhury S. K, "Elements of Workshop Technology", Vol. II, Media Promoters & Publishers Pvt Ltd., Mumbai, 2010
2. Jain R.K. and Gupta S.C., "Production Technology", Khanna Publishers, New Delhi, 2014
3. Rao P.N, "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2013
4. Serope Kalpakjian and Steven R Schmid, "Manufacturing Engineering and Technology", Pearson Education, New Delhi, 2013
5. Sharma P.C., "A Text Book of Production Technology", S.Chand & Company Ltd., New Delhi, 10th Revised edition, 2010

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x			x			x	x
2	x											x
3	x				x			x			x	x
4	x				x			x			x	
5	x				x			x			x	

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15ME405 FLUID POWER SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basics of hydraulics and pneumatics
- To acquire knowledge on hydraulic pumps and various power supply sources
- To introduce the types of cylinders, accumulators, valves and various control components

COURSE OUTCOMES:

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

CO1: List the importance of fluid power technology in industries
CO2: Explain the working principles of hydraulic and pneumatic components
CO3: Describe the basics of fluid flow including the physical laws affecting fluid standards and symbols used in industrial applications
CO4: Illustrate the working principles of various components in fluid power industry and solve problems on pumps
CO5: Develop fluid power systems for certain industrial applications

UNIT I : BASICS OF FLUID POWER SYSTEMS (9)

Hydraulics Vs Pneumatics - standards - application - basic principle of hydraulics - Pascal's law -transmission and multiplication of force - basic properties of hydraulic fluids - liquid flow - static head pressure -pressure loss - power - basic principle of pneumatics - absolute pressure and temperature - gas laws - vacuum

UNIT II : HYDRAULIC AND PNEUMATIC POWER SUPPLY (9)

Hydraulic pump - graphic symbol - pump types - pump flow and pressure - pump drive torque and power - pump efficiency - air compressor - graphic symbols - compressor types - compressor sizing - vacuum pumps

UNIT III : HYDRAULIC AND PNEUMATIC CONTROL COMPONENTS (9)

Cylinders - accumulators - FRL - directional control valves - pressure control valves - flow control valves - electronic control components - symbols

UNIT IV : CIRCUITS IN FLUID POWER SYSTEMS (9)

DCV controlling single acting, double acting cylinder - counter balance circuit - fail safe circuit - AND and OR valve circuit - regenerative circuit - meter in and meter out circuit for extended and retracted stroke - pressure intensifier circuit - accumulator circuits

UNIT V : FLUID POWER SYSTEM MAINTENANCE (9)

Sealing devices - reservoir system - filters and strainers - beta ratio of filters - wear of moving parts - gases in hydraulic fluids - temperature control - troubleshooting

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Antony Esposito, "Fluid Power with applications", 7th ed., Pearson India, 2014
2. Srinivasan.R, "Hydraulic and Pneumatic Controls", 2nd ed., Mcgraw Hill Education, 2008

REFERENCES:

1. Andrew Parr, "Hydraulics And Pneumatics", 1st ed., Jaico Publications, 1993
2. Majumdar S. R, "Oil Hydraulics : Principles and Maintenance", 1st ed., Mcgraw Hill Education, 2001
3. Majumdar S. R, "Pneumatic Systems : Principles And Maintenance", 1st ed., Mcgraw Hill Education, 1995
4. Shanmuga Sundaram.K, "Hydraulics And Pneumatics", 1st ed., S.Chand & Co, 2006
5. Soundararajan and Ilango, "Introduction to Hydraulics and Pneumatics", 2nd ed., PHI Learning Pvt. Ltd, New Delhi, 2011

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Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x			x			x	x
2	x				x			x			x	x
3	x				x			x			x	x
4	x	x	x		x			x	x		x	x
5	x	x	x		x			x			x	x

Approved by Fourth Academic Council

15ME411 THERMAL ENGINEERING SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To know the method to conduct performance measurement in thermal systems
- To understand the properties of fuels in thermal applications
- To acquire knowledge on operating characteristics of Internal Combustion engines

COURSE OUTCOMES:

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

CO1: Conduct the experiments on various thermal engineering systems and analyze the performance
CO2: Analyze the performance of blowers, fan and internal combustion engines
CO3: Know how to balance the heat energy available in engine cylinder after the combustion process
CO4: Estimate the performance of Refrigeration and Air Conditioning systems
CO5: Determine performance of boiler and steam turbine

LIST OF THE EXPERIMENTS

1. Valve timing and Port Timing Diagrams
2. Performance test on C.I engines
3. Morse test on multi cylinder engine
4. Measurement of Frictional power using retardation test
5. Determination of calorific value, flash point and fire point of fuels
6. Performance test on reciprocating air compressor
7. Performance test on air blower
8. Measurement of lift and drag force of an aero foil model
9. Measurement of static pressure distribution around an aero foil model using wind tunnel apparatus.
10. Determination of viscosity using Redwood and Saybolt viscometer
11. Performance test on Boiler and Steam turbine.
12. Heat balance test on C.I engines with Data Acquisition system

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x				x		x	x		x	x
2	x	x				x		x	x		x	x
3	x	x				x		x	x		x	x
4	x	x				x		x	x		x	x
5	x	x				x		x	x		x	x

Approved by Fourth Academic Council

15ME412 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

- To introduce the methods of material testing methods
- To acquire knowledge on the procedure for deflection testing of simply supported beam
- To know the hardness testing methods using hardness measuring machines

COURSE OUTCOMES:

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

CO1: Determine the stress and strain in structures and their components due to the different loading conditions
CO2: Select hardness testing method to measure the hardness of the given specimen
CO3: Analyze the deflection of simply supported beam under point load
CO4: Estimate the strain energy of given specimen using impact testing machine
CO5: Conduct fatigue, compression tests of the specimen and testing of helical spring to find spring constant

LIST OF THE EXPERIMENTS

1. Evaluation of Engineering Stress / Strain Diagram on Steel rod, Thin and Twisted Bars under tension
2. Compression test on Bricks, Concrete blocks
3. Deflection test – Verification of Maxwell theorem
4. Comparison of hardness values of Steel, Copper and Aluminium using Brinell and Rockwell hardness measuring machines
5. Estimation of Spring Constant under Tension and Compression
6. Estimation of Notch Toughness of Steel using Charpy Impact Testing Machine
7. Double shear test in UTM
8. Fatigue test on Steel

TOTAL (P:30) : 30 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x			x	x		x	x		x	x
2	x	x			x	x		x	x		x	x
3	x	x			x	x		x	x		x	x
4	x	x			x	x		x	x		x	x
5	x	x			x	x		x	x		x	x

Approved by Fourth Academic Council

15ME413 MATERIAL REMOVAL PROCESSES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To carry out machining operations in various machines namely lathe, shaping, slotting, milling, grinding machine, gear hobbing etc.,
- To acquire knowledge on the cutting forces, average chip-temperature and surface finish during metal removal processes
- To understand the effect of process parameters on material removal processes

COURSE OUTCOMES:

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

CO1: Machine cylindrical and prismatic parts using metal removal process
CO2: Estimate the cutting forces in machining operations of different materials
CO3: Develop gear model by using gear generation and gear hobbing processes
CO4: Identify the process parameters for machining various materials
CO5: Select a suitable machining process by considering the product requirements

LIST OF THE EXPERIMENTS

1. Experiment in Taper Turning, Thread Cutting, Knurling
2. Experiment in Drilling and boring using Capstan / Turret lathe
3. Experiment in Eccentric Turning and Groove cutting
4. Measurement of cutting forces using Lathe and Milling tool dynamometer
5. Experiment in Machining slots using Shaping and Slotting machine
6. Experiment in Drilling, Reaming and Tapping
7. Experiment in Gear Cutting using Horizontal Milling Machine
8. Experiment in Machining of Slots, Grooves using Vertical Milling machine
9. Experiment in Gear Cutting using gear hobbing machine
10. Abrasive machining of cylindrical shaft using cylindrical Grinding machine
11. Finishing of flat metal surface using Surface Grinding machine

TOTAL (P:60) : 60 PERIODS

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											x
2	x	x			x			x			x	x
3	x							x			x	x
4	x	x			x			x			x	x
5	x				x							x

Approved by Fourth Academic Council

15GYC13 - SOFT SKILLS - READING AND WRITING

L	T	P	C
0	0	2	0

OBJECTIVES:

- To recollect the functional understanding of parts of speech and basic grammar
- To acquire the reading skills through cloze texts, matching and multiple choice modes
- To enhance the writing skills for a variety of purposes

COURSE OUTCOMES:

At the end of this course, student shall be able to

CO1: Apply the knowledge to identify the parts of speech and construct the sentences
CO2: Develop the reading skills through cloze texts, matching and multiple choice modes
CO3: Interpret effectively through writing for a variety of purposes

UNIT I : Grammar **(10)**

Articles - Adjectives - Conjunctions - Prepositions - Idioms & Phrases

UNIT II : Reading **(10)**

Part I : Matching 7 sentences to four short texts
Part II : Text with sentences missing
Part III : Text with multiple choice questions
Part IV : Text with multiple choice gaps
Part V : Identification of additional unnecessary words in text

UNIT III : Writing **(10)**

Part I : E-mail writing, Writing short notes, Memo, Agenda & Minutes
Part II : Report Writing, Complaint Letter, Writing Proposals

TOTAL (P:30) : 30 PERIODS

REFERENCES:

1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007.
2. Whitby, Norman, "Business Benchmark Pre - Intermediate to Intermediate Preliminary", 2nd ed., Cambridge University Press, 2013

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1									x	x		x
2									x	x		x
3									x	x		x

Approved by Fourth Academic Council

15ME501 MECHATRONICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the integrated approach of Mechatronics systems
- To acquire knowledge on sensors, actuators and techniques involved in Mechatronics systems
- To introduce the concept on interfacing of devices with controllers

COURSE OUTCOMES:

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

CO1: Identify the elements of Mechatronics system and/or describe the working principles of controllers
CO2: Recommend the suitable sensors and operational amplifiers for the required function
CO3: Select the type of actuators to achieve the desired output motion
CO4: Demonstrate the knowledge on architecture of microprocessor, microcontroller and PLC
CO5: Design Mechatronics systems with the help of Microprocessor, PLC, other Electrical and Electronics components for an engineering application

UNIT I : MECHATRONICS AND CONTROL MODES (9)

Mechatronic systems - measurement systems - control systems - feedback - open and closed loop systems - heating a room, automatic control of water level, shaft speed control - analogue and digital control systems - control modes - two step, proportional, derivative, integral and PID controllers

UNIT II : SENSORS AND SIGNAL CONDITIONING (9)

Sensor terminologies - displacement, position and proximity sensors - potentiometer, strain gauge, capacitive element, differential transformers, eddy current proximity sensor, optical encoders, Hall effect sensor - velocity and motion sensors - tachogenerator, pyroelectric sensors - force sensors - temperature sensors - signal conditioning processes - operational amplifier - inverting, non inverting, summing, integrating, difference and logarithmic amplifiers - comparator

UNIT III : ACTUATORS IN MECHATRONICS SYSTEMS (9)

Pneumatic and hydraulic systems - rotary actuators - mechanical actuation systems - cams, gears, ratchet and pawl, belt and chain drives - electrical actuation systems - mechanical switches, solenoids, construction and working principle of DC motors, AC motors, stepper motors

UNIT IV : MICROPROCESSOR AND PLC (9)

Microprocessor systems - buses - architecture of Intel 8085A microprocessor - programmable logic controller - basic PLC structure - ladder diagrams - latching and internal relays - timers and counters - shift registers - master and jump controls - data handling - interface requirements - peripheral interface adapters

UNIT V : DESIGN OF MECHATRONICS SYSTEM (9)

The design process - traditional and mechatronics designs - design solutions - timed switch, wind screen wiper motion - case studies of mechatronics systems - pick and place robot - car park barriers - digital camera - car engine management

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Bolton. W, “Mechatronics - A Multidisciplinary Approach”, 4th ed., Pearson Education India, 2016
2. Necsulescu. D, “Mechatronics”, 1st ed., Pearson Education India, 2002

REFERENCES:

1. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, 2nd ed., Cengage Learning India Pvt Ltd, New Delhi , 2012
2. Smaili.A and Mrad.F, “Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, International Edition, 2008
3. Rajput. R. K, “A Text Book of Mechatronics”, 3rd ed., S Chand & Company, 2007
4. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, 4th ed., McGraw Hill Education (India) Private Limited, 2014
5. Clarence W. de Silva, "Mechatronics - A Foundation Course", 1st ed., CRC Press, 2010

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x						x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15ME502 DESIGN OF MACHINE ELEMENTS

(Use of Approved Design data book is permitted)

L	T	P	C
2	2	0	3

OBJECTIVE:

- To introduce the design methodology of machine elements
- To acquire knowledge on analysis of forces acting on the machine elements and appropriate design methodology
- To introduce various standards, methods of standardization and selection procedures

COURSE OUTCOMES:

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

CO1: Estimate the stresses acting on various machine elements by considering the operating conditions
CO2: Predict the variables stresses on the machine elements and/or design shafts for the given loading conditions.
CO3: Determine the maximum stresses acting on the temporary and/or permanent joints under static loads
CO4: Adapt the design procedures to select couplings and/or springs
CO5: Select a type of bearing and/or select the design parameters of engine cylinder and connecting rod

UNIT I: STRESSES IN MACHINE ELEMENTS (6+6)

Procedure in design process - factors influencing machine design - selection of materials based on mechanical properties - fits and tolerance - direct, bending and torsional stress equation - bending stress in curved beams - crane hook and 'C' frame - factor of safety - theories of failures

UNIT II : VARIABLE STRESSES AND DESIGN OF SHAFTS (6+6)

Variable stresses in machine parts - stress concentration factor - cyclic stresses - fatigue and endurance limit - Goodman and Soderberg methods - combined normal stress and variable stress - design of solid and hollow shafts based on strength and rigidity

UNIT III : TEMPORARY AND PERMANENT JOINTS (6+6)

Welded joints - types - basic weld symbols - strength of transverse and parallel fillet welded joints - axially loaded unsymmetrical welded sections - eccentrically loaded welded joints - riveted joints - strength equations, efficiency, design of riveted joints, eccentrically loaded riveted joints - introduction to bolted joints

UNIT IV : DESIGN OF COUPLINGS AND SPRINGS (6+6)

Couplings - types - design of muff coupling, unprotected type flange coupling, bushed pin flexible coupling - springs- types, helical springs, materials, end connections, terms used in compression springs - stresses and deflection in helical springs of circular wire - design of leaf springs - stress and deflection equation, nipping

UNIT V : BEARINGS (6+6)

Sliding contact bearings - theory of lubrication, hydrodynamic bearings, Sommerfield number - design of hydrodynamic bearings - rolling contact bearings, static and dynamic load capacity, cubic mean load, variable load, probability of survival, selection of deep groove ball bearing

TOTAL (L:30 +T:30) : 60 PERIODS

TEXT BOOKS:

1. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 10th ed., McGraw-Hill Education, 2015
2. Bhandari V.B, "Design of Machine Elements", 4th ed., McGraw Hill Education India Private Limited, 2016

REFERENCES:

1. Khurmi.R.S and Gupta.J.K, "A Textbook of Machine Design", S.Chand & Company Ltd., New Delhi, 2014
2. Jalaludeen S.Md, "Machine Design (Volume-1)", 4th ed., Anuradha Publications, Chennai, 2011
3. Sundararajamoorthy T. V. Shanmugam. N, "Machine Design", Anuradha Publications, Chennai, 2003
4. Robert C. Juvinall, Kurt M. Marshek, "Machine Component Design", Wiley India Pvt Ltd., 2016
5. Ganesh Babu.K, Srithar.K, "Design of Machine Elements", 2nd ed., McGraw Hill Education (India) Private Limited, 2009

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x				x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x	x	x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x	x	x	x	x	x	x				x	x

15ME503 HEAT AND MASS TRANSFER

(Use of Approved HMT data book and Steam tables is permitted)

L	T	P	C
2	2	2	4

OBJECTIVE:

- To introduce the concept of heat conduction in various systems
- To acquire knowledge on convection and radiation heat transfer
- To introduce the concept of heat transfer with phase change and heat exchangers
- To introduce the concept of diffusion and convective mass transfer

COURSE OUTCOMES:

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

CO1: Determine the amount of heat transferred in various systems under steady state

CO2: Solve numerical problems on heat transfer with internal heat generation and/or transient heat transfer

CO3: Estimate the heat transfer coefficient and the amount of heat transferred under convection

CO4: Analyze the radiation heat transfer and/or heat transfer by boiling & condensation

CO5: Examine heat transfer in heat exchangers and/or diffusion & convective mass transfer

UNIT I : STEADY STATE HEAT CONDUCTION (6+6)

Mechanisms of heat transfer - General heat conduction equation in Cartesian coordinates - representation of heat equation in cylindrical coordinates - One dimensional steady state heat conduction in composite plane walls with constant thermal conductivity - critical radius of insulation - Rectangular plate fins and pin fins with uniform cross section - Efficiency and effectiveness - circumferential fins

UNIT II : CONDUCTION WITH HEAT GENERATION (6+6)

Solid cylinder with internal heat generation - Transient heat conduction - plane wall with negligible internal resistance - heat flow in an infinitely thick plate - chart solutions of transient heat conduction problems in plane wall

UNIT III : CONVECTION (6+6)

Representation of continuity, momentum and energy equations - thermal and velocity boundary layer in flow over flat plate and flow through circular pipe - Dimensional analysis - forced convection - correlations for flow over flat plate - flow across tube banks - correlations for flow through circular tubes - Natural convection in vertical and horizontal plates

UNIT IV : RADIATION, BOILING AND CONDENSATION (6+6)

Thermal radiation - emissive power - absorption, reflection and transmission - Plank's, Wien's displacement, Stefan-Boltzmann, Kirchhoff's laws - emissivity - grey body - shape factor theorems - Electrical analogy - Radiation shields - pool boiling curve for water - boiling correlations - condensation on vertical surfaces and horizontal tubes

UNIT V : HEAT EXCHANGERS AND MASS TRANSFER (6+6)

Types of heat exchangers - overall heat transfer coefficient - fouling factors - LMTD and Effectiveness - NTU methods - Diffusion mass transfer - Fick's law of diffusion - diffusion coefficient - equimolar counter diffusion - concentration boundary layer - governing equations - convective mass transfer correlations

LIST OF THE EXPERIMENTS

1. Thermal conductivity measurement using guarded plate apparatus
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder
4. Determination of heat transfer coefficient by forced convection inside tube
5. Efficiency calculation of a pin-fin apparatus (natural & forced convection modes)
6. Determination of Stefan - Boltzmann constant
7. Determination of emissivity of a given grey surface
8. Determine the effectiveness of parallel / counter flow heat exchanger
9. Determination of heat flux in boiling and condensation heat transfer

TOTAL (L:30 + T:30 + P:30) : 90 PERIODS

TEXT BOOKS:

1. Yunus A Cengel, "Heat and Mass Transfer", 5th ed., McGraw Hill Education (India) Pvt Ltd, 2015
2. Sachdeva.R.C, "Fundamentals of Engineering Heat and Mass transfer", 4th ed., New age international publishers, 2012

REFERENCES:

1. Kothandaraman.C.P, "Fundamentals of Heat and Mass transfer", 4th ed., New age international publishers, 2012
2. Nag.P.K, "Heat and Mass Transfer", 3rd ed., McGraw Hill Education, 2011
3. Holman.J.P, "Heat Transfer", 10th ed., McGraw Hill Education (India) Pvt Ltd, 2011
4. Incropera and Dewitt, "Fundamentals of Heat and Mass Transfer", 5th ed., Wiley India Pvt Ltd, 2007
5. Ghoshdastidar.P.S, "Heat Transfer", 2nd ed., Oxford University Press, 2012

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x		x		x	x
2	x	x	x	x	x		x		x		x	x
3	x	x	x	x	x		x		x		x	x
4	x	x	x	x	x		x		x		x	x
5	x	x	x	x	x		x		x		x	x

15ME504 DYNAMICS OF MACHINERY

L	T	P	C
2	2	0	3

Approved by Seventh Academic Council

OBJECTIVE:

- To introduce the concepts of turning moment diagrams, flywheel design and the dynamics of reciprocating engines
- To acquire knowledge on the balancing of rotating masses, reciprocating masses, rotors and engines
- To introduce the fundamentals of free, forced and damped vibrations
- To introduce the mechanisms for controlling

COURSE OUTCOMES:

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

CO1: Analyze the static and dynamic forces in mechanisms and flywheel
CO2: Balance the rotary and reciprocating masses of mechanical systems
CO3: Analyze the longitudinal vibrations of systems with single degree of freedom
CO4: Determine the frequency of transverse and torsional systems
CO5: Demonstrate the mechanism control systems like governors and gyroscopes

UNIT I : FORCE ANALYSIS AND FLYWHEELS (6+6)

Static force analysis - static equilibrium conditions - free body diagrams - graphical force analysis without friction - four bar mechanism, slider crank mechanism - Dynamic force analysis - D'Alembert's principle - analytical method of engine force analysis without inertia - Turning moment diagrams - fluctuation of energy

UNIT II : BALANCING (6+6)

Balancing of rotating masses - balancing of reciprocating masses - partial balancing of unbalanced primary force in a reciprocating engine - effect of partial balancing of two cylinder uncoupled locomotives - variation of tractive force, swaying couple, hammer blow - balancing of inline engines - balancing machines

UNIT III : LONGITUDINAL VIBRATION (6+6)

Definitions - types of vibrations - basic features of vibratory systems - degrees of freedom - inertia effect of the mass of spring - damped vibrations - logarithmic decrement - Forced vibrations - forced damped vibrations - magnification factor - vibration isolation and transmissibility

UNIT IV : TRANSVERSE, TORSIONAL VIBRATIONS AND VIBRATION MEASUREMENT (6+6)

Transverse vibrations - Single concentrated load - uniformly loaded shaft - shaft carrying several loads - whirling of shafts - Free torsional vibrations - single rotor system, two rotor system, torsionally equivalent shaft - Vibration measuring instruments - accelerometers - frequency measurement - Fullarton, Frahm Tachometers, vibration absorbing materials

UNIT V : MECHANISMS FOR CONTROL (6+6)

Governors - Types - Watt, Porter, Proell, Hartnell Governors - sensitiveness, hunting, isochronisms, stability - Effort and power of governors - coefficient of Insentiveness - Gyroscope - angular velocity, acceleration - gyroscopic torque - gyroscopic effects in aeroplanes and naval ships

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Joseph E. Shigley, Gordon R. Pennock, John J. Uicker. Jr, "Theory of machines and mechanisms", 4th ed., Oxford university press, New Delhi, 2014
2. Rattan.S.S, "Theory of Machines", 4th ed., Tata McGraw Hill Education Pvt. Ltd., 2014

REFERENCES:

1. Bansal.R.K, Brar.J.S, "Theory of Machines", 5th ed., Laxmi Publications, New Delhi, 2016
2. Kenneth J Waldron, Gary L Kinzel and Sunil Agarwal, "Kinematics, Dynamics and Design of Machinery", 2nd ed., Wiley India Pvt Ltd, 2007
3. Khurmi.R.S, Gupta.J.K, "Theory of Machines", 14th Revised edition, S.Chand & Company Pvt. Ltd., 2005.
4. Singh.V.P, "Mechanical Vibrations", 4th ed., Dhanpat Rai & Co Pvt. Ltd., 2014
5. Thomas Bevan, "Theory of Machines", 3rd ed., Pearson Education Publishers, 2009

Mapping of COs and POs	
COs	POs

	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x				x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x	x	x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x	x	x		x	x					x	x

15ME511 MECHATRONICS LABORATORY

L T P C

Approved by Seventh Academic Council

0 0 4 2

OBJECTIVE:

- To design, model and analyze the electrical, hydraulic and pneumatic systems with mechatronics perspective
- To understand the concepts of computerized data logging system
- To stimulate interfacing techniques between electromechanical and microcontrollers

COURSE OUTCOMES:

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

CO1: Design mechatronics system with Microprocessor, PLC and other Electrical & Electronics control
CO2: Apply the concepts of computerized data logging in mechatronics system
CO3: Build interface between stepper motor and 8051 microcontroller
CO4: Simulate the electrical, hydraulic and pneumatic system using simulation software
CO5: Analyze the velocity and direction in fluid power circuits with the help of simulation software

LIST OF THE EXPERIMENTS

1. Manual Control of single acting and double acting cylinders using direction control valves
2. Simulation of cylinder sequencing using hydraulic control
3. Simulation of cylinder sequencing using hydraulic control by Cascade method
4. Pneumatic cylinder sequencing using electrical controls
5. Pneumatic cylinder sequencing using electrical control with Internal Relay
6. Process control using PID controller
7. Control of double acting cylinder using Timer, DPDT relay with solenoid operated valves
8. Speed - Torque characteristics of AC Servo motor
9. Stepper motor interfacing using 8051 microcontroller
10. Process control of Automatic bottle filling system using PLC and SCADA
11. Computerized data logging system for process control variables like level and temperature
12. Design and testing of fluid power circuits to control direction, velocity and force in double acting cylinder using hydraulic trainer kit

TOTAL (P:60) : 60 PERIODS

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x		x		x	x
2	x	x	x	x	x		x		x		x	x
3	x	x	x	x	x		x		x		x	x
4	x	x	x	x	x		x		x		x	x
5	x	x	x	x	x		x		x		x	x

15ME512 KINEMATICS AND DYNAMICS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVE:

- To introduce the methods of static and dynamic balancing of rotating and reciprocating masses
- To acquire knowledge on types of gears, gear trains and universal joints
- To introduce the deflection testing and cam profile graphing methods
- To provide hands on experience on measurement of Whirling speed, MI, Natural frequency
- To acquire knowledge on characteristic curves of governors and gyroscopic couple

COURSE OUTCOMES:

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

CO1: Measure the deflection of fixed and cantilever beams under various loading conditions
CO2: Determine the jump speed of given cam and plot the cam profile
CO3: Make use of experimental setups to find moment of inertia, natural frequency and whirling speed
CO4: Analyze the Characteristic curves of governors and/or gyroscopic couple
CO5: Adopt the methodology of dynamic balancing to determine the unbalance force and couple in rotating shafts

LIST OF THE EXPERIMENTS

1. Study of Balancing of rotating and reciprocating masses
2. Study of Gears, Gear trains and universal joints
3. Deflection of Fixed and Cantilever beams
4. Determination of jump speed and drawing of the cam profile
5. Determination of moment of inertia of an object by oscillation method
6. Determination of natural frequency of vibration of the spring mass system
7. Determination of whirling speed of shaft
8. Determination of natural frequency of the free torsional vibration of the single rotor system
9. Plotting the Characteristic curves for Watt governor
10. Plotting the Characteristic curves for Porter governor
11. Determination of gyroscopic couple using motorized gyroscope
12. Dynamic balancing of rotating shafts

TOTAL (P:60) : 60 PERIODS

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x				x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x	x	x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x	x	x		x	x					x	x

Approved by Seventh Academic Council

15GY511 SOFT SKILLS APTITUDE AND REASONING - I

(Common to ALL branches)

L	T	P	C
0	0	2	0

OBJECTIVE:

- To enhance the students to write and speak fluently with the help of grammatical structures
- To develop students to workout solution for problems that involves mathematical aptitude
- To develop students to workout solutions for problems that involves general reasoning

COURSE OUTCOMES:

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

CO1: Write and speak fluently without any grammatical errors
CO2: Solve aptitude problems with ease
CO3: Solve reasoning problems with ease

UNIT I : SOFT SKILLS **(10)**

Grammar - Parts of Speech, Tenses, Subject - Verb agreement , Articles, Preposition, Conjunctions, Modal Auxiliaries, Degrees of Comparison - Self Introduction - Role Play - Object Description - Passage writing

UNIT II : APTITUDE **(10)**

Average - Percentage - Age Ratio & Proportion - Partnership - Profit & loss - Mixture & Allegation

UNIT III : REASONING **(10)**

Odd man out - Number series - Syllogism - Coding & decoding - Seating arrangement

TOTAL (P:30) : 30 PERIODS

TEXT BOOKS:

1. Thorpe, Edgar and Shawick Thorpe, "Objective English", 3rd ed., Pearson, New Delhi, 2011
2. Khattar, Dinesh, "Quantitative Aptitude", 3rd ed., Pearson, New Delhi, 2014

REFERENCES:

1. Prasad, Hari Mohan, Uma Rani Sinha, "Objective English for Competitive Examinations", 4th ed., Tata McGraw Hill Education Pvt.Ltd., New Delhi, 2010
2. Aggarwal R.S, "A Modern Approach to Verbal and Non Verbal Reasoning", S.Chand Publishers, New Delhi, 2017

Mapping of COs and POs

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x		x	x		x
2	x	x		x								x
3				x		x		x				x

15ME601 POWER PLANT TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the principles and operation of power plant and its economics.
- To acquire knowledge on working principle of hydroelectric, steam and diesel power plant.
- To introduce the operating principle of Gas turbine and Nuclear power plant.

COURSE OUTCOMES:

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

CO1: Classify the type of energy sources and / or describe the working principle of hydro electric power plant.
CO2: Summarize the working principles of steam power plant and Boilers.
CO3: Identify the component of diesel power plant and their functions.
CO4: List the components of Gas Turbine power plant and their functions.
CO5: Learning the operating principle of Nuclear Power Plant and / or calculate the Economic factor of power plant.

UNIT I : ENERGY SOURCES AND HYDROELECTRIC POWER PLANT (9)

Classification of energy - construction and working principles of solar, wind, ocean thermal, geothermal and fuel cell- fuels and combustion - steam generators, prime movers - hydro electric power plant - run-off - selection of site - essential features - classification - storage plants

UNIT II : STEAM POWER PLANT (9)

Essentials of steam power plant equipment - coal handling - fuel burning furnaces - methods of fuel firing - pulverizing mills - ball mill, ball and race mill, shaft mill - pulverized coal firing - steam condensers - surface condensers, jet condensers - ash disposal - handling equipment - smoke and dust removal - dust collectors - fluidized bed combustion - types - boiler - classification, working principles of Cochran boiler and La Mont boiler

UNIT III : DIESEL POWER PLANT (9)

Diesel engines and classification - general layout of diesel power plant - performance characteristics diesel engine - fuel system - common rail injection, individual pump injection, distributor system - diesel plant operation, efficiency - heat balance of a diesel engine power plant

UNIT IV : GAS TURBINE POWER PLANT (9)

Classification - open cycle and closed cycle power plants - elements of gas turbine power plants - compressors, intercoolers, heat exchangers, combustion chambers, gas turbines - regeneration and reheating cogeneration - auxiliary systems - starting, ignition, lubrication, fuel system and controls - control of gas turbines - applications

UNIT V : NUCLEAR POWER PLANT AND POWER PLANT ECONOMICS (9)

Nuclear energy concepts and terms - energy from nuclear fission - radioactivity - nuclear reactor - parts, nuclear fuel, moderator, moderating ratio, reflector, reactor vessel, biological shielding, coolant - Economics - terms and factors - factors effecting power plant design - effect of power plant type - costs, rates, fixed elements, customer elements - plant selection, power generation - load curves - ideal and realized load curves

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. El.Wakil. M. M, "Power Plant Technology", 1st ed., McGraw-Hill Higher Education, 2002
2. Raja.A.K, Amit Prakash Srivastava, Manish Dwivedi, "Power Plant Engineering", New Age International (P) Limited, 1st ed., Reprint 2010

REFERENCES:

1. Rajput .R.K, "A Textbook of Power Plant Engineering", 5th ed., Laxmi Publications, New Delhi, 2016
2. Nag.P.K, "Power Plant Engineering", 4th ed., Tata McGraw Hill Publishing Company Ltd, 2014.
3. Arora .S.C, Domkundwar, "Power Plant Engineering", 6th ed., Dhanpat Rai & Co, 2013
4. Manoj Kumar Gupta, "Power Plant Engineering", 1st ed., Prentice Hall India, 2010
5. Black, Veatch, "Power Plant Engineering", 1st ed., CBS Publishers, 2005

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x		x				x	x
2	x				x		x				x	x
3	x				x		x				x	x
4	x				x		x				x	x
5	x				x		x				x	x

15ME602 DESIGN OF TRANSMISSION SYSTEMS

(Use of Approved Design data book is permitted)

L	T	P	C
2	2	0	3

OBJECTIVE:

- To understand the various elements involved in a transmission system
- To analyze the various forces acting on the elements of a transmission system.
- To develop working drawings of the system involving pulleys, gears, clutches and brakes.

COURSE OUTCOMES:

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

CO1: Identify the design parameters of the Chain Drives and Belt Drives for power transmission
CO2: Recommend the suitable Gear drive for an industrial application among spur and helical gears
CO3: Design Bevel and Worm Gears by considering various operating conditions
CO4: Select the Gear Box for variable operating speeds
CO5: Design Clutches and Brakes for the automobiles

UNIT I : DESIGN OF FLEXIBLE POWER TRANSMISSION SYSTEMS (6+6)

Design of belts - flat belts and pulleys - V belts and pulleys - design of chain drives

UNIT II : SPUR GEARS AND PARALLEL AXIS HELICAL GEARS (6+6)

Gear geometry - kinematics - forces on gear tooth - stresses in gear tooth - selection of gear material based on bending stress and contact stress - design of spur gear - power transmitting capacity - design of helical gears

UNIT III : BEVEL AND WORM GEARS (6+6)

Types of bevel gears - straight bevel gear - tooth terminology - tooth forces and stresses - estimating the dimensions of pair of straight bevel gears - stresses in worm gear tooth

UNIT IV : DESIGN OF GEAR BOXES (6+6)

Gear boxes - speed selection - geometric progression - standard step ratio - ray diagram, kinematic layout - design of multistage multi speed constant mesh gear boxes

UNIT V : MOTION CONTROL: CLUTCHES AND BRAKES (6+6)

Clutches - types - materials - design of single plate, multi plate and cone clutches - brakes - types - friction materials - single block brake, pivoted block brake - simple band brake - internal expanding brake

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 10th ed., Tata McGraw-Hill, 2015
2. Bhandari V.B, "Design of Machine Elements", 4thed., Tata McGraw-Hill Book Co, 2016

REFERENCES:

1. Jack A. Collins Henry Busby George Staab, "Mechanical Design of Machine Elements and Machines", 2nd ed., Wiley India Pvt Ltd, 2011
2. Robert C. Juvinall, Kurt M. Marshek, "Machine Component Design", Wiley India Pvt Ltd., 2016
3. Sharma P. C, Aggarwal D. K., "A Textbook of Machine Design" S K Kataria & Sons-New Delhi, 2012
4. Spotts M. F ,Shoup T. E , Hornberger L.E , David O. Kazmer "Design of Machine Elements", 8th ed., Pearson India, 2006
5. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x				x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x	x	x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x	x	x	x	x	x	x				x	x

15ME603 FINITE ELEMENT ANALYSIS

L	T	P	C
2	2	0	3

OBJECTIVE:

- To equip the students with the finite element analysis fundamentals
- To enable the students to formulate the design problems using Finite Element Analysis
- To introduce the steps involved in discretization, application of boundary conditions, assembly of stiffness matrix and solution

COURSE OUTCOMES:

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

CO1: Formulate the mathematical model for solution of engineering design problems
CO2: Solve heat transfer and structural problems using 2D elements
CO3: Explain the stages in solving engineering problems under axisymmetric condition
CO4: Analyze and solve the real time problems using isoparametric elements
CO5: Determine the solution for real time 1D structural problems using structural dynamic analysis

UNIT I : BASIC CONCEPTS AND 1D ELEMENTS (6+6)

Basic concepts - general procedure for FEA - discretization - weak form - weighted residual method - Ritz method- applications - finite element modeling - coordinates - shape functions - stiffness matrix and assembly - boundary conditions - solution of equations - mechanical loads, stresses and thermal effects - bar and beam elements

UNIT II : 2D ELEMENTS (6+6)

Finite element modeling - Poisson equation - Laplace equation - plane stress, plane strain - CST element - element equations, load vectors and boundary conditions - Pascal's triangles - assembly - application in two dimensional heat transfer problems

UNIT III : AXISYMMETRIC PROBLEMS (6+6)

Vector variable problems - elasticity equations - axisymmetric problems - formulation - element matrices - assembly - boundary conditions and solutions

UNIT IV : ISOPARAMETRIC ELEMENTS (6+6)

Isoparametric elements - four node quadrilateral element - shape functions - Jacobian matrix - element stiffness matrix and force vector - numerical integration - stiffness integration - displacement and stress calculations

UNIT V : DYNAMIC ANALYSIS (6+6)

Types of dynamic analysis - general dynamic equation of motion, point and distributed mass - lumped and consistent mass - mass matrices formulation of bar and beam element - undamped - free vibration - eigen value and eigen vectors problems

TOTAL (L:30 + T:30) : 60 PERIODS

TEXT BOOKS:

1. Singiresu S Rao, "The Finite Element Method in Engineering", 5th ed., Elsevier, 2012
2. Chandrupatla.T.R and Belegundu.A.D, "Introduction to Finite Elements in Engineering", 4th ed., Pearson Education, New Delhi, 2015

REFERENCES:

1. Seshu. P, "A Text book on Finite Element Analysis", 1st ed., PHI Learning Pvt. Ltd., New Delhi, 2009
2. David V Hutton, "Fundamentals of Finite Element Analysis", 1st ed., Tata McGraw Hill International Edition, 2005
3. Logan D.L, "A First course in the Finite Element Method", 5th ed., Cengage Learning, 2012
4. Reddy J.N, "An Introduction to Finite Element Method", 3rd ed., McGraw Hill International Edition, 2005.
5. Zienkiewicz. O.C and Taylor, R.L, "The Finite Element Method: Its basis and fundamentals", 7th ed., Elsevier, 2013

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x					x
2	x		x	x	x							x
3	x		x		x							x
4	x		x	x	x							x
5	x		x	x	x	x					x	x

15ME604 METROLOGY AND MEASUREMENTS

L	T	P	C
3	0	2	4

OBJECTIVE:

- To introduce the principles of metrology and measurements, measurement parameters and its applications
- To acquire knowledge on the concept of various measurements like linear, angular, surface finish
- To impart knowledge on statistical measurements and the screw thread & gear measuring methods, laser and advances in metrology system

COURSE OUTCOMES:

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

CO1: Describe the limits, fits, tolerance, errors, correction and calibration
CO2: Explain the various methods of measuring mechanical parameters
CO3: Identify the types of linear and angular measurements for a component
CO4: Select a type of form measurement methods for an application
CO5: Summarize various laser metrology and its advances

UNIT I : MEASUREMENT SYSTEMS (9)

General concept - units and standards - characteristics of measuring instruments - sensitivity, stability, range, accuracy and precision - static and dynamic response - repeatability, hysteresis - systematic and random errors - correction, calibration - interchangeability

UNIT II : PARAMETER MEASUREMENTS (9)

Measurement of force, torque, power using mechanical, pneumatic, hydraulic, electrical instruments - flow measurement - rotameter, pitot tube - Temperature measurement - bimetallic strip, thermocouple, electrical resistance thermometer

UNIT III : LINEAR AND ANGULAR MEASUREMENTS (9)

Linear measuring instruments - vernier, micrometer, slip gauges, tool maker's microscope - interferometry, optical flats, comparators - mechanical, pneumatic, electrical applications - angular measurements - sine bar, sine center, bevel protractor, autocollimator

UNIT IV : METROLOGY OF SURFACES (9)

Fundamentals of GD & T - measurement of straightness, flatness and roundness - measurement of surface finish - Functionality of surfaces, parameters, comparative, stylus based and optical measurement techniques, filters- Introduction to 3D surface metrology.

UNIT V : ADVANCED METROLOGY (9)

Precision instruments based on laser - principles - laser interferometer - application in linear, angular measurements - machine tool metrology - Coordinate Measuring Machine (CMM) - constructional features - types, applications - digital devices - computer aided inspection - 3D scanning - machine vision systems

LIST OF THE EXPERIMENTS

1. Measurement of various dimensions using Vernier Caliper (Digital) / Micrometer / Dial Gauge
2. Measurement of gauge block using Vernier Height Gauge and Vernier depth gauge
3. Measurement of Internal Bore diameter using Digital Bore Gauge
4. Measurement of Gear Tooth Dimensions using Gear Tooth vernier
5. Measurement of Taper Angle using Bevel Protractor / Sine bar / Slip Gauges
6. Measurement of thread parameters using Tool Makers Microscope / Floating Carriage Micrometer
7. Measurement of straightness and flatness of surface plate using Autocollimator
8. Measurement of various dimensions of the given component using Profile Projector
9. Measurement of the Surface Finish using Surface roughness tester
10. Measurement of Force and torque
11. Measurement of Temperature using thermo couples
12. Measurement of displacement using LVDT

TOTAL (L:45 + P:30) : 75 PERIODS

TEXT BOOKS:

1. Thomas G. Beckwith, Roy D, Marangoni, John H.Lienhard V., "Mechanical Measurements", 6th ed., Pearson Education India, 2014
2. Jain R.K., "Engineering Metrology", 20th ed, Khanna Publishers, 2009

REFERENCES:

1. Raghavendra N.V, Krishnamurthy L, "Engineering Metrology and Measurements", 1st ed., Oxford University Press, 2013
2. Gupta.I.C., "Engineering Metrology", 10th ed., Dhanpat Rai Publications, 2013
3. Anand K Bewoor, Vinay A Kulkarni, "Metrology & Measurement", McGraw Hill Education, 2009
4. Mahajan.M, "Engineering Metrology", Dhanapat Rai publications, 2014
5. Tayal A.K, "Instrumentation and Mechanical Measurements", 4th ed., Galgotia Publications, 2000

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x						x		x	x
2	x	x	x						x		x	x
3	x	x	x						x		x	x
4	x	x	x						x		x	x
5	x	x	x						x		x	x

Approved by Seventh Academic Council

15ME611 COMPUTER AIDED ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVE:

- To acquire skill in finite element simulations using commercially available software
- To know the steps involved in discretization of the CAD model using various elements
- To teach the steps involved in solving structural, modal, harmonic and thermal problems with given specifications

COURSE OUTCOMES:

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

CO1: Solve structural analysis problems using one dimensional and two dimensional elements
CO2: Determine numerical solution of problem using axi-symmetric condition
CO3: Evaluate various model of failure of a machine component using Modal analysis
CO4: Apply Harmonic analysis to find the response of a structural system using simulation
CO5: Analyze engineering heat transfer problem under given boundary conditions

LIST OF THE EXPERIMENTS

1. Analysis of a plate with a circular hole
2. Analysis of rectangular L bracket
3. Analysis of bar (Straight, Stepped, Taper bar)
4. Analysis of beams (Simply supported, Fixed ends)
5. Analysis of truss component
6. Analysis of an Axi-symmetric component
7. Modal analysis of a component
8. Harmonic analysis of a component
9. Thermal analysis of the components (Fin and Wall)
10. Simulation of deflection in cantilever beam

TOTAL (P:60) : 60 PERIODS

Mapping of COs and POs

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x			x	x	x		x	x
2	x		x	x	x	x	x		x	x		x
3	x	x		x	x	x			x	x		x
4		x		x	x		x	x	x	x	x	
5	x		x		x	x		x	x	x		

Approved by Seventh Academic Council

15GE611 COMPREHENSION

L	T	P	C
0	0	2	1

OBJECTIVE:

- To comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E. Degree course through periodic exercise
- To inculcate the critical thinking required to appear for competitive exams
- To understand and formulate feasible ways of solving technical problems

COURSE OUTCOMES:

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

CO1: Recall the fundamentals of Thermodynamics and Thermal Engineering
CO2: Summarize the concepts of Engineering Design and Fluid Mechanics
CO3: Demonstrate an understanding on Manufacturing Practices and Material Science
CO4: Outline the fundamental concepts of Strength of Materials and Engineering Mechanics
CO5: Relate the concepts of Engineering Graphics and Computer Aided Design & Drafting

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test by objective type questions on all the subject related topics

TOTAL (P:30) : 30 PERIODS

Mapping of COs and POs

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x							x	x
2	x	x	x	x							x	x
3	x	x	x	x							x	x
4	x	x	x	x							x	x
5	x	x	x	x							x	x

15GY611 SOFT SKILLS APTITUDE AND REASONING - II

(for Software Company Placement students only)

L	T	P	C
0	0	2	0

OBJECTIVE:

- To enhance the students to write and speak fluently with the help of grammatical structures
- To develop students to workout solution for problems that involves mathematical aptitude
- To develop students to workout solutions for problems that involves general reasoning

COURSE OUTCOMES:

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

CO1: Write and speak fluently without any grammatical errors
CO2: Solve aptitude problems with ease
CO3: Solve reasoning problems with ease

UNIT I : SOFT SKILLS **(10)**

Grammar - Synonyms and Antonyms, Error Spotting, Statement Completion, Idioms & Phrases, One word Substitution, Confusable Words, Jumbled Words / Sentences, Reading Comprehension, Theme Detection, Punctuation - Job Application with Resume - Written Communication - Impromptu Speech - Group Discussion - Mock Interview

UNIT II : APTITUDE **(10)**

Simple Interest - Probability - Speed & Distance - Time and Work - Calendar - Clock

UNIT III : REASONING **(10)**

Analogy - Blood Relations - Directions - Data Interpretation - Data sufficiency

TOTAL (P:30) : 30 PERIODS

TEXT BOOKS:

1. Thorpe Edgar and Shawick Thorpe, "Objective English", 3rd ed., Pearson, New Delhi, 2011
2. Khattar Dinesh, "Quantitative Aptitude", 3rd ed., Pearson, New Delhi, 2014

REFERENCES:

1. Prasad, Hari Mohan, Uma Rani Sinha, "Objective English for Competitive Examinations", 4th ed., Tata McGraw Hill Education Pvt.Ltd., New Delhi, 2010
2. Aggarwal R.S, "A Modern Approach to Verbal and Non Verbal Reasoning", S.Chand Publishers, New Delhi, 2017

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x		x	x		x
2	x	x		x								x
3				x		x		x				x

Approved by Seventh Academic Council

15ME612 EMPLOYABILITY ENHANCEMENT SKILLS

(for Core Placement students only)

L	T	P	C
0	0	2	0

OBJECTIVE:

- To recall the fundamental and core engineering concepts
- To acquire skills on quantitative aptitude
- To learn and practice various soft and behavioural skills

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge on fundamental and core engineering concepts
CO2: Solve quantitative aptitude problems in practical environments
CO3: Apply soft and behavioral skills in real time situations

UNIT I : TECHNICAL SKILLS **(10)**

Fundamentals of Engineering, Units, Dimensions, standards, Engineering Drawing : first and third angle projections, engineering mechanics, manufacturing processes, material science and metallurgy, materials removal processes, strength of materials, recent trends in mechanical engineering

UNIT II : APTITUDE SKILLS **(10)**

Ratio and Proportion, Percentage, Average, Simple interest and Compound interest, Profit and Loss, Calendar, Area and Volume

UNIT III : SOFT AND BEHAVIOURAL SKILLS **(10)**

Soft Skills : Resume Preparation, Group Discussion, Interview Skills, Public Speaking, Time Management, passage and report writing
Behavioural Skills: Interaction with HR's of core companies

SCHEME OF EVALUATION:

The students will be assessed 100% internally through

- Objective type questions on Technical and Aptitude Skills
- Oral test on soft and behavioral skills

TOTAL (P:30) : 30 PERIODS

REFERENCES:

1. Saeed Moaveni, "Engineering Fundamentals : An Introduction to Engineering", Cengage India, 2015
2. Brett Handley, "Principles of Engineering", 1st ed., Cengage Learning India Private Limited, 2014
3. Jonathan Wickert, "An Introduction to Mechanical Engineering", 3rd ed., Cengage Learning India Private Limited, 2015
4. Jain. R .K, "Mechanical Engineering for competitions", 28th ed., Khanna Publications, 2014
5. "DRDO, ISRO: Mechanical Engineering", Made Easy Publications, 2017
6. "4400 MCQs: Mechanical Engineering", 2nd ed., Made Easy Publications, 2015
7. Jutz Scharkus, "Westermann Tables for the Metal Trade", 2nd ed., New Age International Publications, 2006
8. Heinrich Gerling, "All About Machine Tools", 2nd ed., New Age International Publications, 2006
9. Aggarwal. R. S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing, 2017
10. E. H. Mcgrath, S. J, "Basic Managerial Skills for All", 9th ed., Prentice Hall India, 2011

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x		x	
2	x			x					x		x	
3	x			x					x		x	

15ME613 ENTREPRENEURSHIP

(for Entrepreneurs only)

L	T	P	C
0	0	2	0

OBJECTIVE:

- To heighten the awareness of developing emotional intelligence that may influence the running of business
- To enable the students to manage their time effectively
- To equip them in building rapport and being ethical towards society

COURSE OUTCOMES:

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

CO1: Manage the emotions effectively

CO2: Build strong interpersonal skills

CO3: Follow business etiquettes

UNIT I : EMOTIONAL INTELLIGENCE **(6)**

Introduction, perceiving emotions, understanding emotions, managing emotions, developing emotional intelligence, persuasion. Emotional Intelligence and Leadership Effectiveness

UNIT II : SELF DEVELOPMENT **(6)**

Johari window, Building Interpersonal Skills - Transactional Analysis, Time Management - Steven covey model, Power of Trust - Competencies for building Trust - Delegation

UNIT III : COACHING AND MENTORING **(6)**

Coaching - Methods, Executive coaching, Mentoring vs. counseling, being an effective mentor, reverse mentoring, Techniques of counseling, Leadership coaching. Emergence of Personal Theory of Counseling

UNIT IV : NETWORKING **(6)**

Importance of networking, making contacts, Getting connected, Building rapport, Building the bond, Business Etiquette, connecting on the phone, connecting in writing, social networking. Social Networking sites

UNIT III : BUSINESS ETHICS **(6)**

Does ethics pay? On becoming an ethical manager, Building an ethical organization, Ethics towards competitors, Corporate Social Responsibility. Roots of unethical behaviour

TOTAL (P:30) : 30 PERIODS

REFERENCES:

1. Daniel Goleman, “Emotional Intelligence”, New York: Bantam Books, 2006
2. Joe Healey, “Radical Trust”, New Delhi: Wiley India Pvt. Ltd, 2009.
3. “Coaching and Mentoring”, Boston: Harvard Business School Publishing Corporation, 2004.
4. John Timperley, “Network Your Way to Success”, London: Piatkus, 2010.
5. ManiKutty S, “Being Ethical - IIMA Business Books”, Noida: Random House India, 2011

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x					x	x		x		x	x
2	x					x	x		x		x	x
3	x					x	x		x		x	x

15ME701 CAD / CAM / CIM

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept of geometric modeling
- To introduce the concept of computer graphics
- To understand the stages of Computer Aided Manufacturing
- To understand the basics of CNC machine tools
- To acquire knowledge on the concept of Computer Integrated Manufacturing and production planning

COURSE OUTCOMES:

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

CO1: Explain various CAD models, stages in geometric modeling
CO2: List the steps involved in 2D and 3D transformations in computer graphics
CO3: Summarize the steps involved in Computer Aided Manufacturing and process planning
CO4: Distinguish the NC, CNC & DNC systems and explain their working principles
CO5: Describe the importance of Computer Integrated Manufacturing and stages in production planning

UNIT I : GEOMETRIC MODELLING TECHNIQUES (9)

CAD implementation - design Process - Shigley, Pahl and Beitz, Ohsuga, Earle model - benefits of CAD - hardware - input and output devices - display devices - LCD, LED - geometric modeling - basics of wire frame, surface, solid modeling

UNIT II : PRINCIPLES OF COMPUTER GRAPHICS (9)

Graphic primitives - transformation in graphics - coordinate system used in graphics and windowing - viewport - 2D Transformation - homogeneous transformation - combination transformation - clipping - 3D transformation - projections - scan conversion – rendering

UNIT III : COMPUTED AIDED MANUFACTURING (9)

Function of CAM - benefits of CAM - integrated CAD/CAM organization - computed aided process planning - retrieval type CAPP, generative CAPP - product development cycle - sequential engineering - concurrent engineering

UNIT IV : CNC MACHINE TOOLS (9)

Principle of numerical control - component of NC system - NC procedure - types of CNC machine tools - programming of CNC machine tools - preparatory functions - miscellaneous functions - part programming - types - turning and machining center

UNIT V : COMPUTER INTEGRATED MANUFACTURING AND PRODUCTION PLANNING (9)

Types of manufacturing - evolution of computer integrated manufacturing - CIM hardware and CIM software - nature and role of the elements of CIM system - development of CIM - material requirement planning - capacity requirement planning - manufacturing resource planning - just in time - shop floor control

TOTAL (L:45) : 45 PERIODS

TEXTBOOKS:

1. Ibrahim Zeid and Sivasubramanian, R, “CAD/CAM Theory and Practice”, Tata McGraw Hill Publications, New Delhi, 2009.
2. Radhakrishan.P, Subramanyan.S, Raju.V, “CAD/ CAM/ CIM”, 4th ed., New Age International Publishers Ltd., 2018

REFERENCES:

1. Chris McMahon and Jimmie Browne, "CAD/CAM Principles, Practice and Manufacturing Management", 2nd ed., Pearson Education (Singapore) Pvt. Ltd., 2000
2. David F. Rogers, J. A. Adams, "Mathematical Elements for Computer Graphics", Tata McGraw Hill Publications, 2008.
3. Donald Hearn and M. Pauline Baker, "Computer Graphics", Eastern Economy Edition, 2007.
4. Rao.P.N, "CAD/ CAM", 3rd ed., McGraw Hill Education, 2017
5. Mikell P. Groover and Zimmers.W, "CAD/CAM - Computer Aided and Manufacturing", Pearson India, 2008

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x		x						x
2	x	x	x	x		x					x	
3		x	x	x		x		x				
4	x		x	x		x	X				x	
5	x		x	x		x					x	

15ME711 CAD / CAM LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES :

- To gain practical experience in handling 2D drafting and 3D modeling software.
- To gain practical knowledge on assembly of 3D components in a modeling software.
- To know the application of various machine tools like CNC lathe, CNC Vertical Machining Centre.
- To study the features of CNC Machine Tool and modern control systems.
- To understand the post process steps using CAM packages.

COURSE OUTCOMES:

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

CO1: Construct Three Dimensional CAD model of the machine component with given specifications.
CO2: Develop Three Dimensional assembly model from the generated part models.
CO3: Make use of Manual Part Programming to create the prismatic component using CNC Machining Centre.
CO4: Apply Manual Part Programming to create cylindrical component using CNC Turning Centre.
CO5: Create Cutter Location (CL) data and post process generation using CAM packages

LIST OF THE EXPERIMENTS

1. **3D Modelling**

   Creation of 3D assembly model of following machine elements using 3D Modelling software

   1. Flange Coupling
   2. Fuel injector
   3. Universal Joint
   4. Machine Vice

2. **Manual Part Programming.**

(i) Part Programming - CNC Machining Centre

   5. Manual part programming for CNC Milling machine using linear interpolation and Circular interpolation.
   6. Manual part programming for CNC Milling machine using Circular pocketing, Mirroring & Subroutine.
   7. Manual part programming for CNC Milling machine using Canned Cycle Operations.

(ii) Part Programming - CNC Turning Centre

   8. Manual part programming for CNC turning centre for step turning using linear interpolation and circular interpolation.
   9. Manual part programming for CNC turning centre for Taper Turning and Grooving.
   10. Manual part programming for CNC turning centre for Thread cutting.

3. **Computer Aided Part Programming**

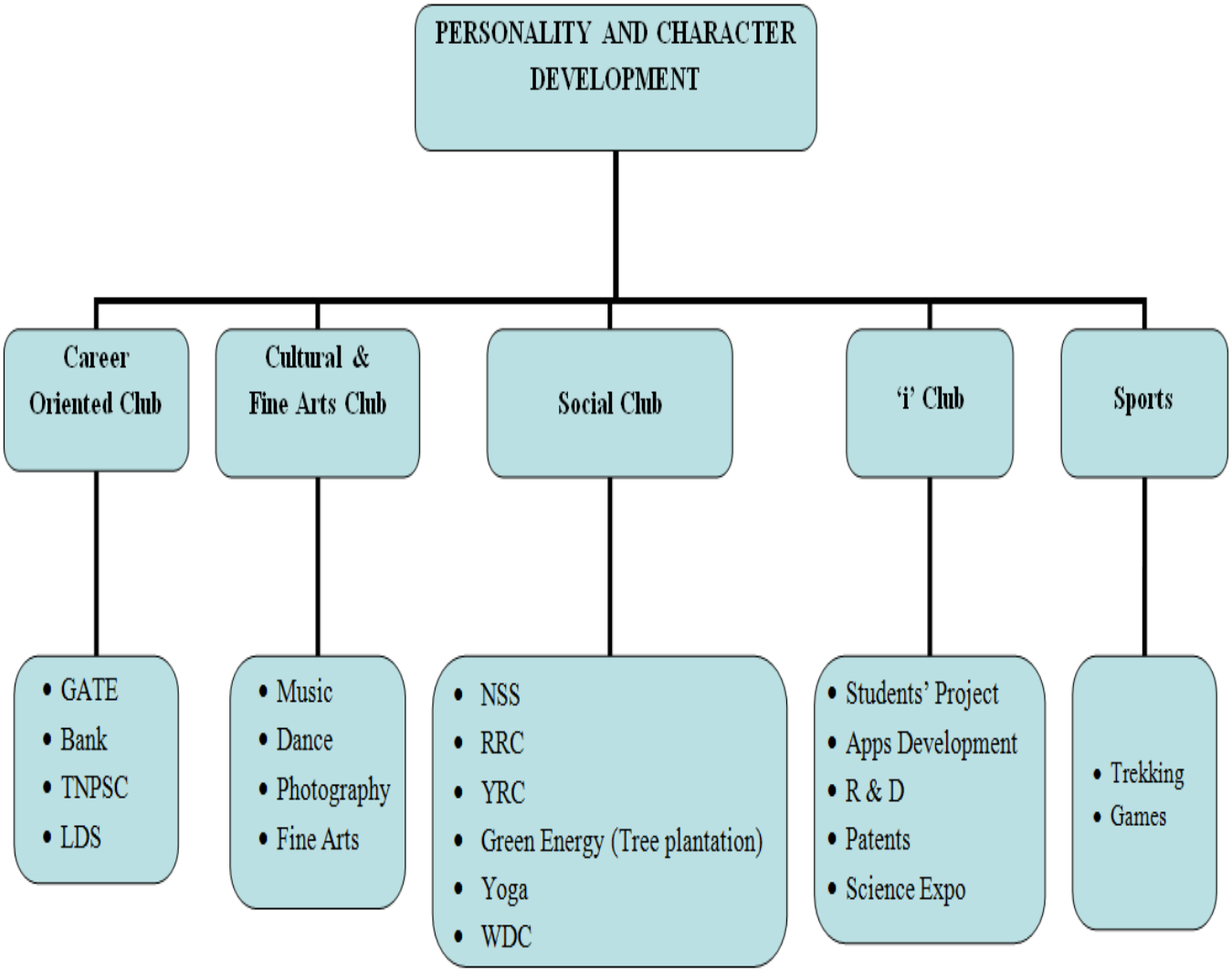
   11. Creation of CL Data and Post process generation using CAM packages.

TOTAL (P:60) : 60 PERIODS

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x	x				x			
2	x		x	x	x				x			
3	x		x	x	x				x		x	
4	x		x	x	x				x		x	
5			x	x	x				x			

15GE711 PERSONALITY AND CHARACTER DEVELOPMENT

L	T	P	C
0	0	1	0



***LDS - Leadership Development Skills**

OBJECTIVES :				
Career Oriented Club	**Cultural & Fine Arts Club**	**Social Club**	**'i' club**	**Sports**
•To provide support for identifying specific career field of interests and career path •To provide support for preparing for competitive exams	•To bring out the hidden talent of students in music, dance and other fine arts. •To promote photography skill among the students •To develop and enhance the performance of students by participating in various events •To inculcate managerial capabilities such as event management and stage organization	•To create social awareness and develop a sense of social and civic responsibility •To inculcate socially and environmentally sound practices and be aware of the benefits •To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	•To inculcate the basic concepts of innovation •To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities •To enrich the academic experience, build competencies and relationships beyond the classroom	•To provide opportunities to excel at sports •To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. •To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. •To develop leadership skills and nurture the team building qualities. **<u>Trekking:</u>** •To provide opportunities to explore nature and educating about the purity of nature •To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
• Find a better career of their interest. • Make use of their knowledge during competitive exams and interviews.	• Take part in various events • Develop team spirit, leadership and managerial qualities	• Develop socially responsive qualities by applying acquired knowledge • Build character, social consciousness, commitment and discipline	• Apply the acquired knowledge in creating better solutions that meet new requirements and market needs • Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team	• Demonstrate positive leadership skills that contribute to the organizational effectiveness • Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle • Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [4 x (P: 15)]: 60 PERIODS

(Cumulatively for Four Semesters)

15ME731 PROJECT – I

L	T	P	C
0	0	8	4

OBJECTIVES :

- To practice the fundamental concepts of basic sciences and mechanical engineering
- To improve the management skills to address a real time situation autonomously or in a team
- To improve technical writing skills
- To apply the technical skills to provide feasible solutions for real-life problems

COURSE OUTCOMES:

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

CO1: Perform survey and infer the data to decide on area of project work
CO2: Formulate a problem definition in the field of Mechanical Engineering through literature survey
CO3: Identify the objectives of the project by thorough understanding of the problem
CO4: Develop methodology using appropriate tools for the problem
CO5: Conclude the results and submit the project report

ACTIVITIES

- Literature survey and Inference
- Problem Identification

(CAT - I)

- Methodology
- Design and Calculation / Numerical / Theoretical Analysis

(CAT - II)

- Modeling / Experimental Setup

(CAT - III)

The students in a group of maximum 4 students per batch on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners.

TOTAL (P:120) : 120 PERIODS

Mapping of COs and POs												
Cos	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x					x	x		X	
2	x		x					x	x		X	
3	x	x		x	x		x	x	x		X	x
4	x	x		x	x		x	x	x		X	x
5		x			x		x	x	x		X	x

15ME831 PROJECT – II

L	T	P	C
0	0	16	8

OBJECTIVES :

- To practice the fundamental concepts of basic sciences and mechanical engineering concepts and principles in addressing a real time situation autonomously or in a team
- To enhance the management skills to achieve the project goal by working as a team and also improve technical writing skills
- To apply the technical skills to provide feasible solutions for real-life problems

COURSE OUTCOMES:

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

CO1: Identify the objectives of the project by thorough understanding of the problem
CO2: Perform the Experimental Analysis to validate the analytical results
CO3: Improve the research and development activities
CO4: Conclude the results and submit the project report
CO5: Take up any challenging practical problems and find solutions

The students in a group of maximum 4 students per batch on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners.

TOTAL (P:240) : 240 PERIODS

Mapping of COs and POs												
Cos	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x					x	x		x	
2	x		x					x	x		x	
3	x	x		x	x		x	x	x		x	x
4	x	x		x	x		x	x	x		x	x
5		x			x		x	x	x		x	x

15MEX01 COMPOSITE MATERIALS AND MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the fundamentals and manufacturing aspects of composite materials
- To acquire knowledge on Lamina Constitutive Equations and analysis of laminated flat plates
- To introduce the thermal analysis of various laminates

COURSE OUTCOMES:

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

CO1: List the types reinforcing materials and their composites
CO2: Recommend a manufacturing process for a composite material
CO3: Demonstrate the governing equations of composite laminates
CO4: Make use of strength analysis techniques to predict the failure of laminated plates
CO5: Estimate the Coefficient of Thermal Expansion of composites by selecting a thermal analysis

UNIT I : INTRODUCTION TO COMPOSITE MATERIALS (9)

Definition - matrix materials - polymers - metals - ceramics - reinforcements - particles, whiskers, inorganic fibers, metal filaments - ceramic fibers - fiber fabrication - natural composite wood, jute - advantages and drawbacks of composites over monolithic materials - mechanical properties and applications of composites, particulate reinforced composite materials, dispersion strengthened composite, fiber reinforced composites - rule of mixtures - characteristics of fiber reinforced composites, manufacturing fiber and composite

UNIT II : MANUFACTURING OF COMPOSITES (9)

Manufacturing of Polymer Matrix Composites (PMCs) - handlay up, spray technique, filament winding, pultrusion, Resin Transfer Moulding (RTM) - bag moulding, injection moulding, Sandwich Mould Composites (SMC) - manufacturing of Metal Matrix Composites (MMCs) - solid state, liquid state, vapour state processing, manufacturing of Ceramic Matrix Composites (CMCs) - hot pressing - reaction bonding process - infiltration technique, direct oxidation – interfaces

UNIT III : INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS (9)

Lamina Constitutive Equations: Lamina Assumptions - macroscopic viewpoint - generalized Hooke's Law - reduction to Homogeneous Orthotropic Lamina - Isotropic limit case, Orthotropic Stiffness matrix (Qij), definition of stress and moment resultants - strain displacement relations - basic assumptions of laminated anisotropic plates - laminate constitutive equations - coupling - Interactions, balanced laminates, symmetric laminates, angle ply laminates, cross ply laminates - laminate structural moduli - evaluation of lamina properties from laminate tests - quasi Isotropic laminates - determination of lamina stresses within Laminates

UNIT IV : LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES (9)

Introduction - maximum stress and strain criteria - Von-Misses yield criterion for isotropic materials - generalized Hill's criterion for anisotropic materials - Tsai-Hill's failure criterion for composites - tensor polynomial (Tsai-Wu) - failure criterion - prediction of laminate failure equilibrium equations of motion - energy formulations - static bending analysis - buckling analysis - free vibrations - natural frequencies

UNIT V : THERMAL ANALYSIS (9)

Assumption of constant Coefficient of Thermal Expansion (C.T.E.) - modification of Hooke's law - modification of laminate constitutive equations - orthotropic lamina C.T.E's - C.T.E's for special laminate configurations - unidirectional, off-axis, symmetric balanced laminates, zero C.T.E laminates, thermally quasi-isotropic laminates

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Malik, P.K., "Fiber Reinforced Composite: Materials, Manufacturing and Design", 3rd ed., CRC Press, 2007
2. Ronald F. Gibson, " Principles of Composite Material Mechanics ", 2nd ed., CRC Press, 2007

REFERENCES:

1. Michael Hyer, Scott R White, " Stress Analysis of Fibre Reinforced Composite Materials", International edition, McGraw-Hill Education, 1998
2. Issac M. Daniel and Oril Shai, "Engineering Mechanics of Composite Materials", 2nd ed., Oxford University Press, 2005
3. John C. Halpin, "Primer on Composite Materials, Analysis", 2nd ed., CRC Press, 1992
4. Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara, " Analysis and Performance of Fiber Composites", 3rd ed., Wiley Publications, 2012
5. Mallick P K, Newman S, " Composite Materials Technology: Processes and Properties", Hanser Gardner Publications, 1991
6. Madhujit Mukhopadhyay, " Mechanics of Composite Materials and Structures", Orient Blackswan Publications, 2004
7. Deborah D. L. Chung, " Composite Materials: Science and Applications", 2nd ed., Springer, 2012

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x	x		x				x	x
2	x	x		x	x		x				x	x
3	x	x		x	x		x				x	x
4	x	x		x	x		x				x	x
5	x	x		x	x		x				x	x

Approved by Seventh Academic Council

15MEX02 DESIGN FOR MANUFACTURING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the selection of materials, methods, fit and tolerance concepts to design a product.
- To familiarize the basic concept of design for castings, welding, forging and manufacturing Processes.
- To get knowledge in basic procedure of design for assembly and environments.

COURSE OUTCOMES:

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

CO1: Describe the manufacturing processes for various engineering materials
CO2: Demonstrate the design procedure for welding and forging processes.
CO3: Summarize the design rules for castings.
CO4: Contrast the design procedure for various machining processes.
CO5: Select the guidelines to minimize environmental impacts using recyclability and remanufacture concepts

UNIT I : FUNDAMENTALS (9)

Design for Manufacture and Assembly - implementation issues - Typical DFMA case studies - selection of materials and processes - General requirements for early materials and process selection - selection of manufacturing processes - process capabilities - selection of materials - primary process/material selection - systematic selection of processes and materials

UNIT II : DESIGN FOR MANUAL ASSEMBLY (9)

Design guidelines - assembly efficiency - classification systems - effect of part symmetry, part thickness, size, weight on handling time - parts requiring two hands for manipulation - chamfer design - obstructed access - restricted vision - insertion time - manual assembly database and design data sheets - application of the DFA - further design guidelines - types of manual assembly methods - effect of assembly layout - assembly quality - learning curves

UNIT III : DESIGN FOR CASTING AND FORMING (9)

Design for sand casting - sand casting alloys - basic characteristics and mold preparation - sand cores- melting and pouring - design for die casting - die casting alloys - die casting cycle - die casting machines - dies - finishing - equipment for automation - optimum number of cavities - design principles - Sheet metal working - Design for Hot forging - characteristics - flash and its removal - allowances - performing - classification of materials

UNIT IV : DESIGN FOR MACHINING (9)

Introduction - machining using single point cutting tools - multipoint tools - abrasive wheels - standardization - choice of work material - shape of work material - machining basic component shapes- assembly of components - accuracy and surface finish - design guidelines - cost estimating for machined components

UNIT V : DESIGN FOR THE ENVIRONMENT (9)

Importance of DFE - environmental objectives - global issues - regional and local issues - basic DFE methods - design guidelines - lifecycle assessment - basic method - AT&T's environmentally responsible product assessment - weighted sum assessment method - techniques to reduce environmental impact - design for minimization of material usage - design for disassembly - design for recyclability - design for remanufacture - design for energy efficiency - design to regulations and standards

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Geoffrey Boothroyd, Peter Dewhurst and Winston A.Knight, "Product Design for Manufacture and Assembly", 3rd ed., CRC Press, 2013
2. Kevin Otto and Kristin Wood, "Product Design", 1st ed., Pearson Education India, 2003

REFERENCES:

1. Chitale .A .K and Gupta.R.C, "Product Design and Manufacturing", 6th Revised edition, Prentice Hall India, 2014
2. Bralla, "Design for Manufacturability Handbook", 2nd ed., McGraw-Hill Education, 1998
3. Joseph Fiksel, "Design for the Environment", 2nd ed., McGraw-Hill Professional Publishers, 2011
4. Harry peck, "Designing for manufacture", Pitman publishing, 1973
5. Jim Lesko, "Industrial Design, Materials and Manufacture Guide", 2nd Revised edition, John Willy and Sons, Inc., 2008

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x			x				x	x
2	x	x	x	x			x				x	x
3	x	x	x	x			x				x	x
4	x	x	x	x			x				x	x
5	x	x	x	x			x				x	x

15MEX03 ENGINEERING FAILURE ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce various aspects of failure under mechanical loading
- To acquire knowledge on fundamentals of fatigue loading and failure analysis
- To introduce the types of failure mechanisms and mechanics of fracture

COURSE OUTCOMES:

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

CO1: Summarize the types of tools available for failure analysis and types of stresses induced under different loading conditions
CO2: Select the operating parameters of an equipment subjected to fatigue loading conditions
CO3: Analyze the failure of materials under corrosion, hydrogen exposure and creep
CO4: Outline the mechanisms of failure and the principles of fracture mechanics
CO5: Interpret the failure in various metals and alloys

UNIT I : MECHANICAL ASPECTS (9)

Tools for failure analysis - Optical microscopy, Transmission electron microscopy, Scanning electron microscopy. Systematic approach to failure analysis - Mechanical aspects - Tensile test, Principal stresses, Stress concentration, Triaxle stresses and constraint, Plane stress, Plane strain

UNIT II : FATIGUE (9)

Loading under high cycle fatigue conditions, Test methods, S-N-P curves, endurance diagrams, influence factors - Low cycle fatigue, fretting fatigue; Fatigue design for combined stress; cumulative damage and life prediction, statistical interpretation of fatigue test data.

UNIT III : ANALYSIS OF FATIGUE (9)

Failures related to corrosion, hot corrosion and stress corrosion cracking; Damages due to hydrogen; Creep of metallic material

UNIT IV : OTHER FAILURE MECHANISMS AND FRACTURE PROCESSES (9)

Fracture processes, Meaning of ductile and brittle fracture, Effect of strain rate and temperature. Fracture mechanics and Failures, Linear elastic fracture mechanics, fracture mechanics principles in design practice, Elastic Plastic fracture mechanics, Examples of crack-growth Analysis for cyclic loading.

UNIT V : FRACTURE MECHANICS AND FAILURES (9)

Welded constructions and screw fastenings, Environmental degradation, Embrittlement of metals and alloys.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. William T. Becker and Roch J. Shipley, "ASM Handbook - Failure Analysis and Prevention - Volume 11", 10th ed., ASM International, 2002
2. Charlie R Brooks and Ashok Choudhury, "Failure Analysis of Engineering Materials", McGraw-Hill Education, 2001

REFERENCES:

1. Arthur J. McEvily, "Metal Failures", 2nd Revised edition, John Wiley & Sons, 2013
2. A Venugopal Reddy, "Investigation of Aeronautical and Engineering Component Failures", CRC Press, 2004
3. Neville W. Sachs, "Practical plant failure analysis", CRC Press, 2007
4. Jose Luis Otegui, "Failure Analysis - Fundamentals and Applications in Mechanical Components", Springer International Publishing, 2014

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x	x	x		x	x
2	x	x				x			x			
3	x	x		x	x	x			x			
4	x	x				x			x			
5	x	x			x	x		x	x			

15MEX04 MECHANICAL VIBRATIONS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the importance of vibration in mechanical design of machine parts that operate in vibratory conditions
- To understand the vibration effects, which causes the reciprocating and rotating parts in engines
- To understand the transcribe of differential equation of motion of vibratory systems
- To understand the fundamentals of free and forced vibrations
- To understand the concept of vibration measurement and frequency measurement instruments

COURSE OUTCOMES:

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

CO1: Derive the differential equation and obtain the linear mathematical model of real life Engineering systems with undamped and damped vibrations

CO2: Solve numerical problems on free and forced vibrations of machines, engines and structures which have single degree of freedom

CO3: Determine the solution for balancing problems on static and dynamic machines, rotors having two degrees of freedom and enumerate the working principles of vibration measuring instruments

CO4: Analyse the balancing problems numerically in multi degrees of freedom equipment

CO5: Apply skills in instrumentation, measurement and signal processing through vibration testing for several physical, mechanical and structural systems

UNIT I : UNDAMPED FREE VIBRATION OF SINGLE DEGREE OF FREEDOM (9)

Basic Concepts - Importance and scope - definition and terminology - representation of harmonic motions - types of vibrations - undamped free vibration - derivation of differential equation of motion - solution of differential equation - simple and compound pendulum - torsional vibrations, equivalent springs - springs in series and parallel

UNIT II : DAMPED FREE AND FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEM (9)

Damped free vibration of single degree of freedom - types of damping - viscous damping - over critically and under damped systems - logarithmic decrement - forced vibrations of single degree of freedom - equation of motion with harmonic force - whirling of shafts - without damping

UNIT III : TWO DEGREES OF FREEDOM SYSTEM (9)

Undamped vibrations - free vibration analysis of undamped systems - mode shapes- semi definite systems - forced vibration analysis of undamped systems - torsional vibrations of two rotor systems - torsionally equivalent shaft - applications - dynamic vibration absorber, centrifugal pendulum absorber

UNIT IV : MULTI DEGREES OF FREEDOM SYSTEM AND CONTINUOUS SYSTEMS (9)

Matrix method -matrix iteration method - Stodola method - Dunkerley method - Continuous systems - transverse vibration of string - longitudinal vibration of a bar - transverse vibration of shaft - longitudinal vibration of a beam

UNIT V : VIBRATION MEASUREMENT (9)

vibration Measurement - vibration measuring instruments - vibrometer - accelerometer - frequency and velocity measuring device - transmissibility - vibration isolation - transducers - classification - displacement transducers - velocity transducers - active and passive transducers - accelerometer - selection of sensors

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Singh V.P "Mechanical Vibrations", 3rd ed., Dhanpat Rai & Co. Ltd, 2012
2. Singiresu S. Rao, "Mechanical Vibrations", 4th ed., Pearson India Publishers, 2014

REFERENCES:

1. Balakumar Balachandran, Edward B. Magrab, "Fundamentals of Vibrations", 1st ed., Cengage Learning, 2009
2. Rattan S.S, "Theory of Machines", 4th ed., McGraw Hill Education India Private Limited, 2014
3. Metha J.S and Kailey A.S, "Mechanical Vibrations", 1st ed., S.Chand & Co. Ltd, 2012
4. Sujatha.C, "Vibration and Acoustics", 1st ed., Tata McGraw Hill Education Private Limited, 2010
5. William T. Thomson, "Theory of Vibrations with Applications", 5th ed., Pearson India Publishers, 2014

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x	x						
2	x	x	x		x							
3					x	x	x	x				
4	x	x				x				x		
5	x	x					x	x			x	x

15MEX05 MICRO ELECTRO MECHANICAL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept of Micro Electro Mechanical Systems and its applications in various fields
- To acquire knowledge on manufacturing process for the given material using various fabrication methods
- To introduce the types of MEMS components and the principle of micro fluidics

COURSE OUTCOMES:

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

CO1: Explain the concept of MEMS with applications and/or working principles of microsensors and actuators
CO2: Identify the materials used for MEMS and Microsystems
CO3: Summarize the steps involved in various microsystem fabrication processes
CO4: Recommend a micromanufacturing process for a particular material
CO5: List the stages of Microsystem packaging

UNIT I : FUNDAMENTALS OF MEMS (9)

MEMS and Microsystems - Typical MEMS and Microsystem products - Microsystems and micro electronics - Applications of Microsystems in automotive and other industries - Microsensors - Acoustic wave sensors, Bio medical sensors - Optical sensors, Pressure sensors - Microactuators - Microgrippers, Micromotors, Microvalves, Micropumps

UNIT II : MATERIALS FOR MEMS AND MICROSYSTEMS (9)

Substrates and Wafers - Active substrate materials - Silicon as a substrate material - Silicon compounds - Silicon Dioxide, Silicon Carbide, Silicon Nitride, Polycrystalline Silicon - Silicon Piezoresistors - Gallium Arsenide - Quartz - Polymers - Polymers as Industrial Materials, Polymers for MEMS and Microsystems, Conductive Polymers - Packaging Materials

UNIT III : MICROSYSTEM FABRICATION PROCESSES (9)

Photolithography - Photoresists and Application, Light Sources, Phoresist Development, Removal and Postbacking - Ion implantation - Diffusion - Oxidation - Chemical Vapor Deposition - Working Principle, Chemical Reactions, Rate of deposition - Physical Vapor Deposition - sputtering

UNIT IV : MICROMANUFACTURING (9)

Bulk Micromanufacturing - Etching - Isotropic and Anisotrotpic Etching, Wet Etching, Dry Etching - Surface Micromachining - General Process, Mechanical problems associated with Surface Micromachining - LIGA Process - general Process, Materials for Substrates and Photoresists - Electroplating - SLIGA Process

UNIT V : MICROSYSTEM PACKAGING (9)

Mechanical Packaging of Microelectronics - Microsystem Packaging - General considerations, Three Levels of Microsystem Packaging - Interfaces in Microsystem Packaging - Essential Packaging Technologies - Die Preparation, Surface bonding, Wire bonding - Three Dimensional Packaging - Assembly of Microsystems - Selection of Packaging Materials

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Tai-Ran-Hsui, "MEMS & Microsystems - Design and Manufacture", 1st ed., Mcgraw Hill Education, 2002
2. Nadim Maluf, Kirt Williams, "An Introduction to Microelectromechanical Systems Engineering", 2nd ed., Artech House Print, 2004

REFERENCES:

1. Stephen R.Santuria, "Microsystem Design",1st ed., Springer, Reprint 2004
2. Minhang Bao, "Analysis and Design Principles of MEMS devices", 1st ed., Elsevier Science, 2005
3. Nitaigour Premchand Mahalik, "MEMS", McGraw Hill Education, 2007
4. Mohamed Gad-el-Hak, "MEMS: Introduction and Fundamentals", 1st ed., CRC Press, 2005
5. Chang Liu, "Foundations of MEMS", 2nd ed., Pearson Education, 2011

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x						x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX06 PRODUCT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept of product development, product planning and customer needs
- To know concept generation, selection, testing and product architecture
- To acquire knowledge on concepts of Design for manufacturing and prototyping

COURSE OUTCOMES:

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

CO1: Describe the steps involved in product development process and product planning
CO2: Demonstrate the process of converting the customer requirements into technical requirements and methods of converting the requirement into product
CO3: Examine the ideas of concept generation for a new product and the development stages
CO4: Choose the architecture of the product considering various functional requirements
CO5: Identify the design and manufacturing constraints during product design and development process

UNIT I : PRODUCT DEVELOPMENT PROCESSES AND PRODUCT PLANNING (9)

Generic product development process - concept development - product development process flows - product planning process - identification of opportunities, evaluation and prioritization of projects, allocation of resources and planning, completion of pre-project planning, reflection on the results and the process

UNIT II : CUSTOMER NEEDS AND PRODUCT SPECIFICATION (9)

Identifying customer needs - gathering raw data from customers - interpretation of raw data in terms of customer needs - organizing the needs into a hierarchy - establishment of the relative importance of the needs - reflection on the results and the process - product specifications and establishment - target and final specifications

UNIT III : CONCEPT GENERATION, SELECTION AND TESTING (9)

Activity of concept generation - clarification of the problem - external and internal search - systematic exploration - reflection on the solution and the process- concept selection - structured method for choosing a concept - screening and scoring - concept testing - defining purpose, survey population and format, communication, measure customer response - interpretation and reflection on the result and the process

UNIT IV : PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN (9)

Product architecture - implications of the architecture product change - establishing the architecture - delayed differentiation - platform planning - related system level design issues - industrial design - assessing the need - impact of industrial design - management of industrial design process - assessing the quality of industrial design

UNIT V : DESIGN FOR MANUFACTURING AND PROTOTYPING (9)

Estimation of manufacturing costs - reduction of the costs of components, costs of assembly, supporting production - impact of DFM decisions on other factors - prototyping - understanding prototypes - principles of prototyping and technologies - planning for prototypes

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Karl T. Ulrich and Steven D. Eppinger, "Product Design and Development", 5th ed., Tata McGraw-Hill Publishing Company Limited, 2016
2. Kevin N.Otto and Kristin L.Wood, "Product Design", 1st ed., Pearson Education, 2003

REFERENCES:

1. Corrodo Poli, "Design for Manufacturing: A structured approach", Butterworth- Heinemann, 2001
2. Ibrahim Zeid, "Mastering CAD/CAM" Tata McGraw-Hill, 2005
3. John W. Priest and Jose M. Sanchez, "Product development and design for manufacturing", Marcel Dekker Publications, 2001
4. Richard Crowson, "Product Design and Factory Development", 2nd ed., Taylor and Francis Groups, 2005
5. Stephen C. Armstrong, "Engineering and Product development Management - The Holistic Approach" Cambridge University Press, 2001

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX07 TOOL DESIGN

(Use of Approved data book is permitted)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To teach students the fundamentals of work holding devices.
- To enable the students design tools, dies, jigs and fixtures.
- To teach students to analyze and optimize an existing jig and fixture.
- To expose students to design of dies for press work and forging.

COURSE OUTCOMES:

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

CO1: Determine the dimensions of single and multipoint cutting tools based on cutting forces
CO2: Identify the importance of work holding device
CO3: Design jigs and fixtures for the given work pieces
CO4: Calculate the required specifications of a press for required operations
CO5: Design tools and dies for required operations

UNIT I : DESIGN OF CUTTING TOOLS **(9)**

Metal cutting process - selection of tool materials - design of single point and multipoint cutting tool - form tools, drills, milling cutters, broaches and chip breakers - problems on design of single point cutting tools only

UNIT II : LOCATING AND CLAMPING METHODS **(9)**

Basic principles of location - locating methods and devices - principles of clamping - mechanical, pneumatic and hydraulic actuation - clamping force analysis - design problems.

UNIT III : DESIGN OF JIGS **(9)**

Types of drill jigs - general considerations in the design of drill jigs - drill bushings - types, methods of construction- simple designs of plate, channel, boxes, post, angle plate, turnovers and pot jigs.

UNIT IV : DESIGN OF FIXTURES **(9)**

Design principles - types of fixtures - fixtures for machine tools: lathe, milling, boring, broaching and grinding - assembly fixtures - inspection and welding fixtures.

UNIT V : DESIGN OF DIES **(9)**

Press tools - Fundamentals of die-cutting operations - Cutting action in punch and die operations - Die clearance - Blanking and Piercing Die construction - Pilots - Strippers and Pressure Pads - Press work materials - Strip layout - Design of simple progressive and compound die sets - Forging Die - Flow lines, parting lines, open and close die forging; Materials for die block.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Donaldson, Lecain and Goold, "Tool Design", 3rd ed., Tata McGraw Hill, 2012
2. John G. Nee, "Tool Design", 6th ed., Society of Manufacturing Engineers, 2010

REFERENCES:

1. Venkataraman. K, "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005
2. Joshi. P.H, "Jigs and Fixtures", 2nd ed., Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2004
3. Elanchezhian. C, "Design of Jigs Fixtures & Press Tools", Eswar Press,Chennai, 2004
4. Hoffman, "Jigs and Fixture Design", Thomson Delmar Learning, Singapore, 2004
5. Vukota Boljanovic Paquin .J. R, "Die Design Fundamentals", 3rd ed., Industrial Press, 2005

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX08 TRIBOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept of tribology in design of products
- To acquire knowledge on the different types of bearings, modeling and performance considerations
- To know the concepts of friction and wear phenomena

COURSE OUTCOMES:

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

CO1: Select tribological elements based on design considerations
CO2: Demonstrate the understanding of friction and wear
CO3: Demonstrate skills to select lubricant
CO4: Summarize the importance of proper choice of tribological elements
CO5: Apply the knowledge of wear and lubricants for different applications

UNIT I : ENGINEERING SURFACES (9)

Measurement methods - statistical and fractal description - non conforming surface contact geometry - stresses in non-conforming contacts - contact of rough surfaces- adhesion - solid-solid contacts- adhesion models - influencing factors - adhesion by surface tension and contact between rough surfaces - stiction

UNIT II : FRICTION AND WEAR (9)

Friction measurement methods - origin of friction - friction theories - other mechanisms - friction of metals and non-metals - wear - types - adhesive, abrasive, corrosive, fatigue wear - minor forms of wear - delamination theory - debris analysis and testing methods - wear of metals, ceramics, polymers - systems approach for wear reduction, Wear maps

UNIT III : LUBRICANTS AND LUBRICATION (9)

Oil lubricants - natural and synthetic organics - greases - viscosity - effect of temperature, pressure and shear rates on viscosity, measurement of viscosity - relative density, specific heat and thermal conductivity - acidity and alkalinity - oxidation stability - flash point - foaming - pour point - demulsibility - extreme pressure properties - additives

UNIT IV : TRIBOLOGICAL CONSIDERATIONS IN MACHINE DESIGN (9)

Rolling contact bearing - plain bearing - gears - wire ropes - seals and packing - conveyor belts - tribological design of machine components - material selection - surface engineering - introduction of system approach - tribological systems - operating variables - systems structure - tribological characteristics

UNIT V : APPLICATIONS OF TRIBOLOGY (9)

Tribology in metal working processes - effect of friction, wear, lubrication in metal working - classification of physical deformation processes - rolling - drawing - extrusion - forging - sheet metal working - metal removal – case studies - tribology in maintenance of transport units - biotribology

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Bharat Bhushan, “Introduction to Tribology”, John Wiley and Sons, 2013.
2. Prasanta Sahoo, “Engineering Tribology”, PHI Learning Private Limited, 2013.

REFERENCES:

1. Basu S. K, Sengupta S. N, Ahuja B. B, “Fundamentals of Tribology”, PHI Learning Pvt. Ltd, 2010.
2. Gohar Ramsey, Rahnejat Homer , “Fundamentals of Tribology”, World Scientific Publishing Co. Pvt Ltd, 2008.
3. Ian M. Hutchings, “Tribology: Friction and Wear of Engineering Materials”, Butterworth-Heinemann Ltd, 1992.
4. Kumar A , “A Textbook of Tribology”, S K Kataria & Sons-New Delhi, 2014.
5. Sushil Kumar Srivastava, “Tribology in Industries”, S.Chand & Company Ltd, 2012.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x								
2					x			x		x		
3		x		x	x	x					x	
4		x								x	x	
5	x		x		x	x						

15MEX31 NEW PRODUCT DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To know about inception, strategy and marketing related to a product
- To understand the value proposition and property rights due to new product
- To learn various managerial aspects in development of product and various stages involved in product management
- To know the efforts to be taken for launching a new product

COURSE OUTCOMES:

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

CO1. Outline the stages in initiation of a new product
CO2. Demonstrate the concept of value analysis and pricing strategies
CO3. Illustrate the managerial aspects during new product development
CO4. Interpret the manufacturing aspects during product design and development
CO5. Summarize the steps involved in product launching in the market

UNIT I : INCEPTION, STRATEGY AND MARKETING (9)

Inception - product definition - origin of new products - concept of risk - strategy - analyzing the external environment - analyzing internal direction - marketing - sales Vs marketing, segmentation, targeting and positioning, marketing 4Ps

UNIT II : VALUE PROPOSITION, INTELLECTUAL PROPERTY AND FUNDING (9)

Value proposition - commodities Vs differentiated products, features, benefits and economic value, damning, strategic elements, pricing models - Intellectual property - effectiveness, brands and intellectual property, accounting, types and monetizing - funding - valuation and finance, risk, time value of money, finance for product managers and entrepreneurs

UNIT III : MANAGERIAL ASPECTS (9)

Organizations - product development groups, effective leadership, inspiring followship, organizational building blocks - milestones - resource triangle, cost profiles and risk reduction, Gantt charts, Go/No-Go decision, journey and destination milestones, building blocks

UNIT IV : PRODUCT MANAGEMENT (9)

Design - product track, business relationships in design and manufacturing, design processes, environmental stewardship, design building blocks - Fabrication, Integration and Delivery (FID) - vertically integrated companies, outsourcing, role of software, FID building blocks - robust design - need and steps involved - quantitative and qualitative economic analysis

UNIT V : PRODUCT LAUNCHING (9)

Launch - five M's of advertising, innovation diffusion theory, social media, launch and recalls, launch building blocks - wrap up - lessons learned, strategies for product success, product design principles, customer relationships, hints for entrepreneurs, keys to the kingdom

TOTAL (L:45) = 45 PERIODS

TEXTBOOKS:

1. Andrea Belz, "Product Development", McGraw Hill, 2011
2. Anita Goyal, Karl T Ulrich and Steven D Eppinger, "Product Design and Development", 4th ed., Tata McGraw-Hill Education, 2009

REFERENCES:

1. George E.Dieter and Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th ed., 2009
2. Kevin Otto and Kristin Wood, "Product Design", Indian Reprint, Pearson Education, 2004
3. Clive L.Dym and Patrick Little, "Engineering Design: A Project-based Introduction", 3rd ed., John Wiley & Sons, 2009
4. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", Cengage Learning India, 2011
5. Beitz.W, Pahl.G, Grote.K.H and Feldhusen.J, "Engineering Design: A Systematic Approach", 3rd ed., Springer, 2014

Mapping of COs and POs												
Cos	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x		x	x	x		x	x	x
2	x		x				x	x		x	x	x
3	x	x						x		x		
4	x						x	x			x	
5	x	x				x		x			x	

15MEX09 ADVANCED AUTOMOBILE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the types of automobiles, structure, construction details and working principles
- To acquire knowledge on engine auxiliary system, transmission, steering, brakes and suspension
- To introduce the types of emissions in automobiles, emission control techniques and advanced technologies

COURSE OUTCOMES:

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

CO1: List the components of an automobile and/or demonstrate the working principles of cooling and lubrication systems
CO2: Identify the components of fuel supply and ignition systems of an automobile
CO3: Classify the types of clutches, gear boxes and other transmission systems
CO4: Describe the working principles of steering, braking and suspension systems
CO5: Summarize the emission levels of the automobiles and the types of advanced technologies

UNIT I : VEHICLE STRUCTURE AND ENGINES (9)

Types of automobiles - vehicle construction - chassis - frame and body - aerodynamics, resistances and moments - component of IC engines - their forms, function and materials - cooling system - lubrication system

UNIT II : ENGINE AUXILIARY SYSTEM (9)

Fuel supply system, Simple and Solex carburetor - Electronically controlled gasoline injection system for SI engines - Mono point and multi point fuel injection system - electronically controlled diesel injection system-rotary distributor type, CRDI, Unit injector system - Ignition system - battery coil ignition system, magneto coil ignition system, electronic coil ignition system - Turbo charger - super charger - electronic engine management system

UNIT III : TRANSMISSION SYSTEM (9)

Clutch - Types and construction - single plate, multi plate, diaphragm clutch - types of gear boxes - sliding mesh, constant mesh, synchromesh - gear shifting mechanism - overdrive - fluid flywheel - torque converter - propeller shaft - slip joint - universal joint - differential - Hotchkiss drive and torque tube drive

UNIT IV : STEERING, BRAKES AND SUSPENSION SYSTEM (9)

Principle of steering - steering geometry - steering linkages - steering gear box - power steering - brakes - types and construction - drum brake, disc brake, pneumatic braking system, hydraulic braking system and antilock braking system (ABS) - types of front and rear axle - suspension system - types and construction - coil spring, leaf spring, stabilizer bars - air suspension - shock absorber

UNIT V : EMISSION CONTROL, SAFETY AND ADVANCED TECHNOLOGY (9)

Automobile emissions - standards - control techniques - exhaust gas recirculation, 3 way catalytic converter - Seat belts - air bags - Electronic Brake Distribution (EBD) - Electronic Stability Program (ESP) - Traction Control System (TCS) - Global Positioning System (GPS) - Collision avoiding system, low tire pressure warning system, driver information system

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering Vol.1 & 2", Standard Publishers, New Delhi, 2011
2. William H. Crouse and Donald L Anglin, "Automotive Mechanics", 10th ed., McGraw Hill Education (India) Private Limited, 2006

REFERENCES:

1. Babu.A.K and Ajit Pal Singh, "Automobile Engineering", 1st ed., S.Chand Publications, 2013
2. Rajput.R.K, "A textbook Automobile Engineering" Laxmi Publishers, 2nd ed., New Delhi, 2014
3. Ramakrishna K, "Automobile Engineering", Prentice Hall India Learning Private Limited, 2012
4. Srinivasan.S, "Automotive Mechanics", 2nd ed., McGraw Hill Education (India) Private Limited, 2003
5. Jain K.K and Asthana.R.B, "Automobile Engineering", 1st ed., McGraw Hill Education Pvt. Ltd., 2002

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x							x	x
2	x	x	x	x							x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX10 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the governing equations of fluid flow with heat transfer and discretization methods
- To acquire knowledge on grid generation techniques and various CFD techniques
- To introduce the types of turbulent models, solution techniques and algorithms for solving fluid flow problems

COURSE OUTCOMES:

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

CO1: Recall the governing differential equation for solving fluid flow

CO2: Recommend a discretization method to divide the complex geometry into number of known elements

CO3: Choose a type of grid by considering the types of coordinates

CO4: Adapt a suitable CFD technique to solve various engineering problems

CO5: Select a turbulent model to analyze the particular problem using a solution technique

UNIT I : BASICS CONCEPTS AND GOVERNING DIFFERENTIAL EQUATIONS (9)

Basic concepts of fluid flow - derivation of the governing equations, conservation of mass, momentum and energy- Mathematical classification of flow - hyperbolic, parabolic, elliptic and mixed flow types

UNIT II : DISCRETIZATION METHODS (9)

Finite difference method - forward, backward and central difference schemes, explicit and implicit methods. Properties of numerical solution methods - stability analysis, error estimation, difference between the FDM and FVM methods

UNIT III : GRID GENERATION (9)

Choice of grid, grid oriented velocity components, Cartesian velocity components, staggered and collocated arrangements, adaptive grids

UNIT IV : CFD TECHNIQUES (9)

Lax - Wendroff technique - MacCormack's technique, relaxation technique - Artificial viscosity, ADI technique, Pressure correction technique, SIMPLE algorithm - Upwind schemes - flux vector splitting

UNIT V : TURBULENCE MODELS AND SOLUTION TECHNIQUES (9)

Reynold's averaged Navier-Stokes equations and classical turbulent models - mixing length model, k-ε model, Reynolds stress equation models - advanced turbulence models - Solution of discretized equations - TDMA, Point iterative methods - Practical problem solving using CFD packages

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. John D Anderson Jr, "Computational Fluid Dynamics - The Basics with Applications", 1st ed., McGraw Hill Education (India) Private Limited, 2012
2. Versteeg.H and Malalasekara.W, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method", 2nd ed., Pearson India, 2009

REFERENCES:

1. Oleg Zikanov, "Essential Computational Fluid Dynamics", Wiley India Pvt Ltd, 2012
2. Suhas V Patankar, "Numerical Heat Transfer and Fluid Flow", CRC Press, 1980
3. Muralidhar.K and Sundararajan.T, "Computational Fluid Flow and Heat Transfer", 2nd ed., Narosa Publishing House, 2003
4. Gautam Biswas and Somenath Mukherjee, Computational Fluid Dynamics, Narosa Oublishing House Pvt. Ltd, New Delhi, 2014
5. Chung.T.J, "Computational Fluid Dynamics", 2nd Revised edition, Scholastic Press, 2010

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX11 CRYOGENIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the basics of Cryogenics Engineering
- To acquire knowledge on the analysis and design of cryogenic systems
- To know the principles of cryogenic instrumentation

COURSE OUTCOMES:

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

CO1: Describe the thermodynamic analysis of cryogenic systems and their types
CO2: Classify the liquefaction processes for various gases
CO3: Explain the fundamentals of separation and purification processes
CO4: Select a measuring instrument to measure the parameters of cryogenic systems
CO5: Identify suitable Cryogenic storage and handling system for engineering applications

UNIT I : THERMODYNAMIC ANALYSIS (9)

Importance - applications of cryogenics - Refrigeration - thermodynamic minimum work - Production of low temperatures - Joule Thomson expansion - adiabatic reversible turbine expansion - cooling by an external refrigerant - Philips, Solvay, Pulse tube, adiabatic magnetic and helium dilution refrigerator

UNIT II : CRYOGENIC LIQUEFACTION PROCESSES (9)

Thermodynamically ideal system for liquefaction - Liquefaction processes for nitrogen, oxygen, argon, methane, neon and hydrogen

UNIT III : SEPARATION AND PURIFICATION PROCESSES (9)

Cryogenic separation processes of air, hydrogen, helium - noncryogenic separation processes of air, hydrogen, helium - gas purification processes - sorption for hydrogen storage

UNIT IV : MEASUREMENT DEVICES AND PROPELLANTS (9)

Temperature - sub atmospheric pressure - Liquid level in a storage vessel - Propellants - nature of propellants - challenges - performance analysis of rocket propulsion - selection of propellants

UNIT V : STORAGE AND TRANSPORTATION (9)

Storage vessel, thermal shields and insulation - transportation of cryogenics fluids - transfer of cryogenics fluids - mechanical design of vessels - safety of storage and transfer of fluids

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Mamata Mukhopadhyay, "Fundamentals of Cryogenic Engineering", PHI Learning Private Limited, 1st ed., 2010.
2. Thomas M.Flynn, "Cryogenic Engineering", CRC Press, 2nd ed., 2009

REFERENCES:

1. Herold Weinstock, "Cryogenic Technology", 1st ed., Boston Tech, 1969
2. Klaus D. Timmerhaus, Richard P.Reed., "Cryogenic Engineering", Springer, 2007
3. Randall F. Barron, "Cryogenic Systems", 2nd ed., CRC Press, 2016.
4. Robert W. Vance, "Cryogenic Technology", 1st ed., John Wiley & Sons, 1966
5. Russell B. Scott., "Cryogenic Engineering", 4th ed., Met Chemical Research, 1988.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x					x	x					
2	x	x	x			x						x
3		x	x		x						x	
4	x	x		x	x							
5							x					x

15MEX12 FUELS AND COMBUSTION

L	T	P	C
3	0	0	3

OBJECTIVE:

- To acquire knowledge on types of fuels and their combustion characteristics
- To introduce the combustion principles and the environmental impacts
- To know the equipments for measuring the combustion properties of fuel and safety aspects

COURSE OUTCOMES:

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

CO1: List the type of fuels and their combustion characteristics
CO2: Summarize the combustion principles of various fuels and estimation methods
CO3: Identify the various types of emissions during combustion process and ways to minimizing emissions
CO4: Describe the working principle of measuring devises for combustion characteristics
CO5: Select the safety equipment for a particular industrial application

UNIT I : FUELS (9)

Fuels - gaseous fuels - heating values, ignition temperature and limits, laminar flame velocity, Wobbe index, methane number - liquid fuels - chemical and physical characteristics - sulfur, ash and water content, carbon residue - solid fuels - characterization, proximate and ultimate analysis, physical properties

UNIT II : COMBUSTION PRINCIPLES (9)

Basic combustion calculations - calculation of the volume and the composition of the flue gas - determination of the combustion temperature - heating values, laminar flame velocity - heat, mass and momentum transport and balance - elementary reactions and radicals - ignition

UNIT III : ENVIRONMENTAL IMPACTS (9)

Pollutants - formation and impact - relevant pollutants - concepts for pollutant reduction - combustion and climate change - primary energy production - combustion and global warming by sectors - mitigation of global warming in the context of combustion - carbon sequestration

UNIT IV : MEASUREMENT METHODS (9)

In situ versus ex situ measurements - fuel characterization - investigation of combustion processes - selection of non-optical methods - selection of optical techniques - particle, spray and other techniques - test beds - advanced combustion control

UNIT V : APPLICATION AND SAFETY (9)

Industrial boilers - fluidized bed combustion - dust firing - metal, ceramic and furnaces used in various industries - gasification and pyrolysis - safety issues - mechanism of fire extinguishing media - fire detectors - deflagrations and detonations - dust explosions - fire suppression by oxygen reduction - safety by process design

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Maximilan Lackner, Arpad B. Palotas, Franz winter, "Combustion", 4th ed., Wiley-VCH Verlag GmbH & Co, 2012
2. Samir Sarkar, "Fuels and Combustion", 3rd ed., Universities Press, 2009

REFERENCES:

1. Jacques Buchetti, "Fuels, Evaporation and Combustion", Nabu Press, 2010
2. Mishra D.P, "Fundamentals of Combustion", Prentice Hall India, Kindle Edition, 2008
3. Mukunda H.S, "Understanding Combustion", 2nd ed., Universities Press, 2009
4. Saha S.N, "Elements of Fuel Combustion and Energy Technology", Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2008
5. Sharma S.P, Mohan Chander, "Fuels and Combustion", Tata Mcgraw Hill, 1984

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x					x	x					x
2	x		x			x					x	x
3			x	x	x						x	x
4			x	x		x	x				x	x
5			x									x

15MEX13 GAS DYNAMICS AND JET PROPULSION
(Use of approved Gas Tables is permitted)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand fundamentals of compressible flows
- To understand the phenomenon of shock waves and its effect on flow
- The students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion

COURSE OUTCOMES:

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

CO1: Evaluate the Mach number and describe compressibility effects, typical flow properties and wave propagation
CO2: Demonstrate the behavior of flow through variable area ducts
CO3: Solve numerical problems on Rayleigh and Fanno flow
CO4: Describe the concept of normal and oblique shock in compressible fluid flow
CO5: Explain the working principle of the rocket propulsion and various propellants

UNIT I : FUNDAMENTALS OF COMPRESSIBLE FLOW (9)

Energy and momentum equations for compressible fluid flow - various regions of flow - reference velocities - stagnation state - velocity of sound - critical states - Mach number, critical Mach number - types of waves - Mach cone, Mach angle - effect of Mach number on compressibility

UNIT II : ISENTROPIC FLOW THROUGH VARIABLE AREA DUCTS (9)

Isentropic flow through variable area ducts - T-s and h-s diagrams for nozzle and diffuser flows - area ratio as a function of Mach number - mass flow rate through nozzles and diffusers - effect of friction in flow through nozzles

UNIT III : FLOW THROUGH CONSTANT AREA DUCTS (9)

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

UNIT IV : NORMAL AND OBLIQUE SHOCKS (9)

Normal shock in nozzle - expression for change in entropy across the normal shock - impossibility of rare function shock - supersonic wind tunnels - determination of Mach number (velocity) of supersonic flow - oblique shocks - Prandtl Meyer relations – Applications

UNIT V : PROPULSION (9)

Jet Propulsion - theory of jet propulsion - thrust equation - thrust power and propulsive efficiency - Operating principle - cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines - Rocket propulsion - types of rocket engines - propellants - feeding systems - ignition and combustion - theory of rocket propulsion - performance study - staging - terminal and characteristic velocity - applications - space flights

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Yahya, S.M. "Fundamentals of Compressible Flow",5th Multi color ed., New Age International (P) Limited, New Delhi, 2014.
2. Anderson, J.D., "Modern Compressible flow", 3rd ed., McGraw Hill, 2012.

REFERENCES:

1. Patrich.H. Oosthvizen, William E.Carscallen, “Introduction to Compressible fluid flow”, 2nd ed., McGraw-Hill, 2013.
2. Ganesan. V., “Gas Turbines”, 3rd ed., Tata McGraw-Hill, New Delhi, 2010
3. Saravanamutto HIH, Cohen. H., Rogers.G.F.C, "Gas Turbine Theory", 5th ed., Dorling Kindersley, 2002
4. Balachandran P, “Fundamentals of Compressible Fluid Dynamics”, Prentice Hall India Learning, 2006
5. Muruga Perumal.P, “Gas Dynamics and Jet Propulsion” 1st ed., Sci-Tech Publications, 2005

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x	x	x		x			x	x
2	x				x			x			x	x
3	x		x	x	x	x		x			x	x
4	x				x			x			x	x
5	x				x			x			x	x

15MEX14 INTERNAL COMBUSTION ENGINES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce students to the working of spark ignition and compression ignition engines
- To teach students about the usage of alternate fuels for IC engines
- To enhance the understanding of students in engine emissions, pollution and their control
- To introduce students to the recent trends in IC Engines like stratification, multi point injection, plasma ignition etc.,

COURSE OUTCOMES:

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

CO1: Determine performance and combustion characteristics of SI engines
CO2: Summarize the combustion characteristics of CI engines
CO3: Estimate emissions from SI and CI engines using quantitative methods
CO4: Demonstrate the performance of IC engines using alternative fuels
CO5: Explain the recent trends in Internal combustion engines with applications

UNIT I : SPARK IGNITION ENGINES (9)

Mixture requirements - Carburetors - Fuel injection systems - Multipoint port injection, single point throttle body injection - feedback systems - flow in intake manifolds - combustion stages in SI engine - combustion chambers for SI engines - Knock in SI engines - abnormal combustion

UNIT II : COMPRESSION IGNITION ENGINES (9)

Combustion - essential features - types of diesel combustion systems - stages of combustion in CI engines - factors affecting delay period - Comparison of Knock in SI and CI engines - Mechanical friction - factors affecting mechanical friction - SAE ratings of lubricants

UNIT III : ENGINE EMISSIONS AND THEIR CONTROL (9)

Emission norms - pollutant formation - Nitrogen oxides, carbon monoxide, unburned hydrocarbon emissions, particulate emissions - emission control methods - catalytic converters, chemical methods, exhaust gas recirculation

UNIT IV : ALTERNATE FUELS (9)

Possible alternatives - solid fuels - liquid fuels - surface ignition alcohol CI engine - spark assisted diesel - vegetable oil - biodiesel - gaseous fuels - hydrogen engines - dual fuel operation - other possible fuels

UNIT V : RECENT TRENDS IN IC ENGINES (9)

Common Rail Direct Injection Engine - Gasoline Direct Injection Engine - Homogeneous charge compression Ignition Engine - Learn Burn Engines - Stratified charge engine - Variable Compression Ratio Engine

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Ganesan V, "Internal Combustion Engines", 4th ed., Tata McGraw Hill, 2012
2. John B. Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill, 2000

REFERENCES:

1. Mathur R. B and Sharma R. P, "Internal Combustion Engines", Dhanpat Rai & Sons, 2002
2. Colin R.Feriguson, Allan.T.Kirkpatrik, "IC Engines : Applied Thermosciences", 3rd Revised edition edition, Wiley-Blackwell, 2015
3. Gupta H.N, "Fundamentals of Internal Combustion Engines", 2nd ed., Prentice Hall India, 2012
4. Rajput R. K, "A Textbook of Internal Combustion Engines", 3rd ed., Laxmi Publications, 2016
5. Richard L Bechfold, "Alternative Fuels Guide Book", SAE International Warrendale,1997.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x										x	
2	x	x				x	x	x	x		x	x
3	x					x	x	x	x		x	x
4	x	x				x	x	x	x		x	x
5	x	x				x	x	x	x		x	x

15MEX15 REFRIGERATION AND AIR CONDITIONING

(Use of approved Refrigeration Tables and charts is permitted in the examination)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the refrigerants & refrigeration cycles and working principles of vapour compression & vapour absorption refrigeration systems
- To acquire knowledge on Refrigeration and Air conditioning systems and non conventional refrigeration systems
- To introduce the psychrometric processes, air conditioning systems and load estimation

COURSE OUTCOMES:

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

CO1: List the types of refrigerants and refrigeration cycles
CO2: Analyze the performance of vapour compression and vapour absorption refrigeration systems
CO3: Demonstrate an understanding on working principles of non conventional refrigeration systems and psychrometric processes
CO4: Identify the equipments and working principles of Air conditioning systems
CO5: Estimate the loads during the design of air conditioner

UNIT I : AIR REFRIGERATION CYCLES AND REFRIGERANTS (9)

Refrigeration - systems, Coefficient of Performance - Reversed Carnot cycle - reversed Brayton cycle - Refrigerants - introduction, classification - primary refrigerants - designation - desirable properties of ideal refrigerant - properties and uses of commonly used refrigerants - secondary refrigerants - comparison and application of refrigerants - Leak detection

UNIT II : VAPOUR COMPRESSION AND ABSORPTION REFRIGERATION SYSTEMS (9)

Simple vapour compression system - functions of parts - T-s diagrams - P-h chart - factors affecting the performance - actual vapour compression cycle - volumetric efficiency - methods of improving simple saturation cycle - Simple vapour absorption system - practical vapour absorption system - COP - Lithium Bromide system

UNIT III : NON CONVENTIONAL REFRIGERATION SYSTEMS (9)

Thermoelectric refrigeration system - thermoelectric effects, comparison between thermoelectric and vapour compression refrigeration- vortex tube and pulse tube refrigeration

UNIT IV : AIR CONDITIONING SYSTEMS AND EQUIPMENTS (9)

Air conditioning cycle - classification of air conditioning systems - central system - zoned system - unitray system - unitary central system - selection of system - RSHF - GSHF - applications of air conditioning - Air conditioning equipments - Package units, Central Units - Noise and noise control

UNIT V : LOAD ESTIMATION, APPLICATIONS OF REFRIGERATION AND AIR CONDITIONING (9)

Cooling and heating load estimate - solar radiation and heat gain - thermal barriers - infiltration - internal heat gains - Design of a cold storage - Domestic refrigerator - Electrical circuit, Maintenance - Year round air conditioner - Year round absorption air conditioner - Air conditioning of theatres - Manufacture of ice

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Rajput.R.K, "A textbook of Refrigeration and Air conditioning", S.K.Kataria & Sons, 2nd ed., Reprint 2014
2. Paul lang V, "Principles of Air conditioning", 3rd ed., CBS Publishers & Distributors Pvt Ltd, New Delhi 2003

REFERENCES:

1. Ananthanarayanan P.N, "Basic Refrigeration and Air Conditioning",4th ed.,McGraw Hill, New Delhi, 2013
2. Arora, C.P., "Refrigeration and Air Conditioning", 3rd ed., McGraw Hill, New Delhi, 2008
3. Khurmi.R.S, Gupta.J.K, "A Textbook of Refrigeration and Air Conditioning", 1st ed., S. Chand Publications, 2011
4. Roy.J.Dossat, "Principles of Refrigeration", 4th ed., Pearson education inc, New Delhi, 2012
5. Warren Marsh.R, Thomas Olivo.C, "Principles of Refrigeration", 2nd ed., CBS Publishers & Distributors Pvt Ltd, New Delhi 2001

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX16 SOLAR THERMAL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To enable the students understand solar radiation received on the earth and fundamentals of solar thermal engineering.
- To enable students know about solar thermal devices like cookers, pumps, ponds etc.
- To introduce students to solar flat plates and solar concentrators.
- To teach students about solar power generation.

COURSE OUTCOMES:

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

CO1: Estimate solar radiation received on a surface
CO2: Predict and analyse the performance of solar devices
CO3: Identify the solar thermal devices in heating and drying applications
CO4: Select a solar thermal device under active and passive modes
CO5: Demonstrate the performance and design aspects of in solar power generation

UNIT I : SOLAR RADIATION **(9)**

Solar radiation on the earth surface - extraterrestrial radiation characteristics, terrestrial radiation, solar insolation, spectral energy distribution of solar radiation - depletion of solar radiation - absorption, scattering

UNIT II : SOLAR FLAT PLATE COLLECTORS **(9)**

Theory of Flat Plate Collectors - Performance Evaluation - Collector Testing - Natural and Forced Circulation - System Configurations - Applications

UNIT III : SOLAR THERMAL DEVICES - I **(9)**

Solar Air Heaters - Theory and Applications - Solar drying - Theory, design, performance analysis and types - Solar Desalination - Theory and Performance analysis

UNIT IV : SOLAR THERMAL DEVICES - II **(9)**

Solar Cooking Devices - Solar cooling - Absorption, adsorption and passive systems - Solar Thermal Pumps - Energy Storage - Solar Ponds

UNIT V : SOLAR CONCENTRATORS AND POWER GENERATION **(9)**

Solar concentrator types - Optics - Performance analysis - Design considerations - Tracking - Solar Electric Power Generation Systems - Economics of Solar thermal systems & devices

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Goswami Y, Kreith F and Kreider J. F, "Principles of Solar Engineering", 3rd ed., CRC Press, 2015
2. Sukhatme. S. P, "Solar Energy : Principles of Thermal Collection and Storage", Tata McGraw Hill, 3rd ed., 2008

REFERENCES:

1. John A Duffie and William A Beckman, "Solar Engineering of Thermal Processes", 4th ed., John Wiley & Sons, 2013
2. Prakash J and Garg H, "Solar Energy : Fundamentals and Applications", 1st ed., McGraw Hill Education, 2000
3. Solanki C.S, "Solar Photovoltaics - Fundamentals, Technologies and Applications", 3rd Revised edition, Prentice Hall India, 2015
4. Tiwari G. N, "Solar Energy : Fundamentals, Design, Modelling and Application", Narosa Publishing House Pvt. Ltd., 2012
5. Neville R. C, "Solar Energy Conversion : The solar cell", 2nd ed., Elsevier Science, 1995

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x		x		x	x
2	x	x	x	x	x		x		x		x	x
3	x	x	x	x	x		x		x		x	x
4	x	x	x	x	x		x		x		x	x
5	x	x	x	x	x		x		x		x	x

15MEX17 NANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the science of nanotechnology, nanomaterials and their synthesis routes
- To acquire knowledge on the characterization methods of nanomaterials
- To know the types of nanostructured materials and applications of nanomaterials

COURSE OUTCOMES:

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

CO1: Summarize the concept of nanotechnology, classification and metallurgical aspects
CO2: Identify the synthesis routes of various nanomaterials
CO3: Select a characterization method for different type of nanomaterials
CO4: Describe the type of nanostructured materials and applications
CO5: Identify the engineering applications of various nanomaterials

UNIT I : INTRODUCTION TO NANOMATERIALS (9)

Science of small things - Classification of Nanostructured Materials - Fascinating Nanostructures - Applications of Nanomaterials - Nanotechnology and nature - Challenges and Future Prospects - Unique Properties of Nanomaterials - Microstructure and Defects in Nanocrystalline Materials - Effect of Nano-dimensions on Materials Behaviors

UNIT II : SYNTHESIS ROUTES (9)

Bottom Up Approaches - PVD, CVD, Spray conversion processing, Sol-gel process, Wet chemical synthesis, Self assembly - top down approaches - mechanical alloying , equal channel angular extrusion, High pressure torsion, Accumulative roll bonding, Nanolithography - consolidation of nano powders

UNIT III : TOOLS TO CHARACTERIZE NANOMATERIALS (9)

X-ray Diffraction - Small Angle X-ray Scattering - Scanning Electron Microscopy - Transmission Electron Microscopy - Atomic Force Microscopy - Scanning Tunnelling Microscope - Field Ion Microscope - Three-dimensional Atom Probe - Nanoindentation

UNIT IV : NANOSTRUCTURED MATERIALS (9)

Quantum Dots - Fabrication and application - carbon nanotubes - types, Chirality, Synthesis, Characterization techniques, physical sensors - GaN nanowires and applications – nanocrystalline ZnO - Crystal structure and properties, Synthesis, Applications - nanocrystalline titanium oxide - Titania-nanopowders, nanotubes - multilayered films - Concerns and Challenges

UNIT V : APPLICATIONS OF NANOMATERIALS (9)

Nano-electronics - Micro and Nano-electromechanical systems - Nanosensors - Nanocatalysts - Food and Agriculture Industry - Cosmetics and Consumer Goods - Structure and Engineering - Automotive Industry - Water Treatment and the Environment - Nano-medical - Textiles - Paints - Energy - Defense, Space and Structural Applications

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Murty.B.S, Shankar.P, Baldev Raj, Rath. B.B and James Murday, “Textbook of and Nanoscience Nanotechnology”, 1st ed., Orient Blackswan Private Limited, New Delhi, 2012
2. Ben Rogers, Jesse Adams and Sumita Pennathur, “Nanotechnology: Understanding Small Systems”, 3rd ed., CRC Press, 2014

REFERENCES:

1. Charles P Poole Jr. and Frank J Owens, “Introduction to Nanotechnology”, Wiley India Publications, 2007
2. Chattopadhyay K.K and Banerjee.A.N, “Introduction to Nanoscience and Nanotechnology”, Prentice Hall India, 2009
3. Lynn E. Foster, “Nanotechnology : Science, Innovations and Opportunity”, 1st ed., Pearson Education, 2007
4. Pradeep.T, “Nano: The Essentials Understanding Nanoscience and Nanotechnology”, 1st ed., McGraw Hill Education (India) Private Limited, 2007
5. Suhas Bhattacharya, “A Textbook of Nanoscience and Nanotechnology”, Wisdom Press, 2013

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x			x	x						x
2	x				x	x						x
3	x			x	x	x	x					x
4	x	x		x	x		x					x
5			x	x			x					x

15MEX18 NONDESTRUCTIVE TESTING AND EVALUATION

L	T	P	C
3	0	0	3

OBJECTIVE:

- To study and understand the various Non Destructive Testing and Evaluation methods
- To know the various applications of Non Destructive testing methods
- To provide a basic understanding with case studies on different surface NDE techniques

COURSE OUTCOMES:

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

CO1: Differentiate various defect types and select the appropriate NDT methods for better evaluation.
CO2: Complete theoretical understanding of the penetrants, penetrant testing and safety precautions.
CO3: Demonstrate the fundamentals of magnetization methods and magnetic testing techniques.
CO4: Apply radiation property for inspecting materials.
CO5: Implement various ultrasonic and eddy current inspection methods to find material imperfections.

UNIT I : OVERVIEW OF NDT AND VISUAL INSPECTION (9)

Non destructive testing - scope, destructive methods of testing - comparison between destructive and non destructive testing - notable events - common NDT Methods, flows and defects, applications - Visual inspection - basic terms, equipments used - machine vision - Ringing test

UNIT II : PENETRANT TESTING (9)

Principle of penetrant testing - tests and standards, test stations - accessories - illustrative examples - types of penetrants, techniques - characteristics of good penetrants - developer and its types - quality and process control - health and safety precautions in Liquid penetrant Inspection, standards - Leak test - Zyglo Fluorescent Penetrant Test

UNIT III : MAGNETIC PARTICLE TESTING (9)

Principle of Magnetic particle testing - scope - basic terms associated with magnetic materials, classification of magnetic materials - magnetic field orientation - methods of magnetization - DC and AC magnetization - skin effect - equipments - lights - magnetic field indicator - testing techniques - applications

UNIT IV: RADIOGRAPHIC INSPECTION (9)

Types of radiations - basic properties - Radiation sources - X-Ray radiography, Gamma radiography - scattered radiations - X-Ray film and accessories - film interpretation and viewing radiographs - beam geometric principles - digital radiography - applications - types of radiographic techniques - precautions against radiation hazards and health - case study, X ray of human body

UNIT V : ULTRASONIC AND EDDY CURRENT TESTING (9)

Principle of ultrasonic testing - notable events - basic terms - equipments - ultrasonic probes - radiated fields of ultrasonic transducers - Ultrasonic inspection techniques – case study, ultrasonography of human body - Eddy current testing - working principle - basic terms - factors affecting eddy currents - eddy current flow characteristics, instruments, probes - scope and applications

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Osama Lari, Rajeev Kumar, “Basics of Non-Destructive testing”, 1st ed., S.K.Kataria & Sons, 2013
2. Don E Bray, Roderick K Stanley, 1st ed., “Nondestructive Evaluation: A Tool in Design, Manufacturing and Service”, CRC Press, 1996

REFERENCES:

1. ASM International, “ASM Handbook: Nondestructive Evaluation and Quality Control - Volume 17”, 9th Revised edition, 1989
2. Baldev Raj, Jayakumar.T, Thavasimuthu.M, “Practical Non-Destructive Testing”, Narosa Publishing house, 2nd ed., Eight Reprint 2013
3. Ravi Prakash, “Non-Destructive Testing Techniques”, First Revised edition, New Age International (P) Limited, 2010
4. Prasad.J, Nair.C.G.K, “Non-Destructive Test and Evaluation of Materials”, 2nd ed., Tata McGraw-Hill Publishing company Limited, 2011
5. Yoshida Kenichi , Laodeno Rem N, “Non-Destructive Testing Technique”, LAP Lambert Academic Publishing, 2013

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x	x		x				x	x
2	x	x		x	x		x				x	x
3	x	x		x	x		x				x	x
4	x	x		x	x		x				x	x
5	x	x		x	x		x				x	x

15MEX19 ADDITIVE MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the fundamentals of Rapid Prototyping technology
- To acquire knowledge Rapid Prototyping systems, virtual prototyping, materials selection and prototyping procedures
- To introduce the types of rapid manufacturing process and their applications

COURSE OUTCOMES:

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

CO1: Describe the fundamentals of rapid prototyping techniques
CO2: Demonstrate the concept of virtual prototyping, material selection and reverse engineering
CO3: Illustrate the types of rapid prototyping systems for various materials
CO4: Summarize the applications of Rapid Prototyping in casting and tooling
CO5: Explain the steps involved in Rapid Manufacturing and applications

UNIT I : FUNDAMENTALS OF RAPID PROTOTYPING (9)

Process requirements for Rapid Prototyping - product prototyping and product development - prototyping - need for prototyping - issues in prototyping - conducting prototyping - design procedure - prototype planning and management - product and prototype cost estimation - fundamentals of cost concepts - prototype cost estimation - cost complexities - prototype design methods - prototype design tools - morphological analysis - functional efficiency technique - paper prototyping - selecting a prototype - learning from nature

UNIT II : VIRTUAL PROTOTYPING, MATERIALS SELECTION AND PROCEDURE FOR PROTOTYPING (9)

Commercial software for virtual prototyping - prototyping materials - material selection methods - Rapid Prototyping overview - Rapid Prototyping cycle - Rapid Prototyping procedure - stl files - converting stl file from various cad files - controlling part accuracy in stl format - slicing the stl file - case studies in design for assembly
Digitization techniques - model reconstruction - data processing for rapid prototyping - Reverse Engineering (RE) methodologies and techniques - selection of re systems - RE software, RE hardware, RE in product development

UNIT III : TYPES OF RAPID PROTOTYPING SYSTEMS (9)

Types of RP Process - Stereolithography - Fused Deposition Modelling - Selective Laser Sintering - 3D Printing process - Laminated Object Manufacturing - Electron Beam Melting Process - history - operation - advantages and disadvantages - applications - relation to other RP technologies (applies to all the process) - Direct Laser Deposition - Multi jet modeling system - Laser Engineered Net Shaping - Electron Beam Melting - processes, materials, products, advantages, applications and limitations

UNIT IV : APPLICATIONS OF RAPID PROTOTYPING (9)

Investment casting - sand casting - permanent mould casting - direct RP tooling - silicone rubber tooling - investment cast tooling - powder metallurgy tooling - desktop machining - case Studies on current applications of RP- novel application of RP systems - future trends of RP systems - conventional tooling Vs rapid tooling - classification of rapid tooling - direct and indirect tooling methods - soft and hard tooling methods - application in design - analysis and planning - application in manufacturing and tooling - aerospace industry - automotive industry

UNIT V : RAPID MANUFACTURING (9)

Rapid Manufacturing - potential of RM on design - geometrical freedom - material combinations - customer input - RM of prototypes - reverse engineering - interactive CAD models - role of materials in RM - materials for RM process - product customisation and case studies - future developments serving RM - production economics of RM - cost of manufacture - application of RM in medical, automotive, aeronautical, space and construction industries

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Chua.C.K, Leong.K.F, Lim.C.S, "Rapid Prototyping Principles and Applications", 3rd ed., Cambridge University Press India Pvt Ltd 2010.
2. Pham D.T and Dimov S.S, "Rapid manufacturing: the technologies and applications of rapid prototyping and rapid tooling", Springer, London, 2001

REFERENCES:

1. Andreas Gebhardt, “Rapid prototyping”, Hanser Gardener Publications, 2003
2. Hari Prasad Ks Badarinarayan, “Rapid Prototyping & Tooling”, Page turners, 2015
3. Ian Gibson, David Rosen, Brent Stucker, “Additive Manufacturing Technologies”, 2nd ed., springer, 2011
4. Liou W.Liou,Frank W.Liou, “Rapid Prototyping and Engineering applications : A tool box for prototype Development”, CRC Press, 2007.
5. Ramesh S, “Textbook of Rapid Prototyping”, Ane book Publications, 2016

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15GEC05 ENGINEERING ECONOMICS AND COST ANALYSIS

(Use of Interest tables is permitted)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of Economics
- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.
- To understand the methods by which Cost Analysis, Pricing and Financial Accounting are done in the Industry

COURSE OUTCOMES:

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

CO1: Apply the basics of economics and cost analysis to engineering applications
CO2: Summarize the steps involved in decision making with economic feasibility
CO3: Evaluate an alternative by considering the economic factors
CO4: Conclude the replacement and maintenance policies of industrial equipment
CO5: Determine the depreciation of industrial equipment over the operating periods using appropriate method

UNIT I : FUNDAMENTALS OF TO ECONOMICS **(9)**

Economics - Flow in an economy, Law of supply and demand - Concept of Engineering Economics - types of efficiency, Scope of engineering economics - Element of costs - other costs/revenues - Break even analysis - profit/volume ratio - Make or buy decision, Elementary economic Analysis

UNIT II : VALUE ENGINEERING AND INTEREST FORMULAS **(9)**

Value analysis / value engineering - Interest formulae and their applications - Time value of money, Single payment compound and present worth amount, Equal payment series - compound amount, sinking fund, Present worth and capital recovery amount - Uniform gradient series annual equivalent amount, Effective interest rate

UNIT III : CASH FLOW **(9)**

Present worth method - Revenue dominated cash flow diagram, cost dominated cash flow diagram - Future worth method - Revenue dominated cash flow diagram, cost dominated cash flow diagram - Annual equivalent method - Revenue dominated cash flow diagram, cost dominated cash flow diagrams - rate of return method

UNIT IV : REPLACEMENT AND MAINTENANCE ANALYSIS **(9)**

Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return, concept of challenger and defender - Simple probabilistic model for items which fail completely

UNIT V : DEPRECIATION **(9)**

Straight line method, declining balance method, Sum of the years-digits method, sinking fund method, service output method - Evaluation of public alternatives - Inflation adjusted decisions - procedure to adjust inflation - Inflation adjusted economic life of machine

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", 2nd ed., PHI learning Pvt. Ltd, New Delhi, 2014
2. James L Riggs, David D Bedworth, Sabah U Randhawa, "Engineering Economics", 4th ed., McGraw Hill Education, 2004

REFERENCES:

1. Leland Blank, Anthony Tarquin, "Engineering Economy", 7th ed., McGraw Hill Education, 2012
2. Chan S.Park, "Contemporary Engineering Economics", 5th ed., Prentice Hall of India, 2011
3. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis", 10th ed., Oxford University Press, 2010
4. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", 14th ed., Pearson India, 2010.
5. Zahid A Khan, "Engineering Economy", 1st ed., Pearson Education, 2012

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x							x	x
2	x	x	x	x							x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15MEX21 INDUSTRIAL ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concepts of industrial engineering, work study and work measurement
- To acquire knowledge on facility layouts, line balancing and inventory control
- To introduce the principles of management, human resource management and marketing management
- To introduce the concept of project management using CPM/PERT

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of the concept of industrial engineering, production systems and productivity
CO2: Describe the steps involved in work study and work measurement
CO3: Recommend a facility layout for the manufacturing operations and/or solve numerical problems on line balancing and inventory control
CO4: Summarize the principles of management, human resource management and marketing management
CO5: Estimate the duration of a project using Critical Path Method and/or Program Evaluation and Review Technique

UNIT I : INDUSTRIAL ENGINEERING AND PRODUCTION SYSTEM (9)

Industrial Engineering - historical development - role of industrial engineer - applications - types of production system - life cycle approach - supply chain management - value chain - productivity - introduction, definition, difference between productivity and production - productivity, efficiency and effectiveness - productivity measurement - base period - productivity index - productivity improvement

UNIT II : WORK STUDY AND WORK MEASUREMENT (9)

Work study - objectives, steps in work study, purpose and procedure of method study - recording methods and facts - process chart symbol - examine, develop & define, install & maintain - motion economy - working area - work measurement - purpose and organizational suitability - stop watch time study - ILO definitions - performance rating - standard time - work sampling - PMTS - MTM - comparison, job evaluation and merit rating

UNIT III : FACILITY LAYOUT, LINE BALANCING AND INVENTORY CONTROL (9)

Objective of facility layout - principles - types of common layouts - part machine incidence matrix - comparison of layouts - objectives and constraints in Line Balancing problem - methods of line balancing - Largest Candidate Rule, Kilbridge-Wester Heuristic, Ranked Positional Weight - Inventory control - inventory costs - deterministic models - other observations of basic EOQ model - gradual replacement model - ABC analysis

UNIT IV : ESSENTIALS OF MANAGEMENT (9)

Principles of management - approaches of management thoughts - role of management - functions of management - levels of management - organization - principles and organization structure and types - organization design - human resource management - organizational behavior - human resource planning - introduction to marketing management - pricing - marketing research

UNIT V : PROJECT MANAGEMENT AND CPM/PERT (9)

Critical Path Method - methodology of critical path analysis - terminology in project management - symbols used in network planning - common flaws in network - Dummy activity and dummy nodes - rules for constructing network diagram - numbering of events in network - AON Vs AOA approaches for diagramming - float or slack - illustration for floats - Program Evaluation and Review Technique

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Kjell B Zandin, Harold B Maynard, "Maynard's Industrial Engineering Handbook", 5th ed., McGraw-Hill Education, 2001
2. Ravishankar, "Industrial Engineering and Management ", 2nd ed., Galgotia Publications, 2009

REFERENCES:

1. Khanna.O.P, "Industrial Engineering and Management", 17th ed., Dhanpat Rai Publications,2010
2. ILO, "Introduction to work study", 4th ed., Universal Publishing Corporation, 2010
3. M.I. Khan, "Industrial Engineering", New Age International Publications, 2007
4. Pravin Kumar, "Industrial Engineering and Management", 1st ed., Pearson Education India, 2015
5. Ravi. V, "Industrial Engineering and Management", 1st ed., PHI Learning Pvt Ltd., 2015

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x	x	x	x	x				x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x	x	x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x		x	x	x	x	x				x	x

15MEX22 LEAN AND AGILE MANUFACTURING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the principles and tools of lean manufacturing
- To explore various visual management techniques, TPM and Lean practices
- To know the concept of agile manufacturing and its drivers

COURSE OUTCOMES:

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

CO1: Demonstrate the lean manufacturing principles to find and eliminate wastes
CO2: Identify the lean manufacturing tools and their potential applications
CO3: Summarize the usage of visual management, TPM and lean practices
CO4: Compare the technology drivers of agile manufacturing
CO5: Explain the technology drivers of agile manufacturing

UNIT I : LEAN MANUFACTURING PRINCIPLES (9)

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

UNIT II : LEAN MANUFACTURING TOOLS (9)

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

UNIT III : VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION (9)

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

UNIT IV : MANAGEMENT AND TECHNOLOGY DRIVERS OF AGILE MANUFACTURING (9)

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

UNIT V : MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF AGILE MANUFACTURING (9)

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

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Devadasan.S.R, Mohan Sivakumar.V, Murugesh.R, Shalij.P.R, "Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities", PHI Learning Private Limited, 2012
2. Pascal Dennis, "Lean Production Simplified", 2nd ed., Productivity Press, 2007

REFERENCES:

1. Bill Carreira, "Lean Manufacturing That Works", 1st ed., PHI Learning Private Limited, 2007.
2. Dennis P. Hobbs, "LEAN Manufacturing Implementation", 1st ed., Cengage Learning, 2009
3. Charles Grantham, James Ware, Cory Williamson, "Corporate Agility.: A Revolutionary New Model for Competing in a Flat World", PHI Learning Private Limited, 2007.
4. Gopalakrishnan.N, "Simplified Lean Manufacture : Elements, rules, tools and implementation", PHI Learning Private Limited, 2010.
5. Steven L Goldman, Roger N Nagel, Kenneth Preiss, "Agile Competitors and Virtual Organizations", John Wiley & Sons, 1994

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x			x	x						x
2	x				x	x						x
3				x		x	x					x
4	x	x			x		x					x
5			x	x			x					x

15MEX23 METAL CASTING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept of foundry technology, molding processes and melting furnaces
- To acquire knowledge on casting design and finishing operations.
- To know the quality control, mechanization and management aspects in foundries

COURSE OUTCOMES:

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

CO1: Explain the principles of foundry technology and steps involved in sand molding process
CO2: Describe the types of metal molding processes and working principle of melting furnaces
CO3: Select the design parameters in casting and finishing operation for a casting process
CO4: Identify the inspection procedure and scope for mechanization
CO5: Summarize the steps involved management aspects and new developments in foundry

UNIT I : FOUNDRY TECHNOLOGY AND SAND MOLDING PROCESSES (9)

Metal casting - classification of foundries - challenges in foundry - industrial sectors - sand molding processes - function of molding sand, classification, ingredients, core sands, testing and control, pattern equipment, types of molding, practical aspects, mold coatings, casting defects due to sand, molding and pattern

UNIT II : METAL MOLDING PROCESSES AND MELTING FURNACES (9)

Die casting - centrifugal, continuous casting - selection of molding processes - furnaces - classification, common melting furnaces - melting procedure, practical aspects - refractories, pouring ladles - selection of melting furnace - casting defects due to improper melting

UNIT III : CASTING DESIGN AND FINISHING OPERATIONS (9)

Solidification process - running and gating system - risering / feeding systems - design of castings - finishing operations - fetling and cleaning - heat treatment of castings - salvaging of defective castings

UNIT IV : INSPECTION, QUALITY CONTROL AND MECHANIZATION (9)

Specification and inspection of castings - analysis of casting defects - quality control and assurance - foundry mechanization - mechanical equipments in foundry - plant site location, layouts - plant engineering, maintenance and services - practical aspects

UNIT V : PLANNING, MANAGEMENT AND NEW DEVELOPMENTS IN FOUNDRY (9)

Planning a new foundry project - organization, management information system - production planning control - practical aspects and case studies - new materials, processes and inspection methods - computer and IT applications - energy conservation - environmental pollution control

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Ramana Rao.T.V, "Metal Casting - Principles and Practice", 1st ed., New Age International Publishers, Reprint 2010
2. Richard W Heine, Carl L Loper and Philip C Resenthal, "Principles of Metal Casting", 2nd ed., McGrawhill education, 2011

REFERENCES:

1. Alexandre Reikher and Michael R Barkhudarov, "Casting: An Analytical Approach", 1st ed., Springer-Verlag London, 2007
2. Jain, P.L, "Principles of Springer-Verlag London", 5th ed., Tata McGraw Hill Pub., Co. Ltd., 2009.
3. Khanna.O.P, "Foundry Technology", Dhanpat Rai Publications", 17th ed., 2011
4. Mahi Sahoo and Sam Sahu, "Principles of Metal Casting", 3rd ed., McGraw hill education, 2014
5. Ravi. B, "Metal Casting : Computer-Aided Design and Analysis", 1st ed., Phi Learning Pvt. Ltd., 2010

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x			x	x						x
2	x				x	x						x
3	x			x	x	x	x					x
4	x	x		x	x		x					x
5			x	x			x					x

15MEX24 METAL FORMING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the theory of metal forming, techniques of forging and extrusion
- To acquire knowledge on operation sequence of rolling and drawing processes
- To know the techniques of sheet metal forming

COURSE OUTCOMES:

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

CO1: Discuss the principles of metal forming, mechanical behaviour of materials and grain structure of materials during forming processes

CO2: Identify the components and explain the working principles of forging and extrusion equipments

CO3: Recommend the process parameters of rolling or drawing for a particular engineering product

CO4: Illustrate the steps involved in sheet metal forming processes considering stress strain relations

CO5: Classify the newer forming processes and describe the working principles of various equipments

UNIT I : FUNDAMENTALS OF METAL FORMING (9)

Classification and methods in forming - tensile test and metallurgy - theory of plasticity - effect of temperature, strain rate, metallurgical microstructure, chemical elements and mechanical properties - friction and lubrication - deformation zone geometry - workability - mechanics of metal forming - flow stress determination

UNIT II : FORGING AND EXTRUSION (9)

Classification of forging - forging equipment - plane strain forging with coulomb friction - residual stresses in forgings - forging defects - open and closed die forging - forging die design - extrusion - principal variables - calculation of extrusion load - defects in extrusion - deformation and flow pattern- extrusion of tubing

UNIT III : ROLLING AND DRAWING (9)

Classification - rolling mills - rolling of bars and shapes - forces and geometrical relationship - cold rolling - frictional forces in the arc of contact - rolling - process variables - defects - cold rolling theory - roll flattening - roll camber - theory of strip - drawing - rod and wire drawing - lubrication - patenting heat treatment - defects - variables in wire drawing.

UNIT IV : SHEET METAL FORMING (9)

Metal spinning - manual spinning - power spinning - spinnability of metals - blanking - rubber pad forming - Marform process - deep drawing process - stress pattern - drawability - defects - stretch forming operation - plastic stress strain relation - deep drawing tools design

UNIT V : NEWER FORMING PROCESSES (9)

Explosive Forming - electro hydraulic forming - magnetic pulse forming - petro forge hammer - drop hammer and dynapak - forming by laser beam - die-less forming

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Fritz Klocke, "Manufacturing Processes 4 - Forming", 1st ed., Springer-Verlag Berlin Heidelberg, 2013.
2. Narayanasamy.R, "Metal Forming Technology", 1st ed., Ahuja Book Publishers & Distributors, 1997

REFERENCES:

1. George E. Dieter, "Mechanical Metallurgy", 3rd ed., Tata McGraw Hill India, 2013.
2. Juneja.B.L, "Fundamentals of Metal Forming Processes", 2nd ed., New Age International Publishers, 2010.
3. Rao.P N, "Manufacturing Technology : Foundry, Forming & Welding",4th ed., Tata McGraw-Hill Education, 2013.
4. Surender Kumar, "Technology of Metal Forming Processes", Prentice Hall India Publications, 2008.
5. William F. Hosford, Robert M. Caddell, "Metal Forming: Mechanics and Metallurgy", 4th ed., Cambridge university press, 2014.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x							x
2	x	x	x			x						x
3	x	x	x			x						x
4	x	x	x			x						x
5	x			x	x		x				x	x

15MEX25 NEW VENTURE PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept, theories of entrepreneurship and functions of entrepreneur
- To know the steps involved in new venture promotion and fund management
- To acquire knowledge on entrepreneurial behavior, development programme roles of entrepreneur

COURSE OUTCOMES:

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

CO1: Explain the concept of entrepreneurship and functions of an entrepreneur

CO2: Describe various theories of entrepreneurship

CO3: Identify the steps involved during new venture establishment and fund requirements

CO4: Summarize the entrepreneurial behavioural aspects and types entrepreneurship development programmes

CO5: Demonstrate the idea of Women and Rural entrepreneurship roles of entrepreneur

UNIT I : FUNCTIONS OF ENTREPRENEUR (9)

Entrepreneur - definition and concept - characteristics of entrepreneur - entrepreneurship - definition and characteristics - emergence of entrepreneurial class - comparison of entrepreneur with entrepreneurship - enterprise and manager - Danhofis classifications, other classifications - intrapreneurs - ultrapreneurs - functions of entrepreneurs

UNIT II : THEORIES OF ENTREPRENEURSHIP (9)

Sociological theories - economic theories - cultural theories - psychological theories - specialistsi views on entrepreneurship - walker on entrepreneurship - Harbison Entrepreneurship - Drucker on entrepreneurship - Peter kilby on entrepreneurship - models on entrepreneurship

UNIT III : PROMOTION OF A VENTURE (9)

Opportunity analysis - environment and entrepreneurship - technological environment - competitive factors - small scale industrial undertakings - steps in setting up a small scale industrial enterprise - legal requirements - important acts - policies of government - raising of funds - internal and external sources of finance - capital structure - capitalization - export finance - venture capital - concept, aims, features of venture capital and financing steps - sources of venture capital and criteria to provide venture capital finance

UNIT IV : ENTREPRENEURIAL BEHAVIOUR AND DEVELOPMENT PROGRAMME (9)

Innovation and entrepreneur - Schumpeteris and Druckeris theories - entrepreneurial behaviour and psychological theories - social responsibility - entrepreneurship development programmes - meaning and objectives - Indian EDP model - phase of EDPs - EDP Curriculum - Common denominators of success of EDPs - Role, Relevance and Achievements of EDPs - Role of government in organizing EDPs

UNIT V : ENTREPRENEURSHIP AND ROLE OF ENTREPRENEUR (9)

Role of entrepreneur - as an innovator in economic growth - generation of employment opportunities - complementing and supplementing economic growth - bringing about social stability and balanced regional development of industries - export promotion and import substitution - foreign exchange earnings and augmenting and meeting local demand - rural entrepreneur - major challenges in the way of development of rural industries - women entrepreneurship

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Shangram Keshari Mohanty, “Fundamentals of Entrepreneurship”, Prentice Hall India Pvt ltd, 2005
2. Robert D Hisrich, Mathew J Manimala, Michael P Peters and Dean A Shepherd, “Entrepreneurship”, 6th ed., Tata Mcgraw Hill Education Private Limited, 2013

REFERENCES:

1. Bruce R. Barringer and Duane Ireland.R, "Entrepreneurship: Successfully Launching New Ventures", 3rd ed., Pearson Education, 2011
2. Jain.P.C, "Handbook of New Entrepreneur", Oxford University Press, 2003
3. Khanka.S.S, "Entrepreneurial Development", 4th ed., S.Chand and Company Limited, New Delhi, 2007.
4. Rao.T.V and Donald F. Kuratko, "Entrepreneurship : A South-Asian Perspective", 1st ed., Cengage Learning India publications, 2012
5. Srinivasan.N.P and Gupta, C.B, "Entrepreneurial Development", Sultan Chand & Sons Publications, 2015

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x		x		x	x	x		x	x	x
2	x		x				x	x		x	x	x
3								x		x		
4	x							x			x	
5	x	x						x			x	

15MEX26 INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the constructional features and other basic information on robotics
- To introduce various sensors used in robotics
- To teach robot programming of a typical robot

COURSE OUTCOMES:

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

CO1: Explain the basics of robots, types and work volumes
CO2: Summarize the methodology of manipulator path control and types of end effectors
CO3: Categorize the types sensors with applications and/or describe the use of machine vision in robots
CO4: Develop robot programming for various industrial applications
CO5: Demonstrate the types of robotic work cells and/or apply economic measures to select a robot for an application

UNIT I : FUNDAMENTALS OF ROBOTICS AND CONTROL SYSTEMS (9)

Robot anatomy - work volume - robot drive systems - control systems and dynamic performance - precision movement - basic control systems concepts and models - controllers - control system analysis- robot activation and feedback components - position and velocity sensors - power transmission - robot joint control design

UNIT II : MOTION ANALYSIS AND END EFFECTORS (9)

Manipulator kinematics - homogeneous transformations - robot kinematics - manipulator path control - robot dynamics - configuration of robot controller - End effectors - types - mechanical grippers - other types of grippers - tools as end effectors - robot end effectors interface - considerations in gripper selection and design

UNIT III : SENSORS AND MACHINE VISION (9)

Transducers and sensors - sensors in robotics - tactile sensors - proximity and range sensors -miscellaneous sensors - sensor based systems - uses of sensors in robotics - machine vision - sensing and digitizing - image processing and analysis - training and vision system - robotic applications

UNIT IV: ROBOT PROGRAMMING AND LANGUAGES (9)

Programming methods - lead through programming - methods, capabilities, limitations - program as a path in space - motion interpolation - WAIT, SIGNAL, DELAY commands - branching - Textual languages - structure - constants, variables, other data objects - motion commands - computations & operations - program control & subroutines - communications & data processing - monitor mode commands

UNIT V : ROBOT CELL DESIGN AND ECONOMIC ANALYSIS (9)

Robot cell layouts - multiple robots - machine interference - other considerations - work cell control - interlocks - work cell control - interlocks - error detection and recovery - work cell controller - cycle time analysis - graphical simulation - economic analysis - methods - differences in production rates - other factors - project analysis form

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Mikell P Groover, "Industrial Robotics: Technology, Programming, and Applications", 2nd ed., McGraw Hill Education (India) Private Limited, 2012
2. Mittal R K, Nagrath I J, "Robotics and Control",1st ed., McGraw Hill Education (India) Private Limited, 2012

REFERENCES:

1. Deb.S.R, "Robotics Technology and Flexible Automation", 2nd ed., McGraw Hill Education (India) Private Limited, 2009
2. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", 1st ed., McGraw Hill Book Co., 2008.
3. Rajput. R. K "Robotics and Industrial Automation" 1st ed., S. Chand Group, 2010.
4. Richard D.Klafter, Thomas A.Chmielewski and Micheal Negin, "Robotic engineering - An Integrated Approach", Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 2005.
5. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x	x	x				x	x
2	x	x	x	x	x	x	x				x	x
3	x	x	x	x	x	x	x				x	x
4	x	x	x	x	x	x	x				x	x
5	x	x	x	x	x	x	x				x	x

15MEX27 PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the steps involved in Process Planning and computer aided process planning
- To acquire knowledge on elements and estimation of cost, material cost and weight estimation
- To introduce the techniques in estimation of time and cost of machining, forging and welding

COURSE OUTCOMES:

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

CO1: Summarize the steps involved in process planning and/or computer aided process planning
CO2: Identify the elements of cost during manufacture of a product and/or apply the methods to estimate the cost
CO3: Estimate the material cost weight for a particular part
CO4: Determine the machining time of material removal processes in lathe, milling, shaping, planning and grinding
CO5: Adopt the methods of estimation in forging and welding processes to find cost of the process

UNIT I : PROCESS PLANNING (9)

Product design and analysis - process selection, planning, steps involved, responsibilities of process planning engineer - steps involved in product design - process design - process approach, pilot development, capacity consideration, commercial plan transfer - variant and generative process planning

UNIT II : ELEMENTS OF COST AND COST ESTIMATION (9)

Classification of costs - Cost estimation - functions of cost estimate - costing - types of estimates - methods of cost estimation - variations in cost estimates - data needed and data sources - estimating procedure - functions of estimator - elements of job estimate - selling price - indirect cost allocation

UNIT III : MATERIAL COST AND WEIGHT ESTIMATION (9)

Steps of estimating material cost - mensuration - area and perimeter, areas of irregular shapes, volume and surface area of solids, centroid, surface areas using centroid, volume of solid of revolution - material weight and cost estimation - steps involved

UNIT IV : ESTIMATION OF MACHINING TIME (9)

Machining operations - turning, tapping, screw cutting, chamfering , taper turning, relief turning, knurling, facing, drilling in lathe , counter boring, counter sinking, reaming in a lathe, centre drilling, planning in a shape, planning in a planning machine, milling, grinding

UNIT V : ESTIMATION OF FORGING AND WELDING COST (9)

Types of forging - forging operations - losses in forging - forging cost - Welding - terminologies - filler material, flux- types of welding - fusion and pressure welding - types of welded joints - techniques of welding - leftward and rightward welding, estimation of welding cost

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Gideon Halevi, "Process and operation planning", 2nd ed., Springer-Verlag New York, 2003.
2. Panneerselvam R, "Process Planning and Cost Estimation", Prentice-Hall of India Pvt.Ltd, 2016

REFERENCES:

1. Adithan.M, "Process Planning and Cost Estimation", New Age International Publishers, 2015
2. Peter Scallan, "Process planning, The Design/Manufacture interface", Butterworth-Heinemann, 2003.
3. Robert Creese, M. Adithan, B.S Pabla, "Estimating and Costing for the Metal Manufacturing Industries", Marcel Dekker, 1992.
4. Chitale, A, K., and Gupta, R. C, "Product Design and manufacturing", Prentice Hall of India, New Delhi , 1997.
5. G.B.S. Narang, V. Kumar, "Production and Costing", Khanna Publishers, 2000.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x			x			x	x
2	x		x	x	x			x	x		x	x
3	x		x	x	x			x	x		x	x
4	x		x	x	x			x	x		x	x
5	x		x	x	x			x	x		x	x

15MEX28 SURFACE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To teach students the basic concepts of surface engineering and its development
- To provide students the knowledge of coatings and the formation of technological surface layers
- To enable the students understand the basic principles of Laser Technology and Plasma Coating Technology

COURSE OUTCOMES:

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

CO1: Explain various properties of a surface and its importance during design of components
CO2: Identify a coating method for a product to improve surface characteristics
CO3: Demonstrate the concept of plasma coating technology and its application
CO4: Select a type of characterization method for a particular coating
CO5: List the types of coatings under hard and soft coatings

UNIT I : INTRODUCTION TO SURFACE ENGINEERING (9)

Differences between surface and bulk, properties of surfaces-wear, corrosion, optical, roughness, electrical and thermal properties, wetability.

UNIT II : CONCEPTS OF COATING (9)

Coatings - concepts of coatings , electroplating and electroplating - metallic and non metallic coatings - galvanizing - thermal spray, types of thermals spray and their advantages and disadvantages - conventional verses nanocoatings

UNIT III : PLASMA COATING TECHNOLOGY (9)

Process parameters, thermal and kinetic history of inflight particle, microstructural features of plasma sprayed coatings, single splat studies, process-structure property relationship, challenges in preparation, plasma spraying of nano powders - its microstructure - properties - Liquid precurser plasma spray- applications

UNIT IV : CHARACTERIZATION OF COATINGS (9)

Coatings - thickness-porosity-hardness, fracture toughness- elastic modulus - adhesion bending strength-fracture strength- tensile strength- wear and corrosion measurement phase analysis

UNIT V : HARD AND SOFT COATINGS (9)

Caser cladding- laser alloying, Electron beam hardening-ion beam implantation - sol-gel coatings - electrophoretic deposition - DLC and diamond coatings, antifriction and anti scratch coatings

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Tadeusz Burakowski, Padeusg and Weirzxhon, “Surface Engineering of Metals, Principles, equipments and Technologies”, CRC press,1998
2. BG Miller, “Surface coatings for protection against wear”, Woodhead publishing, 2006

REFERENCES:

1. P. Fauchais, A. Vardelle, and B. Dussoubs, "Quo Vadis Thermal Spraying?", Journal of Thermal Spray Technology, Volume 10(1) March 2001
2. Kenneth B. Tator, “ASM Handbook: Volume 5b: Protective Organic Coatings”, 1st ed., ASM International, 2015

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x				x	x	x				x	
2	x	x	x		x		x	x			x	x
3	x	x	x	x	x	x	x	x			x	x
4		x			x			x			x	x
5	x	x	x	x	x	x	x	x			x	x

15GEC04 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand total quality management concept s and principles and the various tools available to achieve total quality management, statistical approach for quality control, ISO & QS certification process and its needs for the industries

COURSE OUTCOMES:

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

CO1: Acquire various concepts of quality management
CO2: Implement various principles of quality management
CO3: Impart quality using statistical process
CO4: Use the various tools to maintain quality
CO5: Implement the quality system for ISO certification

UNIT I : INTRODUCTION (9)

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements- Quality planning- Quality councils - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II : TQM PRINCIPLES (9)

Leadership - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle,5S,Kaizen – Supplier Partnership – Partnering, Supplier selection - Supplier Rating.

UNIT III : TQM TOOLS AND TECHNIQUES - I (9)

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV : TQM TOOLS AND TECHNIQUES - II (9)

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V : QUALITY SYSTEMS (9)

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, 3rd ed., Indian Reprint, 2011

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th ed., First Indian Edition, Cengage Learning, 2012.
2. Subburaj Ramasamy , “Total Quality Management”, Tata McGrawHill, First reprint 2009.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x		x	
2	x			x					x		x	
3	x			x					x		x	
4	x			x					x		x	
5	x			x					x		x	

15MEX30 WELDING ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To acquire basic knowledge in the discipline of materials science and engineering
- To introduce the basics of welding and types of welding processes
- To acquire knowledge on welding metallurgy and mathematical analysis of heat affected zone
- To introduce the welding methodology for various materials, pipelines and underwater welding
- To introduce the steps involved in process planning and inspection methods for welding processes

COURSE OUTCOMES:

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

CO1: Demonstrate the knowledge on welding technology for various materials
CO2: Describe the welding metallurgy and/or mathematical analysis of heat affected zone
CO3: Identify a welding method for joining materials and pipelines
CO4: Explain the procedures in welding, steps in process planning and inspection methods
CO5: Summarize the steps involved in underwater welding processes

UNIT I : WELDING TECHNOLOGY AND SCIENCE (9)

Definition and classification - conditions for obtaining satisfactory welds - importance of welding and its applications - welding quality and performance - Characteristics of welding power sources - arc welding power supply equipments - selection criteria - energy input - energy sources - arc characteristics - metal transfer and melting rates - welding parameters and their effects

UNIT II : WELDING METALLURGY AND MATHEMATICAL ANALYSIS (9)

General and welding metallurgy - thermal and mechanical treatment of welds - residual stress and distortion in welds - Heat input to weld - relation between weld cross section and energy input - heat input rate - heat flow equations with practical application - width of Heat Affected Zone (HAZ) - cooling rates - contact resistance heat source

UNIT III : WELDING OF MATERIALS AND PIPELINES (9)

Welding of cast irons - aluminium and its alloys - low carbon HY pipe steels - stainless steels - welding of dissimilar metals - hard surfacing and cladding - welding of plastics - hot air welding of PVC plastics - welding action - equipments - testing of joints - welding of pipelines - piping - joint design - backing rings- heat treatment - offshore pipe work - pipeline welding

UNIT IV : WELDING PROCEDURE, PROCESS PLANNING AND QUALITY (9)

Welding symbols - welding procedure and sheets - joint preparations in fusion welding - welding positions - summary chart - submerged arc welding procedure sheets - welding procedure of MIG/CO_2 welding - Welding quality - undercuts - cracks - porosity - slag inclusion - lack of fusion - lack of penetration - faulty weld size and profile - corrosion testing of welded joints

UNIT V : UNDERWATER WELDING (9)

Comparison of underwater welding and normal air welding - welding procedure - types of underwater welding - underwater welding process development - developments in underwater welding - characteristics desired in electrodes for MMA wet welding - polarity - salinity of sea water - weld shape characteristics - microstructure of underwater welds

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Edward R. Bohnart, "Welding Principles and Practices", 4th ed., McGraw Hill Education, 2014
2. Ibrahim Khan, “Welding Science and Technology”, New Age International (P) Limited, 2007

REFERENCES:

1. Bruce Stirling, “Text Book of Welding Technology”, Dhanpat Rai Publishing Company (P) Ltd, 2013
2. Garg.G.D, “A textbook of Welding Technology”, S. K. Kataria & Sons, 2011
3. Khanna.O.P, “A textbook of Welding Technology”, 22nd ed., Dhanpat Rai Publications, 2008
4. Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2001
5. Parmer.R.S., “Welding Engineering and Technology”, 1st ed., Khanna Publishers, New Delhi, 2008

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x		x				x	x
2	x	x	x	x	x		x				x	x
3	x	x	x	x	x		x				x	x
4	x	x	x	x	x		x				x	x
5	x	x	x	x	x		x				x	x

15CEZ01 ENERGY CONSERVATION IN BUILDINGS
(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVE:

- To get idea on energy estimates considering about climate zones.
- To gain knowledge on energy conservation in buildings and monitoring systems

COURSE OUTCOMES:

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

CO1: Get idea on climate effects on building systems.
CO2: Perform energy estimation for buildings
CO3: Implement thermal insulation techniques in buildings.
CO4: Plan for the energy conservation methods in buildings.
CO5: Apply monitoring and control of energy systems in buildings.

UNIT I CLIMATE (6)

Climate and shelter – Historic buildings – Modern architecture – Examples from different climate zones.

UNIT II ENERGY ESTIMATION (9)

Thermal comfort – Solar geometry and shading – Heating and cooling loads – Energy estimates and site planning – Integrative Modeling methods and building simulation

UNIT III PRINCIPLES OF ENERGY (9)

Principles of Energy conscious building design – Energy conservation in buildings – Day lighting – Water heating and photovoltaic systems – Advances in thermal insulation – Heat gain / loss through building components – Solar architecture

UNIT IV ENERGY CONSERVATION (9)

Passive solar heating – Direct gain – Thermal storage wall – Sunspace – Convective air loop – Passive cooling – Ventilation – Radiation – Evaporation and Dehumidification – Mass effect – Design guidelines

UNIT V MONITORING AND CONTROL SYSTEMS (12)

Energy conservation in building – Air conditioning – HVAC equipment – Computer packages for thermal design of buildings and performance prediction – Monitoring and instrumentation of passive buildings – Control systems for energy efficient buildings – Illustrative passive buildings – Integration of emerging technologies – Intelligent building design principles.

TOTAL: L: 45 = 45 PERIODS

TEXT BOOKS:

1. J.K. Nayak and J.A. PrajapatiHadbook on Energy Consious Buildings, Solar Energy Control MNES, 2006.
2. J.A. Clarke, Energy Simulation in Building Design (2e) Butterworth 2001.

REFERENCES:

1. J.R. Williams, Passive Solar Heating, Ann Arbar Science, 1983.
2. R.W. Jones, J.D. Balcomb, C.E. Kosiewiez, G.S. Lazarus, R.D. McFarland and W.O. Wray, Passive Solar Design Hanbook, Vol.3, Report of U.S. Department of Energy (DOE/CS-0127/3), 1982.
3. M.S. Sodha, N.K., Bansal, P.K. Bansal, A.Kumar and M.A.S. Malik. Solar Passive Building, Science and Design, Pergamon Press, 1986.
4. J.L. Threlkeld, Thermal Environmental Engineering, Prentice Hall, 1970.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**Pos**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x				x					
2	x	x	x				x					x
3	x		x		x		x					x
4	x		x				x		x			x
5		x		x			x				X	

15CEZ02 WASTE MANAGEMENT

(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand of the basic principles of waste and resource management will be supplemented, where appropriate, by practical problem-solving exercises.
- To provide detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes.
- To provide details on resource efficiency plays in conserving resources and contributing to a low carbon economy.

COURSE OUTCOMES:

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

CO1: Understand and apply the basic for solving practical waste management challenges.
CO2: Understand the collection of waste and recycling.
CO3: Understand the fundamental principles of existing and emerging technologies for the treatment of waste.
CO4: Appreciate the role of decision-making tools in the critical assessment of major waste issues.
CO5: Understand the economy and financial aspects of waste management.

UNIT I INTRODUCTION & TYPES OF SOURCES (9)

Problems and need of solid and hazardous waste management - Waste management planning - Toxicology and risk assessment - Legislations on management and handling of different types of wastes.

UNIT II WASTE GENERATION RATES (9)

Composition - Hazardous Characteristics – TCLP tests – waste sampling- reduction of wastes at source – Recycling and reuse. Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations -labeling and handling of hazardous wastes.

UNIT III WASTE PROCESSING (9)

Processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies - energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

UNIT IV DISPOSAL (9)

Site selection - design and operation of sanitary landfills - secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – landfill remediation

UNIT V ECONOMY AND FINANCIAL ASPECTS (9)

Elements of integrated waste management - Economy and financial aspects of waste management. Other Waste Types: Nuclear and Radio Active Wastes.

TOTAL: L: 45 = 45 PERIODS

TEXT BOOKS:

1. 1. Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, Integrated Solid Waste Management, McGraw- Hill, New York, 1993.

REFERENCES:

1. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000
2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.
3. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.
4. Charles A. Wentz, Hazardous Waste Management, Second Edition, Pub: McGraw Hill International Edition, New York, 1995.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**Pos**											
	1	2	3	4	5	6	7	8	9	10	11	12
1		x	x		x		x					
2			x		x		x					
3				x	x							x
4		x	x				x					
5			X		x				x		x	x

15CEZ03 AIR POLLUTION MANAGEMENT
(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVE:

- To study about the characteristics and effects of air and noise pollution and the methods of controlling the same.
- To know about source inventory and control mechanism.

COURSE OUTCOMES:

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

CO1: Understand about nature and characteristics of air pollutants.
CO2: Identify the basic elements of atmosphere and its stability.
CO3: Design stacks and particulate air pollution control devices to meet applicable standards.
CO4: Understand the basic concepts of air quality management.
CO5: Identify, formulate and solve air and noise pollution problems.

UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS (9)

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

UNIT II DISPERSION OF POLLUTANTS (9)

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

UNIT III AIR POLLUTION CONTROL (12)

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV AIR QUALITY MANAGEMENT (8)

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality.

UNIT V NOISE POLLUTION (7)

Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention.

TOTAL: L: 45 = 45 PERIODS

TEXT BOOKS:

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata McGraw Hill, New Delhi, 1996.

REFERENCES:

1. Heumann. W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.
2. Mahajan S.P., "Pollution Control in Process Industries", Tata McGraw Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. "Environmental Engineering", McGraw Hill, New Delhi, 1985.
4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi, 1998
5. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw Hill, New Delhi, 1991.
6. Thod Godesh, "Air Quality, Lewis India Edition, 2013.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**Pos**											
	1	2	3	4	5	6	7	8	9	10	11	12
1		x					x					
2			x		x		x					x
3	x	x	x		x		x				x	x
4			x				x				X	
5		x	x		x						X	x

15CEZ04 BUILDING SERVICES

(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand about electrical systems in building and its specifications.
- To know about the concepts of refrigeration and other safety installations as per NBC
- Planning and scheduling the frequency of inspection and maintenance of building including drainage

COURSE OUTCOMES:

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

CO1: Know about the basic electrical systems in buildings
CO2: Gain knowledge about the modern lighting systems.
CO3: Study about the HVAC systems.
CO4: Be familiar with the concept of planning considerations and fire safety installation in buildings.
CO5: Study about the concepts of plumbing and drainage in building.

UNIT I ELECTRICAL SYSTEMS IN BUILDINGS (9)

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT II PRINCIPLES OF ILLUMINATION & DESIGN (9)

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour –Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT III REFRIGERATION PRINCIPLES & APPLICATIONS (9)

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT IV FIRE SAFETY INSTALLATION (9)

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers.

UNIT V PLUMBING AND DRAINAGE (9)

Plumbing fixtures and fixture fittings – Water conserving fittings – Over flows – Strainers and connectors – Prohibited fixtures – Special fixtures – Installation of water closet – Urinals - Flushing devices – Floor drains – Shower stall – Bath tub – Bidets – Minimum plumbing facilities – Rain water harvesting systems – Necessity – Construction – Different types .

TOTAL: L: 45 = 45 PERIODS

TEXT BOOKS:

1. Udayakumar, “A Text Book on Building Services”, Eswar Press, 2007.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.

REFERENCES:

1. E.R.Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G.Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London, 1969.
4. William H.Severns and Julian R.Fellows, “Air-conditioning and Refrigeration”,John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, the Architectural Press, London, 1980.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and Pos												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1		x	x				x					
2			x				x					
3			x				x					x
4		x	x		x				x			
5		x	x		x		x					x

15CSZ01 SOFTWARE ENGINEERING METHODOLOGIES

(Common to All branches except CSE Branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To Understand the life cycle models of software process
- To Understand fundamental concepts of requirements engineering .
- To learn the systematic procedure for software design
- To Implement the strategies for software testing
- To explore the significance of project planning and management.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Identify the key activities in managing a software project.
CO2: Compare different process models.
CO3: Implement the Concepts of requirements engineering.
CO4: Apply systematic procedure for software design and deployment.
CO5: Compare and contrast the various testing and maintenance.

UNIT I: SOFTWARE PROCESS (9)

Introduction –Software Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation.

UNIT II: SOFTWARE REQUIREMENTS (9)

Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping -Software document. Analysis and modeling – data, functional and behavioral models – structured analysis and data dictionary.

UNIT III: SOFTWARE DESIGN (9)

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV: SOFTWARE TESTING (9)

Taxonomy of software testing – levels – test activities – types of software test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large - software testing strategies - testing using extreme programming.

UNIT V: SOFTWARE PROJECT MANAGEMENT (9)

Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II - Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM - Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics

. **TOTAL (L:45) = 45 PERIODS**

TEXT BOOK:

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, 7th ed., Mc Graw-Hill International Edition, 2010.

REFERENCES :

1. Ian Sommerville, “Software Engineering”, 9th ed., Pearson Education Asia, 2011.
2. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI COURSE Private Limited, 2009.
3. Pankaj Jalote, “Software Engineering - A Precise Approach”, Wiley India, 2010.
4. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
5. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x	x					x		
2		x	x		x							x
3	x	x	x	x	x				x	x		x
4	x		x	x								x
5	x	x		x	x						x	x

15CSZ02 DESIGN THINKING

(Common to All branches except CSE Branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To acquire Design Thinking skills.
- To learn by doing projects.
- To solve so called "wicked problems" (problems for which neither question nor answer is well defined).

COURSE OUTCOMES:

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

CO1: Have a sense of self-efficacy & creative confidence

CO2: Interpret and visualize the scenario..

CO3: Know how to manage a Design Thinking workshop Layout, roles, times and process.

CO4: Apply Design thinking tools to increase research output.

CO5: Do experiments by creating prototype and by obtaining feedback.

UNIT I INTRODUCTION TO DESIGN THINKING (9)

Overview - Use of Design Thinking – Design Process. Getting Started: Define Challenges – Create a Project Plan. Design Thinking Tools.

UNIT II DISCOVERY (9)

Understand the Challenge: Review the Challenge - Build your Team - Refine your Plan. Prepare Research: Identify Sources of Inspiration - Select Research Participants - Prepare For Fieldwork. Gather Inspiration: Immerse Yourself in Context - Seek Inspiration In Analogous Settings - Learn From Experts - Learn From Users.

UNIT III INTERPRETATION (9)

Tell Stories: Capture Your COURSEs- Share Inspiring Stories. Search for meaning: Find Themes - Make Sense of Findings - Define Insights. Frame Opportunities: Create a Visual Reminder - Make Insights Actionable.

UNIT IV IDEATION (9)

Generate Ideas: Prepare for Brainstorming - Facilitate Brainstorming - Select Promising Ideas - Sketch to Think. Refine Ideas - Do a Reality Check - Describe Your Idea.

UNIT V EXPERIMENTATION AND EVOLUTION (9)

Make Prototypes: Create a Prototype. Get Feedback: Identify Sources for Feedback - Select Feedback Participants - Facilitate Feedback Conversations - Capture Feedback COURSEs - Integrate Feedback. Track COURSEs: Define Success - Document Progress. Move Forward: Plan Next.

TOTAL :(L: 45) = 45 PERIODS

REFERENCES:

1. http://www.designthinkingforeducators.com/toolkit
2. https://hbr.org/2008/06/design-thinking
3. http://asimetrica.org/wp-content/uploads/2014/06/design-thinking.pdf

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x				x	x		x		
2					x							x
3	x			x	x		x	x				x
4	x		x									x
5	x	x		x	x	x	x		x	x		

13CSZ03 OPEN SOURCE SOFTWARE
(*Common to All branches except CSE Branch)*

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of open source operating systems.
- To gain the knowledge of working with Linux platform and open source database.
- To be familiar with programming languages PHP, Perl, Python.

COURSE OUTCOMES:

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

CO1: Install and run open-source operating systems.
CO2: Gather information about Free and Open Source Software projects from software releases and from sites on the internet.
CO3: Develop programs using PHP.
CO4: Solve problems using Python programming.
CO5: Develop programs using Perl.

UNIT I: INTRODUCTION **(9)**

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources –Application of pen Sources. Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals –Development with Linux.

UNIT II: OPEN SOURCE DATABASE **(9)**

MySQL: Introduction – Setting up account –Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings –Date and Time – Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web.

UNIT III: OPEN SOURCE PROGRAMMING LANGUAGES **(9)**

PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP –String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails –Debugging and error handling – Security –Templates.

UNIT IV: PYTHON **(9)**

Syntax and Style – Python Objects – Numbers – Sequences – Strings –Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output –Errors and Exceptions – Functions – Modules – Classes and OOP –Execution Environment.

UNIT V: PERL **(9)**

Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures – Subroutines, Packages, and Modules- Working with Files –Data Manipulation.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2003.
2. Steve Suchring, “MySQL Bible”, John Wiley, 2002.

REFERENCES:

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002
2. Wesley J. Chun, "Core Phython Programming", Prentice Hall, 2001
3. Martin C. Brown, "Perl: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
4. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x						x	x		x
2	x	x	x		x					x		x
3	x	x	x	x	x							x
4	x		x	x			x			x	x	x
5	x	x		x	x		x			x	x	x

15CSZ04 INFORMATION SECURITY

(*Common to All branches except CSE branch)*

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Understand the basics of Information Security

CO2: Know the legal, ethical and professional issues in Information Security

CO3: Know the aspects of risk management

CO4: Become aware of various standards in this area

CO5: Know the technological aspects of Information Security

UNIT I: INTRODUCTION **(9)**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

UNIT II: SECURITY INVESTIGATION **(9)**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

UNIT III: SECURITY ANALYSIS **(9)**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk

UNIT IV: LOGICAL DESIGN **(9)**

Blueprint for Security, Information Security Poicy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V: PHYSICAL DESIGN **(9)**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL (L:45) = 45 PERIODS

TEXT BOOK:

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2017.

REFERENCES:

1. Micki Krause, Harold F. Tipton, “ Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw Hill, 2003
3. Matt Bishop, “ Computer Security Art and Science”, Pearson/PHI, 2002.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x				x		x		x
2		x	x	x	x							x
3	x			x	x			x	x	x		x
4	x		x	x				x				x
5	x	x	x	x	x			x	x	x		x

15ECZ01 - AVIONICS

(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the needs for avionics for both Civil and military aircraft.
- To introduce various digital electronic principles and working operations of digital circuit.
- To integrate the digital electronics with cockpit equipments.
- To understand the various principles in flight disk and cockpit panels.

COURSE OUTCOMES:

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

CO1 : Describe the hardware required for aircraft.
CO2 : Interfacing with analog and digital systems.
CO3 : Design avionics system architecture.
CO4 : Describe Civil and Military Cockpits.
CO5 : Design of flight control systems and Radar systems.

UNIT- I INTRODUCTION TO AVIONICS (9)

Need for Avionics in civil and military aircraft and space systems – Integrated Avionics system – Typical avionics sub systems – Design approaches and recent advances - Application Technologies.

UNIT- II PRINCIPLES OF DIGITAL SYSTEMS (9)

Digital Computers – Digital number system- number systems and codes-Fundamentals of logic and combinational logic circuits –Digital arithmetic – interfacing with analogue systems - Microprocessors – Memories.

UNIT- III DIGITAL AVIONICS ARCHITECTURE (9)

Avionics system architecture– salient features and applications of Data buses MIL–STD 1553 B–ARINC 429–ARINC 629.

UNIT- IV FLIGHT DECK AND COCKPITS (9)

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit : MFDS, HUD, MFK, HOTAS 63.

UNIT- V AVIONICS SYSTEMS (9)

Communication Systems - Navigation systems - Flight control systems - Radar electronic warfare - Utility systems Reliability and maintainability - Certification .

TOTAL :(L: 45) =45 PERIODS

TEXT BOOKS:

1. Middleton, D.H. “Avionics Systems”, Longman Scientific and Technical, Longman Group UK.Ltd, England, 1989.
2. Spitzer, C.R. “Digital Avionics Systems”, Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.

REFERENCES:

1. Malcrno A.P. and Leach, D.P., “Digital Principles and Application”, Tata McGraw-Hill, 1990.
2. Gaonkar, R.S., “Microprocessors Architecture – Programming and Application”, Wiley and Sons Ltd., New Delhi, 1990.
3. Cary R .Spitzer, “The Avionics Handbook”, CRC Press, 2000.
4. Brain Kendal, “Manual of Avionics”, The English Book House, 3rd Edition, New Delhi, 1993.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x									
2	x	x		x								x
3		x	x	x								x
4		x		x	x							x
5		x	x		x							x

15ECZ02 - CONSUMER ELECTRONICS
(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To study the basics of audio and video technology.
- To understand the electronic gadgets and telecommunication systems.
- To analyze and design consumer appliances.

COURSE OUTCOMES:

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

CO1 : Know the concepts of audio system.
CO2 : Know the concepts of video system.
CO3 : Analysis different techniques involved in audio and video processing.
CO4 : Identification of new developments in office equipment and domestic appliances.
CO5 : Know the working concepts of consumer applications.

UNIT - I AUDIO SYSTEM COMPONENTS (9)

Introduction to wave motion – Interference and superposition of waves – Beats, Resonance, Echos – characteristics of microphones – types of microphone – wireless microphones – Types of headphones – Loudspeakers

UNIT-II AUDIO PROCESSING (9)

Audio Filters, Types of AGC – Loudspeaker Impedance matching – Pre-emphasis and De-emphasis noise reduction – Optical recording and reproduction – stereophony, Quadraphony – Stereo controls –Equalizers –Mixer.

UNIT - III VIDEO STANDARDS AND SYSTEMS (9)

Elements of a TV system, scanning process – resolution, interlacing, composite signal The Kell factor. LED, LCD, Types of TV camera-Color TV systems- The NTSC system-The PAL systems- The SECAM system. Broadcasting of TV programs-Digital Video Recorder and CCTV Surveillance system

UNIT - IV COMMUNICATION AND CONSUMER GADGETS (9)

Radio system – VHF and UHF – Cellular communication - Types of mobile phones – Establishing cell- Smart card– Facsimile machine – electronic calculators – Digital clocks– Xerography - TV Remote.

UNIT - V CONSUMER APPLICATIONS (9)

Washing Machines – electronic controller, fuzzy logic, Hardware and Software development – Air Conditioners – Components, Remote Controls, Unitary and central air conditioner systems – Bar Coders – Bar codes, scanner and decoder – Set Top Box – Types, firmware development, Interactive program guides.

TOTAL :(L: 45)= 45 PERIODS

TEXT BOOK:

1. S.P.Bali, Consumer Electronics, Pearson Education, 2005.

REFERENCES:

1. C.A. Schuler and W.L.Mc Namee, Modern Industrial Electronics, McGraw Hill, 2002.
2. D.J. Shanefield, Industrial Electronics for Engineers, Chemists and Technicians, Jaico Publishing House, 2007

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x			x
2		x			x			x		x		
3					x							x
4	x							x		x		
5	x		x		x			x		x		

15ECZ03 - MODERN WIRELESS COMMUNICATION SYSTEMS

(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To learn the comprehensive background concepts of wireless and mobile communication.
- To know the flavor of personal communication systems.
- To study the highlights of the latest communication networks and out the next generation networks.

COURSE OUTCOMES:

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

CO1 : Know the fundamentals of basic mobile communication wireless networks.

CO2 : Have a detailed overview of different networking topologies and multiple access methods.

CO3 : Have the information about the several generation of personal communication technologies

CO4 : Know about the principles of operation of the different access technologies like FDMA,TDMA, SDMA and CDMA

CO5 : Identify the different data services and short range networks used in mobile networks.

UNIT- I TRANSMISSION FUNDAMENTALS (9)

Cellphone Generations: 1G, 2G, 2.5G, 3G & 4G Transmission Fundamentals: Time domain & Frequency domain concep Carrier-based signalling, spread- spectrum signalling.

UNIT –II NETWORK CONCEPTS (9)

Communication Networks: LANs, MANs, WANs, circuit switching, packet switching, ATM Cellular Networks: Cells, duplex FDMA, TDMA, SDMA, CDMA, spectral efficiency.

UNIT- III PERSONAL COMMUNICATION SERVICES (9)

GSM, HSCSD, GPRS, D-AMPS, CDMA One, CDMA Two, Packet Data Systems.

UNIT- IV 3G & BEYOND (9)

IMT-2000, W-CDMA, CDMA 2000, EDGE, Wi-Fi, WiMAX, OFDM.

UNIT- V MOBILE DATA SERVICES & SHORT-RANGE NETWORKS (9)

Mobile Data Services: Messaging, wireless web, WAP, site design Short-Range Wireless Networks:Unlicensed spectrum phones, mobile OSs, smart phone applications.

TOTAL :(L: 45)= 45 PERIODS

TEXT BOOKS:

1. Andy Dornan, “The essential guide to wireless communications applications: from cellular systems to Wi-Fi”, 2nd Edition, Prentice Hall, 2002.
2. Misra, “Wireless Communications and Networks: 3G & Beyond”, Tata McGraw-Hill, 2013.

REFERENCES:

1. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, 2nd Edition,
2. Pearson Education, 2009.
3. William Stallings, “Wireless communications and networking”, Prentice Hall, 2005

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x									
2	x	x		x								x
3		x	x	x								x
4		x		x	x							x
5		x	x		x							x

15ECZ04 - ELECTRONIC TESTING

(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of testing and the testing equipments.
- To understand the different testing methods.
- To learn about testable system design.

COURSE OUTCOMES:

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

CO1 : Have knowledge of different types of faults and fault modeling.
CO2 : Design the different testing schemes for Digital circuits.
CO3 : Know the testing schemes for memories and mixed signal systems.
CO4 : Have knowledge of various testability design schemes.
CO5 : Diagnosis the Faults at module level.

UNIT I - INTRODUCTION **(9)**

Test process and automatic test equipment, test economics and product quality, fault modeling.

UNIT II - DIGITAL TESTING **(9)**

Logic and fault simulation, testability measures, combinational and sequential circuit test generation.

UNIT III - ANALOG TESTING **(9)**

Memory Test, DSP Based Analog and Mixed Signal Test, Model based analog and mixed signal test, delay test, IIDQ test.

UNIT IV - DESIGN FOR TESTABILITY **(9)**

Built-in self-test, Scan chain design, Random Logic BIST, Memory BIST, Boundary scan test standard, Analog test bus, Functional Microprocessor Test, Fault Dictionary, Diagnostic Tree, Testable System Design, Core Based Design and Test Wrapper Design, Test design for SOCs, Pre-Silicon to Post silicon test for FPGA.

UNIT V - LOADED BOARD TESTING **(9)**

Unpowered short circuit tests, unpowered analog tests, Powered in-circuit analog, digital and mixed Signal tests, optical and X-ray inspection procedures, functional block level design of in-circuit test Equipment

TOTAL :(L: 45) =45 PERIODS

TEXT BOOKS:

1. Michael L. Bushnell and Vishwani D. Augural, “Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits”, Springer, 2006.
2. Mehdi Dehbashi, Görschwin Fey “Debug Automation from Pre-Silicon to Post-Silicon” Springer, 25-Sep-2014.

REFERENCE:

1. Dimitris Gizopouilos, “Advances in Electronic Testing”, Springer 2006.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x			x
2		x			x			x		x		
3					x							x
4	x							x		x		
5	x		x		x			x		x		

15EEZ01 RENEWABLE ENERGY TECHNOLOGY

L	T	P	C
3	0	0	3

(Common to All Branches except EEE branch)

OBJECTIVE:

- To emphasis the current energy status and role of renewable energy
- To know about the various concept of solar and wind energy
- To know about the various concept of biomass and other renewable energy sources

COURSE OUTCOMES:

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

CO1: Plan appropriate kind of energy for the future development.
CO2: Know about solar energy concepts, techniques and its applications.
CO3: Identify the concepts, various wind turbines, storage and environmental aspects of wind energy.
CO4: Understand the concepts of biomass energy conversion technologies and plant design considerations.
CO5: Know some other renewable energy sources.

UNIT I : INTRODUCTION (9)

World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment-Economy - Energy and Sustainable Development, Energy planning. Reserves of Energy resources - Renewable energy resources - Potentials - Achievements - applications - Technical and social implications, issues in grid integration of power from renewable energy sources.

UNIT II : SOLAR ENERGY (9)

Basic concepts, Solar radiation – Measurement, Solar thermal systems – Flat plate and concentrating collectors, Solar passive space – Solar heating and cooling techniques – Solar desalination – Solar Pond – Solar cooker – Solar dryers – Solar furnaces – Solar pumping – Solar green house- Solar thermal electric power plant – Solar photo voltaic conversion – Solar cells – PV applications – Hybrid systems.

UNIT III : WIND ENERGY (9)

Introduction – Availability- Wind power plants, Power from the wind, Wind energy conversion systems, site characteristics – Wind turbines types – Horizontal and vertical axis – Design principles of wind turbine – Blade element theory - Magnus effect – Performance – Wind energy Applications – Hybrid systems – Wind energy storage – Safety and environmental aspects.

UNIT IV : BIOMASS ENERGY (9)

Biomass – Usable forms- composition – Fuel properties – Applications – Biomass resource – Biomass conversion technologies – Direction combustion – Pyrolysis – Gasification – Anaerobic digestion –Bioethanol and Biodiesel Production – Economics – Recent developments – Energy farming – Biogas technology – Family biogas plants – Community and institutional biogas plants – design consideration – Applications

UNIT V : OTHER RENEWABLE ENERGY SOURCES (9)

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Social and environmental aspects – Fuel cell technology: Types, principle of operation, applications –Hydrogen energy production – Storage – Transportation – Utilization.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Godfrey Boyle, “Renewable Energy”, Power for a Sustainable Future, Oxford University Press, U.K, 1996.
2. Twidell.J.W & Weir.A, “Renewable Energy Sources”, EFN Spon Ltd., UK, 1986.
3. Tiwari.G.N, “Solar Energy - Fundamentals Design”, Modelling and applications, Narosa PublishingHouse, NewDelhi, 2002.

REFERENCES:

1. Kothari P, K C Singal and Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, PHI Pvt. Ltd.,New Delhi, 2008.
2. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 1999.
3. S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x			x
2		x			x			x		x		
3					x							x
4	x							x		x		
5	x		x		x			x		x		

15EEZ02 ENERGY CONSERVATION AND AUDITING | **L T P C**
(Common to All Branches except EEE branch) | **3 0 0 3**

OBJECTIVE:

- To enable the students to acquire the knowledge of energy conservation measures in thermal and electrical energy systems.

COURSE OUTCOMES:

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

CO1: Understand the concepts of energy status and conservation principle.
CO2: Measure the energy conservation in steam systems
CO3: Know about the energy conservation concepts of various fluid machineries
CO4: Identify electrical energy conservation in various industries
CO5: Know the energy management techniques and policies

UNIT I ENERGY CONSERVATION PRINCIPLES **(9)**

Energy scenario - Principles of energy conservation - Resource availability - Energy savings - Current energy consumption in India - Roles and responsibilities of energy managers in industries.

UNIT II ENERGY CONSERVATION IN STEAM SYSTEMS **(9)**

Power plant components - Conservation measures in steam systems, losses in boiler - Methodology of upgrading boiler performance - Blow down control, excess air control - Pressure reducing stations - Condensate recovery - Condensate pumping - Thermo compressor - Recovery of flash steam - Air removal and venting - Steam traps -Cooling towers.

UNIT III ENERGY CONSERVATION IN FLUID MACHINERY **(9)**

Centrifugal pumps - Energy consumption and energy saving potentials - Design consideration - Minimizing over design - Fans and blowers : specification, safety margin, choice of fans, controls and design considerations - Air compressor and compressed air systems: selection of compressed air layout, energy conservation aspects to be considered at design stage.

UNIT IV ELECTRICAL ENERGY CONSERVATION **(9)**

Potential areas for electrical energy conservation in various industries: conservation methods, energy management opportunities in electrical heating, lighting system, cable selection - Energy efficient motors - Factors involved in determination of motor efficiency - Adjustable AC drives - Variable speed drives - Energy efficiency in electrical system.

UNIT V ENERGY AUDITING **(9)**

Energy audit : need, preliminary audit, detailed audit, methodology and approach - Instruments for audit, monitoring energy and energy savings.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Reay.D.A, "Industrial energy conservation", Pergamon Press, 1st ed., 2003.
2. Albert Thumann, "Handbook of energy audits", 6th ed., The Fairmount Press, 2003.

REFERENCES:

1. Smith.C.B, “Energy Management Principles”, Pergamon Press, 2006.
2. Hamies, “Energy Auditing and Conservation; Methods, Measurements, Management and Case study”, Hemisphere, 2003.
3. Trivedi. P.R and Jolka .K.R, “ Energy Management”, Common Wealth Publication, 2002.

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x			x
2		x			x					x		
3												x
4	x											
5	x		x		x			x		x		

15EEZ03 ELECTRICAL MACHINES

(Common to All Branches except EEE branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To disseminate an overview of various electric machines used in industries, power generation and home appliances with a technical know-how on the control techniques

COURSE OUTCOMES:

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

CO1: Understand the constructional details and principle of operation of DC motors,induction machines, alternators, transformers and fractional horse-power motors

CO2: Evaluate the performance of starting and operating characteristics of various electrical machines used in industrial and domestic applications

CO3: Choose an appropriate method of speed control and braking for the drive motors

CO4: Understand the concepts of synchronous motors

CO5: Understand the manufacturing concepts in machines

UNIT I : DC MOTORS **(9)**

Construction and working principle, emf equation, torque equation, starting and running characteristics, speed control, braking, duty of operation, choice of motors.

UNIT II : TRANSFORMERS **(9)**

Construction and working principle, equivalent circuit, regulation and efficiency, autotransformers, industrial applications – welding transformer and furnace transformer.

UNIT III : THREE PHASE INDUCTION MACHINES **(9)**

Construction and working principle. Induction motors - torqueequation, torque–slip characteristics, starting and running characteristics, speed control, braking, choice of motor for industrial applications and traction.

UNIT IV : SYNCHRONOUS MACHINES **(9)**

Construction, principle of operation and types, various types of excitation systems, stand alone and grid connected modes of operation, voltage and frequency control.

UNIT V : FRACTIONAL HORSE POWER MACHINES **(9)**

Factory Automation: Flexible Manufacturing Systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection – Computer Integrated Manufacture – CNC - Intelligent automation - Industrial networking, - Bus standards - HMI Systems - DCS and SCADA - Wireless controls.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. D.P.Kothari and I.J.Nagrath, 'Electric Machines', McGraw Hill Education Private Limited, 4th ed, 2010.
2. Ashfaq Husain, 'Electric machines', Dhanpat Rai & Company, 2nd ed, 2002.

REFERENCES:

1. Gopal K. Dubey, 'Fundamentals of Electrical Drives', Narosa publishing house, 2nd ed, 2011.
2. A Fitzgerald , Charles Kingsley , Stephen Umans, 'Electric Machinery', McGraw Hill Education Private Limited, 6th ed, 2002.
3. K. Murugesh Kumar, 'Induction & Synchronous Machines', Vikas Publishing House Pvt Ltd., 2009.
4. Edward Hughes, 'Electrical and Electronic Technology', Dorling Kindersley (India) Pvt. Ltd., 10th ed, 2011.

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x			x
2		x			x	x	x					
3		x						x	x			
4		x			x	x		x	x			
5		x						x				

15EEZ04 WIND AND SOLAR ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

(Common to All Branches except EEE branch)

OBJECTIVE:

- To familiarize the students with basics of solar and wind energy systems and various techniques for the conversion of solar and wind energy into electrical energy.

COURSE OUTCOMES:

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

CO1: Describe the solar radiation, measurements and characteristics of solar PV cell.
CO2: Develop the model of a PV system and its applications.
CO3: Describe the basic types and mechanical characteristics and model of wind turbine.
CO4: Analyze the electrical characteristics and operation of various wind-driven electrical generators.
CO5: Understand various power electronic converters used for hybrid system.

UNIT I INTRODUCTION TO SOLAR (9)

Basic characteristics of sunlight – solar spectrum – insolation specifics– irradiance and irradiation pyranometer – solar energy statics- Solar PV cell – I-V characteristics –P-V characteristics– fill factor- Modeling of solar cell– maximum power point tracking.

UNIT II PHOTO VOLATIC (9)

PV module – blocking diode and bypass diodes– composite characteristics of PV module – PV array– PV system –PV-powered fan–PV fan with battery backup – PV-powered pumping system – PV powered lighting systems–grid- connected PV systems.

UNIT III WIND ENERGY (9)

Wind source–wind statistics-energy in the wind –turbine power characteristics - aerodynamics – rotor types – parts of wind turbines– braking systems–tower- control and monitoring system.

UNIT IV GENERAL CHARACTERISTICS OF INDUCTION GENERATORS (9)

Grid-connected and self-excited systems – Steady state equivalent circuit - Performance predetermination – Permanent magnet alternators: steady-state performance.

UNIT V HYBRID SYSTEMS (9)

Power electronic converters for interfacing wind electric generators – Power quality issues - Wind-diesel systems – Wind-solar systems.

TOTAL = 45 PERIODS

TEXT BOOKS:

1. S N Bhadra, S Banerjee and D Kastha, 'Wind Electrical Systems', Oxford University Press, 1st Edition, 2005.
2. Chetan Singh Solanki, 'Solar Photovoltaics: Fundamentals, Technologies and Applications' PHI Learning Publications, 2nd Edition, 2011.

REFERENCES:

1. Roger A. Messenger and Jerry Ventre, "Photovoltaic Systems Engineering", Taylor and Francis Group Publications, 2nd Edition, 2003.
2. M. Godoy Simoes and Felix A. Farret, "Alternative Energy Systems: Design and Analysis with Induction Generators", CRC Press, 2nd Edition, 2008.
3. Ion Boldea, 'The Electric Generators Handbook- Variable Speed Generators', CRC Press, 2010.
4. Bin Wu, Yongqiang Lang, Navid Zargari, Samir Kouro, "Power Conversion and Control of Wind Energy Systems", IEEE Press Series on Power Engineering, John Wiley & Sons, 2011.
5. S. Sumathi,L. Ashok Kumar,P. Surekha ,'Solar PV and Wind Energy Conversion Systems', Springer 2015.

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x			x					x			x
2		x			x			x		x		
3					x							x
4	x							x		x		
5	x		x		x			x		x		

15EIZ01 AUTOTRONIX

(Common to ALL Branches Except EIE)

L	T	P	C
3	0	0	3

OBJECTIVE:

This course focuses on the extent and nature of electronic circuitry in automotive systems including monitoring and control circuits for engines, emission control system, ignition systems and fuel systems. The course imparts applications of sensors on automotive systems .

COURSE OUTCOMES:

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

CO1: Understand the application of electronics in automotive industry.
CO2: Identify different control systems in automotives and their control.
CO3: Design and implement various control algorithms in automotives.
CO4: Demonstrate different instrumentation systems in automotives.
CO5: Identify, formulate and solve real time engineering problems.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (9)

Electronic Engine Management System – Components – Open and Closed Loop Control Strategies – PID Control – Look Up Tables – Introduction – Modern Control Strategies Like Fuzzy Logic and Adaptive Control – Controlled Parameters – SI and CI Engines.

UNIT II SENSORS AND ACTUATORS (9)

Introduction – Basic Sensor Arrangement – Types Of Sensors – Hall Effect Sensor – Hot Wire Anemometer – Thermistor – Piezo-Electric Sensor – Piezo-Resistive Sensors – Oxygen Concentration Sensor – Lambda Sensor – Crankshaft Angular Position Sensor – Cam Position Sensor – Mass Air Flow (MAF) Rate – Manifold Absolute Pressure (MAP) – Throttle Plate Angular Position – Engine Oil Pressure Sensor – Vehicle Speed Sensor – Stepper Motors – Relays – Detonation Sensor – Emission Sensors.

UNIT III SPARK IGNITION ENGINE MANAGEMENT (9)

Feedback Carburetor System – Throttle Body Injection – Multi Point Fuel Injection System – Injection System Controls –Advantage of Electronic Ignition Systems – Three Way Catalytic Converter – Conversion Efficiency Versus Lambda – Group and Sequential Injection Techniques – Fuel System Components – Advantages of Electronic Ignition Systems – Solid State Ignition Systems – Principle Of Operation – Types – Contact Less Electronic Ignition System – Electronic Spark Timing Control.

UNIT IV COMPRESSION IGNITION ENGINE MANAGEMENT (9)

Fuel Injection System – Parameters Affecting Combustion – Noise and Emissions in CI Engines – Pilot, Main, Advanced – Post Injection and Retarded Post Injection – Electronically Controlled Unit Injection System – Layout of the Common Rail Fuel Injection System – Fuel Injector – Fuel Pump – Rail Pressure Limiter – Flow Limiter – Working Principle – EGR Valve Control in Electronically Controlled Systems.

UNIT V DIGITAL ENGINE CONTROL SYSTEM (9)

Open Loop and Closed Loop Control System – Engine Cooling and Warm Up Control – Idle Speed Control – Acceleration and Full Load Enrichment – Deceleration Fuel Cut-off – Fuel Control Maps – Open Loop Control of Fuel Injection – Closed Loop Lambda Control – Exhaust Emission Control – On Board Diagnostics: Diagnostics – Future Automotive Electronic Systems.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Arthur Primrose Young, Leonard Griffiths, “Automobile Electrical and Electronic Equipment: Theory and Practice for Students, Designers, Automobile Electricians and Motorists”, London Butterworths, Ninth Edition, 1986.
2. William Ribbens, “Understanding Automotive Electronics: An Engineering Perspective”, Butterworth-Heinemann, Seventh Edition, 2013.

REFERENCES:

1. Allan Bonnick, “Automotive Computer Controlled Systems” Taylor & Francis, Fifth Edition, 2001.
2. Tom Denton, “Automobile Electrical and Electronics Systems”, Butterworth- Heinemann, Fourth Edition, 2004.
3. Robert Bosch GmbH and Horst Bauer, “Gasoline-Engine Management”, Bentley Publishers, Second Edition, 2006.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x	x				
2						x	x		x			
3	x		x	x		x	x					
4	x	x									x	
5			x	x		x	x					

15EIZ02 FIBER OPTIC SENSORS
(Common to ALL Branches Except EIE)

L	T	P	C
3	0	0	3

OBJECTIVE:

- This course introduces fundamental physical principles of both classical and modern optics as well as principles of optical design used in the engineering of optical systems.
- The course also provides exposure to practical aspects of optical materials and devices.
- The intention of the course is to provide foundation of basic principles, design methodology, and practical considerations needed to design or use optical and laser instruments in engineering practice.

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of optical fibres and their properties.
CO2: Have adequate knowledge about the Industrial applications of optical fibres.
CO3: Relate and identify different types of lasers and their applications.
CO4: Demonstrate industrial applications of lasers.
CO5: Understand holography and medical applications of laser.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES (9)

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES (9)

Fibre optic sensors–Fibre optic instrumentation system – Different types of modulators –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS (9)

Fundamental characteristics of lasers –Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS (9)

Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS (9)

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumours of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOKS:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 2009.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

REFERENCES:

1. Donald J.Sterling Jr, 'Technicians Guide to Fibre Optics', 3rd Edition, Vikas Publishing House, 2000.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Read, 'Industrial Applications of Lasers', Academic Press, 2004.
4. Monte Ross, 'Laser Applications', McGraw Hill, 2008
5. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 2003.
6. Mr. Gupta, 'Fiber Optics Communication', Prentice Hall of India, 2004.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x	x				
2						x	x		x			
3	x		x	x		x	x					
4	x	x									x	
5			x	x		x	x					

Approved by Seventh Academic Council

15EIZ03 INDUSTRIAL AUTOMATION
(Common to ALL Branches Except EIE)

L	T	P	C
3	0	0	3

OBJECTIVE:

- This course produces students who can use their multidisciplinary skills to meet growing demand from an industry that is pushing the limits of technology by exploiting the growing convergence of these fields.
- The course aims to provide knowledge on fundamentals of robots, robot programming, and its vision system and apply to demonstrate their knowledge in real time application.

COURSE OUTCOMES:

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

CO1: Demonstrate the concepts of robotic principles and various robot configurations.
CO2: Develop solutions for the robot position and orientation for given application.
CO3: Identify the appropriate configuration for the application.
CO4: Design intelligence systems incorporating real time data capturing using vision systems.
CO5: Understand robotic programming and develop simple robotic systems.

UNIT I BASIC CONCEPTS (9)

Definition and origin of robotics –different types of robotics–various generations of robots –degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II POWER SOURCES AND SENSORS (9)

Hydraulic, pneumatic and electric drives–determination of HP of motor and gearing ratio–variable speed arrangements –path determination –micro machines in robotics–machine vision–ranging –laser –acoustic–magnetic, fiber optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS (9)

Construction of manipulators–manipulator dynamics and force control–electronic and pneumatic manipulator control circuits–end effectors–U various types of grippers–design considerations.

UNIT IV KINEMATICS AND PATH PLANNING (9)

Solution of inverse kinematics problem–multiple solution jacobian work envelop–hill climbing Techniques – robot programming languages

UNIT V CASE STUDIES (9)

Mutiple robots–machine interface–robots in manufacturing and non-manufacturing applications –robot cell design–selection of robot.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Industrial Robotics (SIE): Technology, Programming and Applications Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger Nagel, Ashish Dutta , Mcgrawhill, 2012.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1999.

REFERENCES:

1. S.R. Deb, Robotics technology and flexible Automation, John Wiley, USA 1992.
2. C.R. Asfahl., Robots and manufacturing Automation, John Wiley, USA 1992.
3. R.D. Klafter, T.A. Chimielewski, M. Negin, Robotic Engineering –An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. P.J. Mc Kerrow, Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x	x				
2						x	x		x			
3	x		x	x		x	x					
4	x	x									x	
5			x	x		x	x					

15EIZ04 ULTRASONIC INSTRUMENTATION
(Common to ALL Branches Except EIE)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To know the generation and detection of ultrasonic waves and to provide knowledge on the concepts of Ultrasonic Instrumentation.

COURSE OUTCOMES:

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

CO1: Understand the applications of ultrasonic instrumentation
CO2: Characterize the ultrasonic waves
CO3: Analyze the sensors used in ultrasonic application
CO4: Apply the concepts to make simple applications
CO5: Model and analyze ultrasonic systems.

UNIT I ULTRASONIC WAVE CHARACTERISTICS (9)

Principles and propagation of various waves, Characterization of ultrasonic transmission, Reflection and Transmission coefficients, Intensity and attenuation of sound beam.

UNIT II GENERATION/DETECTION OF ULTRASONIC WAVES (9)

Magnetostrictive and piezoelectric effects, Detection of Ultrasonic Waves: Mechanical, Optical and Electrical Method, Precise Measurement: Pulse– echo Overlap, Cross correlation

UNIT III ULTRASONIC TEST METHODS (9)

Ultrasonic test methods: pulse echo, transit time, resonance, direct contact and immersion type and ultrasonic methods of flaw detection.

UNIT IV ULTRASONIC MEASUREMENTS (9)

Ultrasonic measurements: ultrasonic methods of measuring thickness, depth and flow, variables affecting ultrasonic testing in various applications.

UNIT V ULTRASONIC APPLICATIONS (9)

Ultrasonic methods of flaw detection, Flow meters, Density measurement, Viscosity measurement, Level measurement, Sensor for Temperature and Pressure measurements, Measuring thickness, Depth, Rail Inspection, SONAR, Inspection of Welds and defect detection in welds

TOTAL :(L: 45) = 45 PERIODS

TEXTBOOKS:

1. Baldev Raj, V.Rajendran, P.Palanichamy, “Science and Technology of Ultrasonics”,Alpha Science International, UK, 2004.
2. LawrenceE.Kinsler, Austin R.Frey, Alan B.Coppens, James V. Sanders, “Fundamentals of Acoustics,” John Wiley and Sons Inc,USA, 2000.

REFERENCES:

1. J.David N.Cheeke,”Fundamentals and Applications of Ultrasonic Waves,” CRC Press, Florida, 2002
2. L.A. Bulavin, YU.F.Zabashta, “Ultrasonic Diagnostics in Medicine,” VSP, Koninklijke, Brill,Boston, 2007.
3. Emmanuel P. Papadakis, “Ultrasonic Instruments and Devices”Academic Press,1999.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1				x			x	x				
2						x	x		x			
3	x		x	x		x	x					
4	x	x									x	
5			x	x		x	x					

15ITZ01 - PC HARDWARE AND TROUBLE SHOOTING

(Common to All branches except IT Branchs)

L	T	P	C
3	0	0	3

OBJECTIVE:

- This course will provide participant a much needed knowledge of computer hardware and networking, enabling them to identify and rectify the onboard computer hardware, software and network related problems.
- Upgrading of existing hardware / software as and when required. The main aspect of this program is to eliminate cost for the computer engineer boarding the vessel for troubleshoot, install / configure the application program and network related problems and there by charging exorbitant fees to ship owners / managers.

COURSE OUTCOMES:

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

CO1: Disassemble and reassemble a working computer Handle and repair

CO2 : Establish a local computer network & Load and configure a working Windows Operating System

CO3 : Make minor repairs and upgrades to a laptop computer& evaluate a computer system for individual customers, making suggestions to optimize the system for the individual

CO4 : Implement the design using Objective C and Ios

CO5 : Configure the power management features on a computer system, Troubleshoot, configure and repair printers.

UNIT I INTRODUCTION (9)

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers - Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II PERIPHERAL DEVICES (9)

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III PC HARDWARE OVERVIEW (9)

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE (9)

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V TROUBLESHOOTING (9)

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOK:

1. B. Govindarajalu, "IBM PC Clones Hardware, Troubleshooting and Maintenance", 2/E, TMH, 2002.

REFERENCES:

1. Peter Abel, Niyaz Nizamuddin, “IMB PC Assembly Language and Programming”, Pearson Education, 2007.
2. Scott Mueller, “Repairing PC's”, PHI,1992

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
1							x	x	x		x	
2				x								
3		x							x			
4		x		x			x			x	x	
5		x	x		x		x	x			x	

15ITZ02 - CYBERCRIME INVESTIGATIONS AND DIGITAL FORENSICS

(Common to All branches except IT Branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To give knowledge of constitutional and case law to search and capture digital evidence, determine the most effective and appropriate forensic response strategies to digital evidence, and provide effective proof in a case involving digital evidence.

COURSE OUTCOMES:

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

CO1: To have various ideas about cybercrime.

CO2: To have knowledge of the various issues of cybercrime.

CO3 : To investigate and find the cybercrime.

CO4: To identify the cybercrime.

CO5: To have clear idea of the various laws and acts.

UNIT I INTRODUCTION **(9)**

Introduction and Overview of Cyber Crime - Nature and Scope of Cyber Crime - Types of Cyber Crime: Social Engineering - Categories of Cyber Crime - Property Cyber Crime.

UNIT II CYBER CRIME ISSUE **(9)**

Unauthorized Access to Computers - Computer Intrusions - White collar Crimes - Viruses and Malicious Code - Internet Hacking and Cracking - Virus Attacks – Software Piracy - Intellectual Property - Mail Bombs - Exploitation - Stalking and Obscenity in Internet - Digital laws and legislation - Law Enforcement Roles and Responses.

UNIT III INVESTIGATION **(9)**

Introduction to Cyber Crime Investigation - Investigation Tools – Discovery - Digital Evidence Collection - Evidence Preservation - E-Mail Investigation – Tracking - IP Tracking - E-Mail Recovery - Hands on Case Studies - Encryption and Decryption Methods - Search and Seizure of Computers - Recovering Deleted Evidences - Password Cracking.

UNIT IV DIGITAL FORENSICS **(9)**

Introduction to Digital Forensics - Forensic Software and Hardware - Analysis and Advanced Tools - Forensic Technology and Practices - Forensic Ballistics and Photography - Face, Iris and Fingerprint Recognition - Audio Video Analysis - Windows System Forensics - Linux System Forensics - Network Forensics.

UNIT V LAWS AND ACTS **(9)**

Laws and Ethics - Digital Evidence Controls - Evidence Handling Procedures - Basics of Indian Evidence ACT IPC and CrPC - Electronic Communication Privacy ACT - Legal Policies.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Nelson Phillips and Enfinger Steuart, —Computer Forensics and Investigationsll, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, —Incident Response and Computer Forensics —Tata McGraw - Hill, New Delhi, 2006.

REFERENCES:

1. Robert M Slade, Software Forensics , Tata McGraw Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, —Cybercrime, ABC – CLIO Inc, California, 2004.
3.Understanding Forensics in IT — NIIT Ltd, 2005.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
1							x	x	x			
2				x			x		x			
3						x			x			
4				x		x				x	x	
5			x		x		x	x			x	

15ITZ03 - DEVELOPING MOBILE APPS

(Common to All branches except IT Branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- Understand system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks.
- Generate mobile application design.
- Implement the design using specific mobile development frameworks.
- Deploy the mobile applications in marketplace for distribution.

.

COURSE OUTCOMES:

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

CO1: Describe the requirements for mobile applications

CO2: Explain the challenges in mobile application design and development

CO3: Implement the design using Android SDK

CO4: Implement the design using Objective C and iOS

CO5: Deploy mobile applications in Android and iPone marketplace for distribution

UNIT I INTRODUCTION **(9)**

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II BASIC DESIGN **(9)**

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN **(9)**

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV TECHNOLOGY I - ANDROID **(9)**

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V TECHNOLOGY II - IOS **(9)**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOKS:

1. http://developer.android.com/develop/index.html.

2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

REFERENCES:

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech,2012
2. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
1								x				
2					x		x					
3		x				x			x			
4				x		x		x		x	x	
5			x		x		x	x			x	

15ITZ04 - SOFTWARE PROJECT MANAGEMENT

(Common to All branches except IT Branch)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
- To understand successful software projects that support organization's strategic goals.

.

COURSE OUTCOMES:

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

CO1: Evaluate and select the most desirable projects & Identify desirable characteristics of effective project managers.

CO2: Apply appropriate approaches to plan a new project.

CO3: Apply appropriate methodologies to develop a project schedule.

CO4: Develop a suitable budget for a new project & Identify important risks facing a new project.

UNIT I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT (9)

Project Definition – Contract Management – Activities Covered By Software Project Management – Overview Of Project Planning – Stepwise Project Planning.

UNIT II PROJECT EVALUATION (9)

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT III ACTIVITY PLANNING (9)

Objectives – Project Schedule – Sequencing and Scheduling Activities –NetworkPlanning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT IV MONITORING AND CONTROL (9)

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Priortizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT V MANAGING PEOPLE AND ORGANIZING TEAMS (9)

Introduction – Understanding Behavior – Organizational Behaviour: A Background –Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation– The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress – Health And Safety – Case Studies.

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOK:

1. Bob Hughes, Mikecotterell, “Software Project Management”, Third Edition, Tata McGraw Hill, 2004.

REFERENCES:

1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Royce, “Software Project Management”, Pearson Education, 1999.
3. Jalote, “Software Project Management in Practice”, Pearson Education, 2002.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
1	x							x	x			
2			x				x					
3		x				x			x			
4	x			x				x		x	x	
5			x		x		x	x			x	

Approved by Seventh Academic Council

15MEZ01 SIX SIGMA

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the techniques and phases of six sigma
- To acquire knowledge on design for six sigma during product development stage
- To introduce the lean concepts in service sectors

COURSE OUTCOMES:

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

CO1: Formulate the six sigma project definition for process improvement in an industry
CO2: Summarize the stages in preparation of technical requirements and team formation
CO3: Create a project definition document and/or assess the process condition through collected data
CO4: Apply the six sigma tools the analyze the process parameters and/or identify the scope for process improvement
CO5: Recommend a system to sustain the results and/or list the tools in design for six sigma and lean servicing

UNIT I : INTRODUCTION **(9)**

Overview of Six Sigma and Lean Manufacturing - 6 sigma, TQM & MBNQA - common terms - organizational success factors - leadership, strategic initiative - internal communication - launching of 6 sigma - organizational structure - six sigma training plan - project selection - assessing organizational readiness - common pitfalls - work as a process - vertical functions and horizontal processes.

UNIT II : PREPARATION PHASE **(9)**

Voice of the customer - importance, identify the customer, collect VOC data, Critical-to-Quality customer requirements - project management - challenges - project culture - project management processes - team typing-team stages - understanding team dynamics - forming, storming, norming, performing, characteristics of effective teams.

UNIT III : DEFINE AND MEASURE PHASE **(9)**

DMAIC Phases - define phase overview - project charter - voice of the customer - high level process map - project team - measure phase overview - statistical methods - normal distribution - Population Parameters Vs Sample Statistics - sampling plan - data collection plan - choosing statistical software - measure tools - measurements - cost of poor quality - probability distributions - measurement system analysis - Process Capability.

UNIT IV: ANALYZE AND IMPROVE PHASE **(9)**

Overview - process analysis - hypothesis testing - statistical tests and tables - tools for analyzing relationships among variables - survival analysis - improve phase overview - process redesign - generating improvement alternatives - design of experiments - pilot experiments - Cost/Benefit Analysis - implementation plan - card one case study improve phase results.

UNIT V : CONTROL PHASE, DESIGN FOR SIX SIGMA AND LEAN SERVICING **(9)**

Control phase overview - control plan - process scorecard - failure mode and effects analysis - SPC Charts - final project report and documentation - design for six sigma overview - DFSS Tools - Quality Function Deployment - TRIZ - Lean Production Overview - lean servicing concepts - getting started with lean - continuous flow production.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Michael L George, David T Rowlands, and Bill Kastle, “What is Lean Six Sigma”, McGraw Hill, New York, 2004
2. Betsi Harris Ehrlich, “Transactional Six Sigma and Lean Servicing”, St. Lucie Press, 2002.

REFERENCES:

1. Kai Yang and Basem El Haik, “Design for Six Sigma”, McGraw Hill, New York, 2004
2. Thomas Pyzdek, “Six Sigma Handbook: Complete Guide for Green belts, Black belts and Managers at All Levels”, Tata McGraw Hill Companies Inc, 2003
3. Donald W Benbow and Kubiak T M, “Certified Six Sigma Black Belt Handbook”, Pearson Education, 2007
4. Urdhwarashe, “Six Sigma for Business Excellence”, 1st ed., Pearson Education India, 2010
5. Gopalakrishnan. N, “Simplified Six Sigma: Methodology, Tools and Implementation, Prentice Hall India, 2012.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x						x			x
2	x	x	x		x		x		x		x	x
3	x	x	x		x		x		x		x	x
4	x	x	x	x	x		x		x		x	x
5	x	x	x	x	x		x		x		x	x

15MEZ02 PROJECT MANAGEMENT
(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To gain knowledge about project, project management and its basics
- To know stages of project management in an organization
- To understand the roles and responsibilities of a project manager

COURSE OUTCOMES:

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

CO1: Demonstrate the skill set of a project manager
CO2: Develop skills in managing project works by effective team building
CO3: Strategize proper plan and premeditate the risks related to projects
CO4: Phase the project work as various stages and develop skills to control the project
CO5: Apply project management concepts by identifying and carrying out a real time project

UNIT I : PROJECTS, PROJECT MANAGEMENT AND PROJECT MANAGER (9)

Project Management - process context - interpersonal and behavioral context - organizational context - defining project success - responsibilities of project manager - common challenges expected to face - skill requirements and functional competencies - unofficial job duties - value of introspection and self-awareness to the soft side

UNIT II : PROJECT DEFINITION, EFFECTIVE TEAM BUILDING (9)

Evolution of projects - understanding the problem - identification of optimum solution - development of solution and preliminary plan - formal launching of project - evaluation of political environment - mechanics of building a team - team leadership - fostering teamwork and synergism - getting the most from team members

UNIT III : PROJECT PLANNING, RISK AND UNCERTAINTY (9)

Project Planning - estimating - scope management - time management - cost management - project management software - understanding risk and uncertainty - managing risk - identifying what can hurt you - quantifying how badly you can get hurt - analyzing the biggest threats - responding to high-threat problems - accommodating uncertainty

UNIT IV: PROJECT CONTROL AND INTERFACES (9)

Project Control - Establishing a Baseline of Measurement - Information Needs - Information Gathering - ensuring Good Information - Analyzing the Information - Reacting to the Information - Project Interfaces - Roles of Internal Stakeholders and External Stakeholders - Other Interfaces - Considerations in Interface Management

UNIT V : PROJECT COMMUNICATION, DOCUMENTATION AND CONCLUSION (9)

Configuration plan - documentation and communication road map - methods of communicating - guidelines for effective communication - conducting high quality meetings - communication skills - key project documentation - early termination - key elements in project closure - punch list approach - project completion checklist

TOTAL (L:45) : 45 PERIODS

TEXTBOOKS:

1. Gary R. Heerkens, "Project Management", 2nd ed., McGraw-Hill Book Company, 2013

REFERENCES:

1. Harold Kerzner, "Project Management", 12th ed., John Wiley & Sons, 2017
2. John M Nicholas, Herman Steyn, "Project Management for Engineering, Business and Technology", 5th ed., Taylor&Francis, 2016
3. Prasanna Chandra, "Projects : Planning, Analysis, Selecting, Financing, Implementation and Review", 8th ed., McGraw Hill Education, 2017
4. Eric W Larson and Clifford F Gray, Gautam V Desai, "Project Management: The Managerial Process", 6thed., McGraw Hill Education, 2017

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x			x			x			x
2	x		x		x		x		x		x	x
3	x		x		x		x		x		x	x
4	x	x	x	x	x		x		x		x	x
5	x	x	x	x	x		x		x		x	x

15MEZ03 ELECTRIC VEHICLE TECHNOLOGY

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the working principles of batteries and their types
- To acquire knowledge on applications of alternative energy sources in vehicles
- To introduce the electrical drives, mathematical modeling and design considerations

COURSE OUTCOMES:

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

CO1: Differentiate the types of batteries which are used in electrical vehicles
CO2: List the types of alternative energy sources and/or working principles of fuel cells
CO3: Assess the potential of hydrogen energy in vehicles and energy storage techniques
CO4: Recommend an electrical drive and its controller in vehicular applications
CO5: Explain the concepts of electric vehicle modeling and design aspects

UNIT I : INTRODUCTION AND BATTERIES (9)

Types of electric vehicle - battery parameters - lead acid batteries - nickel based batteries - battery charging - designer‟s choice of battery - use of batteries in hybrid vehicles - battery modelling.

UNIT II : ALTERNATIVE ENERGY SOURCES AND FUEL CELLS (9)

Solar photovoltaics - wind power - flywheels - super capacitors - supply rails - hydrogen fuel cells - fuel cell thermodynamics - connecting cells in series - water and thermal management in PEM fuel cell.

UNIT III : HYDROGEN SUPPLY AND STORAGE (9)

Introduction - fuel reforming - fuel cell requirements, steam reforming, partial oxidation and autothermal reforming, further fuel processing, mobile applications - storage as hydrogen - chemical methods.

UNIT IV: ELECTRIC MACHINES AND CONTROLLERS (9)

Brushed DC electric motor - DC regulation and voltage conversion - brushless electric motors - motor cooling, efficiency, size and mass - electrical machines for hybrid vehicles.

UNIT V : ELECTRIC VEHICLE MODELLING AND DESIGN CONSIDERATIONS (9)

Introduction - tractive effort - modelling vehicle acceleration and electric vehicle range - simulations - aerodynamic considerations - rolling resistance - transmission efficiency - vehicle mass - general issues

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd., 2015
2. Iqbal Husain, “Electric and Hybrid Vehicles”, 2nd ed., CRC Press, 2010.

REFERENCES:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles”, 2nd ed., CRC Press 2009
2. Chau.K.T, “Electric vehicle machines and drives”, Wiley-IEEE Press, 2015
3. James D Halderman, “Hybrid and Alternative Fuel Vehicles”, 3rd Revised edition, Pearson Education, 2012
4. Jingyu Yan , Huihuan Qian , Yangsheng Xu, “Hybrid Electric Vehicle Design and Control”, McGraw-Hill Professional Publishing, 2013
5. Chris Mi; M. Abul Masrur and David Wenzhong Gao, “Hybrid Electric Vehicles”, John Wiley & Sons, 2011

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x		x		x		x				x	x
2	x		x		x		x				x	x
3	x		x		x		x				x	x
4	x		x		x		x				x	x
5	x		x		x		x				x	x

15MEZ04 VALUE ENGINEERING

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concept of value engineering for eliminating the unnecessary costs of a product
- To acquire knowledge on various value engineering techniques, team dynamics and job plan
- To introduce the financial aspects and human factors of value engineering

COURSE OUTCOMES:

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

CO1: Estimate the value of a product and/or identify the primary and secondary functions of a product
CO2: Determine the cost, worth of a product and their elements
CO3: Demonstrate the value engineering techniques for industrial applications
CO4: Summarize the stages in team dynamics and value engineering job plan
CO5: Illustrate the financial aspects and human factors of value engineering

UNIT I : VALUE AND FUNCTION (9)

Seven types values - economic value - cost, use, esteem and exchange values - mathematical model of value - types and levels of functions - function identification - method of finding functions of a product - case study - vocabulary of verbs and nouns.

UNIT II : COST AND WORTH (9)

Cost and price - elements of cost - direct material, direct labour, direct expenses, overheads - calculation of cost - case study - method of determining function cost - evaluation of worth - guidelines to find out worth - value gap and value index.

UNIT III : VALUE ENGINEERING TECHNIQUES (9)

Brainstorming and Gordon techniques - feasibility ranking - morphological analysis technique - ABC analysis - probabilistic approach - make or buy - function-cost-worth analysis - FAST - weighted evaluation method - evaluation matrix - life cycle cost.

UNIT IV: TEAM DYNAMICS AND JOB PLAN (9)

Team structure - team building - physical, intellectual, spiritual transformations - job plan - orientation phase - information phase - function phase - creative phase - evaluation phase - recommendation phase - implementation phase - audit phase.

UNIT V : FINANCIAL ASPECTS AND HUMAN RELATION (9)

Break-even point - payback period - return on investment - discounted cash flows - balance sheet and profit and loss account - human aspects in value engineering - individual ego states - techniques of transactions - human interactions - Managerial grid

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Mukhophadhyaya A K, "Value Engineering", Sage Publications Pvt. Ltd., New Delhi, 2003
2. Mukhophadhyaya A K, "Value Engineering Mastermind", Sage Publications Pvt. Ltd., New Delhi, 2009

REFERENCES:

1. Richard J Park, "Value Engineering - A plan for inventions", St.Lucie Press, London, 1998.
2. Iyer. S. S, "Value Engineering: A How to Manual", 3rd ed., New age publishers, 2009
3. Larry W Zimmesman. P E , "VE - A Practical approach for owners designers and contractors", 1st ed., CBS Publishers, Delhi, 1992
4. Theodore C. Fowler, "Value Analysis in Design", John Wiley & Sons, 1997
5. Arthus E Mudge, "Value Engineering", McGraw Hill book company, 1971

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x			x				x			x
2	x	x			x				x		x	x
3	x	x			x				x		x	x
4	x	x			x				x		x	x
5	x	x			x				x		x	x

15MYZ01- MATHEMATICAL STRUCTURES

(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basic concepts of logic and their applications.
- To give you a familiarity with rigour and a grounding in the art of formal reasoning.
- To understand the concepts of sets and relations.
- To understand basic concepts of functions.
- To understand the characteristic of a group and the coset

.

COURSE OUTCOMES:

At the end of this course, the students would know

CO1 : To extend the logical and mathematical ability to deal with abstraction.
CO2 : Be aware of counting principle
CO3 : Exposed to concepts and properties of set theory
CO4 : Identify and analyze the basic proofs involving functions.:
CO5 : Be exposed to concepts and properties of algebraic structures such as Semi groups

UNIT I - PROPOSITIONAL CALCULUS **(9)**

Propositions - Logical connectives-Compound propositions - Conditional and biconditional propositions - Truth tables - Tautologies and Contradictions - Logical and Equivalences and implications - DeMorgan's Laws - Normal forms

UNIT II – PREDICATE CALCULUS **(9)**

Predicates - Statement Function – Variables - free and bound variables – Quantifiers - Universe of discourse -Logical equivalences and implications for quantified statements

.

UNIT III – SET THEORY **(9)**

Cartesian product of sets- Relations of sets-Types of relations and their properties – Relational matrix and the graph of a relation- Equivalence relations – Partial ordering – Poset – Hasse diagram.

UNIT IV – FUNCTIONS **(9)**

Definition – Classification of functions – Composition of functions – Inverse functions – Binary and n-ary operations – Characteristic function of a set..

.

UNIT V – ALGEBRAIC STRUCTURES **(9)**

Algebraic systems - Semi groups and monoids - Groups – Subgroups - Homomorphisms – Normal subgroup and coset – Lagrange's theorem..

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. **Tremblay J.P and Manohar R**, "Discrete Mathematical Structures with Applications to Computer Science" ,Tata McGraw-HILL, New Delhi, ,30th Reprint 2011.
2. **Veerarajan.T,** "Discrete Mathematics with Graph Theory and Combinatorics", Fourth Edition, Tata McGraw Hill , New Delhi, Reprint 2013.

REFERENCES:

1. **Kenneth H.Rosen**, "Discrete Mathematics and its Applications", Fifth Edition, Tata McGraw- Hill publications, New Delhi 2012.
2. **Venkatraman M.K.,** "Discrete Mathematics", The National Publishing Company, Chennai,2007.

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Mapping of COs and POs												
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	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x									
2	x	x		x								x
3	x		x				x					
4	x	x					x		x			
5	x	x	x								x	

Approved by Seventh Academic Council

15MYZ02- OPTIMIZATION TECHNIQUES

(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide the concept and an understanding of basic concepts in Operations Research.
- To understand, develop and solve mathematical model of Transport and assignment problems.
- To understand, develop and solve mathematical model of linear programming problems.
- To provide Techniques for Analysis and Modeling in Computer Applications.
- To understand network modeling for planning and scheduling the project activities

COURSE OUTCOMES:

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

CO1 : Construct and solve linear programming models to answer business optimization
CO2 : Apply transportation and assignment models to find optimal solution in warehousing and Travelling.
CO3 : Prepare project scheduling using PERT and CPM.
CO4 : Appraise theoretical predictions obtained from Game Theory analyses against real world conflicts.
CO5 : Identify and analyze appropriate queuing model to reduce the waiting time in queue

.

UNIT I - LINEAR PROGRAMMING MODELS **(9)**

Mathematical Formulation - Graphical Solution of Linear Programming Models - Simplex Method - Big-M Method

UNIT II – TRANSPORTATION AND ASSIGNMENT MODELS **(9)**

Mathematical Formulation of Transportation Problem - Methods for Finding Initial Basic Feasible Solution: North West Corner Rule, Least Cost Method, VAM - Optimum solution – Mathematical Formulation of Assignment Models.

UNIT III – PERT AND CPM **(9)**

Network Construction – Critical Path Method – Project Evaluation and Review Technique

UNIT IV– GAME THEORY **(9)**

Definition - Pay-off - Two Person Zero - Sum Games -The Maximin - Minimax Principle - Games without Saddle Points (Mixed Strategies) - 2x2 Games without Saddle Points - Graphical Method for 2xn or mx2 Games.

UNIT V – QUEUING MODELS **(9)**

Characteristics of Queuing Models – Poisson Queues – (M/M/1): (FIFO/∞/∞), (M/M/1): (FIFO/N/∞), (M/M/C): (FIFO/∞/∞), (M/M/C) : (FIFO/N/∞) Models.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Taha, H.A. “Operations Research: An Introduction”, 8th Edition, Pearson Education, 2008.
2. V.Sundaresan, K.S.Ganapathy Subramanian, K.Ganesan, ”Resource Management Techniques”, A.R.Publication, 2002.

REFERENCES:

1. A .M. Natarajan, P. Balasubramani, A.Tamilarasi, “Operations Research” , Pearson Education, Asia, 2005.
2. Prem Kumar Gupta , D.S. Hira “Operations Research”, S. Chand & Company Ltd., New Delhi, Third Edition, 2003.
3. Manmohan .,Kandi swarp.,Gupta., “Operations Research”,Sultan Chand & Sons(first edition),New delhi.”.

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Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x								x
2	x	x					x		x		x	x
3	x	x	x			x					x	
4	x		x								x	x
5	x								x		x	x

15MYZ03- STATICS FOR ENGINEERS
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To Aware knowledge of parallel forces
- To know the concept of equilibrium of forces.
- To acquire the knowledge of moments and couples.
- To know resultant of co-planar forces acting on a rigid body.
- To learn the necessary and sufficient conditions of equilibrium.
-

COURSE OUTCOMES:

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

CO1 : Knowledge about different types of forces and their resultant
CO2 : To bring the polygon of forces to be in equilibrium.
CO3 : Moments and couples of parallel forces.
CO4 : To know about co-planar forces.
CO5 : Necessary and sufficient conditions to bring the equilibrium of forces.

UNIT I - TYPES OF FORCES **(9)**

Forces acting at a point – Parallelogram law – triangle law

UNIT II – EQUILIBRIUM OF FORCES **(9)**

(λ, μ) theorem – Polygon of forces – conditions of equilibrium.

UNIT III – MOMENTS AND COUPLES **(9)**

Parallel forces – Moments and couples composition of parallel forces (like and unlike).

UNIT IV – CO-PLANAR FORCES **(9)**

Moment of a force about a point – Varignons theorem – Co-planar forces acting on a rigid body – Theorem on three co-planar forces in equilibrium

UNIT V – REDUCTION OF A SYSTEM OF CO-PLANAR FORCES **(9)**

Reduction of a system of co-planar forces to a single force and a couple – necessary and sufficient conditions of equilibrium only – Equation to the line of action of the resultant.

TOTAL (L:45) : 45 PERIODS

TEXT BOOK:

1. M.K.Venkataraman, Statics, Agasthiar Publications, Trichy, 1999

REFERENCES :

1. A.V.Dharmapadam, Statics, S.Viswanathan Printers and Publishing Pvt., Ltd, 1993.

2 P.Duraipandian and Laxmi Duraipandian, Mechanics, S.Chand and Company Ltd, Ram Nagar, New Delhi-55,

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x		x			x		x	
2	x	x	x	x		x			x		x	
3	x	x	x	x		x			x		x	
4	x	x	x	x		x			x		x	
5	x	x	x	x		x			x		x	

15MYZ04- STATISTICS FOR ENGINEERS
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To assess the validity of statistical conclusions.
- To determine the outcomes and probabilities for experiments.
- To Understand how to develop Null and Alternative Hypotheses
- To understand difference between Parametric and Nonparametric Statistical Procedures.
- To estimate the relationships among variables

COURSE OUTCOMES:

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

CO1 : The fundamental knowledge of basic statistics and probability distribution concepts.
CO2 : Empirical distribution of sample means is closer to bell shaped when the size of the sample increases.
CO3 : The knowledge of test of Hypothesis as well as to calculate confidence limits for a given population parameter for single sample and two sample cases.
CO4 : Various methods of non parametric tests and concepts related to the testing of hypothesis.
CO5 : The application of correlation, regression and time series analysis in various aspects.

UNIT I INTRODUCTION TO STATISTICS **(9)**

Statistics – Definition, Types. Types of variables – Organizing data – Descriptive Measures: Mean, Median, Mode, Standard Deviation, Mean Deviation.

UNIT II INTRODUCTION TO PROBABILITY **(9)**

Basic definitions and rules for probability - conditional probability - independence of events - Probability distributions: Binomial, Poisson and Normal distributions.

UNIT III TESTING OF HYPOTHESIS **(9)**

Hypothesis testing: one sample and two sample tests for means and proportions of large samples(z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one way and two ways.

UNIT IV NON-PARAMETRIC METHODS **(9)**

Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Rank sum test. Kolmogorov – Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test.

UNIT V CORRELATION, REGRESSION AND TIME SERIES ANALYSIS **(9)**

Correlation analysis, estimation of regression line. Time series analysis: variations in time series, Trend analysis, Cyclical variations, seasonal variations and irregular variations (Self-study).

TOTAL :(L: 45) = 45 PERIODS

TEXT BOOKS:

1. Richard I.Levin, David S.Rubin, Statistics for Management, 7th Ed, 2011.
2. Aczel A.D. and Sounderpandian J., Complete Business Statistics 6th edition, Tata McGraw – Hill, Publishing company Ltd, New Delhi, 2012.

REFERENCES:

1. Srivatsava TN and Shailaja rego, Statistics for Management Tata McGraw Hill, 2008.
2. Ken Black, Business Statistics, 6th Ed., Wiley India Edition, 2009.
3. Anderson D.R. Sweeney D.J. and Williams T.A., Statistics for business and economics, 9th edition, Thomson (South- Western) Asia, Singapore, 2012.
4. N.D.Vohra, Business Statistics, Tata McGraw Hill, 2012.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x	x	x	x					x		x	
2	x	x	x		x	x	x			x	x	
3	x	x	x			x	x				x	
4	x	x	x	x					x	x	x	
5	x	x	x		x	x					x	

15PYZ01- NANOMATERIALS
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide basic knowledge about nanomaterials
- To understand the properties of nanomaterials and the mechanisms used in characterization
- To provide in-depth knowledge in characterization of nanomaterials in engineering and biology.
- To provide knowledge various testing mechanisms adopted for nanomaterials
- To understand the ways of full utilization of nanomaterials in various fields

COURSE OUTCOMES:

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

CO1 : Acquire knowledge of basics of nanomaterials
CO2 : Understand the peculiar properties of nanomaterials
CO3 : Know the various microscopy techniques involved in analysis of nanomaterials
CO4 : Understand the synthesis of different types of nanomaterials
CO5 : Appreciate the application of nanomaterials in engineering and biology

UNIT I - FUNDAMENTAL PRINCIPLES OF NANOMATERIALS **(9)**

Size & scale, units, scaling Laws, atoms, molecules & clusters, super molecules, nanoscale phenomena; Tunneling, Chemical Bonds (types and strength); Intermolecular forces, molecular and crystalline structures; Hierarchical structures and functionality; Surfaces and interfaces, bulk to surface transition, self-assembly and surface reconstruction.

UNIT II – PROPERTIES OF NANO MATERIALS **(9)**

Size dependence of properties, phenomena and properties at nanoscale; Mechanical/frictional, optical, electrical transport; Magnetic properties.

UNIT III – SYNTHESIS OF NANOMATERIALS **(9)**

Fabrication techniques: Self-assembly, self-replication, sol-gels; Langmuir-Blodgett thin films, nanolithograph, bio-inspired syntheses, microfluidic processes; Chemical vapor deposition; Semiconductors, cadmium sulfide, silicon, fullerenes carbon nanotubes; Nano-composites, nanoporous materials, biological materials.

UNIT IV –NANOMATERIAL CHARACTERIZATION **(9)**

Electron microscopy, scanning probe microscopies, near field microscopy, micro- and near field Raman spectroscopy, surface-enhanced Raman, spectroscopy, X-ray photoelectron spectroscopy.

UNIT V –APPLICATIONS OF NANOMATERIALS **(9)**

Nanoelectronics, Nanosensors, environmental, biological, energy storage and fuel cells.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1 Edelstein A. A. and Cammarata R .C., "Nanomaterials- Synthesis, Properties and Applications", Institute of Physics Publishing, 1998.
2 Nalwa H.S., "Handbook of Nanostructured Materials and Nanotechnology", Vols. 1- 5, Academic Press 2000.

REFERENCES:

1. Benedek et al G., "Nanostructured Carbon for Advanced Applications", Kluwer Academic Publishers 2001.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											
2	x											
3					x							
4	x				x							
5	x											

15PYZ02- NUCLEAR PHYSICS AND REACTORS
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide knowledge of building block of nature –Nuclei –and its interaction with light
- To provide knowledge about the various reactors and power generation
- To empower knowledge in core science of reactor designing.
- To provide the understanding of different types of reactors
- To provide understanding of effective methods to utilize the nuclear energy

COURSE OUTCOMES:

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

CO1 : Acquire knowledge regarding fundamentals of nuclear reactions
CO2 : Understand the interaction of light with matter
CO3 : Acquire the knowledge about power generation form nuclear reactions
CO4 : Understand the mechanisms involved in reactor designing
CO5 : Enhance knowledge of thermal energy generation and reactor safety

UNIT I - STRUCTURE OF NUCLEI AND REACTIONS **(9)**

Fundamental particles, structure of nuclei; Binding Energy – nuclear stability – radioactive decay-nuclear reactions

UNIT II – INTERACTION OF RADIATION WITH MATTER **(9)**

Neutron interactions- energy loss in scattering collisions. Nuclear fission reaction- gamma ray interaction with matter-charged particles.

UNIT III – NUCLEAR REACTOR AND NUCLEAR POWER **(9)**

Fission chain reaction – reactor fuels. Nuclear power resources- power plants –nuclear reactors

UNIT IV–NUCLEAR REACTOR THEROY **(9)**

One group reactor equation –slab reactor –thermal reactor –reflected reactor

UNIT V –HEAT REMOVAL FROM NUCLEAR REACTORS **(9)**

Heat generations in reactors – heat flow in reactors, heat transfer mechanism. Radiation shielding: Gamma ray shielding, nuclear reactor shielding.

TOTAL (L:45) : 45 PERIODS

TEXT BOOK:

1. Leroy Murray Raymond, :Nuclear Reactor Physics", Prentice Hall

REFERENCE:

1. R. Lamarsh John, J. Baratta Anthony, "Introduction to Nuclear Engineering".

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	**POs**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											
2			x		x							
3			x				x					
4	x				x							
5	x											

Approved by Seventh Academic Council

15PYZ03- SPACE SCIENCE AND TECHNOLOGY
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide basics of space technology
- To give a knowledge of Space transportation systems
- To provide the understanding of transportation and satellite communication
- To understand the various space programs undertaken by international organizations
- To provide knowledge of application of space technology and manned missions

COURSE OUTCOMES:

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

CO1 : Acquire knowledge about classical theory of satellite orbits.
CO2 : Understand the rocket transportation to space.
CO3 : Acquire the applications of satellite communication and navigation.
CO4 : Appreciate the applications of space technology changed human life.
CO5 : Understand the importance of manned mission.

UNIT I - EARTH AND ORBITING SATELLITES **(9)**

Basic principles -Keplerian orbits and Kepler equations. Orbital elements, from velocity and position information. Perturbation theory and applications, Data receiving and handling

UNIT II – ROCKETS AND ROCKET PROPULSION **(9)**

Rockets and rocket propulsion, liquid fuels, solid fuels, Electromagnetic propulsion, Ion propulsion, Important satellite launching stations –Facilities at !SRO, NASA and ESRO Russian and Chinese facilities.

UNIT III – SATELLITE COMMUNICATION AND GPS **(9)**

Earth to satellite communication, Laser communication, Satellite to satellite communication Global navigation satellite systems, Application of GPS systems.

UNIT IV – APPLICATIONS OF SPACE TECHNOLOGY **(9)**

Physics of the earth's space, Solar observations in infrared, visible and X-rays, Communication satellite and applications, Earth resource monitoring, Remote sensing and others, Hubble space telescope. Military, applications, Weather satellite and applications.

UNIT V – MANNED FLIGHTS **(9)**

Manned flights to moon, Manned orbiting space crafts, NASA Space shuttles, Immunology and infection in space, The ISS and application, Russian space crafts, Skylab.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

2. Space Science and Technology by Hans Mark, John Wiley and Sons.
3. The Cambridge encyclopedia of Space, missions, applications and exploration by Verger et at, Cambridge University Press 2003

REFERENCE BOOKS :

1. Space environment and it's interaction with spacecraft by C. Uberoi and S.C. Chakravorty, IISc — ISRO Educational Program
2. Introduction to GPS the global positioning system by El-Rabbany, Ahmed, London: Artech house

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x											
2	x		x		x							
3	x				x							
4	x				x							
5	x											

15CYZ01-CHEMISTRY FOR ENGINEERS
(Common to all branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- Basic information and applications of chemistry in daily life.
- Imparting knowledge on basic concepts and applications of thermodynamics
- To know about the chemistry of building materials.
- To understand the concepts of phase rule and alloys
- To understand the principles and applications of photochemistry and nuclear chemistry.

COURSE OUTCOMES:

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

CO6 : Identify the role and importance of chemistry in daily life.
CO7 : Understand the thermodynamic and predict the feasibility of chemical reactions.
CO8 : Use the modern engineering tools for building materials and their industrial applications
CO9 : Acquire the knowledge of industrial importance of phase rule and alloys.
CO10 : Outline the principles and applications of photochemistry and nuclear chemistry.

UNIT I : CHEMISTRY IN DAILY LIFE **(9)**

Introduction – role and importance of chemistry in day to day life - Food additives - Fruits - vegetables - milk and egg - constituents and benefits - chemistry of soft drinks – adulterants - simple tests for the identification of adulterants in food stuffs – Fats and Oils – difference – analysis of fats and oils – saponification number – iodine number – principle and applications of green chemistry – safer solvents and auxiliaries

UNIT II : THERMODYNAMICS **(9)**

Thermodynamic process (isothermic, isobaric, isochoric and adiabatic process) – Internal energy – First law of thermodynamics (Mathematical derivation and limitation) – Enthalpy – Second law of thermodynamics - Entropy – Entropy change of an ideal gas and problems - Free energy - work function – Gibbs Helmoltz equation (derivation - applications –Third law and zeroeth law (only statements) – Van't Hoff isotherm (derivation only)

UNIT III : CHEMISTRY OF BUILDING MATERIALS **(9)**

Lime – classification – manufacture - properties of lime – Cement – classification – Portland cement – chemical composition – manufacture – setting and hardening – analysis of cement – concretes – weathering of concrete - special cements - gypsum – plaster of Paris – Glass – manufacture - types - properties and uses .

UNIT IV : PHASE RULE AND ALLOYS **(9)**

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead – silver system only).

Alloys: Introduction- Definition- Properties of alloys- significance of alloying, Functions and effect of alloying elements - ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V : PHOTOCHEMISTRY & NUCLEAR CHEMISTRY **(9)**

Photochemistry: Laws of photochemistry–Einstein law and Lambert- Beer Law. Quantum efficiency – determination - Photo processes – Fluorescence - Phosphorescence, Chemiluminescence and Photo-sensitization. Nuclear chemistry**:** Nuclear decay – Half life period – Nuclear fission and fusion – Nuclear reactors – light water nuclear power plant – Applications of radioactivity.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co.,New Delhi , 2012.
2. Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd.,Chennai, 2015.

REFERENCES:

1. Dara S.S.Umare S.S, “Engineering Chemistry”, S. Chand& Company Ltd., New Delhi 2014.
2. Puri B.R., Sharma L.R. and Pathania M.S., Principles of physical chemistry, ShobanLal Nagin Chand & Co., New Delhi
3. K. Karunakaran et al., “Engineering Chemistry”, Sonaversity, Sona College of Technology,Salem, 2014.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x					x						
2	x						x					
3	x		x									
4	x		x			x						
5	x					x						

15CYZ02- SOIL CHEMISTRY
(Common to all branches)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To build fundamental knowledge and skills of the students within the different areas of soil chemistry.
- To familiarize the students with the origin of soil, properties of soil and soil forming processes.
- To identify and describe physical, chemical and biological properties of soil that affect agricultural and non-agricultural land.
- To impart basic knowledge on pesticides and fertilizers
- To understand the basic concepts of biomass energy production from wastes.

COURSE OUTCOMES:

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

CO1 : Gain the fundamental knowledge about soil chemistry
CO2 : Understand the properties of soil.
CO3 : Understand the impact of soil fertility in agricultural processes.
CO4 : Gain the knowledge about pesticides and fertilizers.
CO5 : Apply the knowledge to develop energy recovering technology from bio wastes.

UNIT I : SOIL INTRODUCTION **(9)**

Soil – definition – Composition of soil - classification of soils – Soil forming rocks and minerals – Soil forming factors and processes –Chemical weathering–hydration–oxidation–reduction–hydrolysis–solution method.

UNIT II : SOIL PROPERTIES **(9)**

Important physical properties of soil – Soil texture – bulk density – particle density and soil porosity– their importance – Ion exchange in soil – anion exchange capacity – cation exchange capacity – Soil colloids – definition – types – soil inorganic colloids –layer silicate clays – amorphous minerals

UNIT III : SOIL FERTILITY AND BIO FERTILIZERS **(9)**

Soil organic matter – its composition and decomposition – effect of soil organic matter on soil fertility – Humus – formation of humus – maintenance of humus – Bio fertilizers – Introduction – types – importance – Nitrogen fixer – rhizobium – algal bio fertilizers – cyanobacteria.

UNIT IV : PESTICIDES AND FERTILIZER CHEMISTRY **(9)**

Pesticides – classification – Chloro pesticides (Methoxychlor) – organophosphorus pesticides (Parathion) – carbamate pesticides (corbaryl) – Fertilizers – nitrogen fertilizers (urea, ammonium nitrate) – phosphorus fertilizers (single super phosphate, triple super phosphate) – potassium fertilizers (potassium sulphate) – NPK fertilizers (diammonium phosphate)

UNIT V : AGRICULTURAL WASTE AS A BIOMASS **(9)**

Bioenergy from wastes – Introduction – agricultural wastes – sources – utilization as a fuel – Bio chemical conversion of organic wastes – anaerobic digestion – methane production – thermal liquefaction –liquid fuel production – sludge treatment – activated sludge process

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Brady, N.C and Weil, R.R 2012. The Nature and properties of Soils (13th Ed.). Pearson Education.
2. Clair N Sawyer, Perry I. Mc Carty, Gene F Parkin, Chemistry for Environmental engineering and science, Tata Mc graw – Hill Edition, 2014.

REFERENCES:

1. A text book of Bio technology by S.C.Bhatia, Atlantic publishers – 2015.
2. Samuel L. Disdale, Werner L. Nelson, James D. Beaton, Soil fertility and fertilizers, 8th Edition, Pearson Publishers, 2013.
3. Biofuels from agricultural wastes and Byproducts by Hans Blascheck, Thaddeus Ezeji, Jurgen Scheffran John Wiley & Sons, 2010.

Mapping of Course Outcomes (COs) and Programme Outcomes (POs)

Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x					x						
2	x						x					
3	x		x									
4	x		x			x						
5	x					x						

15CYZ03 - ORGANIC CHEMISTRY
(Common to all branches)

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the basic concepts of organic chemistry.
- To study the type of components in which organic reaction take place.
- To know the preparation ofthe essential organic compounds.
- To impart knowledge on synthetic routes to many types of industrially important organic compounds and their characterization.
- To gain knowledge on carbohydrates, amino acids and proteins

COURSE OUTCOMES

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

CO1 : Apply knowledge of fundamental concepts of organic chemistry.
CO2 : Gain basic principles involved in different chemical synthesis and apply them in chemical industries.
CO3 : Outline the importance of pharmaceutical chemistry.
CO4 : Discuss carbohydrates, amino acids and proteins.
CO5 : Knowledge on various reaction mechanisms, preparation of organic compounds and their properties.

UNIT I : REACTIONS AND REAGENTS **(9)**

Organometallic compounds – Grignard reagent- synthesis of different types of compounds like - alchohol - aldehyde – acid- amine - Acetoacetic ester – tautomerism – base hydrolysis – acid hydrolysis- malonic ester - cyano acetic ester – synthesis of dicarboxylic acids – oxalic acid – succinic acid.

UNIT II : CARBOHYDRATES **(9)**

Monosaccharide - definition – classification - glucose – synthesis and chemical properties of glucose - Disaccharides - definition – classification - sucrose - synthesis and chemical properties of sucrose - Polysaccharides - definition – classification - cellulose - synthesis and chemical properties of cellulose - derivatives of cellulose.

UNIT III : AMINO ACIDS AND PROTEINS **(9)**

Proteins – definition – classification of amino acid - synthesis of alpha amino acid– chemical properties of alpha amino acid – Proteins – classification of proteins - chemical properties of proteins - structure of proteins - denaturation of proteins – colour test of proteins.

UNIT IV : HETEROCYCLIC COMPOUNDS **(9)**

Preparation, physical and chemical properties and uses of pyrrole –furan – thiophene- indole- pyridine – quinoline.

UNIT V : PHARMACEUTICAL CHEMISTRY **(9)**

Synthesis of malonylurea – phenacetin – isoniazid - p-amino benzoic acid (PABA)- chloroquine – sulphaniliamide.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Morrison.R.T, & Boyd R, “Organic Chemistry” Edn., Prentice Hall India Pvt. Ltd. New Delhi, 2014
2. I.L. Finar “Organic Chemistry” Volume. 1, Sixth Edition, 2012.

REFERENCES:

1. Tewari. K.S, Vishnoi.N.k, Malhotra S.N., A Text Book of Organic Chemistry, Vikas publishing House Pvt. Ltd., New Delhi, 1986
2. Lakshmi. S, Pharmaceutical Chemistry First Edition (1995), Sultan Chand and Sons,New Delhi
3. P.L.Soni, A Text Book of organic Chemistry, Sultan Chand and Sons publishing Pvt. Ltd., 18th edition(1985).

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Mapping of COs and POs												
COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x					x						
2	x						x					
3	x		x									
4	x		x			x						
5	x					x						