SRM
UNIVERSITY
(Under section 3 of UGC Act 1956)

B. TECH. –MECHANICAL ENGINEERING
CURRICULUM & SYLLABUS
2013 – 2014

DEPARTMENT OF MECHANICAL ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY
SRM NAGAR, KATTANKULATHUR – 603 203

STUDENT OUTCOMES

The curriculum and syllabus for B.Tech programs (2013) conform to outcome based teaching learning process. In general, **ELEVEN STUDENT OUTCOMES** (a-k) have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

B. Tech. Mechanical Engineering
Curriculum – 2013-'14
(Applicable for students admitted from the Academic year 2013-14 onwards)

SEMESTER I& II						
Course Code	**Category**	**Course Name**	**L**	**T**	**P**	**C**
THEORY						
LE1001	G	ENGLISH	1	2	0	2
LE1002	G	VALUE EDUCATION	1	0	0	1
PD1001	G	SOFT SKILLS I	1	0	1	1
PD1002	G	SOFT SKILLS II	1	0	1	1
MA1001	B	CALCULUS AND SOLID GEOMETRY	3	2	0	4
MA1002	B	ADVANCED CALCULUS AND COMPLEX ANALYSIS	3	2	0	4
PY1001	B	PHYSICS	3	0	0	3
CY1001	B	CHEMISTRY	3	0	0	3
BT1001	B	BIOLOGY FOR ENGINEERS	2	0	0	2
PY1003	B	MATERIALS SCIENCE	2	0	2	3
CY1003	B	PRINCIPLES OF ENVIRONMENTAL SCIENCE	2	0	0	2
CE1001	E	BASIC CIVIL ENGINEERING	2	0	0	2
EE1001	E	BASIC ELECTRICAL ENGINEERING	2	0	0	2
EC1001	E	BASIC ELECTRONICS ENGINEERING	2	0	0	2
ME1001	E	BASIC MECHANICAL ENGINEERING	2	0	0	2
ME1002	E	ENGINEERING MECHANICS	3	2	0	4
PRACTICAL						
CS1001	G	PROGRAMMING USING MATLAB	1	0	2	2
PY1002	B	PHYSICS LABORATORY	0	0	2	1
CY1002	B	CHEMISTRY LABORATORY	0	0	2	1
ME1003	B	ACTIVE LEARNING LABORATORY	0	0	2	1
ME1004	E	WORKSHOP PRACTICE	0	0	3	2
ME1005	E	ENGINEERING GRAPHICS	1	0	4	3

NC1001/ NS1001/ SP1001/ YG1001	G	*NCC/NSS/NSO/YOGA	0	0	1	1
TOTAL			**35**	**8**	**20**	**49**

*NCC-National Cadet Corps
NSS-National Service Scheme
NSO-National Sports Organization (India)

Legend:
L - Number of lecture hours per week
T - Number of tutorial hours per week
P - Number of practical hours per week
C - Number of credits for the course

Category of courses:
G - General
B - Basic Sciences
E - Engineering Sciences and Technical Arts
P - Professional Subjects

SEMESTER III & IV						
Course Name	**Category**	**Course Name**	**L**	**T**	**P**	**C**
THEORY						
LE1003/ LE1004/ LE1005/ LE1006/ LE1007	G	GERMAN LANGUAGE PHASE I / FRENCH LANGUAGE PHASE I/ JAPANESE LANGUAGE PHASE I / KOREAN LANGUAGE PHASE I / CHINESE LANGUAGE PHASE I	2	0	0	2
LE1008/ LE1009/ LE1010/ LE1011/ LE1012	G	GERMAN LANGUAGE PHASE II / FRENCH LANGUAGE PHASE II/ JAPANESE LANGUAGE PHASE II/ KOREAN LANGUAGE PHASE II / CHINESE LANGUAGE PHASE II	2	0	0	2
PD1003	G	APTITUDE I	1	0	1	1
PD1004	G	APTITUDE II	1	0	1	1

MA1013	B	FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS	4	0	0	4
MA1004	B	NUMERICAL METHODS	4	0	0	4
IC1051	E	ELECTRONICS AND INSTRUMENTATION	3	0	0	3
ME1007	E	THERMODYNAMICS	2	2	0	3
ME1008	P	MANUFACTURING TECHNOLOGY	3	0	0	3
ME1009	P	FLUID MECHANICS	2	2	0	3
ME1010	P	MECHANICS OF SOLIDS	2	2	0	3
ME1011	P	APPLIED THERMAL ENGINEERING	3	2	0	4
ME1012	P	MACHINES AND MECHANISMS	2	2	0	3
ME1013	P	COMPUTER AIDED DESIGN AND ANALYSIS	3	0	0	3
	P	*DEPARTMENTAL ELECTIVE – I*	3	0	0	3
PRACTICAL						
IC1052	E	ELECTRONICS AND INSTRUMENTATION LABORATORY	0	0	2	1
ME1014	P	MANUFACTURING PROCESS LABORATORY	0	0	2	1
ME1015	P	FLUID DYNAMICS LABORATORY	0	0	2	1
ME1016	P	STRENGTH OF MATERIAL LABORATORY	0	0	2	1
ME1017	P	COMPUTER AIDED DESIGN LABORATORY	0	0	2	1
ME1018	P	MANUFACTURING AND ASSEMBLY DRAWING	1	0	3	2
TOTAL			**38**	**10**	**15**	**49**

SEMESTER V&VI						
Course Code	**Category**	**Course Name**	**L**	**T**	**P**	**C**
THEORY						
PD1005	G	APTITUDE III	1	0	1	1
PD1006	G	APTITUDE IV	1	0	1	1
MA1005	B	PROBABILITY AND STATISTICS	4	0	0	4

ME1019	P	FUNDAMENTALS OF VIBRATION AND NOISE	2	2	0	3
ME1020	P	MECHANICAL ENGINEERING DESIGN	2	2	0	3
ME1021	P	HEAT AND MASS TRANSFER	2	2	0	3
ME1022	P	MATERIALS TECHNOLOGY	3	0	0	3
ME1023	P	GAS DYNAMICS AND SPACE PROPULSION	2	2	0	3
ME1024	P	ELEMENTS OF MECHATRONICS	3	0	0	3
ME1025	P	FLUID POWER CONTROL	3	0	0	3
	P	*DEPARTMENTAL ELECTIVE – II*	3	0	0	3
	P	*DEPARTMENTAL ELECTIVE – III*	3	0	0	3
	P	*OPEN ELECTIVE – I*	3	0	0	3
	P	*OPEN ELECTIVE – II*	3	0	0	3
	P	*OPEN ELECTIVE – III*	3	0	0	3
PRACTICAL						
ME1027	P	MACHINE DYNAMICS LABORATORY	0	0	2	1
ME1028	P	HEAT POWER LABORATORY	0	0	2	1
ME1029	P	MATERIALS TECHNOLOGY LABORATORY	0	0	2	1
ME1030	P	AUTOMATION LABORATORY	0	0	2	1
ME1031	P	HEAT AND MASS TRANSFER LABORATORY	0	0	2	1
ME1033	P	COMPUTER SKILL*	0	0	0	0
ME1047	P	INDUSTRIAL TRAINING I (Training to be undergone after IV semester)	0	0	1	1
ME1049	P	MINOR PROJECT	0	0	2	1
TOTAL			**38**	**8**	**15**	**49**

SEMESTER VII&VIII						
Course Code	**Category**	**Course Name**	**L**	**T**	**P**	**C**
THEORY						
ME1034	P	ECONOMICS AND PRINCIPLES OF MANAGEMENT	3	0	0	3
ME1035	P	METROLOGY AND QUALITY CONTROL	3	0	0	3

ME1036	P	DESIGN OF TRANSMISSION SYSTEMS	2	2	0	3
ME1037	P	COMPUTER AIDED MANUFACTURING	3	0	0	3
	P	*DEPARTMENTAL ELECTIVE – IV*	3	0	0	3
	P	*DEPARTMENTAL ELECTIVE – V*	3	0	0	3
PRACTICAL						
ME1039	P	METROLOGY AND QUALITY CONTROL LABORATORY	0	0	2	1
ME1040	P	COMPUTER AIDED MANUFACTURING LABORATORY	0	0	2	1
ME1048	P	INDUSTRIAL TRAINING II (Training to be undergone after VI semester)	0	0	1	1
ME1050	P	MAJOR PROJECT/PRACTICE SCHOOL	0	0	24	12
TOTAL			**17**	**2**	**29**	**33**
Total Contact Hours (Approx.)			**25**			

DEPARTMENTAL ELECTIVES						
Course Code	**Category**	**Course Name**	**L**	**T**	**P**	**C**
ME1101	P	FINITE ELEMENT METHODS	3	0	0	3
ME1102	P	ROBOTICS ENGINEERING AND APPLICATIONS	3	0	0	3
ME1103	P	MECHANISM DESIGN, ANALYSIS AND SYNTHESIS	3	0	0	3
ME1104	P	DIGITAL IMAGE PROCESSING AND MACHINE VISION	3	0	0	3
ME1105	P	DESIGN FOR MANUFACTURING AND ASSEMBLY	3	0	0	3
ME1106	P	OPTIMISATION IN ENGINEERING DESIGN	3	0	0	3
ME1107	P	NEURAL NETWORK AND FUZZY SYSTEMS	3	0	0	3
ME1108	P	INDUSTRIAL TRIBOLOGY	3	0	0	3
ME1121	P	MODERN MANUFACTURING TECHNIQUES	3	0	0	3
ME1122	P	PRECISION ENGINEERING	3	0	0	3
ME1123	P	PRODUCTION MANAGEMENT	3	0	0	3
ME1124	P	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	3	0	0	3

ME1125	P	PROCESS PLANNING AND COST ESTIMATION	3	0	0	3
ME1126	P	TOOL ENGINEERING DESIGN	3	0	0	3
ME1127	P	FLEXIBLE MANUFACTURING SYSTEMS	3	0	0	3
ME1128	P	NON TRADITIONAL MACHINING TECHNIQUES	3	0	0	3
ME1129	P	OPERATIONS RESEARCH	3	0	0	3
ME1130	P	FOUNDRY ENGINEERING	3	0	0	3
ME1131	P	FATIGUE , FRACTURE MECHANICS AND CREEP	3	0	0	3
ME1132	P	LINEAR ELASTICITY	3	0	0	3
ME1141	P	COMBUSTION ENGINEERING	3	0	0	3
ME1142	P	GAS TURBINE TECHNOLOGY	3	0	0	3
ME1143	P	BOUNDARY LAYER THEORY	3	0	0	3
ME1144	P	FUEL CELL TECHNOLOGY	3	0	0	3
ME1145	P	ELEMENTS OF SPACE TECHNOLOGY	3	0	0	3
ME1146	P	ROCKET PROPULSION	3	0	0	3
ME1147	P	REFRIGERATION AND AIR CONDITIONING SYSTEM	3	0	0	3
ME1148	P	ALTERNATIVE SOURCES OF ENERGY	3	0	0	3
ME1149	P	ENERGY ENGINEERING AND MANAGEMENT	3	0	0	3
ME1150	P	DESIGN OF PUMPS AND TURBINES	3	0	0	3
ME1151	P	COMPUTATIONAL FLUID DYNAMICS	3	0	0	3
ME1152	P	INTERNAL COMBUSTION ENGINES	3	0	0	3
ME1153	P	TURBO MACHINES	3	0	0	3
ME1154	P	THERMAL POWER SYSTEMS	3	0	0	3
ME1155	P	SOLAR ENERGY SYSTEMS	3	0	0	3
ME1156	P	AUTOMOTIVE ELECTRONICS	3	0	0	3
ME1181	P	INDUSTRIAL ENGINEERING	3	0	0	3
ME1182	P	MATERIALS MANAGEMENT	3	0	0	3
ME1183	P	HUMAN RELATIONS MANAGEMENT	3	0	0	3
ME1184	P	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3
ME1185	P	FACILITIES PLANNING	3	0	0	3

ME1186	P	INDUSTRIAL SAFETY AND ENVIRONMENT	3	0	0	3
ME1187	P	SUPPLY CHAIN MANAGEMENT	3	0	0	3
ME1188	P	TQM AND RELIABILITY ENGINEERING	3	0	0	3
ME1189	P	MARKETING AND SALES MANAGEMENT	3	0	0	3
ME1190	P	PLC AND DATA ACQUISITION SYSTEMS	3	0	0	3
ME1191	P	INSTRUMENTATION AND CONTROL	3	0	0	3
ME1192	P	MICROPROCESSOR BASED SYSTEM DESIGN	3	0	0	3

COURSES OFFERED TO OTHER DEPARTMENTS						
Course Code	**Category**	**Course Name**	**L**	**T**	**P**	**C**
ME1251	P	PRINCIPLES OF ENGINEERING METALLURGY (NANO TECH.)	2	0	0	2
ME1252	P	INTRODUCTION TO MANUFACTURING ENGINEERING (NANO TECH.)	2	0	0	2
ME1253	P	ROBOTICS TECHNOLOGY	2	0	0	2
ME1254	P	THERMODYNAMICS AND FLUID MECHANICS (E&IE)	3	0	0	3
ME1255	P	KINEMATICS OF MACHINERY (FOOD PROCESS ENGG.)	3	0	0	3
ME1256	P	REFRIGERATION AND COLD CHAIN (FOOD PROCESS ENGG.)	3	0	0	3

Summary of credits						
Category	**I& II**	**III & IV**	**V & VI**	**VII & VIII**	**Total**	**%**
G	**8**	**6**	**2**		**16**	**8.47**
B	**24**	**8**	**4**		**36**	**20.34**
E	**17**	**7**			**24**	**13.56**
P		**25**	**28**	**27**	**80**	**44.07**
Open Elective			**9**		**9**	**5.08**
Departmental Elective		**3**	**6**	**6**	**15**	**8.47**
Total	**49**	**49**	**49**	**33**	**180**	**100**

LANGUAGE COURSES AND VALUE EDUCATION

LE1001	ENGLISH
LE1002	VALUE EDUCATION
LE1003/ LE1004/ LE1005/ LE1006/ LE1007	GERMAN LANGUAGE PHASE I / FRENCH LANGUAGE PHASE I/ JAPANESE LANGUAGE PHASE I / KOREAN LANGUAGE PHASE I / CHINESE LANGUAGE PHASE I
LE1008/ LE1009/ LE1010/ LE1011/ LE1012	GERMAN LANGUAGE PHASE II / FRENCH LANGUAGE PHASE II/ JAPANESE LANGUAGE PHASE II/ KOREAN LANGUAGE PHASE II / CHINESE LANGUAGE PHASE II

LE1001	ENGLISH	L	T	P	C
	Total Contact Hours-45	1	2	0	2
	Prerequisite				
	Nil				

PURPOSE

To help students achieve proficiency in English and develop their professional communication skills to meet the demand in the field of global communication to enable them to acquire placement anywhere with ease and confidence.

INSTRUCTIONAL OBJECTIVES

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

UNIT I - INVENTIONS **(9 hours)**

1. Grammar and Vocabulary – Tense and Concord:
2. Listening and Speaking – Common errors in Pronunciation (Individual sounds); Process description (Describing the working of a machine, and the manufacturing process)
3. Writing – Interpretation of data (Flow chart, Bar chart)
4. Reading -- (Reading Comprehension -- Answering questions)

UNIT II - ECOLOGY **(9 hours)**

1. Grammar and Vocabulary – Error Analysis – Synonyms and Antonyms, Parallelisms
2. Listening and Speaking - Conducting Meetings
3. Writing – Notice, Agenda, Minutes , letters to the editor via email : Email etiquette
4. D Reading Comprehension – Summarizing and Note-making

UNIT III - SPACE **(9 hours)**

1. Grammar and Vocabulary – tense and concord; word formation
2. Listening and Speaking – Distinction between native and Indian English (Speeches by TED and Kalam) – accent, use of vocabulary and rendering;
3. Writing – Definitions and Essay writing
4. Reading Comprehension – Predicting the content

UNIT IV - CAREERS **(9 hours)**

1. Grammar and Vocabulary –Homonyms and Homophones
2. Listening and Speaking – – Group Discussion
3. Writing Applying for job, cover letter and resume
4. Reading, etymology (roots ; idioms and phrases), Appreciation of creative writing.

UNIT V - RESEARCH **(9 hours)**

1. Grammar and Vocabulary – Using technical terms, Analogies
2. Listening and Speaking -- Presentation techniques (Speech by the learner)
3. Writing – Project Proposal
4. Reading Comprehension -- Referencing Skills for Academic Report Writing (Research Methodology – Various methods of collecting data) Writing a report based on MLA Handbook

TEXTBOOK

1. Department of English and Foreign Languages. "*English for Engineers*", SRM University Publications, 2013.

REFERENCES

1. Dhanavel.S.P. "*English and Communication Skills for Students of Science and Engineering*", Orient Blackswan Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharma. "*Technical Communication-Principles and Practice*", Oxford University Press, 2009.
3. Day.R A. Scientific English: "*A Guide for Scientists and Other Professionals*", 2nd ed. Hyderabad: Universities Press, 2000.

	VALUE EDUCATION	L	T	P	C
LE1002	Total Contact Hours- 15	**1**	**0**	**0**	**1**
	Prerequisite				
	Nil				

PURPOSE

To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.

INSTRUCTIONAL OBJECTIVES

1.	To help individuals think about and reflect on different values.
2.	To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the community and the world at large
3.	To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening

UNIT I - INTRODUCTION **(3 hours)**

Definition, Relevance, Types of values, changing concepts of values

UNIT II - INDIVIDUAL AND GROUP BEHAVIOUR **(3 hours)**

Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses (Influences -- Peer pressure, familial and societal expectations, media)

UNIT III - SOCIETIES IN PROGRESS **(3 hours)**

Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility

UNIT IV - ENGINEERING ETHICS **(3 hours)**

Definition - Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research -- Ethical and Unethical practices – case studies – situational decision making

UNIT V - SPIRITUAL VALUES **(3 hours)**

What is religion? -- Role of religion – Misinterpretation of religion – moral policing – Consequences -- Religion as spiritual quest – Aesthetics and religion

TEXT BOOK

1. Department of English and Foreign Languages SRM University, "*Rhythm of Life",* SRM Publications, 2013.

REFERENCE

1. Values **(**Collection of Essays). Published by: Sri Ramakrishna Math, Chennai-4. 1996.

LE1002 VALUE EDUCATION													
Course Designed by		**Department of English and Foreign Languages**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
						x				x		x
2.	Mapping of instructional objectives with student outcome						1,3			1-3		1-3
3.	Category	General (G)	Basic Sciences(B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1003	**GERMAN LANGUAGE PHASE I**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

Germany offers infinite opportunities for students of engineering for higher studies, research and employment in Germany. B.Tech Students are offered German Language during their second year. Knowledge of the language will be helpful for the students to adjust themselves when they go for higher studies.

INSTRUCTIONAL OBJECTIVES

1.	To introduce the language, phonetics and the special characters in German language
2.	To introduce German culture & traditions to the students.
3.	By the end of Phase – I, the students will be able to introduce themselves and initiate a conversation..
4.	We endeavor to develop the ability among the students to read and understand small texts written in German
5.	To enable the students to elementary conversational skills.

UNIT I (**6 hours)**

Wichtige Sprachhandlungen: Phonetics – Sich begrüßen - Sich und andere vorstellen formell / informell - Zahlen von 1 bis 1 Milliarde - verstehen & sprechen
Grammatik: regelmäßige Verben im Präsens - "sein" und haben im Präsens - Personalpronomen im Nominativ

UNIT II **(6 hours)**

Wichtige Sprachhandlungen Telefon Nummern verstehen und sprechen
Uhrzeiten verstehen und sagen Verneinung "nicht und kein" (formell und informell)
Grammatik : Wortstellung – Aussagesatz – W-Frage und Satzfrage (Ja/Nein Frage) Nomen buchstabieren und notieren bestimmter und unbestimmter Artikel und Negativartikel im Nom. & Akkusativ

UNIT III **(6 hours)**

Wichtige Sprachhandlungen Tageszeiten verstehen und über Termine sprechen -Verabredungen verstehen - Aufgaben im Haushalt verstehen **Grammatik** Personalpronomen im Akkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was usw.- Genitiv bei Personennamen - Modalverben im Präsens "können, müssen, möchten"

UNIT IV **(6 hours)**

Wichtige Sprachhandlungen Sich austauschen, was man kann, muss – Bezeichnungen Lebensmittel – Mengenangaben verstehen – Preise verstehen und Einkaufzettel schreiben

Grammatik Wortstellung in Sätzen mit Modalverben – Konnektor "und" – "noch"-kein-------mehr – "wie viel, wie viele, wie alt, wie lange" –Possessivartikel im Nominativ.

UNIT V **(6 hours)**

Wichtige Sprachhandlungen Freizeitanzeigen verstehen – Hobbys und Sportarten Anzeigen für Freizeitpartner schreiben bzw. darauf antworten – Vorlieben und Abneigungen ausdrucken

Grammatik Verben mit Vokalwechsel im Präsens – Modalverben im Präsens " dürfen, wollen und mögen- "haben und sein" im Präteritum – regelmäßige Verben im Perfekt – Konnektoren "denn, oder, aber

TEXT BOOK

1. Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprach training).

REFERENCES

1. German for Dummies
2. Schulz Griesbach

<table>
<tr><th colspan="14">LE1003 GERMAN LANGUAGE PHASE I</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="12">Department of English and Foreign Languages</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1-5</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="3">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="2">Professional Subjects(P)</td></tr>
<tr><td colspan="2">X</td><td colspan="3"></td><td colspan="4"></td><td colspan="2"></td></tr>
<tr><td>4.</td><td>Approval</td><td colspan="12">23rd Meeting of Academic Council, May 2013</td></tr>
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LE1004	FRENCH LANGUAGE PHASE I	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

To enable the student learners acquire a basic knowledge of the French language and concepts of general French for everyday interactions and technical French at the beginner's level and also to get to know the culture of France.

INSTRUCTIONAL OBJECTIVES

1.	To enable students improve their grammatical competence.
2.	To enhance their listening skills.
3.	To assist students in reading and speaking the language.
4.	To enhance their lexical and technical competence.
5.	To help the students introduce themselves and focus on their communication skills.

UNIT I **(6 hours)**

1. Grammar and Vocabulary: Usage of the French verb "se presenter", a verb of self- introduction and how to greet a person- "saluer"
2. Listening and Speaking – The authentic sounds of the letters of the French alphabet and the accents that play a vital role in the pronunciation of the words.
3. Writing – correct spellings of French scientific and technical vocabulary.
4. Reading -- Reading of the text and comprehension – answering questions.

UNIT II **(6 hours)**

1. Grammar and Vocabulary – Definite articles , "prepositions de lieu" subject pron ouns
2. Listening and Speaking – pronunciation of words like Isabelle, presentez and la liaison – vous etes, vous appelez and role play of introducing each other – group activity
3. Writing – particulars in filling an enrollment / registration form
4. Reading Comprehension – reading a text of a famous scientist and answering questions.

UNIT III **(6 hours)**

1. Grammar and Vocabulary – verb of possession "avoir' and 1st group verbs "er", possessive adjectives and pronouns of insistence- moi, lui..and numbers from 0 to 20
2. Listening and Speaking –nasal sounds of the words like feminine, ceinture , parfum and how to ask simple questions on one's name, age, nationality, address mail id and telephone number.
3. Writing –conjugations of first group verbs and paragraph writing on self – introduction and introducing a third person.
4. Reading Comprehension – reading a text that speaks of one's profile and answering questions

UNIT IV **(6 hours)**

1. Grammar and Vocabulary –negative sentences, numbers from 20 to 69, verb "aimer"and seasons of the year and leisure activities.
2. Listening and Speaking – To express one's likes and dislikes and to talk of one's pastime activities (sports activities), je fais du ping-pong and nasal sounds of words – janvier, champagne
3. Writing- conjugations of the irregular verbs – faire and savoir and their usage. Paragraph writing on one's leisure activity- (passé temps favori)
4. Reading- a text on seasons and leisure activities – answering questions.

UNIT V **(6 hours)**

1. Grammar and Vocabulary – les verbes de direction- to ask one's way and to give directions, verbes- pouvoir and vouloir and 2nd group verbs , a droite, la premiere a gauche and vocabulary relating to accommodation.
2. Listening and Speaking – to read and understand the metro map and hence to give one directions – dialogue between two people.
3. Writing –paragraph writing describing the accommodation using the different prepositions like en face de, derriere- to locate .
4. Reading Comprehension -- a text / a dialogue between two on location and directions- ou est la poste/ la pharmacie, la bibliotheque?.....

TEXT BOOK

1. Tech French

REFERENCES

1. French for Dummies.
2. French made easy-Goyal publishers
3. Panorama

LE1004 FRENCH LANGUAGE PHASE I												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1-5				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
		x	--			--					--	
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE 1005	JAPANESE LANGUAGE PHASE I	L	T	P	C
	Total Contact Hours- 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

To enable students achieve a basic exposure on Japan, Japanese language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the Japanese scripts viz. hiragana and a few basic kanji.
2.	To make the students acquire basic conversational skill.
3	To enable students to know about Japan and Japanese culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Japan.

UNIT I **(8 hours)**

1. Introduction to Japanese language. Hiragana Chart 1 - vowels and consonants and related vocabulary.
2. Self introduction
3. Grammar – usage of particles wa, no, mo and ka and exercises
4. Numbers (1-100)
5. Kanji – introduction and basic kanjis – naka, ue, shita, kawa and yama
6. Greetings, seasons, days of the week and months of the year
7. Conversation – audio
8. Japan – Land and culture

UNIT II (**8 hours)**

1. Hiragana Chart 1 (contd.) and related vocabulary
2. Grammar – usage of kore, sore, are, kono, sono, ano, arimasu and imasu. Particles – ni (location) and ga. Donata and dare.
3. Numbers (up to 99,999)
4. Kanji – numbers (1-10, 100, 1000, 10,000 and yen)
5. Family relationships and colours.
6. Conversation – audio
7. Festivals of Japan

UNIT III (**5 hours)**

Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary
Lesson 3
Grammar - particles ni (time), kara, made and ne. Koko, soko, asoko and doko.
Time expressions (today, tomorrow, yesterday, day before, day after)
Kanji – person, man, woman, child, tree and book
Directions – north, south, east and west

UNIT IV **(5 hours)**

Grammar - directions,-kochira, sochira, achira and dochira. Associated vocabulary (mae, ushiro, ue, shita, tonari, soba, etc.)
Conversation – audio
Japanese art and culture like ikebana, origami, etc.

UNIT V **(4hours)**

Kanji – hidari, migi, kuchi
Japanese sports and martial arts

TEXT BOOK

1. First lessons in Japanese, ALC Japan

REFERENCES

1. Japanese for dummies. Wiley publishing co. Inc., USA.
2. Kana workbook, Japan foundation

LE1005 JAPANESE LANGUAGE PHASE I												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1006	KOREAN LANGUAGE PHASE I	L	T	P	C
	Total Contact Hours-30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the scripts.
2.	To make the students acquire basic conversational skill.
3	To enable students to know about Korean culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea.

UNIT I **(6 hours)**

Lesson 1 < Introduction to Korean Language >, Lesson2 < Consonants and Vowels >, <Basic Conversation, Vocabularies and Listening >

UNIT II (**10 hours)**

Lesson 3 < Usage of "To be" >, Lesson 4 < Informal form of "to be" >, Lesson 5 <Informal interrogative form of "to be" >, Lesson 6 < To be, to have, to stay >, < Basic Conversation, Vocabularies and Listening >

UNIT III (**10 hours)**

Lesson 7 < Interrogative practice and Negation >, < Basic Conversation, Vocabularies and Listening >

UNIT IV **(4 hours)**

Lesson 8 < Korean Culture and Business Etiquette >, < Basic Conversation, Vocabularies and Listening

TEXT BOOK

1. Korean Through English 1 (Basic Korean Grammar and Conversation).

REFERENCES

1. Bharati Korean (Intermediate Korean Grammar).
2. Hand-outs.
3. Various visual mediums such Movie CD, Audio CD.
4. Collection of vocabularies for engineering field.

LE1006 KOREAN LANGUAGE PHASE I													
Course Designed by		Department of English and Foreign Languages											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
								x					
2.	Mapping of instructional objectives with student outcome							1 -4					
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)		
		x	--			--					--		
4.	Approval	23rd Meeting of Academic Council, May 2013											

LE1007	CHINESE LANGUAGE PHASE I	L	T	P	C
	Total contact hours- 30	2	0	0	2
	Prerequisite				
	NIL				

PURPOSE

To enable students achieve a basic exposure on China, Chinese language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the Chinese scripts.
2.	To make the students acquire basic conversational skill.
3	To enable students to know about China and Chinese culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with china.

UNIT I

Introduction of Chinese Language

UNIT II

Phonetics and Notes on pronunciation

a) 21 Initials:

b p m f d t n l g k h j q x z c s zh ch sh r

b) 37 Finals:

a	o	e	i	u	ü
ai	ou	ei	ia	ua	üe
an	ong	en	ian	uai	üan
ang		eng	iang	uan	ün
ao		er	iao	uang	
			ie	uei(ui)	
			in	uen(un)	
			ing	ueng	
			iong	uo	
			iou(iu)		

c) The combination of Initials and Finals - Pinyin

UNIT III

Introduction of Syllables and tones

a) syllable=initial+final+tone

b) There are four tones in Chinese: the high-and-level tone, the rising tone, the falling-and-rising tone, and the falling tone. And the markers of the different tones.

UNIT IV

A. Tones practice

B. the Strokes of Characters

1. Introduction of Chinese Characters
2. The eight basic strokes of characters

UNIT V

1. Learn to read and write the Characters:

八(eight) 不(not) 马(horse) 米(rice) 木(wood).

2. **classes are organized according to several Mini-dialogues.**

TEXT BOOK

1. A New Chinese Course 1- Beijing Language and Culture University Press.

REFERENCES

1. New Practical Chinese Reader Textbook (1) – Beijing Language and Culture University Press.
2. 40 Lessons For Basic Chinese Course I – Shanghai Translation Press.
3. My Chinese Classroom - East China Normal University Press.

LE1007 CHINESE LANGUAGE PHASE I												
Course Designed by		Department of English and Foreign Languages										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1008	GERMAN LANGUAGE PHASE II	L	T	P	C
	Total Contact Hours- 30	2	0	0	2
	Prerequisite				
	LE1003-German Language Phase I				

PURPOSE

Familiarity in German language will be helpful for the students in preparing their resumes in German. Proficiency in the language will be an added asset for the students to have an edge in the present day highly competitive and global job market.

INSTRUCTIONAL OBJECTIVES

1.	To enable the students to speak and understand about most of the activities in the day to day life.
2.	The students will be able to narrate their experiences in Past Tense.
3.	The students will be able to understand and communicate even with German Nationals.
4.	By the end of Phase – II the students will have a reasonable level of conversational skills.

UNIT I **(6 hours)**

Wichtige Sprachhandlungen: Zimmersuche, Möbel

Grammatik: Verben mit trennbaren Vorsilben im Präsens und Perfekt. Verben mit trennbaren Vorsilben und Modalverben imPräsens. Verben mit untrennbaren Vorsilben im Perfekt. Unregelmäßige und gemischte Verben im Perfekt.

UNIT II **(6 hours)**

Wichtige Sprachhandlungen: Kleidung ,Farben , Materialien.

Grammatik : formelle Imperativsätze mit "Sie" informelle Imperativsätze Vorschläge mit "wir" – "sollen/wollenwir"—Soll ich? Modalpartikeln "doch" "mal" "doch mal.

UNIT III **(6 hours)**

Wichtige Sprachhandlungen : Sehenswürdigkeite (Prater, Brandenburger Tör,Kolossium, Eifeltürm)

Grammatik : Ortsangaben mit Akk. und Dativ "alle","man" Indefinitepronomen "etwas", "nichts",

UNIT IV **(6 hours)**

Wichtige Sprachhandlungen : Wegbeschreibung/ Einladung interkulturelle Erfahrung.

Grammatik : Verwendung von Präsens für zukünftigen Zeitpunkt.

UNIT V **(6 hours)**

Wichtige Sprachhandlungen: Essen und Trinken im Restaurant , Partyvorbereitung und Feier

Grammatik: Nomen aus Adjektiven nach "etwas"und "nichts" Nomen aus dem Infinitiv von Verben, zusammegesetzte Nomen und ihre Artikel. Adjektive im Nom. und Akk. nach unbestimmten Artikel, Negativartikel und Possessivartikel.

TEXT BOOK

1. Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprachtraining).

REFERENCES

1. German for Dummies
2. Schulz Griesbach

LE01008 GERMAN LANGUAGE PHASE II												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1009	FRENCH LANGUAGE PHASE II	L	T	P	C
	Total Contact Hours- 30	2	0	0	2
	Prerequisite				
	LE1004- French Language Phase I				

PURPOSE

To enable the students communicate effectively with any French speaker and have a competitive edge in the international market.

INSTRUCTIONAL OBJECTIVES

1.	To enable students access information on the internet
2.	To receive and send e mails
3	To assist students in gaining a certain level of proficiency to enable them to give the level 1 exam conducted by Alliance Française de Madras.
4.	To enhance their lexical and technical competence.

UNIT I **(6 hours)**

1. Grammar and Vocabulary: The second group verbs: Finir, rougir, grossir, grandir. "Les preposition de temps": à, en, le, de 7h à 8h, jusqu' à, vers.
2. Listening and Speaking – the semi- vowels: Voilà, pollutant. Writing –the days of the week. Months, technical subjects, time, "les spécialités scientifiques et l' année universitaire, paragraph writing about time table.
3. Reading -- Reading of the text and comprehension – answering questions

UNIT II **(6 hours)**

Grammar and Vocabulary – The adjectives, the nationality, feminine & masculine noun forms "les métiers scientifiques".
Listening and Speaking – Vowels: soirée, année, près de, très.
Writing – Countries name, nationality, "les métiers scientifiques", numbers from: 69 to infitive and some measures of unit.
Reading Comprehension – reading a text.

UNIT III **(6 hours)**

Grammar and Vocabulary – near future, The demonstrative adjectives, Express the aim by using the verb, Listening and Speaking –"La liaison interdite – en haut". Writing – some scientific terms, French expressions to accept an invitation. Sentence framing. Reading Comprehension – reading a text.

UNIT IV **(6 hours)**

Grammar and Vocabulary –the verbs: manger, boire , the partitive articles
Listening and Speaking – "le 'e' caduc Writing- the food, the ingredients, fruits, vegetables, expression of quantity, paragraph writing about food habits. Reading – reading a text.

UNIT V **(6 hours)**

Grammar and Vocabulary – "les prepositions de lieu": au à la, à l', chez, the reflexives verbs, verbs to nouns. Listening and Speaking – "le 'e' sans accents ne se prononce pas. C'est un "e" caduc. Ex: quatre, octobre. " les sons (s) et (z)- salut , besoin. Writing –paragraph writing about one's everyday life, French culture. Reading Comprehension -- reading a text or a song.....

TEXT BOOK

1. Tech French

REFERENCES

1. French for Dummies
2. French made easy: Goyal publishers
3. Panorama

LE1009 FRENCH LANGUAGE PHASE II												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE 1010	**JAPANESE LANGUAGE PHASE II**	**L**	**T**	**P**	**C**
	Total Contact Hours- 30	**2**	**0**	**0**	**2**
	Prerequisite				
	LE1005- Japanese Language Phase I				

PURPOSE

To enable students to learn a little advanced grammar in order to improve their conversational ability in Japanese.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn Katakana script (used to write foreign words)
2.	To improve their conversational skill.
3	To enable students to know about Japan and Japanese culture.
4.	To improve their employability by companies who are associated with Japan.

UNIT I **(8 hours)**

Introduction to Verbs; Ikimasu, okimasu, nemasu, tabemasu etc.
Grammar – usage of particles de, o, to, ga(but) and exercises
Common daily expressions and profession.
Katakana script and related vocabulary.
Religious beliefs, Japanese housing and living style.
Conversation – audio

UNIT II **(8 hours)**

Grammar :Verbs –Past tense, negative - ~mashita, ~masen deshita..
i-ending and na-ending adjectives - introduction
Food and transport (vocabulary)
Japanese food, transport and Japanese tea ceremony.
Kanji Seven elements of nature (Days of the week)
Conversation – audio

UNIT III **(6 hours)**

Grammar - ~masen ka, mashou
Adjectives (present/past – affirmative and negative)
Conversation – audio

UNIT IV **(4 hours)**

Grammar – ~te form
Kanji – 4 directions
Parts of the body
Japanese political system and economy
Conversation – audio

UNIT V **(4 hours)**

Stationery, fruits and vegetables
Counters – general, people, floor and pairs

TEXT BOOK

1. First lessons in Japanese, ALC Japan

REFERENCES

1. Japanese for dummies. Wiley publishing co. Inc., USA.
2. Kana workbook, Japan foundation

LE1010 JAPANESE LANGUAGE PHASE II												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1011	KOREAN LANGUAGE PHASE II	L	T	P	C
	Total Contact Hours-30	2	0	0	2
	Prerequisite				
	LE1006-Korean Language Phase I				

PURPOSE

To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the scripts.
2.	To make the students acquire basic conversational skill.
3	To enable students to know about Korean culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea.

UNIT I **(9 hours)**

Lesson 1 <Review of Vowels and Consonants>, Lesson2 < Various Usages of "To be">, Lesson3 < Informal form of "to be"> <Basic Conversation, Vocabularies and Listening>

UNIT II **(9 hours)**

Lesson 4 < Informal interrogative form of "to be">, Lesson 5 < To be, to have, to stay>, Lesson 5 < Advanced Interrogative practice>, Lesson 6 < Types of Negation>, <Basic Conversation, Vocabularies and Listening>

UNIT III **(9 hours)**

Lesson 7 < Honorific forms of noun and verb2>, Lesson8 < Formal Declarative2>, Lesson 9 < Korean Business Etiquette>, <Basic Conversation, Vocabularies and Listening>

UNIT IV **(3 hours)**

Lesson 10 <Field Korean as an Engineer1>, <Field Korean as an Engineer2> <Basic Conversation, Vocabularies and Listening>

TEXT BOOK

1. Korean through English 2 (Basic Korean Grammar and Conversation)

REFERENCES

1. Bharati Korean (Intermediate Korean Grammar)
2. Hand-outs
3. Various visual media such Movie CD, Audio CD, and music
4. Collection of vocabularies for engineering field.

LE1011 KOREAN LANGUAGE PHASE II												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1012	CHINESE LANGUAGE PHASE II	L	T	P	C
	Total Contact Hours-30	2	0	0	2
	Prerequisite				
	LE1007-Chinese Language Phase I				

PURPOSE

To enable students achieve a basic exposure on China, Chinese language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the Chinese scripts.
2.	To make the students acquire basic conversational skill.
3.	To enable students to know about China and Chinese culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with china.

UNIT I

A) Greetings
Questions and answers about names
Introducing oneself
Receiving a guest
Making corrections

New words: 你ˆyouˇ 好ˆgood 'well ˇ
工作ˆwork 'job ˇ人员ˆpersonnel 'staff member ˇ 请问ˆMay I ask… ˇ 贵ˆexpensive 'valuable ˇ 姓ˆone's family name is ˇ

B) Questions and answers about the number of people in a family
Expressing affirmation/negation
Questions and answers about the identity of a person same or not.

New words: 家ˆfamily 'home ˇ 有ˆhave ˇ 几ˆseveral ˇ
爸爸 (father ˇ 妈妈 (mother) 哥哥 (elderly brother ˇ

UNIT II

A. About places
B. About numbers
C. if one knows a certain person
D. Expressing apology
E. Expressing affirmation/negation
F. Expressing thanks.

New Words:
客人ˆguest,visitor ˇ这儿ˆhere ˇ中文ˆChinese ˇ 对ˆright, correct ˇ
学生ˆstudent ˇ 多ˆmany, a lot ˇ

Grammar: Sentences with a verbal predicate

UNIT III

Introducing people to each other

A. Exchanging amenities
B. Making/Negating conjectures
C. Questions and answers about nationality

Grammar: Sentences with an adjectival predicate

UNIT IV

A) About places to go
Indicating where to go and what to do
Referring to hearsay.
Saying good-bye

B) Making a request
Questions and answers about postcodes and telephone numbers
Reading dates postcodes and telephone numbers
Counting Renmibi

Grammar: Sentences with a subject-verb construction as its predicate
Sentences with a nominal predicate

UNIT V

A. Asking and answering if someone is free at a particular time
B. Making proposals
C. Questions about answers about time
D. Making an appointment
E. Telling the time
F. Making estimations

TEXT BOOK

1. A New Chinese Course 1- Beijing Language and Culture University Press

REFERENCES

1. New Practical Chinese Reader Textbook (1) – Beijing Language and Culture University Press
2. 40 Lessons For Basic Chinese Course I – Shanghai Translation Press
3. My Chinese Classroom - East China Normal University Press

LE1012 CHINESE LANGUAGE PHASE II												
Course Designed by		**Department of English and Foreign Languages**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1 -4				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

PERSONALITY DEVELOPMENT COURSES

PD1001	SOFT SKILLS I
PD1002	SOFT SKILLS II
PD1003	APTITUDE I
PD1004	APTITUDE II
PD1005	APTITUDE III
PD1006	APTITUDE IV

	SOFT SKILLS-I	L	T	P	C
PD1001	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	To develop inter personal skills and be an effective goal oriented team player.
2.	To develop professionals with idealistic, practical and moral values.
3.	To develop communication and problem solving skills.
4.	To re-engineer attitude and understand its influence on behavior.

UNIT I-SELF ANALYSIS **(4 hours)**

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem

UNIT II-ATTITUDE **(4 hours)**

Factors influencing Attitude, Challenges and lessons from Attitude.

Change Management

Exploring Challenges, Risking Comfort Zone, Managing Change

UNIT III-MOTIVATION **(6 hours)**

Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

UNIT IV - GOAL SETTING **(6 hours)**

Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

Time Management

Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

UNIT V-CREATIVITY **(10 hours)**

Out of box thinking, Lateral Thinking

Presentation

ASSESSMENT

1. A practical and activity oriented course which has continuous assessment for 75 marks based on class room interaction, activities etc.
2. Presentation – 25 marks

TEXT BOOK

1. INSIGHT, 2012, Career Development Centre, SRM Publications.

REFERENCES

1. Covey Sean, *Seven Habits of Highly Effective Teens*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, *How to win Friends and Influence People*, New York: Simon & Schuster, 1998.
3. Thomas A Harris, *I am ok, You are ok* , New York-Harper and Row, 1972
4. Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006

PD1001 - SOFT SKILLS-I												
Course Designed by		Career Development Centre										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					X		X	X		X		
2.	Mapping of instructional objectives with student outcome				1		2	3		4		
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1002	SOFT SKILLS-II	L	T	P	C
	Total Contact Hours - 30	1	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	To develop inter personal skills and be an effective goal oriented team player.
2.	To develop professionals with idealistic, practical and moral values.
3.	To develop communication and problem solving skills.
4.	To re-engineer attitude and understand its influence on behavior.

UNIT I - INTERPERSONAL SKILLS (6 hours)

Understanding the relationship between Leadership Networking & Team work, Realizing Ones Skills in Leadership, Networking & Team Work, and Assessing Interpersonal Skills Situation description of Interpersonal Skill.

Team Work

Necessity of Team Work Personally, Socially and Educationally

UNIT II - LEADERSHIP (4 hours)

Skills for a good Leader, Assessment of Leadership Skills

Change Management

Exploring Challenges, Risking Comfort Zone, Managing Change

UNIT III - STRESS MANAGEMENT (6 hours)

Causes of Stress and its impact, how to manage & distress, Understanding the circle of control, Stress Busters.

Emotional Intelligence

What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.

UNIT IV - CONFLICT RESOLUTION (4 hours)

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V - DECISION MAKING (10 hours)

Importance and necessity of Decision Making, process of Decision Making, Practical way of Decision Making, Weighing Positives & Negatives.

Presentation

ASSESSMENT

1. A practical and activity oriented course which has a continuous assessment for 75 marks based on class room interaction, activities etc.,
2. Presentation - 25 marks

TEXT BOOK

1. INSIGHT, 2009. Career Development Centre, SRM Publications.

REFERENCES

1. Covey Sean, *Seven Habit of Highly Effective Teens*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, *How to win Friends and Influence People*, New York: Simon & Schuster, 1998.
3. Thomas A Harris, *I am ok, You are ok* , New York-Harper and Row, 1972
4. Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006

PD1002 - SOFT SKILLS-II												
Course Designed by		Career Development Centre										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					X		X	X		X		
2.	Mapping of instructional objectives with student outcome				1		2	3		4		
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1003	APTITUDE-I	L	T	P	C
	Total Contact Hours - 30	1	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	To improve aptitude, problem solving skills and reasoning ability of the student.
2.	To collectively solve problems in teams & group.

UNIT I–NUMBERS **(6 hours)**

Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II-ARITHMETIC – I **(6 hours)**

Percentages, Profit & Loss, Simple Interest & Compound Interest, Clocks & calendars

UNIT III-ALGEBRA-I **(6 hours)**

Logarithms, Problems on ages

UNIT IV-MODERN MATHEMATICS - I **(6 hours)**

Permutations, Combinations, Probability

UNIT V-REASONING **(6 hours)**

Logical Reasoning, Analytical Reasoning

ASSESSMENT

1. Objective type – Paper based / Online – Time based test

REFERENCES

1. Agarwal.R.S – *Quantitative Aptitude for Competitive Examinations,* S.Chand Limited 2011
2. Abhijit Guha*, Quantitative Aptitude for Competitive Examinations,* Tata McGraw Hill, 3rd Edition*,* 2011
3. Edgar Thrope, *Test Of Reasoning for Competitive Examinations,* Tata McGraw Hill, 4th Edition, 2012
4. *Other material related to quantitative aptitude*

PD1003 – APTITUDE-I												
Course Designed by		**Career Development centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X			X							
2.	Mapping of instructional objectives with student outcome	1			2							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects(P)	
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1004	APTITUDE-II3	L	T	P	C
	Total Contact Hours - 30	1	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1. To improve verbal aptitude, vocabulary enhancement and reasoning ability of the student.

UNIT I **(6 hours)**

Critical Reasoning – Essay Writing

UNIT II **(6 hours)**

Synonyms – Antonyms - Odd Word - Idioms & Phrases

UNIT III **(6 hours)**

Word Analogy - Sentence Completion

UNIT IV **(6 hours)**

Spotting Errors - Error Correction - Sentence Correction

UNIT V **(6 hours)**

Sentence Anagram - Paragraph Anagram - Reading Comprehension

ASSESSMENT

1. Objective type – Paper based /Online – Time based test

TEXT BOOK

1. Personality Development -Verbal Work Book, Career Development Centre, SRM Publications

REFERENCES

1. Green Sharon Weiner M.A & Wolf Ira K.*Barron's New GRE*, *19th Edition*. Barron's Educational Series, Inc, 2011.
2. Lewis Norman, *Word Power Made Easy*, Published by W.R.Goyal Pub, 2011.
3. Thorpe Edgar and Thorpe Showich, *Objective English.* Pearson Education 2012.
4. Murphy Raymond, *Intermediate English Grammar*, (Second Edition), Cambridge University Press, 2012.

PD1004 - APTITUDE-II												
Course Designed by		**Career Development Centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X				
2.	Mapping of instructional objectives with student outcome							1				
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1005	APTITUDE-III	L	T	P	C
	Total Contact Hours - 30	1	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	Understand the importance of effective communication in the workplace.
2.	Enhance presentation skills – Technical or general in nature.
3.	Improve employability scope through Mock GD, Interview

UNIT I **(6 hours)**

Video Profile

UNIT II **(6 hours)**

Tech Talk / Area of Interest / Extempore / Company Profile

UNIT III **(6 hours)**

Curriculum Vitae

UNIT IV **(6 hours)**

Mock Interview

UNIT V **(6 hours)**

Group Discussion / Case Study

ASSESSMENT

1. Objective type – Paper based / Online – Time based test
2. 50% marks based on test, 50 % based on Continuous Communication assessment

REFERENCES

1. Bovee Courtland and Throill John, *Business Communication Essentials: A skills-Based Approach to Vital Business English*. Pearson Education Inc., 2011
2. Dhanavel, S.P., *English & Communication Skills for Students of Science and Engineering*. Orient Black Swan, 2009
3. Rizvi M. Ashraf *Effective Technical Communication*, Tata McGraw-Hill Publishing Company Limited, 2006.

PD1005 – APTITUDE-III												
Course Designed by		Career Development Centre										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X		X	X	
2.	Mapping of instructional objectives with student outcome							1,2,3		1,2		2,3
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1006	APTITUDE-IV	L	T	P	C
	Total Contact Hours - 30	1	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	To improve aptitude, problem solving skills and reasoning ability of the student.
2.	To collectively solve problems in teams & group.

UNIT I - ARITHMETIC-II **(6 hours)**
Ratios & Proportions, Averages, Mixtures & Solutions

UNIT II - ARITHMETIC–III **(6 hours)**
Time, Speed & Distance, Time & Work

UNIT III - ALGEBRA–II **(6 hours)**
Quadratic Equations, Linear equations & inequalities

UNIT IV - GEOMETRY **(6 hours)**
2D Geometry, Trigonometry, Mensuration

UNIT V - MODERN MATHEMATICS–II **(6 hours)**
Sets & Functions, Sequences & Series, Data Interpretation, Data Sufficiency

ASSESSMENT
1. Objective type – Paper based / Online – Time based test

REFERENCES

1. Agarwal.R.S – *Quantitative Aptitude for Competitive Examinations,* S Chand Limited 2011
2. Abhijit Guha*, Quantitative Aptitude for Competitive Examinations,* Tata Mcgraw Hill, 3rd Edition
3. Edgar Thrope*, Test Of Reasoning For Competitive Examinations,* Tata Mcgraw Hill, 4th Edition
4. *Other material related to quantitative aptitude*

PD1006 - APTITUDE-IV												
Course Designed by		**Career Development Centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X			X							
2.	Mapping of instructional objectives with student outcome	1			2							
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		X										
4.	Approval	23rd Meeting of Academic Council, May 2013										

MATHEMATICS COURSES

MA1001	CALCULUS AND SOLID GEOMETRY
MA1002	ADVANCED CALCULUS AND COMPLEX ANALYSIS
MA1013	FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS
MA1004	NUMERICAL METHODS
MA1005	PROBABILITY AND STATISTICS

	CALCULUS AND SOLID GEOMETRY	**L**	**T**	**P**	**C**
MA1001	Total Contact Hours-75	**3**	**2**	**0**	**4**
	(Common to all Branches of Engineering except Bio group)				

PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES

1.	To apply advanced matrix knowledge to Engineering problems.
2.	To equip themselves familiar with the functions of several variables.
3.	To familiarize with the applications of differential equations.
4.	To improve their ability in solving geometrical applications of differential calculus problems
5.	To expose to the concept of three dimensional analytical geometry.

UNIT I - MATRICES **(12 hours)**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley – Hamilton theorem orthogonal reduction of a symmetric matrix to diagonal form – Orthogonal matrices – Reduction of quadratic form to canonical form by orthogonal transformations.

UNIT II - FUNCTIONS OF SEVERAL VARIABLES **(12 hours)**

Function of two variables – Partial derivatives – Total differential – Taylor's expansion – Maxima and Minima – Constrained Maxima and Minima by Lagrangian Multiplier method – Jacobians – Euler's theorem for homogeneous function.

UNIT III - ORDINARY DIFFERENTIAL EQUATIONS (12 hours)

Linear equations of second order with constant and variable coefficients – Homogeneous equation of Euler type – Equations reducible to homogeneous form – Variation of parameter – Simultaneous first order with constant co-efficient.

UNIT IV - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS (12 hours)

Curvature – Cartesian and polar coordinates – Circle of curvature – Involutes and Evolutes – Envelopes – Properties of envelopes.

UNIT V - THREE DIMENSIONAL ANALYTICAL GEOMETRY (12 hours)

Equation of a sphere – Plane section of a sphere – Tangent Plane – Orthogonal Sphere - Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

TEXT BOOKS

1. Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 10th edition, 2012.
2. K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian & V.Srinivasan, "*Engineering Mathematics*",Gamma publications, Revised Edition, 2013.

REFERENCES

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 42nd Edition,2012.
2. Veerajan. T, "*Engineering Mathematics I*", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
3. Kandasamy P etal. "*Engineering Mathematics*", Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
4. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students*", Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
5. Venkataraman M.K., "*Engineering Mathematics*" – First Year (2nd edition), National Publishing Co., Chennai, 2000.

MA1001 CALCULUS AND SOLID GEOMETRY												
Course Designed by		**Department of Mathematics**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--	x			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

MA1002	ADVANCED CALCULUS AND COMPLEX ANALYSIS	L	T	P	C
	Total Contact Hours -75	3	2	0	4
	(Common to all Branches of Engineering except Bio group)				

PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES

1.	To have knowledge in multiple calculus
2.	To improve their ability in Vector calculus
3.	To equip themselves familiar with Laplace transform
4.	To expose to the concept of Analytical function
5.	To familiarize with Complex integration

UNIT I - MULTIPLE INTEGRALS **12 hours)**

Double integration in Cartesian and polar coordinates – Change of order of integration – Area as a double integral – Triple integration in Cartesian coordinates – Conversion from Cartesian to polar – Volume as a Triple Integral.

UNIT II - VECTOR CALCULUS **(12 hours)**

Gradient, divergence, curl – Solenoidal and irrotational fields – Vector identities (without proof) – Directional derivatives – Line, surface and volume integrals – Green's, Gauss divergence and Stoke's theorems (without proof) – Verification and applications to cubes and parallelopipeds only.

UNIT III - LAPLACE TRANSFORMS (12 hours)

Transforms of simple functions – Basic operational properties – Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – periodic functions – Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

UNIT IV - ANALYTIC FUNCTIONS (12 hours)

Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions - Determination of harmonic conjugate – Milne-Thomson's method – Conformal mappings: 1/z, az, az+b and bilinear transformation.

UNIT V - COMPLEX INTEGRATION (12 hours)

Line integral – Cauchy's integral theorem (without proof) – Cauchy's integral formulae and its applications – Taylor's and Laurent's expansions (statements only) – Singularities – Poles and Residues – Cauchy's residue theorem – Contour integration – Unit circle and semi circular contour.

TEXT BOOKS

1. Kreyszig.E, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons. Singapore, 2012.
2. Ganesan.K, Sundarammal Kesavan, K.S.Ganapathy Subramanian & Srinivasan.V, "*Engineering Mathematics*", Gamma publications, Revised Edition, 2013.

REFERENCES

1. Grewal B.S, "*Higher Engg Maths*", Khanna Publications, 42nd Edition, 2012.
2. Veerajan, T., "*Engineering Mathematics I*", Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006.
3. Kandasamy P etal. "*Engineering Mathematics*", Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
4. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics*" for Engineering students, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
5. Venkataraman M.K., "*Engineering Mathematics*" – First Year (2nd edition), National Publishing Co., Chennai, 2000.

MA1002 ADVANCED CALCULUS AND COMPLEX ANALYSIS												
Course Designed by		Department of Mathematics										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)				Engineering Sciences and Technical Arts (E)				Professional Subjects(P)	
		--	x				--				--	
4.	Approval	23rd Meeting of Academic Council, May 2013										

MA 1013	FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS & ITS APPLICATIONS	L	T	P	C
	Total contact hours = 60 hours	4	0	0	4
	(Common to Auto, Aero, Mech, Nano, Civil & Chemical)				

PURPOSE:

To inculcate the problem solving ability in the minds of students so as to apply the theoretical knowledge to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES:

1.	To know to formulate and solve partial differential equations
2.	To have thorough knowledge in Fourier series
3.	To learn to solve boundary value problems
4.	To be familiar with applications of PDE in two dimensional heat equation
5.	To gain good knowledge in the application of Fourier transform

UNIT I - PARTIAL DIFFERENTIAL EQUATIONS (12 hours)

Formation - Solution of standard types of first order equations - Lagrange's equation - Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

UNIT II - FOURIER SERIES (12 hours)

Dirichlet's conditions - General Fourier series - Half range sine and cosine series- Parseval's identity - Harmonic analysis.

UNIT III - BOUNDARY VALUE PROBLEMS (12 hours)

Classification of second order linear partial differential equations - Solutions of one-dimensional wave equation - one-dimensional heat equation

UNIT IV - TWO DIMENSIONAL HEAT EQUATION (12 hours)

Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates & Polar coordinates.

UNIT V - FOURIER TRANSFORMS (12 hours)

Statement of Fourier integral theorem (without proof) - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

TEXT BOOKS

1. Kreyszig.E, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons. Singapore,2012.
2. Grewal.B.S, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, New Delhi, 2012.

REFERENCES

1. Sivaramakrishna Das P. and Vijayakumari.C, A text book of Engineering Mathematics-III,Viji's Academy,2010
2. Kandasamy, P., etal., Engineering Mathematics, Vol. II & Vol. III (4th revised edition), S.Chand & Co., New Delhi, 2000
3. Narayanan, S., Manickavachagom Pillay, T.,. and Ramanaiah,G., Advanced Mathematics for Engineering students, Volume II & III (2nd edition), S,Viswanathan Printers and Publishers, 1992
4. Venkataraman, M, K., Engineering Mathematics - Vol.III - A & B (13th edition), National Publishing Co., Chennai, 1998.
5. Sankara Rao, "Introduction to Partial Differential Equations", 2nd Edition, PHI Learning Pvt. Ltd., 2006.

MA 1013 - FOURIER SERIES, PDE & ITS APPLICATIONS													
Course Designed by		Department of Mathematics											
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	
		x				x							
2.	Mapping of instructional objectives with student outcome	1-5				1-5							
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)		
		--	x			--					--		
4.	Approval	23rd Meeting of Academic Council, May 2013											

MA1004	NUMERICAL METHODS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	(Common to Auto, Aero, Mech, Mechatronics, EEE, Civil , Chemical, ICE & EIE)				

PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES

1.	To familiarise with numerical solution of equations
2.	To get exposed to finite differences and interpolation
3.	To be thorough with the numerical Differentiation and integration
4.	To find numerical solutions of ordinary differential equations
5.	To find numerical solutions of partial differential equations

UNIT I - CURVE FITTING AND NUMERICAL SOLUTION OF EQUATIONS (12 hours)

Method of Least Squares – Fitting a straight line – Fitting a parabola – Fitting an exponential curve – Fitting a curve of the form $y = ax^b$ – Calculation of the sum of the squares of the residuals.- Newton-Raphson method – Gauss Elimination method – Gauss Jacobi method – Gauss Seidel method.

UNIT II - FINITE DIFFERENCES AND INTERPOLATION (12 hours)

First and Higher order differences – Forward differences and backward differences and Central Differences – Differences of a polynomial – Properties of operators – Factorial polynomials – Shifting operator E – Relations between the operators. Interpolation – Newton-Gregory Forward and Backward Interpolation formulae - Divided differences – Newton's Divided difference formula – Lagrange's Interpolation formula – Inverse interpolation

UNIT III - NUMERICAL DIFFERENTIATION AND INTEGRATION (12 hours)

Newton's forward and backward differences formulae to compute first and higher order derivatives – The Trapezoidal rule – Simpson's one third rule and three eighth rule.

UNIT IV - NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS (12 hours)

Solution by Taylor's series – Euler's method – Improved and modified Euler method – Runge-Kutta methods of fourth order (No proof) – Milne's Method - Adam's Bashforth method.

UNIT V - NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

(12 hours)

Classification of Partial differential equations of the second order - Difference quotients – Laplace's equation and its solution by Liebmann's process – Solution of Poisson's equation – Solutions of Parabolic and Hyperbolic equations.

TEXT BOOKS

1. B.S. Grewal, "*Numerical Methods in engineering and science"*, Khanna Publishers, 42nd edition, 2012.
2. S.S. Sastry, "*Introductory Methods of Numerical Analysis",* 4th edition, 2005.

REFERENCES

1. Dr. M.K. Venkataraman*, "Numerical Methods in Science and Engineering"*, National Publishing Co., 2005.
2. Balagurusamy.E, "*Computer Oriented Statistical and Numerical Methods"* – Tata McGraw Hill., 2000.
3. Jain.M.K, SRK Iyengar and R.L.Jain, "*Numerical Methods for Scientific and Engineering Computation"*, Wiley Eastern Ltd., 4th edition, 2003.
4. Jain.M.K, "*Numerical Solution of Differential Equations"*, 2nd edition (Reprint), 2002.
5. Kandasamy etal. P, "*Numerical Methods"*, S.Chand & Co., New Delhi, 2003.

MA1004 NUMERICAL METHODS												
Course Designed by		**Department of Mathematics**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--	x			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

MA1005	**PROBABILITY AND STATISTICS**	**L**	**T**	**P**	**C**
	Total contact hours = 60 hours	**4**	**0**	**0**	**4**
	(Common to Auto, Aero, Mech, Mectr, Civil , Chemical, ICE & EIE)				

PURPOSE

To develop an understanding of the methods of probability and statistics which are used to model engineering problems.

INSTRUCTIONAL OBJECTIVES	
1.	To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.
2.	To appropriately choose, define and/or derive probability distributions such as the Binomial, Poisson and Normal etc to model and solve engineering problems.
3.	To learn how to formulate and test hypotheses about means, variances and proportions and to draw conclusions based on the results of statistical tests.
4.	To understand how regression analysis can be used to develop an equation that estimates how two variables are related and how the analysis of variance procedure can be used to determine if means of more than two populations are equal.
5.	To understand the fundamentals of quality control and the methods used to control systems and processes.

UNIT I - PROBABILITY AND RANDOM VARIABLES (12 hours)

Sample space, Random experiments and random variables, Concept of probability, Conditional probability, Addition and multiplication laws, Baye's theorem - One dimensional Random Variables- Expectation, Variance, Covariance, and Moments.

UNIT II - THEORETICAL DISTRIBUTIONS (12 hours)

Discrete: Binomial, Poisson, Geometric, Negative Binomial; Continuous: Exponential and Normal Distributions, their properties and applications to industrial problems.

UNIT III - TESTING OF HYPOTHESIS (12 hours)

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between proportions - Small sample tests based on t, F distributions- Test for single mean, difference between means, standard deviation, difference between standard deviation - Chisquare test for goodness of fit - Independence of attributes.

UNIT IV - CORRELATION, REGRESSION AND ANALYSIS OF VARIANCE (12 hours)

Pearson's Correlation coefficient- Spearman's Rank correlation coefficient. Regression-Concepts – Regression lines – Multiple correlation and regression. Analysis of Variance- One-way classification and two way classification.

UNIT V - STATISTICAL QUALITY CONTROL (12 hours)

Introduction – Process control – control charts for variables - X and R, X and S charts control charts for attributes: p chart, np chart, c chart and their applications in process control.

TEXT BOOKS

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
2. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill,3rd edition, 2008.

REFERENCES

1. Ross. S., "A first Course in Probability", Fifth Edition, Pearson Education, Delhi 2002.
2. Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
3. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.
4. Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.

MA 1005 - PROBABILITY AND STATISTICS												
Course Designed by		**Department of Mathematics**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X				X						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		--	x			--					--	
4.	Approval	23rd Meeting of Academic Council, May 2013										

SCIENCE COURSES

PY1001	**PHYSICS**
PY1002	**PHYSICS LABORATORY**
PY1003	**MATERIAL SCIENCE**
CY1001	**CHEMISTRY**
CY1002	**CHEMISTRY LABORATORY**
CY1003	**PRINCIPLES OF ENVIRONMENTAL SCIENCE**
BT1001	**BIOLOGY FOR ENGINEERS**

	PHYSICS	**L**	**T**	**P**	**C**
PY1001	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

INSTRUCTIONAL OBJECTIVES

1.	To understand the general scientific concepts required for technology
2.	To apply the Physics concepts in solving engineering problems
3.	To educate scientifically the new developments in engineering and technology
4.	To emphasize the significance of Green technology through Physics principles

UNIT I - MECHANICAL PROPERTIES OF SOLIDS AND ACOUSTICS (9 hours)

Mechanical properties of solids: Stress-strain relationship – Hooke's law – Torsional Pendulum – Young's modulus by cantilever – Uniform and non-uniform bending –– Stress-strain diagram for various engineering materials – Ductile and brittle materials – Mechanical properties of Engineering materials (Tensile strength, Hardness, Fatigue, Impact strength, Creep) – Fracture – Types of fracture (Elementary ideas).

Acoustics: Intensity – Loudness – Absorption coefficient and its determination – Reverberation – Reverberation time – Factors affecting acoustics of buildings and their remedies – Sources and impacts of noise – Sound level meter – Strategies on controlling noise pollution – Ultrasonic waves and properties – Methods of Ultrasonic production (Magnetostriction and Piezoelectric) – Applications of Ultrasonics in Engineering and medicine.

UNIT II - ELECTROMAGNETIC WAVES, CIRCUITS AND APPLICATIONS (9 hours)

Del operator – grad, div, curl and their physical significances - displacement current –Maxwell's equations (derivation) – Wave equation for electromagnetic waves – Propagation in free space – Poynting theorem – Characteristic of Transverse electric and magnetic waves – Skin depth – Rectangular and circular waveguides – High powered vacuum-based cavity magnetrons – Applications including radars, microwave oven and lighting systems.

UNIT III - LASERS AND FIBER OPTICS (9 hours)

Lasers: Characteristics of Lasers – Einstein's coefficients and their relations – Lasing action – Working principle and components of CO_2 Laser, Nd-YAG Laser, Semiconductor diode Laser, Excimer Laser and Free electron Laser – Applications in Remote sensing, holography and optical switching – Mechanism of Laser cooling and trapping.

Fiber Optics: Principle of Optical fiber – Acceptance angle and acceptance cone – Numerical aperture – V-number – Types of optical fibers (Material, Refractive index and mode) – Photonic crystal fibers – Fiber optic communication – Fiber optic sensors.

UNIT IV - QUANTUM MECHANICS AND CRYSTAL PHYSICS (9 hours)

Quantum mechanics: Inadequacies of Classical Mechanics – Duality nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg's uncertainty principle –Schrödinger's wave equation – Particle confinement in 1D box (Infinite Square well potential). **Crystal Physics:** Crystal directions – Planes and Miller indices – Symmetry elements – Quasi crystals – Diamond and HCP crystal structure – Packing factor – Reciprocal lattice – Diffraction of X-rays by crystal planes – Laue method and powder method – Imperfections in crystals.

UNIT V - GREEN ENERGY PHYSICS (9 hours)

Introduction to Green energy – **Solar energy:** Energy conversion by photovoltaic principle – Solar cells – **Wind energy:** Basic components and principle of wind energy conversion systems – **Ocean energy:** Wave energy – Wave energy conversion devices – Tidal energy – single and double basin tidal power plants – Ocean Thermal Electric Conversion (OTEC) – **Geothermal energy:** Geothermal sources (hydrothermal, geo-pressurized hot dry rocks, magma) – **Biomass:** Biomass and bio-fuels – bio-energies from wastages – **Fuel cells**: H_2O_2 – **Futuristic Energy:** Hydrogen – Methane Hydrates – Carbon capture and storage (CCS).

1. One problem sheet consisting of 10 to 15 problems is to be prepared for each unit and discussed in the class.
2. Few problems based on design considerations related to appropriate branches of engineering can be incorporated in each problem sheet.

TEXT BOOKS

1. Thiruvadigal.J.D, Ponnusamy.S, Sudha.D. and Krishnamohan.M, "*Physics for Technologists"*, Vibrant Publication, Chennai, 2013
2. Dattu R.Joshi, "Engineering Physics",Tata McGraw- Hill,New Delih,2010.

REFERENCES

1. Wole Soboyejo, "*Mechanical Properties of Engineered Materials*", Marcel Dekker Inc., 2003.
2. Frank Fahy, "*Foundations of Engineering Acoustics*", Elsevier Academic Press, 2005.
3. Alberto Sona, "*Lasers and their applications*", Gordon and Breach Science Publishers Ltd., 1976.
4. David J. Griffiths, "*Introduction to electrodynamics*", 3rd ed., Prentice Hall, 1999.
5. Leonard. I. Schiff, "*Quantum Mechanics"*, Third Edition, Tata McGraw Hill, 2010.
6. Charles Kittel, "*Introduction to Solid State Physics*", Wiley India Pvt. Ltd, 7th ed., 2007.
7. Godfrey Boyle, "*Renewable Energy: Power sustainable future*", 2nd edition, Oxford University Press, UK, 2004.

PY1001 PHYSICS												
Course Designed by		**Department of Physics and Nanotechnology**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						x
2.	Mapping of instructional objectives with student outcome	1		4		2						3
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		--	x			--					--	
4.	Approval	23rd Meeting of Academic Council, May 2013										

PY1002	PHYSICS LABORATORY	L	T	P	C
	Total Contact Hours - 30	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to develop scientific temper in experimental techniques and to reinforce the physics concepts among the engineering students

INSTRUCTIONAL OBJECTIVES	
1.	To gain knowledge in the scientific methods and learn the process of measuring different Physical variables
2.	Develop the skills in arranging and handling different measuring instruments
3.	Get familiarized with experimental errors in various physical measurements and to plan / suggest on how the contributions could be made of the same order, so as to minimize the errors.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of a given material – Uniform / Non-uniform bending methods.
2. Determination of Rigidity modulus of a given material – Torsion pendulum
3. Determination of dispersive power of a prism – Spectrometer
4. Determination of laser parameters – divergence and wavelength for a given laser source –laser grating/ Particle size determination using laser
5. Study of attenuation and propagation characteristics of optical fiber cable
6. Calibration of voltmeter / ammeter using potentiometer
7. Construction and study of IC regulation properties of a given power supply
8. Study of electrical characteristics of a solar cell
9. Mini Project – Concept based Demonstration

TEXT BOOKS

1. Thiruvadigal. J. D., Ponnusamy,S..Sudha.D. and Krishnamohan M., "*Physics for Technologists"*, Vibrant Publication, Chennai, 2013
2. Shukla.R.K and Anchal Srivastava, "*Practical Physics*", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.

REFERENCES

1. Souires.G.L, "*Practical Physics:*", 4th Edition, Cambridge University, UK, 2001.
2. Chattopadhyay.D, Rakshit.P.C. and Saha.B, "*An Advanced Course in Practical Physics*", 2nd ed., Books & Allied Ltd., Calcutta, 1990.

PY1002 PHYSICS LABORATORY												
Course Designed by		**Department of Physics and Nanotechnology**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						
2.	Mapping of instructional objectives with student outcome	1	3			2						
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--		x			--				--	
4.	Approval	23rd Meeting of Academic Council, May 2013										

PY1003	MATERIALS SCIENCE	L	T	P	C
	Total Contact Hours - 60	2	0	2	3
	Prerequisite				
	Nil				

PURPOSE

The course introduces several advanced concepts and topics in the rapidly evolving field of material science. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for desired engineering applications.

INSTRUCTIONAL OBJECTIVES

1.	To acquire basic understanding of advanced materials, their functions and properties for technological applications
2.	To emphasize the significance of materials selection in the design process
3.	To understand the principal classes of bio-materials and their functionalities in modern medical science
4.	To get familiarize with the new concepts of Nano Science and Technology
5.	To educate the students in the basics of instrumentation, measurement, data acquisition, interpretation and analysis

UNIT I - ELECTRONIC AND PHOTONIC MATERIALS (6 hours)

Electronic Materials: Fermi energy and Fermi–Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect – Dilute Magnetic Semiconductors (DMS) and their applications

Superconducting Materials: Normal and High temperature superconductivity – Applications.

Photonic Materials: LED – LCD – Photo conducting materials – Photo detectors – Photonic crystals and applications – Elementary ideas of Non-linear optical materials and their applications.

UNIT II - MAGNETIC AND DIELECTRIC MATERIALS (6 hours)

Magnetic Materials: Classification of magnetic materials based on spin – Hard and soft magnetic materials – Ferrites, garnets and magnetoplumbites – Magnetic bubbles and their applications – Magnetic thin films – Spintronics and devices (Giant magneto resistance, Tunnel magneto resistance and Colossal magneto resistance).

Dielectric Materials: Polarization mechanisms in dielectrics – Frequency and temperature dependence of polarization mechanism – Dielectric loss – Dielectric waveguide and dielectric resonator antenna – Piezoelectric, pyroelectric and ferroelectric materials and their applications.

UNIT III - MODERN ENGINEERING AND BIOMATERIALS (6 hours)

Modern Engineering Materials: Smart materials – Shape memory alloys – Chromic materials (Thermo, Photo and Electro) – Rheological fluids – Metallic glasses – Advanced ceramics – Composites.

Bio-materials: Classification of bio-materials (based on tissue response) – Comparison of properties of some common biomaterials – Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydrogels) – Tissue replacement implants – Soft and hard tissue replacements – Skin implants – Tissue engineering – Biomaterials for organ replacement (Bone substitutes) – Biosensor.

UNIT IV - INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY (6 hours)

Basic concepts of Nanoscience and Nanotechnology – Quantum wire – Quantum well – Quantum dot – fullerenes – Graphene – Carbon nanotubes – Material processing by chemical vapor deposition and physical vapor deposition – Principle of SEM, TEM, AFM, Scanning near-field optical microscopy (SNOM) – Scanning ion-conducting microscopy (SCIM) – Potential uses of nanomaterials in electronics, robotics, computers, sensors, sports equipment, mobile electronic devices, vehicles and transportation – Medical applications of nanomaterials.

UNIT V - MATERIALS CHARACTERIZATION (6 hours)

X-ray diffraction, Neutron diffraction and Electron diffraction– X-ray fluorescence spectroscopy – Fourier transform Infrared spectroscopy (FTIR) – Ultraviolet and visible spectroscopy (UV-Vis) – Thermogravimetric Analysis (TGA) – Differential Thermal Analysis (DTA) – Differential Scanning Calorimetry (DSC).

PRACTICAL EXPERIMENTS (30 hours)

1. Determination of resistivity and band gap for a semiconductor material – Four probe method / Post-office box
2. Determination of Hall coefficient for a semiconducting material
3. To study V-I characteristics of a light dependent resistor (LDR)
4. Determination of energy loss in a magnetic material – B-H curve
5. Determination of paramagnetic susceptibility – Quincke's method
6. Determination of dielectric constant for a given material
7. Calculation of lattice cell parameters – X-ray diffraction
8. Measurement of glucose concentration – Electrochemical sensor
9. Visit to Advanced Material Characterization Laboratory (Optional)

TEXT BOOKS

1. Thiruvadigal.J.D, Ponnusamy.S, Sudha.D. and Krishnamohan.M, "*Materials Sciences"*, Vibrant Publication, Chennai, 2013
2. Rajendran.V, "*Materials Science*",Tata McGraw- Hill,New Delhi,2011

REFERENCES

1. Rolf E. Hummel, "*Electronic Properties of Materials"*, 4th ed., Springer, New York, 2011.
2. Dennis W. Prather, "*Photonic Crystals: Theory, Applications, and Fabrication"*, John Wiley & Sons, Hoboken, 2009.
3. James R. Janesick, "*Scientific Charge-Coupled Devices",* Published by SPIE - The International Society for Optical Engineering, Bellingham, Washington, 2001.
4. David M. Pozar, "*Microwave Engineering*", 3rd ed., John Wiley & Sons, 2005.
5. Silver.F and Dillion.C, "*Biocompatibility: Interactions of Biological and Implantable Materials*", VCH Publishers, New York, 1989.
6. Severial Dumitriu, "*Polymeric Biomaterials*" Marcel Dekker Inc, CRC Press, Canada 2001.
7. Cao.G, "*Nanostructures and Nanomaterials: Synthesis, Properties and Applications*", Imperial College Press, 2004.
8. Pradeep.T, "*A Text Book of Nanoscience and Nanotechnology*", Tata McGraw Hill, New Delhi, 2012.
9. Sam Zhang, "*Materials Characterization Techniques*", CRC Press, 2008.

PY1003 MATERIALS SCIENCE												
Course Designed by		**Department of Physics and Nanotechnology**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x		x	x						x
2.	Mapping of instructional objectives with student outcome	1	5		4	2						3
3.	Category	General (G)	Basic Sciences(B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--	x			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	CHEMISTRY	L	T	P	C
CY1001	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To enable the students to acquire knowledge in the principles of chemistry for engineering applications

INSTRUCTIONAL OBJECTIVES	
1.	The quality of water and its treatment methods for domestic and industrial applications.
2.	The classification of polymers, different types of polymerizations, preparation, properties and applications of important polymers and FRPs.
3.	The phase rule and its application to one and two component systems.
4.	The principle, types and mechanism of corrosion and protective coatings.
5.	The classification and selection of lubricants and their applications.
6.	The basic principles, instrumentation and applications of analytical techniques

UNIT I - WATER TREATMENT (9 hours)

Water quality parameters: Physical, Chemical & Biological significance - Hardness of water - estimation of hardness (EDTA method) - Dissolved oxygen – determination (Winkler's method), Alkalinity - determination - disadvantages of using hard water in boilers: Scale, sludge formation - disadvantages - prevention - treatment: Internal conditioning - phosphate, carbon and carbonate conditioning methods - External: Zeolite, ion exchange methods - desalination - reverse osmosis and electrodialysis - domestic water treatment.

UNIT II - POLYMERS AND REINFORCED PLASTICS (9 hours)

Classification of polymers - types of polymerization reactions - mechanism of addition polymerization: free radical, ionic and Ziegler - Natta - effect of structure on the properties of polymers - strength, plastic deformation, elasticity and crystallinity -Preparation and properties of important resins: Polyethylene, PVC, PMMA, Polyester, Teflon, Bakelite and Epoxy resins - compounding of plastics - moulding methods - injection, extrusion, compression and calendaring - reinforced plastics - FRP – Carbon and Glass- applications.

UNIT III - PHASE EQUILIBRIA, LUBRICANTS AND ADHESIVES (9 hours)

Phase rule: Statement - explanation of the terms involved - one component system (water system only). Condensed phase rule - thermal analysis - two component systems: simple eutectic, Pb-Ag; compound formation, Zn-Mg.

Lubricants: Classification –solid, semi solid, liquid, emulsion- properties – selection of lubricants for different purposes, Adhesives: classification-natural, synthetic, inorganic- Adhesive action - applications.

UNIT IV - CORROSION AND ITS CONTROL (9 hours)

Corrosion: Basic concepts - mechanism of chemical, electrochemical corrosion - Pilling Bedworth rule – Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion - pitting corrosion - stress corrosion – Measurement of corrosion (wt. loss method only) - factors influencing corrosion. Corrosion control: Cathodic protection - sacrificial anodic method - corrosion inhibitors. Protective coatings: surface preparation for metallic coatings - electro plating (copper plating) and electroless plating (Nickel plating) - chemical conversion coatings - anodizing, phosphating & chromate coating.

UNIT V - INSTRUMENTAL METHODS OF ANALYSIS (9 hours)

Basic principles, instrumentation and applications of potentiometry, UV - visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy and flame photometry .

TEXT BOOKS

1. Kamaraj.P & Arthanareeswari. M, "*Applied Chemistry", 9th Edition*, Sudhandhira Publications, 2012.
2. Dara.S.S, A Text book of Engineering Chemistry, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003

REFERENCES

1. Jain.P.C and Monika Jain, "*Engineering Chemistry*", Danpat Rai publishing company (P) Ltd, New Delhi, 2010.
2. Helen P Kavitha, "*Engineering Chemistry – I", Scitech* Publications, 2nd edition, 2008.

CY1001 CHEMISTRY												
Course Designed by		**Department of Chemistry**										
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x	x		x						x
2.	Mapping of instructional objective with student outcome	1-6	1,5	3		2						4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		x		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

CY1002	CHEMISTRY LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To apply the concepts of chemistry and develop analytical skills for applications in engineering.

INSTRUCTIONAL OBJECTIVES

1. To enable the students to understand the basic concepts involved in the analyses.

LIST OF EXPERIMENTS

1. Preparation of standard solutions
2. Estimation of total, permanent and temporary hardness by EDTA method
3. Conductometric titration - determination of strength of an acid
4. Estimation of iron by potentiometry.
5. Determination of molecular weight of polymer by viscosity average method
6. Determination of dissolved oxygen in a water sample by Winkler's method
7. Determination of Na / K in water sample by Flame photometry (Demonstration)
8. Estimation of Copper in ore
9. Estimation of nickel in steel
10. Determination of total alkalinity and acidity of a water sample
11. Determination of rate of corrosion by weight loss method.

REFERENCES

1. Kamaraj & Arthanareeswari, Sudhandhira Publications "*Practical Chemistry*" (work book) , 2011.
2. Helen P. Kavitha "*Chemistry Laboratory Manual*" , Scitech Publications, 2008.

CY1002 CHEMISTRY LABORATORY													
Course Designed by		Department of Chemistry											
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k	
		x	x									x	
2.	Mapping of instructional objective with student outcome	1	1									1	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)			
		--		x		--				--			
4.	Approval	23rd Meeting of Academic Council, May 2013											

CY1003	PRINCIPLES OF ENVIRONMENTAL SCIENCE	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

The course provides a comprehensive knowledge in environmental science, environmental issues and the management.

INSTRUCTIONAL OBJECTIVES

To enable the students

1.	To gain knowledge on the importance of environmental education and ecosystem.
2.	To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution.
3.	To understand the treatment of wastewater and solid waste management.
4.	To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence.
5.	To be aware of the national and international concern for environment for protecting the environment

UNIT I - ENVIRONMENTAL EDUCATION AND ECOSYSTEMS (6 hours)

Environmental education: Definition and objective. Structure and function of an ecosystem – ecological succession –primary and secondary succession - ecological pyramids – pyramid of number, pyramid of energy and pyramid of biomass.

UNIT II - ENVIRONMENTAL POLLUTION (6 hours)

Environmental segments – structure and composition of atmosphere - Pollution – Air, water, soil , thermal and radiation – Effects – acid rain, ozone layer depletion and green house effect – control measures – determination of BOD, COD, TDS and trace metals.

UNIT III - WASTE MANAGEMENT (6 hours)

Waste water treatment (general) – primary, secondary and tertiary stages.
Solid waste management: sources and effects of municipal waste, bio medical waste - process of waste management.

UNIT IV - BIODIVERSITY AND ITS CONSERVATION (6 hours)

Introduction: definition - genetic, species and ecosystem diversity – bio diversity hot spots - values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife – endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

UNIT V - ENVIRONMENTAL PROTECTION (6 hours)

National concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

TEXT BOOKS

1. Kamaraj.P & Arthanareeswari.M, "*Environmental Science – Challenges and Changes"*, 4th Edition, Sudhandhira Publications, 2010.
2. Sharma.B.K. and Kaur, "*Environmental Chemistry",* Goel Publishing House, Meerut, 1994.

REFERENCES

1. De.A.K., "*Environmental Chemistry"*, New Age International, New Delhi, 1996.
2. Helen P Kavitha, "*Principles of Environmental Science*", Sci tech Publications, 2nd Edition, 2008.

CY1003 – PRINCIPLES OF ENVIRONMENTAL SCIENCE												
Course Designed by		**Department of Chemistry**										
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k
				x		x	x		x	x	x	
2.	Mapping of instructional objective with student outcome			5		2	4		1,3	3	2, 5	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
				x		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

BT1001	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

INSTRUCTIONAL OBJECTIVES	
1.	To familiarize the students with the basic organization of organisms and subsequent building to a living being
2.	To impart an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.
3.	To provide knowledge about biological problems that require engineering expertise to solve them

UNIT I - BASIC CELL BIOLOGY (6 hours)

Introduction: Methods of Science-Living Organisms: Cells and Cell theory Cell Structure and Function, Genetic information, protein synthesis, and protein structure, Cell metabolism-Homoeostasis- Cell growth, reproduction, and differentiation.

UNIT II - BIOCHEMISTRY AND MOLECULAR ASPECTS OF LIFE (5 hours)

Biological Diversity --Chemistry of life: chemical bonds--Biochemistry and Human biology--Protein synthesis—Stem cells and Tissue engineering.

UNIT III - ENZYMES AND INDUSTRIAL APPLICATIONS (5 hours)

Enzymes: Biological catalysts, Proteases, Carbonic anhydrase, Restriction enzymes, and Nucleoside monophosphate kinases—Photosynthesis

UNIT IV - MECHANOCHEMISTRY (7 hours)

Molecular Machines/Motors—Cytoskeleton—Bioremediation—Biosensors

UNIT V - NERVOUS SYSTEM, IMMUNE SYSTEM, AND CELL SIGNALING (7 hours)

Nervous system--Immune system- General principles of cell signaling

TEXT BOOK

1. ThyagaRajan.S, Selvamurugan.N, Rajesh.M.P, Nazeer.R.A, Richard W. Thilagaraj.S, Barathi, and Jaganathan.M.K, "*Biology for Engineers*," Tata McGraw-Hill, New Delhi, 2012.

REFERENCES

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "*Biochemistry*," W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, "*Molecular Biology*," MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, "*Biosensors A Practical Approach*" Bellwether Books**, 2**004.
4. Martin Alexander, "*Biodegradation and Bioremediation,"* Academic Press, 1994.
5. Kenneth Murphy, "*Janeway's Immunobiology*," Garland Science; 8th edition, 2011.
6. Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, "Principles of Neural Science, McGraw-Hill, 5th Edition, 2012.

BT1001 BIOLOGY FOR ENGINEERS												
Course Designed by		**Department of Biotechnology**										
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x			x						x	
2.	Mapping of instructional objective with student outcome	1			2						3	
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
			x			--					--	
4.	Approval	23rd Meeting of Academic Council, May 2013										

BASIC ENGINEERING COURSES

CE1001	**BASIC CIVIL ENGINEERING**
EC1001	**BASIC ELECTRONICS ENGINEERING**
EE1001	**BASIC ELECTRICAL ENGINEERING**
ME1001	**BASIC MECHANICAL ENGINEERING**
CS1001	**PROGRAMMING USING MATLAB**
IC1051	**ELECTRONICS AND INSTRUMENTATION**

	BASIC CIVIL ENGINEERING	**L**	**T**	**P**	**C**
CE1001	Total contact hours- 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer.

INSTRUCTIONAL OBJECTIVES

1.	To know about different materials and their properties
2.	To know about engineering aspects related to buildings
3.	To know about importance of surveying and the transportation systems
4.	To get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

UNIT I - BUILDING MATERIALS **(6 hours)**

Introduction – Civil Engineering – Materials: Bricks – composition – classifications – properties –uses. Stone – classification of rocks – quarrying – dressing – properties –uses. Timber - properties –uses –ply wood. Cement – grades –types – properties –uses. Steel – types – mild steel – medium steel – hard steel – properties – uses – market forms. Concrete – grade designation – properties – uses.

UNIT II - MATERIAL PROPERTIES **(6 hours)**

Stress – strain – types – Hook's law – three moduli of elasticity – poisons ratio – relationship – factor of safety. Centroid - center of gravity – problems in symmetrical sections only (I, T and channel sections). Moment of inertia, parallel, perpendicular axis theorems and radius of gyration (definitions only).

UNIT III - BUILDING COMPONENTS (6 hours)

Building – selection of site – classification – components. Foundations –functions – classifications – bearing capacity. Flooring – requirements – selection – types – cement concrete marble – terrazzo floorings. Roof – types and requirements.

UNIT IV - SURVEYING AND TRANSPORTATION (6 hours)

Surveying – objectives – classification – principles of survey. Transportation – classification – cross section and components of road – classification of roads. Railway – cross section and components of permanent way –functions. Water way – docks and harbor – classifications – components. Bridge – components of bridge.

UNIT V - WATER SUPPLY AND SEWAGE DISPOSAL (6 hours)

Dams – purpose – selection of site – types –gravity dam (cross section only). Water supply – objective – quantity of water – sources – standards of drinking water – distribution system. Sewage – classification – technical terms – septic tank – components and functions.

TEXT BOOKS

1. Raju.K.V.B, Ravichandran.P.T, "*Basics of Civil Engineering"*, Ayyappa Publications, Chennai, 2012.
2. Rangwala.S.C," *Engineering Material"s*, Charotar Publishing House, Anand, 2012.

REFERENCES

1. Ramesh Babu, "*Civil Engineering"*, VRB Publishers, Chennai, 2000.
2. National Building Code of India, Part V, "*Building Material"s*, 2005
3. Surendra Singh, "*Building Material's"*, Vikas Publishing Company, New Delhi, 1996.

CE1001 - BASIC CIVIL ENGINEERING												
Course Designed by		Department of Civil Engineering										
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2.	Mapping of instructional objective with student outcome	1-4				1-4						2-4
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
						x						
4.	Approval	23rd Meeting of Academic Council, May 2013										

EC1001	BASIC ELECTRONICS ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

This course provides comprehensive idea about working principle, operation and characteristics of electronic devices, transducers, Digital Electronics and Communication Systems.

INSTRUCTIONAL OBJECTIVES

At the end of the course students will be able to gain knowledge about the

1. Fundamentals of electronic components, devices, transducers
2. Principles of digital electronics
3. Principles of various communication systems

UNIT I - ELECTRONIC COMPONENTS (4 hours)

Passive components – resistors, capacitors & inductors (properties, common types, I-V relationship and uses).

UNIT II - SEMICONDUCTOR DEVICES (7 hours)

Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT, JFET, optoelectronic devices (LDR, photodiode, phototransistor, solar cell, optocouplers)

UNIT III - TRANSDUCERS (5 hours)

Transducers - Instrumentation – general aspects, classification of transducers, basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers – piezoelectric and thermocouple.

UNIT IV - DIGITAL ELECTRONICS (7 hours)

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression.

UNIT V - COMMUNICATION SYSTEMS (7 hours)

Block diagram of a basic communication system – frequency spectrum - need for modulation - methods of modulation - principles of AM, FM, pulse analog and pulse digital modulation – AM / FM transmitters & receivers (block diagram description only)

TEXT BOOKS

1. Thyagarajan.T. K.P, SendurChelvi.T.R, Rangaswamy, *"Engineering Basics: Electrical, Electronics and Computer Engineering"*, New Age International, Third Edition, 2007.
2. Somanathan Nair.B, Deepa.S.R, "*Basic Electronics",* I.K. International Pvt. Ltd., 2009.

REFERENCES

1. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th Edition, 2011.
2. Rajput.R.K, *"Basic Electrical and Electronics Engineering"*, Laxmi Publications, First Edition, 2007.

EC1001 BASIC ELECTRONICS ENGINEERING												
Course Designed by		**Department of Electronics and Communication Engineering**										
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x										
2.	Mapping of instructional objective with student outcome	1,2 ,3										
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		x				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	BASIC ELECTRICAL ENGINEERING	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**2**	**0**	**0**	**2**
EE1001	Prerequisite				
	Nil				

PURPOSE

This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments.

INSTRUCTIONAL OBJECTIVES

1.	Understand the basic concepts of magnetic circuits, AC & DC circuits.
2.	Explain the working principle, construction, applications of DC & AC machines and measuring instruments.
3.	Gain knowledge about the fundamentals of wiring and earthing

UNIT I - UNDAMENTALS OF DC CIRCUITS (6 hours)

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division

UNIT II - MAGNETIC CIRCUITS (6 hours)

Introduction to magnetic circuits-Simple magnetic circuits-Faraday's laws, induced emfs and inductances

UNIT III - AC CIRCUITS (6 hours)

Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, J operator. Analysis of R-L, R-C, R-L-C circuits. Introduction to three phase systems - types of connections, relationship between line and phase values.

UNIT IV - ELECTRICAL MACHINES & MEASURING INSTRUMENTS (6 hours)

Working principle, construction and applications of DC machines and AC machines (1 - phase transformers, single phase induction motors: split phase, capacitor start and capacitor start & run motors). Basic principles and classification of instruments -Moving coil and moving iron instruments.

UNIT V - ELECTRICAL SAFETY, WIRING &INTRODUCTION TO POWER SYSTEM (6 hours)

Safety measures in electrical system- types of wiring- wiring accessories-staircase, fluorescent lamps & corridor wiring- Basic principles of earthing-Types of earthing- Simple layout of generation, transmission & distribution of power.

TEXT BOOK

1. DashS.S, Subramani.C, Vijayakumar.K, "BasicElectrical Engineering",First edition,Vijay Nicole Imprints Pvt.Ltd, 2013.

REFERENCES

1. Smarajt Ghosh, "*Fundamentals of Electrical & Electronics Engineering*", Second edition, PHI Learning, 2007.
2. MethaV.K, Rohit Metha, "*Basic Electrical Engineering*", Fifth edition, S.Chand & Co, 2012.
3. Kothari.D.P and Nagrath.I.J, "*Basic Electrical Engineering*", Second edition, Tata McGraw - Hill, 2009
4. Bhattacharya.S.K, "*Basic Electrical and Electronics Engineering"*, First edition, Pearson Education, 2011.

EE1001 - BASIC ELECTRICAL ENGINEERING													
Course Designed by		**Department of Electronics and Communication Engineering**											
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k	
		x				x							
2.	Mapping of instructional objective with student outcome	1-3				1							
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)			
		--		--		x				--			
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1001	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours - 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

To familiarize the students with the basics of Mechanical Engineering.

INSTRUCTIONAL OBJECTIVES

1. To familiarize with the basic machine elements
2. To familiarize with the Sources of Energy and Power Generation
3. To familiarize with the various manufacturing processes

UNIT I - MACHINE ELEMENTS - I **(5 hours)**

Springs: Helical and leaf springs – Springs in series and parallel. **Cams:** Types of cams and followers – Cam profile.

UNIT II - MACHINE ELEMENTS - II **(5 hours)**

Power Transmission: Gears (terminology, spur, helical and bevel gears, gear trains). Belt drives (types). Chain drives. Simple Problems.

UNIT III - ENERGY **(10 hours)**

Sources: Renewable and non-renewable (various types, characteristics, advantages/disadvantages). **Power Generation:** External and internal combustion engines – Hydro, thermal and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). Simple Problems.

UNIT IV - MANUFACTURING PROCESSES - I **(5 hours)**

Sheet Metal Work: Introduction – Equipments – Tools and accessories – Various processes (applications, advantages / disadvantages). **Welding:** Types – Equipments – Tools and accessories – Techniques employed -applications, advantages / disadvantages – Gas cutting – Brazing and soldering.

UNIT V - MANUFACTURING PROCESSES– II (5 hours)

Lathe Practice: Types - Description of main components – Cutting tools – Work holding devices – Basic operations. Simple Problems. **Drilling Practice:** Introduction – Types – Description – Tools. Simple Problems.

TEXT BOOKS

1. Kumar.T, Leenus Jesu Martin and Murali.G, *"Basic Mechanical Engineering"*, Suma Publications, Chennai, 2007.
2. Prabhu.T.J, Jai Ganesh. V, and Jebaraj.S, *"Basic Mechanical Engineering"*, Scitech Publications, Chennai, 2000.

REFERENCES

1. Hajra Choudhary.S.K, and HajraChoudhary.A.K, "*Elements of Workshop Technology", Vols. I & II*, Indian Book Distributing Company Calcutta, 2007.
2. Nag.P.K, "*Power Plant Engineering"*, Tata McGraw-Hill, New Delhi, 2008.
3. Rattan.S.S, "*Theory of Machines"*, Tata McGraw-Hill, New Delhi, 2010.

ME1001 BASIC MECHANICAL ENGINEERING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1- 3				1- 3						
3.	Category	General (G)		Basic sciences (B)		Engineering sciences and technical art (E)				Professional subjects (P)		
		--		--		x				--		
4.	Approval	23rd meeting of the Academic Council , May 2013										

CS1001	PROGRAMMING USING MATLAB	L	T	P	C
	Total Contact Hours - 45	1	0	2	2
	Prerequisite				
	Nil				

PURPOSE

This Lab Course will enable the students to understand the fundamentals and programming knowledge in MATLAB.

INSTRUCTIONAL OBJECTIVES

1.	To learn the MATLAB environment and its programming fundamentals
2.	Ability to write Programs using commands and functions
3.	Able to handle polynomials, and use 2D Graphic commands

LIST OF EXPERIMENTS

1. Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files.
2. Data types, Constants and Variables, Character constants, operators, Assignment statements.
3. Control Structures: For loops, While, If control structures, Switch, Break, Continue statements.
4. Input-Output functions, Reading and Storing Data.
5. Vectors and Matrices, commands to operate on vectors and matrices, matrix Manipulations.
6. Arithmetic operations on Matrices, Relational operations on Matrices, Logical operations on Matrices.
7. Polynomial Evaluation, Roots of Polynomial, Arithmetic operations on Polynomials.
8. Graphics: 2D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Pie chart.

TEXT BOOK

1. Bansal.R.K, Goel.A.K, Sharma.M.K, "*MATLAB and its Applications in Engineering*", Pearson Education, 2012.

REFERENCES

1. Amos Gilat, *"MATLAB-An Introduction with Applications"*, Wiley India, 2009.
2. Stephen.J.Chapman, *"Programming in MATLAB for Engineers"*, Cengage Learning, 2011.

CS1001 PROGRAMMING USING MATLAB												
Course Designed by		**Department of Computer Science and Engineering**										
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x									x
2.	Mapping of instructional objective with student outcome	2,3	1-3									1
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		x	--			--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

IC1051	ELECTRONICS AND INSTRUMENTATION	L	T	P	C
	Total Contact Hours- 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The aim of this course is to familiarize the student with the principle of operation, capabilities and limitation of Electronics and instrumentation so that he will be able to use this knowledge effectively.

INSTRUCTIONAL OBJECTIVES

1.	To study the basics of Electronics.
2.	To study the Characteristics of Semiconductor action and Transistor.
3.	To study the application of Semiconductor Devices like UJT, MOSFET, SCR, UJT.
4.	To study the Basic of Measurement.
5.	To study the use of Primary sensing element and Signal Conditioning Unit.

UNIT I - SEMICONDUCTOR DIODE (9 hours)

Semiconductor diode - Crystal diode as a rectifier - Equivalent circuit of a Crystal Diode - Half Wave Rectifier - Efficiency of Half Wave Rectifier - Full wave Rectifier - Center tap Full Wave Rectifier - Full Wave Bridge Rectifier Efficiency of Full Wave Rectifier - Zener Diode - Equivalent Circuit of Zener Diode - Zener Diode as Voltage Stabilizer.

UNIT II - TRANSISTOR & ITS BIASING (9 hours)

Transistor Symbols - Transistor as an Amplifier - Connections - CB, CE, &CC - Characteristics - Comparison of Transistor Connection. Transistor as an Amplifier in CE arrangement - Transistors Load Line analysis, Operating Point - CE Circuit - Performance of Transistor Amplifier - Cut Off and Saturation points - Transistor biasing: Methods of transistor Biasing - Base resistor method - Biasing with feedback resistor - Voltage divider bias method .

UNIT III - FET, SCR & UJT (9 hours)

Types of Field Effect Transistor - JFET - Working Principles of JFET - JFET as an Amplifier and its Output Characteristics - JFET Applications - MOSFET Working Priniciples, SCR - Equivalent Circuit and V-I Characteristics. SCR as a Half wave and full wave rectifier - Application of SCR - Triac and Diac characteristics and its applications. UJT - Equivalent Circuit of a UJT and its Characteristics.

UNIT IV - MEASUREMENT SYSTEM (9 hours)

Measurements and its Significance, Methods of Measurements, Classification of Instruments and application, Elements of a Generalized Measurement System, Static and Dynamic Characteristics of an Instruments, Errors in Measurement Systems - Units, System, Dimension and standards.

UNIT V - PRIMARY SENSING ELEMENTS AND SIGNAL CONDITIONING (9 hours)

Introduction - Transducers - Advantage of Electric Transducers, Classification Based upon Principle of Transduction, Primary and Secondary transducer, Passive and Active transducers, Analog and Digital transducers, Transducers and inverse transducers and examples for each. Characteristics and Choice of transducers, Input, Transfer and output Characteristics and its application. Operational Amplifier, Characteristics of Operational Amplifier, Basic Filters, A/D Converters. Simple Types

TOTAL 45

TEXT BOOKS

1. Sawhney.A.K, "*A Course in Electrical and Electronic Measurement and Instrumentation"*, Dhanpat Rai & Sons, New Delhi, 2012.
2. Mehta.V.K, and Rohit Metha, "*Principles of Electronics"*, S.chand & Company Ltd., First Edition, 2010.

REFERENCES

1. Millman and Halkias, "*Electronic devices and Circuits"*, Tata McGraw Hill International Edition, 2010.
2. Mithal.G.K, "*Electronic Devices and Circuits"*, Khanna Publishers, New Delhi, 2008.
3. Salivahanan.S, Sureshkumar.N, and Vallavaraj.A, "*Electronic Devices and Circuits"*, Tata McGraw - Hill, New Delhi, 2011.
4. Sze.S.M, "*Semiconductor Devices - Physics and Technology"*, 2nd Edtion, John Wiley & Sons, New York, 2006.
5. Ben G. Streetman and Sanjay Banerjee, "*Solid State Electronic Devices"*, Pearson Education, 2009.
6. Ernest O. Doebelin, "*Measurement Systems - Application and Design"*, Tata McGraw-Hill, New Delhi, 2011.

IC1051 ELECTRONICS AND INSTRUMENTATION												
Course Designed by		**Department of Electrical and Electronics Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x	x		x		x				x
2.	Mapping of instructional objectives with student outcome	1,2	1-5	1-5		1-5		1-5				5
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
						X						
4.	Approval	23rd Meeting of Academic Council, May 2013										

IC1052	ELECTRONICS AND INSTRUMENTATION LABORATORY	L	T	P	C
	Prerequisite	0	0	2	1
	Nil				

PURPOSE

To study various Basic Circuits of Electronics and Measurements.

INSTRUCTIONAL OBJECTIVES

1. Characteristics of semiconductor devices.
2. Characteristics of different types of transducers

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor Diode and Zener diode.
2. Characteristics of Transistor under Common Emitter Configuration.
3. Characteristics of Transistor Under Common Base Configuration.
4. Characteristics of Transistor Under Common Collector Configuration.
5. Characteristics of UJT and FET.
6. Characteristics of SCR, DIAC and TRIAC.
7. Characteristics of RTD.
8. Characteristics of Thermistor.
9. Characteristics of Thermocouple.
10. Strain Gauge and Load Cell Characteristics.

TOTAL : 45

REFERENCE

1. Electronic Devices and Measurement Manual

IC1052 - ELECTRONICS AND INSTRUMENTATION LABORATORY												
Course Designed by		Department of Electrical and Electronics Engineering										
1.	Student outcomes	a	B	c	d	e	f	g	h	i	j	k
		x	X	x	x	x						x
2.	Mapping of instructional objectives with student outcome	1,2	1,2	1,2	1,2	1,2						1,2
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

PROGRAM COURSES

	ENGINEERING MECHANICS	L	T	P	C
ME1002	Total Contact Hours-75	3	2	0	4
	Prerequisite				
	Nil				

PURPOSE

To develop the ability, in the engineering student, to understand, formulate, and solve a given problem in a logical manner and to apply it to solve a few basic problems in engineering mechanics.

INSTRUCTIONAL OBJECTIVES

1. Static equilibrium of particles and rigid bodies.
2. Analysis of trusses and friction.
3. Properties of surfaces and volumes.
4. Dynamic equilibrium of particles.
5. Dynamic equilibrium of rigid bodies.

UNIT I - STATICS OF PARTICLES (16 hours)

Equilibrium of Particles: Fundamental concepts and principles of engineering mechanics - Forces on particles –vector addition- Concurrent forces in a plane - Resolution of forces - Resultant of several concurrent forces - Free body diagram –Forces in space. **Equilibrium of rigid bodies**: Principles of transmissibility - Moment of a force - Varignon's theorem - Equivalent system of forces - Reduction of system of forces into single force and couple-Equipollent system of forces - Types of supports and corresponding reactions - Equilibrium of rigid bodies in two dimensions.- Equilibrium of a two force body , statically determinate and indeterminate structures.

UNIT II - ANALYSIS OF TRUSSES AND FRICTION (15 hours)

Trusses: Definition of a truss - Simple Trusses - Analysis of Trusses - Method of joints- Method of sections. **Friction**: Laws of Friction - Angle of Friction –Dry friction- Wedges - Rolling friction - Belt Friction - Thrust and Journal bearings.

UNIT III - PROPERTIES OF SURFACES AND VOLUMES (14 hours)

Centre of Gravity: - Centroids of lines, areas, and volumes –Determination of centroids by integration - Theorem of Pappus-Guldinus - **Moment of Inertia**: Second moment or Moment of inertia of an area**-** Determination of moment of inertia of area by integration - Radius of gyration - Parallel and perpendicular axis theorems - Polar moment of inertia - Mass moment of inertia.

UNIT IV - DYNAMICS OF PARTICLES (15 hours)

Rectilinear motion –uniform velocity and uniformly accelerated motion- Rectangular components of velocity and acceleration- Curvilinear motion –Normal and tangential components- Radial and transverse components-Newton second law – D'Alembert's principle- Principle of work and energy –Applications- Conservative forces-Principle of impulse and momentum - Impulsive motion - Impact of elastic bodies – Direct central- Oblique central impact.

UNIT V - DYNAMICS OF RIGID BODIES (15 hours)

Introduction to Kinematics of rigid bodies - Translation and rotation of rigid bodies - Fixed axis rotation – General plane motion –Absolute and Relative velocity in plane motion - Instantaneous center of rotation in plane motion - Principle of work and energy for a rigid body - Principle of impulse and momentum for the plane motion of a rigid body.

TOTAL 75

TEXTBOOKS

1. Ferdinand.P. Beer. E, Russell Johnston Jr., David Mazurek, Philip J Cornwell, "*Vector Mechanics for Engineers: Statics and Dynamics"* , McGraw - Hill, New Delhi, Tenth Edition, 2013.
2. Palanichamy.M.S, and Nagan.S, "*Engineering Mechanics (Statics and Dynamics)"*, Tata McGraw Hill, New Delhi Eighth reprint, 2011(Third edition).

REFERENCES

1. Timoshenko, and Young, "*Engineering Mechanics"*, Tata Mc-Graw Hill Book Company, Edition 4, New Delhi, 1988.
2. Mclean, and Nelson, "*Theory and problems of Engineering Mechanics (Statics and Dynamics)"*, 3rd Edition Schaum Series, 1980.
3. Rajasekaran.S, & Sankarasubramanian.G, "*Engineering Mechanics"*, Vikas Publishing House Pvt Ltd, 2011.
4. Shames.I.H, and Krishna Mohana Rao.G, "*Engineering Mechanics (Statics and Dynamics)"*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2006.
5. Dr.Bansal.R.K, & Sanjay Bansal, "*A Text book of Engineering Mechanics"*, Lakshimi publications, Edition 7, 2011.

ME1002 - ENGINEERING MECHANICS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-5				1-5					1-5	
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
				X								
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1003	**ACTIVE LEARNING LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours-30	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

To make the students to understand some basic concepts using learning through discovery method.

INSTRUCTIONAL OBJECTIVES

1. To familiarise the students with basic concepts, theorems, etc

LIST OF EXPERIMENTS

1. Verifying Lami's theorem
2. Verifying Lami's theorem using Angle method
3. Find out unknown weight using Lami's theorem (Angle method)
4. Find out two unknown weights using Lami's theorem(Angle method)
5. Discovering Friction (Activity – I)
6. Discovering Friction (Activity – II)
7. Discovering Friction (Activity – III)
8. Discovering Friction (Activity – IV)
9. Verify Grashof's Law
10. Inversion of Four bar mechanism

TOTAL : 30

REFERENCE

1. Laboratory Manual.

ME1003ACTIVE LEARNING LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x					x	
2.	Mapping of instructional objectives with student outcome	1	1			1					1	
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
		x										
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1004	WORKSHOP PRACTICE	L	T	P	C
	Total contact hours - 45	0	0	3	2
	Prerequisite				
	Nil				

PURPOSE

To provide the students with hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

INSTRUCTIONAL OBJECTIVES

1. To familiarize with the basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy
2. To familiarize with the production of simple models in the above trades.

UNIT I - FITTING **(9 hours)**

Tools & Equipments – Practice in filing.
Making Vee Joints, Square, Dovetail joints and Key making - plumbing.
Mini project – Assembly of simple I.C. engines.

UNIT II - CARPENTRY **(9 hours)**

Tools and Equipments- Planning practice.
Making Half Lap, Dovetail, Mortise &Tenon joints.
Mini project - model of a single door window frame.

UNIT III - SHEET METAL **(9 hours)**

Tools and equipments– practice.
Making rectangular tray, hopper, scoop, etc.
Mini project - Fabrication of a small cabinet, dust bin, etc.

UNIT IV - WELDING **(9 hours)**

Tools and equipments -
Arc welding of butt joint, Lap joint, Tee fillet.
Demonstration of gas welding, TIG & MIG welding.

UNIT V - SMITHY **(9 hours)**

Tools and Equipments –
Making simple parts like hexagonal headed bolt, chisel.

TEXT BOOK

1. Gopal.T.V, Kumar.T, and Murali.G, "*A first course on workshop practice – Theory, Practice and Work Book"*, Suma Publications, Chennai, 2005.

REFERENCE BOOKS

1. Kannaiah.P and Narayanan.K.C, "*Manual on Workshop Practice"*, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy.V.S, "*First year Engineering Workshop Practice"*, Ramalinga Publications, Madurai, 1999.
3. Laboratory Manual.

ME1004 - WORKSHOP PRACTICE												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	B	c	d	e	f	g	h	i	j	k
			×	×				×				
2.	Mapping of instructional objectives with student outcome		1,2	1,2				1,2				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)			Professional Subjects(P)			
						X						
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1005	**ENGINEERING GRAPHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	**1**	**0**	**4**	**3**
	Prerequisite				
	Nil				
First Angle Projection is to be followed - Practice with Computer Aided Drafting tools					
PURPOSE					
1. To draw and interpret various projections of 1D, 2D and 3D objects.					
2. To prepare and interpret the drawings of buildings.					

INSTRUCTIONAL OBJECTIVES	
1.	To familiarize with the construction of geometrical figures
2.	To familiarize with the projection of 1D, 2D and 3D elements
3.	To familiarize with the sectioning of solids and development of surfaces
4.	To familiarize with the Preparation and interpretation of building drawing

UNIT I - FUNDAMENTALS OF ENGINEERING GRAPHICS (2 hours)

Lettering – Two dimensional geometrical constructions – Conics – Representation of three-dimensional objects – Principles of projections – Standard codes – Projection of points.

UNIT II - PROJECTION OF LINES AND SOLIDS (4 hours)

Projection of straight lines – Projection of planes - Projection of solids – Auxiliary projections.

UNIT III - SECTIONS AND DEVELOPMENTS (3 hours)

Sections of solids and development of surfaces.

UNIT IV - PICTORIAL PROJECTIONS (4 hours)

Conversion of Projections: Orthographic projection – Isometric projection of regular solids and combination of solids.

UNIT V - BUILDING DRAWING (2 hours)

Plan, Elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course) with electrical wiring diagram.

PRACTICAL:(60 hours)

TEXT BOOKS

1. Venugopal.K and Prabhu Raja.V, "*Engineering Graphics"*, Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
2. Natarajan.K.V, "*A Text Book of Engineering Graphics"*, 21st Edition, Dhanalakshmi Publishers, Chennai, 2012.
3. Jeyapoovan.T, "*Engineering Drawing and Graphics using AutoCAD"*, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

REFERENCES

1. Bethune.J.D, *"Engineering Graphics with AutoCAD 2013",* PHI Learning Private Limited, Delhi, 2013.
2. Bhatt.N.D, "*Elementary Engineering Drawing (First Angle Projection)"*, Charotar Publishing Co., Anand, 1999.
3. Narayanan.K.L and Kannaiah.P, "*Engineering Graphics"*, Scitech Publications, Chennai, 1999.
4. Shah.M.B and Rana.B.C, "*Engineering Drawing"*, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.

ME1005 ENGINEERING GRAPHICS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
			x	x				x				
2.	Mapping of instructional objectives with student outcome		1-4	1-4				1-4				
3.	Category	General (G)		Basic sciences(B)		Engineering sciences and technical art (E)					Professional subjects (P)	
		--		--		x					--	
4.	Approval	23rd meeting of the Academic Council , May 2013										

NC1001/ NS1001/ SP1001/ YG1001	**NATIONAL CADET CORPS (NCC)/ NATIONAL SERVICE SCHEME (NSS)/ NATIONAL SPORTS ORGANIZATION (NSO) / YOGA**	**L**	**T**	**P**	**C**
	Total Contact Hours – 15 (minimum, but may vary depending on the course)	**0**	**0**	**1**	**1**
	Prerequisite				
	Nil				
PURPOSE					
To imbibe in the minds of students the concepts and benefits of NCC/NSS/NSO/YOGA and make them practice the same					
INSTRUCTIONAL OBJECTIVES					
1.	To enable the students to gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice				

NATIONAL CADET CORPS (NCC)

Any student enrolling as a member of National Cadet Core (NCC) will have to attend sixteen parades out of twenty parades each of four periods over a span of academic year.

Attending eight parades in first semester will qualify a student to earn the credits specified in the curriculum. Grading shall be done based on punctuality, regularity in attending the parades and the extent of active involvement.

NATIONAL SERVICE SCHEME (NSS)

A student enrolling as member of NSS will have to complete 60 hours of training / social service to be eligible to earn the credits specified in the curriculum.

Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

NATIONAL SPORTS ORGANIZATION (NSO)

Each student must select one of the following games/sports events and practice for one hour per week. An attendance of 75% is compulsory to earn the credits specified in the curriculum. Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

List of games/sports:

Basket Ball, Football, Volley Ball, Ball Badminton, Cricket, Throw-ball, Track events

Field events or any other game with the approval of faculty member.

YOGA

Benefits of Agnai Meditation -Meditation - Agnai, Asanas, Kiriyas, Bandas, Muthras

Benefits of santhi Meditation - Meditation Santhi Physical Exercises (I & II)

Lecture & Practice - Kayakalpa Yoga Asanas, Kiriyas, Bandas, Muthras

Analysis of Thought - Meditation Santhi Physical Exercises III & IV

Benefits of Thuriyam - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Attitude - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Importance of Arutkappy & Blessings - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Benefits of Blessings - Meditation Santhi Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Assessment

An attendance of 75% is compulsory to earn the credits specified in the curriculum. Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

TEXT BOOKS

1. Yogiraj Vethathiri Maharishi, "*Yoga for Modern Age*", Vethathiri Publishers, 1989.
2. Vethathiri Maharishi.T, "*Simplified Physical Exercises*", Vethathiri Publishers, 1987.

NC1001/ NS1001/ SP1001/ YG1001		**NATIONAL CADET CORPS (NCC)/ NATIONAL SERVICE SCHEME (NSS)/NATIONAL SPORTS ORGANIZATION (NSO)/YOGA**										
Course Designed by		**Department of Mechanical Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					x					x		
2.	Mapping of instructional objectives with student outcome											
3.	Category	General (G)		Basic sciences(B)		Engineering sciences and technical art (E)				Professional subjects (P)		
		x										
4.	Approval	23rd meeting of the Academic Council , May 2013										

ME1007	**THERMODYNAMICS**	**L**	**T**	**P**	**C**
	Total contact hours - 60	**2**	**2**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course provides the basic knowledge about thermodynamic laws and relations, and their application to various processes.

INSTRUCTIONAL OBJECTIVES

1.	Understand the thermodynamic laws and their applications.
2.	Know the concept of entropy and availability.
3.	Know about the properties of steam and the use of steam tables and Mollier chart.
4.	Know about thermodynamic relations.

UNIT I - BASIC CONCEPTS OF THERMODYNAMICS (12 hours)

Macroscopic approach and microscopic approach - Thermodynamic system and surrounding - forms of energy - Properties of a system - State and equilibrium - Quasi static process - Zeroth law of thermodynamics, first law of thermodynamics, heat, work - Application of first law to non-flow system - Thermodynamic analysis of control volume - Steady flow energy equation - Applications.

UNIT II - SECOND LAW OF THERMODYNAMICS (12 hours)

Kelvin-Planck statement - Clausius statement - Carnot cycle - Cyclic heat engine - Heat reservoirs - Refrigerator and heat pump - Equivalence of Kelvin - Planck and Clausius statements - Reversibility and irreversibility.

UNIT III - ENTROPY AND AVAILABILITY (12 hours)

Clausius theorem - Clausius inequality - Entropy principle - Property diagrams involving entropy - Entropy change of ideal gases - Entropy generation in a closed system - Entropy generation in an open system - Third law of thermodynamics - Introduction to availability in non-flow and flow process.

UNIT IV - PROPERTIES OF STEAM (12 hours)

Steam formation - Temperature entropy diagram-Mollier diagram-Specific properties of steam -Use of steam tables & Mollier chart - Methods of heating and expanding the steam - Constant volume heating - Constant pressure expansion - Isothermal expansion - Hyperbolic **e**xpansion-isentropic expansion - Polytrophic expansion - Throttling process - Dryness fraction measurement.

UNIT V - THERMODYNAMIC RELATIONS (12 hours)

Maxwell's equations - Clapeyron equation -general relations for du, dh, ds, C_p and C_v - Joule Thomson coefficient. Gas mixtures - Dalton's law of partial pressures - P-V-T behavior of gas mixtures - Property calculations.

TOTAL : 60

TEXT BOOKS

1. Nag.P.K, "*Engineering Thermodynamics"*, 4th Edition, Tata McGraw Hill Education, New Delhi, 2008.
2. Yunus.N.J, Cengel.A, and Michael Boles, "*A., Thermodynamics - An Engineering Approach, 6th Edition"*, Tata McGraw Hill- Education, 2008.

DATA BOOKS

1. Ramalingam. K.K, "*Steam tables, Sci.Tech Publishers"*, 2009.
2. Khurmi.R.S, "*Steam Table"s*, S.Chand Publishers, 2012.

REFERENCES

1. Kothandaraman.C.P, Domkundwar.S, Anand Domkundwar, *"A Course in Thermal Engineering"*, Dhanpat Rai & Co. (P) Ltd., 2010.
2. Mahesh M. Rathore, "*Thermal Engineering"*, Tata Mc Graw Hill Education private limited, Reprint 2011.
3. Michael Moran.J, and Howard Shapiro.N, "*Fundamentals of Engineering Thermodynamics"*, 4th Edition, John Wiley & Sons, New York, 2000.
4. William Z. Black, James G.Hartley, "*Thermodynamics"*, 3rd edition Pearson, 2010.

ME1007 - THERMODYNAMICS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-4				1-4						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
						X						
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1008	MANUFACTURING TECHNOLOGY	L	T	P	C
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To make the students aware of different manufacturing processes like casting, metal forming, metal cutting and gear manufacturing.

INSTRUCTIONAL OBJECTIVES

1.	Concepts of casting Technology.
2.	Mechanical working of metals.
3.	Theory of metal cutting.
4.	Gear manufacturing process .
5.	Surface finishing processes.
6.	Milling machine & other machine tools.

UNIT I - CASTING **(8 hours)**

Introduction to casting - Patterns - Types - Pattern materials - Allowances. Moulding - types - Moulding sand - Gating and Risering - Core making. Special Casting Process – Shell- Investment - Die casting - Centrifugal Casting - Design of Casting, defects in casting.

UNIT II - MECHANICAL WORKING OF METALS **(9 hours)**

Hot and Cold Working: Rolling, Forging, Wire Drawing, Extrusion - types – Forward-backward and tube extrusion.

Sheet Metal Operations: Blanking - blank size calculation, draw ratio, drawing force, Piercing, Punching, Trimming, Stretch forming, Shearing, Bending - simple problems - Bending force calculation, Tube forming - Embossing and coining, Types of dies: Progressive, compound and combination dies, defects in forming.

UNIT III - THEORY OF METAL CUTTING **(9 hours)**

Orthogonal and oblique cutting - Classification of cutting tools: single, multipoint - Tool signature for single point cutting tool - Mechanics of orthogonal cutting - Force relations : Merchant circle – Determination of Shear angle - Chip formation- Cutting tool materials - Tool wear and tool life - Machinability - Cutting Fluids - Simple problems.

UNIT IV - GEAR MANUFACTURING AND SURFACE FINISHING PROCESS **(9 hours)**

Gear manufacturing processes: Extrusion, Stamping, and Powder Metallurgy. Gear Machining: Forming. Gear generating process - Gear shaping, Gear hobbing. Surface Finishing Process: Grinding process, various types of grinding machine, Grinding Wheel - types - Selection of Cutting speed and work speed, dressing and truing. Fine Finishing - Lapping, Buffing, Honing, and Super finishing.

UNIT V - MACHINE TOOLS **(10 hours)**

Milling Machine - Types, Types of cutters, operations, Indexing methods. Shaping, Planing and Slotting Machine – Operations and quick return mechanisms, Work and tool holding devices. Boring machine - Operations, Jig boring machine. Broaching machine - operations, Tool nomenclature-Simple Problems.

TOTAL : 45

TEXT BOOKS

1. Sharma.P.C, "*Production Technology : Manufacturing Processes",* 7th Edition, S. Chand Publisher, 2008.
2. Rao.P.N, "*Manufacturing Technology, Vol I and II",* Tata McGraw Hill Publishing Co., 2nd edition, 2009.

REFERENCES

1. Hajra Choudhary.S.K and Hajra Choudhary.A.K, "*Elements of Manufacturing Technology"*, Vol II, Media Publishers, Bombay, 2007.
2. Jain.R.K, "*Production Technology : Manufacturing Processes, Technology and Automation"*, 17th Edition, Khanna Publishers, 2011.
3. Kalpakjian, "*Manufacturing Engineering and Technology"*, 4th edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.
4. Chapman.W.A.J, "*Workshop Technology Vol. I and II"*, Arnold Publisher, New Delhi, 2001.

ME1008 – MANUFACTURING TECHNOLOGY													
Course Designed by		**Department of Mechanical Engineering**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
		x		x							x		
2.	Mapping of instructional objectives with student outcome	1-6		1-6									
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)			
						X							
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1009	**FLUID MECHANICS**	**L**	**T**	**P**	**C**
	Total contact hours - 60	**2**	**2**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to fluid flow problems.

INSTRUCTIONAL OBJECTIVES

1.	To understand the properties of the fluid.
2.	To understand and solve the fluid flow problems.
3.	To understand the mathematical techniques of practical flow problems.
4.	To understand the energy exchange process in fluid machines.

UNIT I - PROPERTIES OF FLUIDS AND FLUID STATICS (9 hours)

Fluid properties: Mass density, specific weight, specific volume, specific gravity, viscosity, vapour pressure, compressibility, surface tension and capillarity. Fluid statics: fluid pressure at a point, variation of pressure within a static fluid, hydrostatic law - Pressure head, Pascal's law. Measurement of pressure - Piezometric tube, manometry.

UNIT II - FLUID KINEMATICS AND FLUID DYNAMICS (12 hours)

Fluid kinematics: Lagrangian and Eulerian description of fluid flow - Velocity and acceleration of fluid particles - Different types of fluid flow. Description of flow pattern: Stream line, streak line, path line. Principle of conservation of mass - Continuity equation.

Fluid dynamics: Euler's equation of motion along a stream line - Bernoulli's equation. Practical applications of Bernoulli's equation in flow measurement devices like venturimeter, orificemeter and pitot tube. Concept of impulse momentum equation & angular momentum principle with applications.

UNIT III - DIMENSIONAL AND MODEL ANALYSIS (9 hours)

Dimensional analysis: dimensions, dimensional homogeneity, methods of dimensional analysis-Buckingham Pi theorem. Model analysis - Advantages and applications of model testing. similitude, derivations of important dimensionless numbers, model laws.

UNIT IV - FLOW THROUGH PIPES (9 hours)

Laminar and turbulent flow characteristics, laminar flow through circular pipes - Hagen Poiseuille law, major and minor losses in pipes, pipe friction, Darcy - Weisbach equation, parallel, series and branched pipes.

UNIT V - BOUNDARY LAYER THEORY AND FLUID FLOW OVER BODIES (9 hours)

Boundary layer development on a flat plate and its characteristics - Boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Momentum equation for boundary layer by Vonkarman, drag on flat plate, boundary layer separation and its control. Aerofoil theory, lift and drag coefficients, streamlined and bluff bodies.

UNIT VI - HYDRAULIC MACHINES (12 hours)

Hydraulic turbine: Classification, difference between impulse and reaction turbine. Construction and working of Pelton turbine, Francis turbine and Kaplan turbine, velocity triangle, heads and efficiencies. Pumps: classification, difference between positive and non-positive displacement pumps. construction and working of reciprocating pump. Centrifugal pump-heads of a centrifugal pump, priming, velocity triangle, work done, efficiencies of centrifugal pump.

TOTAL : 60

TEXT BOOKS

1. Rajput.R.K, "*A text book of Fluid Mechanics and Hydraulic Machines"*, S. Chand & Company Ltd., New Delhi, Fourth edition, 2010.
2. Bansal.R.K, "*Fluid Mechanics and Hydraulics Machines"*, 5th edition, Laxmi publications (P) Ltd., New Delhi, Ninth Edition, 2006.

REFERENCES

1. White.F.M, "*Fluid Mechanics"*, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
2. Streeter.V.L, and Wylie.E.B, "*Fluid Mechanics"*, McGraw Hill, 1983.
3. Modi P.N, & Seth S.M, "*Hydraulics and Fluid Mechanics"*, Standard Book House, New Delhi, 14th edition, 2002.
4. Shiv Kumar, "*Fluid Mechanics & Fluid Machines: Basic Concepts & Principles"*, Ane Books Pvt. Ltd., New Delhi, 2010.
5. Yunus A Cengel & John M. Cimbala, Fluid Mechanics, Tata McGraw Hill Edition, New Delhi, 2006

ME1009 FLUID MECHANICS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-4				1-4						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1010	**MECHANICS OF SOLIDS**	**L**	**T**	**P**	**C**
	Total contact hours - 60	**2**	**2**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements.

INSTRUCTIONAL OBJECTIVES

1. Know the concepts of stress and strain.
2. Analyze the beam of different cross sections for shear force, bending moment, slope and deflection.
3. Understand the concepts necessary to design the structural elements and pressure vessels.

UNIT I - CONCEPT OF STRESSES AND STRAINS (12 hours)

Concept of stress and strain, Hooke's law - Tension, Compression, and Shear, stress-strain diagram - Poisson's ratio, elastic constants and their relationship - Deformation of simple and compound bars. Thermal stresses – simple and Composite bars. Principal plane, principal stress, maximum shearing stress - Uniaxial, biaxial state of stress - Mohr's circle for plane stresses.

UNIT II - ANALYSIS OF BEAMS (12 hours)

Types of beams and loads - shear force and bending moment diagrams for cantilevers, simply supported and over hanging beams. Theory of pure bending - Bending stresses in simple and composite beams. Shear stress distribution in beams of different sections.

UNIT III - TORSION OF SHAFTS (12 hours)

Theory of pure torsion, torsion of circular shafts and composite shafts.

UNIT IV - DEFLECTION OF BEAMS (12 hours)

Slope and deflection of cantilever, simply supported beam by double integration method - Macaulay's method - Moment area method - Castigliano's theorem.

UNIT V - COLUMNS AND CYLINDERS (12 hours)

Columns and struts: Member subjected to combined bending and axial loads, Euler's theory, Crippling load, Rankine's theory. **Cylinders And Shells:** Thin cylinder, thin spherical shells under internal pressure - Thick cylinders - Lame's equation - Shrink fit and compound cylinders.

TOTAL : 60

TEXT BOOKS

1. Bansal.R.K, "*A Text Book of Strength of Materials"*, Lakshmi Publications Pvt. Limited, New Delhi, 2010.
2. Prabhu.T.J, "*Mechanics of solids"*, Private Publication, 2002.
3. Rajput.R.K, "*Strength of Materials"*, Fourth Edition ,S. Chand Limited, 2007.
4. Ferdinand P.Beer, and Rusell Johnston.E, "*Mechanics of Materials"*, SI Metric Edition, McGraw Hill, 2011(Hard cover).

REFERENCES

1. William A. Nash, "*Theory and Problems of Strength of Materials"*, Schaum's Outline Series, McGraw Hill International Edition, 3rd Edition, 2007.
2. Srinath.L.S, "*Advanced Mechanics of Solids"*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.

3. Egor P. Popov, "*Engineering Mechanics of Solids"*, 2nd edition, Prentice Hall of India Private Limited, New Delhi, 2009.
4. James M. Gere,"*Mechanics of Materials*", Eighth Edition, Brooks/Cole, USA, 2013.
5. Shigley.J.E, "*Applied Mechanics of Materials"*, International Student Edition, McGraw Hill Koyakusha Limited, 2000.

ME1010 MECHANICS OF SOLIDS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-3				1-3						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1011	APPLIED THERMAL ENGINEERING	L	T	P	C
	Total contact hours - 75	3	2	0	4
	Prerequisite				
	Thermodynamics				

PURPOSE

On completion of this course, the students are expected to understand the concept and working of gas, vapour power cycles, air compressors, refrigeration and air conditioning systems.

INSTRUCTIONAL OBJECTIVES

1.	To understand various gas power cycles.
2.	To study vapour power cycles with reheat and regeneration.
3.	To study the performance of air compressors.
4.	To study the refrigeration and air conditioning systems

UNIT I - GAS POWER CYCLES **(15 hours)**

Air standard cycles - Assumptions - Otto, Diesel, Dual - Air standard efficiency - Mean effective pressure and power; Brayton cycle - Reheat and regeneration.

UNIT II - VAPOUR POWER CYCLES **(15 hours)**

Rankine cycle - Performance - Comparison between Rankine cycle and Carnot cycle - Simple, reheat and regenerative cycle - Introduction to binary vapour cycle - Combined cycle.

UNIT III - AIR COMPRESSORS **(15 hours)**

Reciprocating air compressors - Types - Compression without clearance - Effect of clearance - multistage compression - Optimum intermediate pressure for perfect inter-cooling - Compressor efficiencies and mean effective pressure. Rotary compressors - Vane compressor, roots blower - Comparison between reciprocating compressors and rotary compressors.

UNIT IV - REFRIGERATION SYSTEMS **(15 hours)**

Vapour compression systems - Working principle, refrigerants - Classifications - Properties - Eco friendly refrigerants. Analysis of vapour compression refrigeration cycle, use of P-h chart, effect of sub cooling and superheating - Calculations of COP. Vapour absorption systems - types - Working principle, comparison.

UNIT V - PSYCHROMETRY AND AIR CONDITIONING **(15 hours)**

Properties of atmospheric air - Psychrometric chart, relations. Psychrometric processes - Sensible heating and cooling, cooling and dehumidification, heating and humidification, adiabatic mixing of two air streams. Air conditioning - Classifications - summer, winter, year round air conditioning system, window, split and centralized - Introduction to heat load calculations.

TOTAL : 75

TEXT BOOKS

1. RajputR.K, "*Thermal Engineering"*, Laxmi Publications, 8th Edition, New Delhi, 2010.
2. Kothandaraman.C.P, Domkundwar.S, Anand Domkundwar, "*A Course in Thermal Engineering"*, Dhanpat Rai & Co. (P) Ltd., 2010.

DATA BOOKS

1. Ramalingam.K.K, "*Steam Tables"*, SciTech Publishers, 2009.
2. Mehta.F.S, Mathur.M.L, "*Refrigeration & Psychrometric Properties Tables & Charts"*, 2nd Edition, Jain Publishers, 2007.

REFERENCES

1. Sarkar.B.K, "*Thermal Engineering"*, 3rd Edition, Tata McGraw Hill, New Delhi, 2009.
2. Rudramoorthy.R, "*Thermal Engineering*", Tata McGraw Hill, New Delhi, 2003.
3. Eastop.T.D, Mcconkey.A, "*Applied Thermodynamics for Engineering Technologists"*, 5th Edition, Pearson Education Publications, 2009.

ME1011 – APPLIED THERMAL ENGINEERING												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-4				1-4						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1012	MACHINES AND MECHANISMS	L	T	P	C
	Total contact hours - 60	2	2	0	3
	Prerequisite				
	Nil				

PURPOSE

To expose the students to learn the fundamentals of various laws governing rigid bodies and its motions.

INSTRUCTIONAL OBJECTIVES

1.	Basic mechanisms, velocity and acceleration of simple mechanisms
2.	Drawing the profile of cams and its analysis
3.	Gear train calculations , Gyroscopes
4.	Inertia force analysis and flywheels
5.	Balancing of rotating and reciprocating masses

UNIT I - MECHANISMS (14 hours)

Introduction - Links - Pairs - Chain - Mechanism - Machine structure - Degrees of freedom - Fodur bar chains - Terminology and definition - Planer, Spherical and Spatial Mechanisms - Grashoff's law - Kutzback criterion - Grubler's criterion for plane mechanism. Inversion of mechanisms - Four bar, single slider crank and double slider crank mechanisms - Simple problems - Instantaneous centre - Kennedy's theorem - Velocity and Acceleration of Four bar and single slider crank mechanisms by relative velocity Method.

UNIT II - CAMS **(10 hours)**

Types of cams and followers - Follower motion - Uniform, Parabolic, SHM and cycloidal. Cam terminology - Cam profiles construction for roller, flat faced and knife edge follower types - pressure angle - Derivatives of Follower motion - High speed cams - circular arc and tangent cams – Standard cam motion - Pressure angle and undercutting.

UNIT III - GEAR TRAINS AND CONTROL MECHANISMS **(12 hours)**

Spur gear terminology and definition - Gear trains: simple, compound, reverted and epicyclic - Velocity ratio and torque calculation in gear trains - Automobile differential.Gyroscopes: Gyroscopic forces and couple - Forces on bearing due to gyroscopic action - Gyroscopic effect in ship, motor cycle, car and aircraft.

UNIT IV - FORCE ANALYSIS **(12 hours)**

Inertia force and inertia torque calculations – D'Alembert's principle – The principle of super position – Dynamic analysis in reciprocating engines – Gas forces – Equivalent masses – Bearing loads – crank shaft torque. Turning moment diagrams: Fly wheels - Application of flywheel - Punching presses.

UNIT V - BALANCING **(12 hours)**

Static and dynamic Balancing: Balancing of rotating masses - Balancing of single cylinder engine - Balancing of multi cylinder engine –partial balancing in locomotive engines – Hammer blow – Swaying couple – Tractive force - Balancing machines.

TOTAL : 60

TEXT BOOKS

1. Ratan.S.S, "*Theory of Machines"*, Tata McGraw Hill Publishing company Ltd., 2nd Edition, 2005.
2. Thomas Bevan, "*Theory of Machines"*, CBS Publishers and Distributors, 3rd Edition, 1984.

REFERENCES

1. Shigley.J.E, and Uicker.J.J, "*Theory of Machines and Mechanisms"*, McGraw Hill, 1995.
2. Ghosh.A, and Mallick.A.K, "*Theory of Mechanisms and Machines"*, Affiliated East-West Pvt Ltd., New Delhi, 1988.
3. Rao.J.S, and Dukkipati.R.V, "*Mechanism and Machine Theory"*, Wiley-Eastern Ltd., New Delhi, 1995.

ME1012 MACHINES AND MECHANISMS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		**x**		**x**					**x**	
2.	Mapping of instructional objectives with student outcome	1-4		1-5		1-5						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1013	**COMPUTER AIDED DESIGN AND ANALYSIS**	**L**	**T**	**P**	**C**
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To study how computer can be applied in mechanical engineering design.

INSTRUCTIONAL OBJECTIVES

1.	Concepts of modeling in 2D and 3D.
2.	Concepts of computer graphics in 2D.
3.	CAD Packages and its features.
4.	Theory of analysis.
5.	Implementation in CAD.

UNIT I - INTRODUCTION **(9 hours)**

Introduction to Design process - CAD. Geometric Modeling: Types - Wireframe, surface and solid modeling. Solid modeling techniques: CSG and B-rep - Operations: Boolean - Extrude - Sweep - Revolve. Mathematical Representation- Line - Circle - Ellipse - Parabola - Cubic Spline, Bezier and B-spline (Basic treatment only).

UNIT II - GRAPHICS CONCEPTS (2D and 3D) **(9 hours)**

Coordinate systems - Transformations: translation, scaling, reflection, rotation - Concatenated transformation - Inverse transformation. Clipping-Hidden line removal - Visibility Techniques- Algorithm-Shading - constant, Phong , Gourand & Enhancement- Colouring - color models- Rendering .

UNIT III - SOFTWARE PACKAGES AND RECENT TECHNOLOGY (9 hours)

Commercial solid modeling packages: Salient features - Technical comparison - Modules and tools - Brief outline of data exchange standards. Brief outline of feature technology: Classification of features - Design by features - Applications of features - Advantages and limitations.

UNIT IV - FEM FUNDAMENTALS (9 hours)

Introduction - Steps involved in FEA: Nodes - Elements and their types, shape function - 2noded -3 noded, constraints, forces and nodal displacements - Stiffness matrix - Solution techniques. Simple problems involving stepped bar subject to axial loading and simple structural members with triangular element.FEA in CAD Environment: Stages of FEA in CAD environment - Preprocessor - Solver and postprocessor.

UNIT V - IMPLEMENTATION OF CAD (9 hours)

Implementation of CAD in - CAM - CIM - RPT, kinematic analysis, Manufacturability analysis, simulation and Animation – Types – Techniques.

TOTAL : 45

TEXT BOOKS

1. Ibrahim Zeid, "*CAD / CAM - Theory and Practice 2E"*, Tata Mcgraw-Hill, New Delhi, 2010.
2. Radhakrishnan.P, "*CAD / CAM / CIM",* New age international,2008.
3. Chriss Mcmahon and Jimmie Browne, "*CAD/CAM"*, Addision Wesly, New York, 2000.

REFERENCES

1. Chandupatla and Belagundu, "*Introduction to Finite Element Methods in Engineering"*, Prentice Hall of India Private Limited, New Delhi, 2011.
2. Newman and Sproull R.F, "*Principles of interactive computer graphics"*, Tata Mcgraw-Hill, New Delhi, 2004.
3. Mikell P. Groover, "*CAD/CAM"*, Prentice Hall of India Private Limited, New Delhi, 2008.

ME1013 – COMPUTER AIDED DESIGN AND ANALYSIS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	
2.	Mapping of instructional objectives with student outcome	1-5	2-4	4,5		4,5				1	4	3-5
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1014	MANUFACTURING PROCESS LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To expose hands-on training to the students on various machines like lathe, Shaper, Slotter, Milling, Gear hobbing, grinding machines.

INSTRUCTIONAL OBJECTIVES

1.	Various types of lathe operations.
2.	production of flat surface and contour shapes on the given component.
3.	gear making processes.
4.	Surface finishing process.

LIST OF EXPERIMENTS

1. Introduction- lathe machine, plain turning, Step turning & grooving (Including lathe mechanisms, simple problems).
2. Taper turning-compound rest/offset method & Drilling using lathe (Including Drilling feed mechanism, Twist drill nomenclature, and Different types of taper turning operations).
3. External threading-Single start (Including Thread cutting mechanism-simple problems).
4. Eccentric turning-Single axis.
5. Shaping-V-Block (Including Shaper quick return mechanism).
6. Grinding-Cylindrical /Surface/Tool & cutter.
7. Slotting-Keyways (Including Broaching tool nomenclature and Slotter mechanism).
8. Milling-Polygon /Spur gear (Including Milling mechanism, simple problems).
9. Gear hobbing-Helical gear.
10. Drilling, reaming, counter boring.
11. Planning/Capstan lathe/Burnishing process (Planner Mechanism, Description of capstan and turret lathe).
12. Mini Project work- Application oriented products using above experiments.

TOTAL : 30

REFERENCES

1. Laboratory Manual.
2. Chapman.W.A.J, "*Workshop Technology",* Vol. I and II, Arnold Publisher, 2001.
3. Hajra Choudhary.S.K and Hajra Choudhary.A.K, "*Elements of Manufacturing Technology Vol II"*, Media Publishers, 2007.

ME1012 MACHINES AND MECHANISMS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x									
2.	Mapping of instructional objectives with student outcome	1-4	1-4									
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1015	FLUID DYNAMICS LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To enable the students to acquire knowledge of fluid flow concepts, working principles of flow meters, pumps and turbines.

INSTRUCTIONAL OBJECTIVES

1. Understand the working of flow meters.
2. Gain knowledge on different forms of energy of flowing fluids.
3. Estimate the various losses in pipes.
4. Study the performance of pumps and turbines.

LIST OF EXPERIMENTS

1. Determination of coefficient of discharge of orifice meter.
2. Determination of coefficient of discharge of venture-meter.
3. Verification of Bernoulli's theorem.
4. Major loss due to friction in pipe flow.
5. Minor losses due to pipe fittings in pipes.
6. Performance test on centrifugal pump.
7. Performance test on reciprocating pump.
8. Performance test on gear pump.
9. Performance test on submersible pump.
10. Performance test on jet pump.
11. Performance test on Pelton turbine .
12. Performance test on Francis turbine.
13. Effect of water jet on vane.
14. Determination of type of flow by Reynolds apparatus.

TOTAL : 30

REFERENCE

1. Laboratory manual

ME1015 FLUID DYNAMICS LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						
2.	Mapping of instructional objectives with student outcome	1-4	1-4			1-4						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1016	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To familiarize the students with the use of stress, strain measuring instruments.

INSTRUCTIONAL OBJECTIVES

1. The students will be able to understand procedures for conducting tensile.
2. Determine the Young's modulus using deflection test on beams and tensile test on rods.

LIST OF EXPERIMENTS

1. Tensile test on Mild steel rod .
2. Compression test of Concrete cubes and cylinders.
3. Open Coil spring test.
4. Izod –imapct test.
5. Charpy-Impact test.
6. Digital Torsion test on Graded steels.
7. Closed coil spring test.
8. Deflection test using Maxwell reciprocal theorem for central and non .central loading.
9. Rockwell hardness testing of metals.
10. Brinell Hardness testing of hardened alloys.
11. Ductility testing of metals using bend test.
12. Strain aging factor determination in metals using Rebend test.
13. Fatigue testing of materials.

TOTAL : 30

REFERENCES

1. Kazimi.S.M.A, "*Solid Mechanics"*, First Revised Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1994.
2. Laboratory Manual.

ME1016 – STRENGTH OF MATERIALS LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						x
2.	Mapping of instructional objectives with student outcome	1,2	1,2			1,2						**1**
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1017	COMPUTER AIDED DESIGN LABORATORY	L	T	P	C
	Total contact hours - 30	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

To provide hands-on training to the students on various software in mechanical engineering.

INSTRUCTIONAL OBJECTIVES

1.	Drafting practice using computer.
2.	Modeling of 2D and 3D parts.
3.	Assembly of modeled parts.
4.	Analysis of modeled parts.

COMPUTER AIDED DRAFTING OF MACHINE ELEMENTS

Orthographic views - Isometric views - Sectional views. Dimensioning - Annotations - Symbols - Welding-Surface finish - Threads. Text - Bill of Materials- Title block. Exercise: Knuckle, Gib and Cotter Joint - Screw Jack - Foot step bearing.

GEOMETRIC MODELING OF MACHINE COMPONENTS

Protrusion - cut - Sweep - Revolve - Draft and loft - Modify/edit - Pattern - Transformation - Boolean operation.**Exercise:** Individual parts of Universal Joint - Flange Coupling - Piston and Connecting rod.

CONVERSION OF 3D TO 2D

Conversion of 3D to 2D and Mass property calculations for parts created in Units I and II.

ASSEMBLY OF MACHINE PARTS

Exercise: Assemble from parts created in Unit II.

FINITE ELEMENT ANALYSIS

FEA of simple structural members - Cantilever beam - Simply supported beam and a plate with a hole.

LIST OF EXPERIMENTS

1. Orthographic projections – I (from part model)
2. Orthographic projections – II (from assembly model)
3. 3D part modelling with basic features.
4. 3D part modelling with advanced features.
5. 3D assembly modelling.
6. Data exchange standards.
7. 3D to 2D conversion.
8. Structural analysis

TOTAL : 30

REFERENCE

1. Laboratory Manual.

ME1017 COMPUTER AIDED DESIGN LABORATORY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x					x	x
2.	Mapping of instructional objectives with student outcome	1-4	3,4			4					3	2-4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1018	MANUFACTURING AND ASSEMBLY DRAWING	L	T	P	C
	Total contact hours - 60	1	0	3	2
	Prerequisite				
	Nil				

PURPOSE

To enable the students to prepare a detailed assembly drawing for given machine components and jigs and fixtures.

INSTRUCTIONAL OBJECTIVES

1.	Understand Indian standards for machine drawing.
2.	Understand Fits and Tolerances in technical drawing.
3.	Prepare assembly drawing of joints, couplings and machine elements.
4.	Design and prepare Jigs and fixtures for given components.

UNIT I - TECHNICAL DRAWING STANDARDS (4 hours)

BIS Code of practice for Engineering Drawing: General principles of presentation, conventional representation of dimensioning and sectioning, threaded parts, gears, springs and common features. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.

UNIT II - FITS AND TOLERANCES (4 hours)

Tolerance types and representation on the drawing – Fits types and selection for different applications – Basic hole systems - Basic shaft systems – Allowances. Geometric tolerances – Form and positional. Datum and datum features symbols used to represent geometric tolerances.

UNIT III - ASSEMBLY DRAWING OF JOINTS, COUPLING AND BEARINGS (4 hours)

Preparation of drawing for keys and keyways, cotter joints, knuckle joints and threaded fasteners. Preparation of drawing for Couplings - Flange coupling and universal coupling, Bearings, Plummer block - Representation of tolerances in drawing.

UNIT IV - ASSEMBLY DRAWING OF MACHINE ELEMENTS (4 hours)

Preparation of assembled views using parts details - Lathe tail stock - Lathe chuck - Connecting rod – Screw jack - Machine vice - Tool head of shaper.

UNIT V - JIGS AND FIXTURES **(4 hours)**

Jigs types-plate, latch, channel, box, post, pot jigs, automatic drill jigs - lathe, milling and broaching fixtures- Grinding, planing, shaping fixtures, and welding fixtures. Preparation of Jigs/Fixtures for basic components.

NOTE:

1. Computer aided approach shall be followed.
2. Examination must include an assembly drawing of machine elements.

PRACTICAL (40 hours)
TOTAL : 60

TEXT BOOKS

1. Narayana.K.L, Kanniah.P and Venkata Reddy.K, Machine *Drawing*, New Age International, New Delhi, 2006.
2. Gopalakrishnan.K.R, *Machine Drawing,* Subash Publishers, Bangalore, 2000.
3. Joshi P.H, "*Jigs & Fixtures",* New Delhi -Tata McGraw Hill Pub. Co. Ltd., 11th print 1999.

REFERENCES

1. Sidheswar Kannaiah.N, Sastry.P.V.V.V, "*Machine Drawing",* Tata McGraw Hill, New Delhi, 1997.
2. Bhatt.N.D, "*Machine Drawing",* Charotar publishing house, Anand, 1999.
3. Junnarkar.N.D, "*Machine Drawing"*, First Indian print, Pearson Education (Singapore) Pvt. Ltd., 2005.
4. *"P.S.G. Design Data Book",* Coimbatore, 2001.
5. Revised IS codes: 10711, 10712, 10713, 10714, 9609, 11665, 10715, 10716, 11663, 11668, 10968, 11669, and 8000.

ME1018 – MANUFACTURING AND ASSEMBLY DRAWING												
Course Designed by		**Department of Mechanical Engineering**										
	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x				x				x
2.	Mapping of instructional objectives with student outcome			1-5				1-5				1-5
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1019	FUNDAMENTALS OF VIBRATION AND NOISE	L	T	P	C
	Total contact hours - 60	2	2	0	3
	Prerequisite				
	Nil				

PURPOSE

To familiarize the students with the sources of vibration and concept of noise and make design modifications to reduce the vibration and noise and improve the life of the components. .

INSTRUCTIONAL OBJECTIVES

1.	Know the concepts of vibration and single degree of freedom systems.
2.	Analyze the two Degree and Multi degree of Freedom Systems.
3.	Understand the working principle of various vibration measuring instruments.
4.	Know the concepts of noises and the ways to control it

UNIT I - FUNDAMENTALS OF VIBRATION (12 hours)

Introduction- - Types of vibration-Equations of motion for undamped free vibration – Translational and Torsional vibration- Free damped vibration- Forced vibration problems- Harmonic excitation- Rotating unbalance- critical speed, vibration isolation.

UNIT II - TWO DEGREE OF FREEDOM SYSTEMS (12 hours)

Two degree - Formulation of solution - undamped free vibration- Lagrangian energy method-coordinate Coupling- Un damped vibration absorber- Rotor systems- Geared systems

UNIT III - MULTI DEGREE OF FREEDOM SYSTEMS (12 hours)

Eigen value and vector-Linear system-Matrix method- Influence coefficients-Numerical methods - Holzer's method, - Rayleigh's Approach - Dunkerley's method, Rayleigh Ritz method.

UNIT IV - VIBRATION MEASURING INSTRUMENTS AND FIELD MEASUREMENT (12 hours)

Vibration instruments – Transducer – Vibrometer – Velometer – Accelerometer - Seismometer - Frequency measuring instruments-Single reed-Multi reed – Stroboscope-Vibration Exciters-Experimental modal analysis-Condition monitoring techniques- Diagnostic tools -Signal Analysis-Time and Frequency Domain analysis- Balancing of rotors.

UNIT V - NOISE - CONCEPT AND CONTROL **(12 hours)**

Basics of noise - Introduction, amplitude, frequency, wavelength - Pressure level, noise dose level - Measurement and analysis of noise. Methods for control of noise - Mechanical noise - Sound enclosures - Acoustic barriers.

TOTAL : 60

TEXT BOOKS

1. Rao.S.S, "*Mechanical Vibrations"*, 4th Edition, Pearson Education Inc. Delhi 2009.
2. Ambekar.A.G, "*Mechanical Vibrations and Noise engineering"*, Eastern Economy Edition, New Delhi, 2006.

REFERENCES

1. Rao.J.S and Gupta.K, "*Introductory course on theory and practice of mechanical vibrations"*, New Age International, New Delhi, 1999.
2. Thomson.W.T, "*Theory of Vibration and its Applications"*,5th Edition, Prentice Hall, New Delhi, 2001.
3. Meirovitch.L, "*Elements of Vibration Analysis"*, 2ndEdition, Mc Graw-Hill Book Co., New York,, 1993.
4. Keith Mobley.R, "*Vibration Fundamentals"*, Plant Engineering Maintenance Series, Elsevier, 2007.
5. Ramamurthi.V, "*Mechanical Vibration Practice with Basic Theory"*, 1st edition, Narosa Publishing House, Chennai, 2000.
6. Kewel pujara, "*Vibration and noise for engineers"*, Dhanpat rai & Sons, 2009.

<table>
<tr><th colspan="13">ME1019 – FUNDAMENTALS OF VIBRATION AND NOISE</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">Department of Mechanical Engineering</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1,2</td><td></td><td></td><td></td><td>1,2</td><td></td><td></td><td></td><td></td><td></td><td>3</td></tr>
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<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
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ME1020	MECHANICAL ENGINEERING DESIGN	L	T	P	C
	Total contact hours - 60	2	2	0	3
	Prerequisite				
	Nil				

PURPOSE

To study the basic design principles and apply the principles to the design of various elements encountered in Mechanical machines and structures.

INSTRUCTIONAL OBJECTIVES

1. To determine the strength of the components.
2. To determine the failure conditions and apply them to real life Problems.
3. To design simple joints, fasteners, levers and springs.

UNIT I - FUNDAMENTALS OF MECHANICAL DESIGN (12 hours)

Basic Definitions - Phases of Design - Types of Loads. Types of stresses: Normal, shear, and combined stresses. Criteria for Design: strength, contact fatigue, stiffness, wear resistance, vibration resistance, heat resistance, reliability. Overview of engineering materials, theories of failure. Design of members subjected to simple stresses and combined stresses.

UNIT II - DESIGN FOR VARIABLE STRESSES (12 hours)

Members subjected to variable stresses. Failure and endurance limit - Factors affecting endurance limit. Stress concentration - Methods of reducing stress concentration - Notch sensitivity. Combined steady and Variable stresses - Soderberg, Gerber and Goodman methods for combination of stresses and their application in design problems. Members subjected to impact loads and dynamic loads.

UNIT III - DESIGN OF TEMPORARY JOINTS AND CURVED BEAMS (12 hours)

Design of cotter joints and knuckle joints. Design of bolted joints. Curved beams - crane hook - Frames, clamps.

UNIT IV - DESIGN OF PERMANENT JOINTS (12 hours)

Design of riveted joints, welded joints and its application to pressure vessels.

UNIT V - DESIGN OF LEVERS AND SPRINGS (12 hours)

Design of levers - Design of springs - Helical and leaf springs.

TEXT BOOKS

1. Prabhu.T.J, "*Design of machine elements"*, Kasthuri Publication, Chennai, 2007.
2. Patel.R.C, Sikh.S.S and Pandya, "*Machine Design"*, Volume I, C. Jamdan & Co., 1999.
3. Khurmi.R.S, and Gupta.J.K,"*Machine Design",* S.Chand Publishing., 2011.

REFERENCES

1. Norton.R.L, "*Design of Machinery"*, McGraw Hill, 2004.
2. Robert.C.Juvinall, "*Fundamentals of Machine Component Design"*, John Wiley & sons, 3rd Edition, 2002.
3. Spots.M.F, Soup.T.E, "*Design of Machine Elements"*, Prentice Hall of India Private Limited, New Delhi, 2006.
4. William Orthwein, "*Machine Component Design"*, Vol. I and II, Jaico Publising House, Chennai, 1996.
5. Maitra (Gitin M), "*Handbook of Gear Design"*, Tata Mcgraw-Hill, New Delhi, 1994.
6. Design Data, "*PSG College of Technology"*, Coimbatore, 2006.

ME1020 – MECHANICAL ENGINEERING DESIGN												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x	x		x					x	
2.	Mapping of instructional objectives with student outcome	1	2	3		3					2	
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1021	**HEAT AND MASS TRANSFER**	**L**	**T**	**P**	**C**
	Total contact hours - 60	**2**	**2**	**0**	**3**
	Prerequisite				
	Thermodynamics and Fluid Mechanics				

PURPOSE

This course provides the knowledge to understand the various modes of heat transfer and the basic concept of mass transfer.

INSTRUCTIONAL OBJECTIVES	
1.	To understand the concept of conduction.
2.	To understand the convection and radiation heat transfer
3.	To analyze the phase change heat transfer and sizing of heat exchangers.
4.	To understand the basic concept of mass transfer

UNIT I - CONDUCTION (**15 hours)**

Basic concepts - Mechanism of heat transfer - Conduction, convection and radiation - General differential equation of heat conduction - Fourier law of conduction - Cartesian coordinate - One dimensional steady state heat conduction - Conduction through plane wall, cylinders and spherical systems - Composite systems - Critical thickness of insulation - Conduction with internal heat generation - Extended surfaces - Unsteady heat conduction - Lumped analysis - Infinite and semi infinite solids.

UNIT II - CONVECTION **(12 hours)**

Hydrodynamic and thermal boundary layer: Principles and governing equations - Dimensional analysis of free and forced convection heat transfer. Forced convection - External flow - Flow over plates, cylinders and spheres and bank of tubes - Internal flow - Free convection - Flow over vertical plate, horizontal plate, inclined plate, cylinders and spheres.

UNIT III - RADIATION (**12 hours)**

Basic concepts, laws of radiation - Wien's displacement law - Stefan Boltzman law, Kirchoff law - Black body radiation - Grey body radiation - Shape factor algebra - Electrical analogy - Radiation shields - Solar radiation - Introduction to gas radiation.

UNIT IV - PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

(12 hours)

Nusselts theory of condensation - Regimes of pool boiling and flow boiling, correlations in boiling and condensation. Heat exchangers: Types - Overall heat transfer coefficient - Fouling factors - analysis - LMTD, ε - NTU methods - Introduction to compact heat exchanger.

UNIT V - MASS TRANSFER (**9 hours)**

Basic concepts - Diffusion mass transfer - Fick's law of diffusion - Equimolar counter diffusion - Stefan's law, evaporation in atmosphere, convective mass transfer - Momentum, heat and mass transfer analogy - Convective mass transfer correlations.

TOTAL : 60

TEXT BOOKS

1. Sachdeva.R.C, "*Fundamentals of Engineering Heat and Mass Transfer"*, New Age International, 2009.
2. Kothandaraman.C.P, "*Fundamentals of Heat and Mass Transfer"*, New Age International, New Delhi, 2006.

DATA BOOKS

1. Kothandaraman.C.P, Subramanyan.S, "*Heat and Mass Transfer Data Book"*, New age International, 7th edition, 2010.
2. Khurmi.R.S, "*Steam Tables"*, S.Chand Publishers, 2012.

REFERENCES

1. Holman.J.P, "*Heat and Mass Transfer"*, Tata McGraw-Hill, 2008.
2. Ozisik.M.N, "*Heat Transfer"*, McGraw-Hill Book Co., 2003.
3. Nag.P.K, "*Heat Transfer"*, Tata McGraw-Hill, New Delhi, 2006.
4. Frank.P, Incropera and D.P, DeWitt, "*Fundamentals of Heat and Mass Transfer"*, John Wiley and Sons, 2001.
5. Yunus.A, Cengel, "*Heat and Mass transfer"*, Tata- Mcgraw Hill Education, 2007.

ME1021 – HEAT AND MASS TRANSFER												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2.	Mapping of instructional objectives with student outcome	1-4		1-3		1-4						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	MATERIALS TECHNOLOGY	**L**	**T**	**P**	**C**
ME1022	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				
PURPOSE					
To impart the knowledge about the behavior of materials and their applications.					

INSTRUCTIONAL OBJECTIVES	
1.	Elastic, plastic and fracture behavior of materials.
2.	Phase diagram and heat treatment.
3.	Modern metallic and non metallic materials

UNIT I - ELASTIC AND PLASTIC BEHAVIOUR (9 hours)

Elasticity in metals - Mechanism of plastic deformation - Role of yield stress, shear strength of perfect and real crystals - Strengthening mechanisms - work hardening, Solid solutioning, grain boundary strengthening, particle, fibre and dispersion strengthening - Effect of temperature, strain and strain rate on plastic behavior.

UNIT II - FRACTURE BEHAVIOUR (9 hours)

Griffith's theory, stress intensity factor and fracture toughness - Ductile to brittle transition - High temperature fracture, modes of fracture, creep - Deformation mechanism maps - Fatigue, Low and high cycle fatigue test, crack initiation and propagation mechanisms - Fracture of Non-metallic materials. Failure analysis, Sources of failure, procedure of failure analysis.

UNIT III - PHASE DIAGRAMS AND HEAT TREATMENTS (9 hours)

Introduction - Solid solutions - Intermediate phases - Phase rules - Free energy in intermediate phases - Phase diagrams - Phase changes in alloys - Determination of phase diagrams - Ternary phase diagrams - Cooling curves - Equilibrium diagrams of Iron and Iron -Carbide diagram - Definition of structures – Annealing – Normalizing – Tempering – Hardening.

UNITIV - MODERN METALLIC MATERIALS (9 hours)

Dual phase alloys - Micro alloyed steels, High Strength Low alloy (HSLA) steel - Transformation induced plasticity (TRIP) steel, Maraging steel - Intermettalics, Ni and Ti aluminides - Smart materials - Shape memory alloys - Metallic glasses - Quasi crystals and nano crystalline materials.

UNIT V - NON METALLIC MATERIALS (9 hours)

Polymeric materials - Formation of polymer structure - Production techniques of fibre, foams, adhesives and coating - structure and properties and applications of engineering polymers - Advanced structure ceramics, WC, TiC, Al_2O_3, SiC, Si_2N_4, CBN and Diamond - Properties, processing and applications. Composite materials: Types, production techniques, structure, properties and applications.

TEXT BOOKS

1. Flake.C Campbell**, "***Elements of Metallurgy and Engineering Alloys",* ASM International, 2008.
2. Dieter.G.E, "*Mechanical Metallurgy"*, McGraw Hill, Singapore, 2001.
3. Thomas H. Courtney, "*Mechanical Behaviour of Engineering materials"*, McGraw Hill, Singapore, 2000.

REFERENCES

1. Flinn.R.A and Trojan.P.K, "*Engineering Materials and their applications"*, Jaico, Bombay, 1990.
2. Budinski.K.G and Budinski.M.K, "*Engineering Materials Properties and selection"*, Prentice Hall of India Private Limited, New Delhi, 2004.
3. ASM Metals Hand book, "*Failure analysis and prevention"*, Vol: 10, 14th edition, New York, 2002.

ME1022 MATERIALS TECHNOLOGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x								
2.	Mapping of instructional objectives with student outcome	1-5		1-5								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1023	**GAS DYNAMICS AND SPACE PROPULSION**	**L**	**T**	**P**	**C**
	Total contact hours - 60	**2**	**2**	**0**	**3**
	Prerequisite : Fluid Mechanics, Thermodynamics				

PURPOSE

On completion of this course, the students will be in a position to apply their knowledge to solve problems in basic compressible flow, aircraft and rocket engines.

INSTRUCTIONAL OBJECTIVES

1.	Flow through constant area duct with friction and heat transfer.
2.	Aircraft propulsion and performance.
3.	Rocket enginesand performance.
4.	Compressible fluid flow concepts.
5.	Isentropic flow through variable area ducts and normal shocks.

UNIT I - FUNDAMENTALS OF COMPRESSIBLE FLOW (10 hours)

Energy equation for compressible fluid flow, stagnation state, Mach number, various regimes of flow, critical state, reference velocities, second kind Mach number, Crocco number, equivalent of Bernoulli's equation for compressible flow, effect of Mach number on compressibility, wave propagation-Mach cone and Mach angle.

UNIT II - FLOW THROUGH VARIABLE AREA DUCTS (16 hours)

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzles and diffusers, area ratio as a function of Mach number, impulse function, mass flow rate equations, Flienger's formula.

Normal shock wave - Governing equations - Static pressure, static temperature, stagnation pressure and change in entropy across the shock, Prantl-Meyer equation, Rankine Huguenot equation, limiting case of normal shock and impossibility of shock in subsonic flow.

UNIT III - FLOW THROUGH CONSTANT AREA DUCTS (16 hours)

Flow in constant area ducts with friction - Fanno curves and Fanno flow equations, variation of flow properties- stagnation pressure loss and change in entropy, Fanno flow variation of Mach number with duct length, normal shock in Fanno flow.

Flow in constant area ducts with heat transfer - Rayleigh curve, constant entropy lines and constant enthalpy lines, Rayleigh flow equations, variation of flow properties, maximum heat transfer concept.

UNIT IV - AIRCRAFT PROPULSION (9 hours)

Aircraft propulsion: Types of aircraft engines, energy flow through jet engines, aircraft propulsion theory and performance of turbojet engines, thrust augmentation, ramjet and pulse jet engines.

UNIT V - ROCKET PROPULSION (9 hours)

Rocket propulsion: Types of rocket engines, solid, liquid and hybrid propellants, comparison of different propulsion systems, rocket propulsion theory and performance, rocket applications and space flights.

TOTAL : 60

TEXT BOOKS

1. Yahya.S.M, "*Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion"*, New Age International (P) Ltd, New Delhi, 3rd edition, 2012.
2. Radhakrishnan.E, "*Gas Dynamics"*, PHI Learning Pvt. Ltd, 4th edition, 2012.

DATA BOOK

1. Yahya.S.M, "*Gas Tables for compressible flow calculations"*, New Age International (P) Ltd, New Delhi, 6th edition, 2011.

REFERENCES

1. Mattingly.J.D, "*Elements of Propulsion: Gas turbines and Rockets"*, McGraw Hill, 2012.
2. Balachandran.P, "*Fundamentals of compressible fluid dynamics"*, PHI Learning, 2012.
3. Robert.D.Zucker, "*Oscar Biblarz, Fundamentals of Gas Dynamics"*,John Wiley and Sons, 2nd edition, 2011.

ME1023- GAS DYNAMICS AND SPACE PROPULSION												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				X						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1024	**ELEMENTS OF MECHATRONICS**	**L**	**T**	**P**	**C**
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To present the concept and components of mechatronics systems in a structured way.

INSTRUCTIONAL OBJECTIVES

1.	Basic key elements of Mechatronics systems.
2.	Performance of commonly used sensors and transducers .
3.	Different actuation systems, signal processing and controllers.
4.	The PLC and Programming using ladder logic.
5.	Mechatronics Design and applications.

UNIT I - INTRODUCTION TO MECHATRONICS (8 hours)

Introduction to Mechatronics systems, Mechatronics system components - Measurement Systems, Control Systems, Open and Closed Loops Systems, Sequential Controllers with examples- Water level controller, Shaft speed control, Washing machine control, Automatic camera and Engine management systems.

UNIT II - SENSORS AND TRANSDUCERS (10 hours)

Introduction to sensors and transducers- classifications- Principle and working of Resistive, capacitive, inductive and resonant transducers- optical measurement systems-encoders, photo electric, vision sensor, Fibre optic transducers- solid state sensors and transducers-magnetic measurements, temperature measurements, Chemical measurements-piezoelectric – accelerometers - ultrasonic sensors and transducers- flow, distance, velocity measurements.

UNIT III - ELECTRICAL DRIVES AND CONTROLLERS (9 hours)

Introduction, Electromagnetic Principles, Solenoids and Relays, Electrical drives - stepper motors, servo motors. Signal processing- Multiplexer, operational amplifier - A/D and D/A converters – Introduction to Data acquisition system - Proportional, Integral, Derivative and PID controller, Micro controller.

UNIT IV - PROGRAMMABLE LOGIC CONTROLLERS (9 hours)

Programmable logic controller – Basic structure - Programming units - Memory - Input - Output Modules - Mnemonics – Latching- Timers – Internal relays - Counters - Shift Registers - Master and Jump Controls -Programming the PLC using Ladder diagram - Simple example of PLC application.

UNIT V - MECHATRONICS SYSTEM DESIGN AND APPLICATION (9 hours)

Mechatronics in Engineering Design, Traditional and mechatronics design, Applications - Pick and Place robots, Car park barriers, Bar code reader, Wind screen wiper wing stepper motor control. Case studies - Coin counters, Robot walking machine.

TOTAL : 45

TEXT BOOKS

1. Bolton.W, "*Mechatronics"*, Addison Wesley, 4th Edition, New Delhi, 2010.
2. Bradley.D.A, Dawson.D Burd N.C.and Loader A.J, "*Mechatronics"*, Chapman and Hall Publications, New York, 1993.
3. Jacob Fraden, "*Handbook of Modern Sensors Physics, Designs, and Applications"*, Third Edition, Springer-Verlag New York, 2004.

REFERENCES

1. James Harter, "*Electromechanics, Principles and Concepts and Devices"*, Prentice Hall, New Delhi, 1995.
2. David W. Pessen, "*Industrial Automation Circuit Design and Components"*, John Wiley, New York, 1990.
3. Rohner.P, "*Automation with Programmable Logic Controllers"*, Macmillan / McGraw Hill, New York, 1996.
4. Brian Morris, "*Automatic Manufacturing Systems Actuators, Controls and Sensors"*, McGraw Hill, New York, 1994.
5. Godfrey C. Onwubolu, "*Mechatronics Principles and applications"*, Butterworth-Heinemann, New Delhi, 2006.

ME1024 ELEMENTS OF MECHATRONICS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				**x**						
2.	Mapping of instructional objectives with student outcome	1,3				2-5						
3.	Category	General (G)		Basic Sciences(B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1025	**FLUID POWER CONTROL**	**L**	**T**	**P**	**C**
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To expose the learner to the fundamentals of hydraulic and pneumatic power control and their circuits with industrial applications.

INSTRUCTIONAL OBJECTIVES

1.	The fundamentals of fluid power.
2.	Principles and characteristics of the hydraulic and pneumatic Components.
3.	Circuit designing using logic controls.
4.	Trouble shooting.

UNIT I - HYDRAULIC POWER GENERATING AND UTILIZING SYSTEMS

(10 hours)

Introduction to fluid power system - Hydraulic fluids - functions, types, properties, selection and application.

POWER GENERATING ELEMENTS: Pumps, classification, working of different pumps such as Gear, Vane, Piston (axial and radial), pump performance or characteristics, pump selection factors- simple Problems.

POWER UTILIZING ELEMENTS: Fluid Power Actuators: Linear hydraulic actuators – Types and construction of hydraulic cylinders – Single acting, Double acting, special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism.

Hydraulic Motors, types – Gear, Vane, Piston (axial and radial) – performance of motors.

UNIT II - HYDRAULIC VALVES AND ACCESSORIES (9 hours)

Hydraulic valves : Directional, Pressure and Flow control valves-Types and applications

Intensifier – Applications of Intensifier – Intensifier circuit.

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves.

Accessories: switches, filters, seals, fittings and other accessories.

Accumulators: Types and applications.

UNIT III - PNEUMATIC SYSTEMS (9 hours)

Introduction, comparison with hydraulic systems and electrical systems. Construction, operation, characteristics and symbols of pneumatic components. Air treatment – principles and components.

Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Pneumatic logic circuits, ladder diagrams for various fluid power applications

Pneumatic Sensors – types, characteristics and applications.

UNIT IV - DESIGN OF FLUID POWER SYSTEMS (11 hours)

Speed, force and time calculations, Calculation of pressure and pressure drop across components, sizing of actuators, pumps, reservoirs and accumulators. Calculations of Heat generation in fluids.

Design of hydraulic/pneumatic circuit for practical application, Selection of different components such as reservoir, various valves, actuators, filters, pumps based on design.

hydraulic/pneumatic circuit – Simple reciprocating, Regenerative, Speed control (Meter in, Meter out and bleed off), Sequencing, Synchronization, transverse and feed, cascading circuit(two and three cylinders), automatic reciprocating, fail safe circuit, counter balance circuit, actuator locking.

UNIT V - APPLICATIONS, MAINTENANCE AND TROUBLE SHOOTING (6 hours)

Industrial circuits – riveting machine, actuator locking, hydraulic press, unloading circuit, material handling systems.

Maintenance and Trouble Shooting

Maintenance in fluid power systems – preventive and breakdown. Maintenance procedures. Trouble shooting of fluid power systems – fault finding process, equipments / tools used, causes and remedies. Safety aspects involved.

TOTAL : 45

TEXT BOOKS

1. Anthony Esposito, "*Fluid Power with applications"*, Prentice Hall International, 2009.
2. Majumdar.S.R, "*Oil Hydraulic Systems: Principles and Maintenance"*, Tata McGraw Hill, 2006.
3. Majumdar.S.R, "*Pneumatic systems – principles and maintenance"*, Tata McGraw-Hill, New Delhi, 2006.

REFERENCES

1. Werner Deppert / Kurt Stoll, "*Pneumatic Application:Mechanization and Automation by Pneumatic Contro"l*, Vogel verlag, 1986.
2. John Pippenger, Tyler Hicks, "*Industrial Hydraulics"*, McGraw Hill International Edition, 1980.
3. Andrew Parr, "*Hydraulics and Pneumatics: A technician's and engineer's guide"*, Elsevier Ltd, 2011.
4. FESTO, "*Fundamentals of Pneumatics"*, Vol I, II and III.
5. Hehn Anton, H., "*Fluid Power Trouble Shooting",* Marcel Dekker Inc., NewYork, 1995.
6. Thomson, "*Introduction to Fluid power",* Prentice Hall, 2004.

ME1025 - FLUID POWER CONTROL												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x						
2.	Mapping of instructional objectives with student outcome			1-3		4,5						
3.	Category	General(G)		Basic Sciences(B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											x	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1027	MACHINE DYNAMICS LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To study the static and dynamic behaviour of machines.

INSTRUCTIONAL OBJECTIVES

1.	Understand and verify the laws governing the kinematics and dynamics of machines.
2.	Understand the behaviour of vibration in simple mechanical systems.
3.	Understand the case studies on the field of Vibration.

LIST OF EXPERIMENTS

Kinematics

1. CAM Analysis - angle Vs displacement and jump phenomenon.
2. Study of gear parameters.
3. Kinematics of gear trains - simple, compound and epicyclic.
4. Determination of moment of inertia of systems.

Dynamics

1. Governors - determination of characteristics and sensitivity.
2. Gyroscope.
3. Measurement of cutting forces using Drill, Lathe and Milling Dynamometers.
4. Torque analysis for epi-cyclic and differential gear trains.
5. Static and Dynamic Balancing of rotating masses.
6. Dynamic Balancing of reciprocating masses (IC engine).

Vibration

1. Measurement of strain using strain gauge and strain meter.
2. Measurement of amplitude, velocity and acceleration using vibration pick-ups.
3. Free and Forced Vibration analysis of spring mass systems.
4. Free and forced transverse vibration analysis for beams.
5. Free damped and un-damped torsional vibration on rotor systems .
6. Whirling of shaft.
7. Transmissibility ratio in vibration isolation systems.
8. Diagnostics and field measurement of vibrations using FFT analyzer.

Sound analysis

1. Transmission loss analysis using Sound level meter.

TOTAL : 30

REFERENCE

1. Laboratory Manual.

ME1027 MACHINE DYNAMICS LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						
2.	Mapping of instructional objectives with student outcome	1-3	1-3			1-3						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1028	HEAT POWER LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

This laboratory course is intended to give the students, experimental knowledge on the performance and operations of I.C. Engines.

INSTRUCTIONAL OBJECTIVES

1.	Components and functions of 2 stroke and 4 four stroke engine.
2.	Testing the lubricants and fuels used for IC engines.
3.	Performance testing of IC engines using various dynamometers and heat balance.
4.	Boiler trail.

LIST OF EXPERIMENT

1. Valve and port timing diagrams on four and two stroke engines.
2. Determination of flash and fire point of fuels.
3. Determination of viscosity- Redwood viscometer.
4. Determination of viscosity Say bolt viscometer.
5. Performance test on single cylinder slow speed diesel engine with belt brake dynamometer.
6. Performance test on twin-cylinder diesel engine with electrical dynamometer.
7. Performance test on single cylinder high speed diesel engine with rope brake dynamometer.
8. Retardation test to find frictional power of a diesel engine.
9. Performance test on Petrol engine.
10. Heat balance test on four stroke diesel engine.
11. Performance test on CI engine using Eddy current dynamometer.
12. Trial on boiler.

TOTAL 30

REFERENCE

1. Laboratory Manual

ME1028 HEAT POWER LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						
2.	Mapping of instructional objectives with student outcome	1-4	1-4			1-4						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1029	MATERIALS TECHNOLOGY LAB	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To acquire the knowledge of identifying the metals and understanding the metallurgical concepts.

INSTRUCTIONAL OBJECTIVES

1. Prepare different metal specimen for identification.
2. Study the microstructure of metals.
3. Understand the treatment procedures.

LIST OF EXPERIMENTS

1. Specimen preparation for metallographic examination.
2. Study of metallurgical microscope, different types and their operations.
3. Microstructural study of ferrous materials like low, medium and high carbon steels, quenched and tempered steel, Stainless steel, S.G. Iron, Malleable iron, Grey CI, White CI and Cold worked and recrystallised specimens.
4. Microstructural study of non-ferrous materials like Al, Brass, Bronze.
5. Microstructural study of steel weldment.
6. Study of hardness of heat treated steel..
7. Jomney end quench test.
8. Grain size measurement by comparison with ASTM Charts.
9. Wear analysis using Pin-on-Disc machine and Dry Abrasion tester.

TOTAL : 30

REFERENCE

1. Laboratory Manual

ME1029 MATERIALS TECHNOLOGY LAB													
Course Designed by		Department of Mechanical Engineering											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
				x									
2.	Mapping of instructional objectives with student outcome			1-3									
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)			
										X			
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1030	AUTOMATION LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To train the students in hydraulic and pneumatic circuit design using different control devices.

INSTRUCTIONAL OBJECTIVES

1.	Design of Hydraulic and Pneumatic circuits for low cost automation
2.	Control of stepper and servo motors
3.	Control of photo and ultrasonic, positional and velocity sensors
4.	Programming of PLC, Pick and place robot.

LIST OF EXPERIMENTS

1. Design and formation of different Hydraulic and Pneumatic circuits
2. Speed control of stepper and servo motors
3. Photo sensors and Ultrasonic sensors
4. Positional and velocity sensors
5. PID controller
6. Writing program for pick and place operation of a robot.
7. Controls using PLC and universal programming kit
8. Programming through virtual instrumentation.

TOTAL : 30

REFERENCE

1. Laboratory Manual

ME1030- AUTOMATION LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
			x			x						x
2.	Mapping of instructional objectives with student outcome		1-3			1-3						1,3, 4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)			Professional Subjects(P)			
									X			
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1031	HEAT AND MASS TRANSFER LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

This course provides the necessary background for the student to understand the fundamental modes of heat transfer by doing experiments in various heat transfer equipment, observing data and analyzing the results.

INSTRUCTIONAL OBJECTIVES

1.	To experimentally analyze free and forced convective heat transfer.
2.	To experimentally analyze radiation heat transfer.
3.	Performance study on refrigeration and air conditioning systems.

LIST OF EXPERIMENTS

1. Heat transfer through a composite wall.
2. Thermal conductivity of a specimen by guarded hot plate apparatus.
3. Heat transfer through composite lagged pipe.
4. Heat transfer from pin fin by natural convection
5. Heat transfer from pin fin by forced convection.
6. Heat transfer by natural convection.
7. Heat transfer by forced convection.
8. Analysis of parallel flow and counter flow Heat exchanger.
9. Determination of emissivity of a grey surface.
10. Determination of Stefan – Boltzmann's constant.
11. Performance analysis on a refrigeration test rig.
12. Performance analysis on an air conditioning test Rig.

TOTAL : 30

REFERENCE

1. Laboratory Manual

ME1031 HEAT AND MASS TRANSFER LABORATORY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						
2.	Mapping of instructional objectives with student outcome	1-4	1-4			1-4						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	COMPUTER SKILL	L	T	P	C
ME1033	Prerequisite	**0**	**0**	**0**	**0**
	Nil				

PURPOSE

To acquire extramural knowledge on the computer implementation of various engineering solutions.

INSTRUCTIONAL OBJECTIVES

1.	The students are expected to undergo at least two computer courses from a list of courses provided from time to time by all the departments of engineering and technology.
2.	Resources for conducting the courses will be found from in-house talents and outside professionals with expertise in the particular course.
3.	Certification will be done by both the university and the bodies drafted for the purpose.

	ECONOMICS AND PRINCIPLES OF MANAGEMENT	L	T	P	C
ME1034	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To familiarize the concepts of Engineering Economics and Principles of Management.

INSTRUCTIONAL OBJECTIVES

1.	The different engineering economic principles and strategies .
2.	Principles of organizational management .
3.	Behaviour of human at organizations with modern management concepts .

UNIT I - ENGINEERING ECONOMICS (9 hours)

Introduction - Economics - Scope and Definition - Importance of Economics in Engineering - Economic optimization- Demand and Revenue Analysis - Law of Demand - Demand Forecasting -Methods of Demand Forecasting - Demand curves - Factors affecting Demand - Demand Elasticity - Production Analysis - simple problems.

UNIT II - SUPPLY, COST AND OUTPUT (9 hours)

Supply - Supply schedule - Law of Supply - Elasticity of Supply - Cost and Supply Analysis - Types of Costs - Price and output Determination - Price Fixation - Pricing methods - Pricing Policies - Factors governing Pricing Policies - Break-Even analysis - Estimation of Break-Even Point - Usefulness of BEP - Limitations - simple problems.

UNIT III - MANAGEMENT AND ITS ENVIRONMENT (9 hours)

Management - Definition - Functions - Evolution of Modern Management movement - Different Schools of Management - Types and Forms of Business Organization - Designing effective organizations - Individual ownership - Partnership - Joint stock companies - Cooperative enterprises - Public Sector Undertakings.

UNIT IV - MANAGEMENT OF HUMAN AT WORK (9 hours)

Human Resource Development - Motivating individuals and workgroups - Leadership for Managerial Effectiveness - Team working and Creativity - Managerial Communication - Time Management - Performance Appraisal- Career Planning.

UNIT V - MODERN MANAGEMENT CONCEPTS (9 hours)

Management by Objectives (MBO) - Principles and Steps - Advantages and Disadvantages - Management by Exception (MBE) - Strategic management - SWOT analysis - Enterprise Resource Planning (ERP) - Supply Chain Management (SCM) - Activity Based Management (ABM).

TOTAL : 45

TEXT BOOKS

1. Sasmita Mishra*, "Engineering Economics and Costing' Eastern economy Edition", 2009.*
2. Chandran.J.S, "*Organizational Behaviours"*, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
3. Ernest Dale, "*Management Theory and Practice"*, International Student Edition, McGraw Hill Publishing Co., New Delhi, 1973.

REFERENCES

1. Richard Pettinger, "*Mastering Organizational Behaviour"*, Macmillan Press, London, 2000.
2. Chaiger.N.A, "*Energy Consumption and Environment"*, McGraw Hill Publishing Co., New Delhi, 1981.
3. Gail Freeman - Bell and Janes Balkwill, "*Management in Engineering* - Principles and Practive", Prentice Hall of India Pvt.Ltd., 1998.
4. Barathwal.R.R, "*Engineering Economics*", McGraw Hill, 1997.

ME1034 ECONOMICS AND PRINCIPLES OF MANAGEMENT												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		**x**			**x**			
2.	Mapping of instructional objectives with student outcome			1,2		1			1-5			
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1035	METROLOGY AND QUALITY CONTROL	L	T	P	C
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To understand the need for metrology in the industries and its role in SQC.

INSTRUCTIONAL OBJECTIVES

1.	To make the student to understand
2.	Types of errors, design of limit gauges and various comparative measurement
3.	Fundamentals of gears, thread measurements and measurements of surface finish Non contact measurement techniques using optical methods and vision Techniques.
4.	Coordinate metrology and Form Measurement Use of control charts and acceptance sampling in SQC.

UNIT I - INTRODUCTION TO METROLOGY (9 hours)

Basic Concepts - Legal Metrology - Precision - Accuracy - Types of errors -least square fit.Linear and Angular Measurements - Standards of Measurements - Calibration - Interchangeability and selective assembly- Gauges for inspection-types-Gauge design-Taylor's principle- Introduction to Comparators - Types of Comparators - Mechanical, Mechanical - Optical, Electrical and Electronic, pneumatic- flow type-differential pressure type.

UNIT II - MEASUREMENTS OF SCREW THREAD - GEAR ELEMENTS – SURFACE FINISH (9 hours)

Internal and External screw threads: Measurements of various elements of thread - Best size wire - Two and three wire method. Gear: Measurements of various elements - Constant chord method - Base tangent method. Surface Finish: Surface topography definitions - Measurement of Surface Texture - Methods - Evaluation of Surface finish.

UNIT III - OPTICAL METROLOGY and NON CONTACT MEASUREMENT TECHNIQUES (9 hours)

Principle of light wave interference - Light sources –Measurement with optical flats- Types of Interferometers - Michelson, Twyman Green Specialisation of Michelson, NPL flatness Interferometers, The Pitter NPL gauge - laser interferometer- laser micrometer- surface roughness measurement using laser. Machine vision -Image processing techniques-edge detection-feature extraction-applications.

UNIT IV - COORDINATE METROLOGY AND FORM MEASUREMENT (6 hours)

Coordinate Measuring Machine-components of CMM-types-measuring head - types of probe- alignment error-causes of error -measuring accuracy-calibration of CMM-performance of CMM-applications-measurement integration, Measurement of straightness - Flatness - squareness - parallelism - circularity – roundness and runout.

UNIT V - THEORY OF CONTROL CHARTS & ACCEPTANCE SAMPLING (12 hours)

Introduction - Definition of Quality - Chance Causes and assignable Causes - SQC Benefits and Limitations-**Theory of Control Charts**: Control Charts for Variables - $\bar{x}$ - R , $\bar{x}$-σ charts - run up - run down - Process capability studies. Control Charts for attributes – P chart, nP chart, C and U chart. acceptance sampling- OC curve - AQL - LTPD - AOQL - Sampling Plans - Simple - Double - Multiple and sequential sampling plans –simple problems

TOTAL : 45

TEXT BOOKS

1. Jain.R.K, "*Engineering Metrology"*, Khanna Publishers, New Delhi, 2012.
2. Gupta.R.C, "*Statistical Quality Control"*, Khanna Publishers, New Delhi, 1994
.

REFERENCES

1. Kevin Harding ,"*Handbook of Optical Dimensional Metrology"*, CRC Press, A Taylor & Francis group, 2013.
2. Robert.J Hocken, Paulo H. Pereira,Coordinate, "*Measuring Machines And Systems"*, CRC Press,Taylor & Francis Group, 2011.
3. Connie Dotson, Roger Harlow and Richard L. Thompson, "*Fundamentals of Dimensional Metrology, Thomson Delmar Learning"*,4th edition, 2005.
4. Toru Yoshizawa, Handbook of Optical Metrology: Principles And Applications, CRC PressGrant E. L., "*Statistical Quality Control"*, McGraw Hill, New York, 2000.

ME1035– METROLOGY AND QUALITY CONTROL												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		**x**		**x**			**x**			
2.	Mapping of instructional objectives with student outcome	1-3		1,5		1			5			
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)			Professional Subjects(P)			
						X						
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1036	**DESIGN OF TRANSMISSION SYSTEMS**	**L**	**T**	**P**	**C**
	Total contact hours - 60	**2**	**2**	**0**	**3**
	Prerequisite				
	MACHINES AND MECHANISMS and MECHANICAL ENGINEERING DESIGN				

PURPOSE

To study the design of various mechanical transmission systems.

INSTRUCTIONAL OBJECTIVES

1.	Friction drives.
2.	Gears.
3.	Speed reducers.
4.	Power transmission systems

UNIT I - DESIGN OF FLEXIBLE DRIVES **(12 hours)**

Design of flat belt, V-Belt, rope and chain drives.

UNIT II - DESIGN OF PARALLEL GEARS **(12 hours)**

Design of Spur Gear & Helical gear based on strength and wear.

UNIT III - DESIGN OF NON-PARALLEL GEARS (10 hours)

Design of Bevel & Worm gear based on strength and wear.

UNIT IV - DESIGN OF GEAR BOX (12 hours)

Design of Multi speed gear box for machine tool - Structural diagram, ray diagram, speed diagram, No. of teeth calculation, Meshing arrangement.

UNIT V - POWER TRANSMISSION MEMBERS (14 hours)

Design and selection of bearings. Clutches - Plate and Cone clutch, Brakes – Band and Block.

DATA BOOK

1. Design Data, "*PSG College of Technology"*, 2009.

TEXT BOOKS

1. Prabhu.T.J, "*Design of Transmission Systems"*, Private Publication, Fifth edition, 2000.
2. Mehtha.N.K, "*Machine Tool Design and Numerical Control",* Tata Mc-Graw Hill*, Third Edition, 2012*
3. Richard Budynas, Keith Nisbett, "*Mechanical Engineering Design"*, Mc Graw Hill, 2011.

REFERENCES

1. Robert Norton, "*Design of Machinery"*, McGraw Hill, Fifth Edition, 2011.
2. Spotts.M.F, Shoup.T.E, Hornberger.L.E, "*Design of Machine Elements"*, Prentice Hall of India Eighth Edition, 2004.
3. William Orthwein, "*Machine Component Design"*, Vol. I and II, Jaico Publising house, New Edition, 2006.
4. Gitin M Maitra, L. Prasad, "*Handbook of Gear Design"*, Tata Mcgraw-Hill, 2004.

ME1036 – DESIGN OF TRANSMISSION SYSTEMS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2.	Mapping of instructional objectives with student outcome	1-4		1,4		1-4						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1037	COMPUTER AIDED MANUFACTURING	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To familiarize with the components of computer aided manufacturing and production planning.

INSTRUCTIONAL OBJECTIVES

1.	Basics of manufacturing and CNC machines .
2.	Constructional features of CNC machines.
3.	System of automation.
4.	Material handling systems .
5.	Computer aided production planning .

UNIT I - MANUFACTURING SYSTEMS AND CNC MACHINES (9 hours)

Manufacturing systems - types, current trends. Group technology - part families, coding and classification. Production flow analysis, FMS and CIM – principle. Fundamentals of CNC machines- principles of operation - features - Classification - Developments, Machining Centers, its Economics.

UNIT II - ELEMENTS OF CNC MACHINES (9 hours)

Interpolations - Open loop and closed loop control systems - CNC controllers - Direct Numerical Control, Adaptive Control - Machine structures, slide ways, linear bearings, Recirculating ball screws, Drives - spindle and feed drives - Feed back devices, ATC and automatic pallet system.

UNIT III - AUTOMATION AND AUTOMATED ASSEMBLY (9 hours)

Automated manufacturing system - historical development and future trends. Automation - need, basic elements, levels, strategies, advantages and limitations. Automated assembly – Fundamental, system configuration, part delivery at workstation, design for automated assembly.

UNIT IV - MATERIAL HANDLING SYSTEMS (9 hours)

Automated material handling systems-conveyor, automated guided vehicles, pallets- Automated storage and retrieval systems. Introduction to Industrial Robots, Robot physical Configuration, Basic Robot motions, Technical features-work volume, precision, movement, speed, movement, weight carrying capacity, type of drive systems.

UNIT V - COMPUTER AIDED PRODUCTION PLANNING AND CONTROL (9 hours)

Introduction to Computer aided production planning - Application of computers - Shop floor monitoring - Materials requirement planning - Inventory control-simple problem, JIT approach and Case studies.

TOTAL :45

TEXT BOOKS

1. Rao.P.N, Tewari.N.K and Kundra.T.K, "*Computer Aided Manufacturing"*, Tata McGraw-Hill, New Delhi, 2008.
2. Mikell P. Groover, Emory W. Zimmers Jr., "*CAD/CAM:Computer Aided Design and Manufacturing"*, Prentice Hall of India Private Ltd., New Delhi, 2008.
3. Mikell P. Groover, "*Automation, Production systems and computer integrated manufacturing"*, Prentice Hall of India Private Ltd., New Delhi, 2007.

REFERENCES

1. Ibrahim Zeid, "*CAD/CAM Theory and Practice"*, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2010.
2. James Madison, "*CNC Machining Hand Book"*, Industrial Press Inc., New York, 1996.
3. Barry Hawkes, "*The CAD/CAM Process"*, Wheeler Publishing, 1992.
4. Hans B. Kief and Frederick Waters, T., "*Computer Numerical Control - A CNC Reference Guide"*, Macmillan / McGraw-Hill, New York, 1992.
5. Radhakrishnan.P, Subramanyan.S and Raju.V, "*CAD/CAM/CIM*", New Age International Publishers, 2000.

ME1037 - COMPUTER AIDED MANUFACTURING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x								x
2.	Mapping of instructional objectives with student outcome			1-5								1-5
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1039	**METROLOGY AND QUALITY CONTROL LABORATORY**	**L**	**T**	**P**	**C**
	Total contact hours - 30	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

To understand the various measuring techniques in dimensional ,optical and computer aided inspection in the industries and its role in SQC.

INSTRUCTIONAL OBJECTIVES	
1.	Various standards of measurement(line, end and wavelength standards).
2.	On measurement of fundamental, gear, thread and form measurement .
3.	On calibration of measuring instruments,
4.	Computer aided measurement techniques.

LIST OF EXPERIMENTS

1. Use of Precision Measuring Instrument (linear and angular) and Gauges
2. Gear parameter measurement, Thread Parameter measurement
3. Calibration of Measuring Instruments
4. Indirect method of measurement using standard balls and rollers
5. Usage of various comparators(mechanical, electrical ,pneumatic etc)
6. Process capability study using mechanical Comparator
7. Various parameter measurement using Computerised profile projector
8. Straightness, flatness measurement using autocollimator
9. Surface roughness measurement
10. Interferometers and measurements using laser
11. Fundamental measurement using CMM, automatic probing

TOTAL :30

REFERENCE:

1. Laboratory manual.

ME1039 – METROLOGY AND QUALITY CONTROL LABORATORY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						x
2.	Mapping of instructional objectives with student outcome	1,2	2,3			1						4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1040	COMPUTER AIDED MANUFACTURING LABORATORY	L	T	P	C
	Total contact hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To familiarize programming techniques in CNC part programming and the machining procedure in CNC machines.

INSTRUCTIONAL OBJECTIVES

1.	Part programming for Lathe operations and milling operations.
2.	Canned cycles for different operations.
3.	Machining of components using CNC Lathe and CNC milling machine.
4.	CAM software.

LIST OF EXPERIMENTS

1. Part programming using CAM software.
2. CNC LATHE
3. Part programming for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation, Combination of few operations.
4. CNC MILLING MACHINEPart programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands.
5. Part Programming using Fixed or Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting
6. Machining of components using CNC Lathe, CNC Milling Machine and wire-cut EDM

TOTAL : 30

REFERENCE

1. Laboratory Manual.

ME1040 - COMPUTER AIDED MANUFACTURING LABORATORY													
Course Designed by		Department of Mechanical Engineering											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
				x								x	
2.	Mapping of instructional objectives with student outcome			1-3								1-4	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)			
										X			
4.	Approval	23rd Meeting of Academic Council, May 2013											

	INDUSTRIAL TRAINING I (Training to be undergone after IV semester)	L	T	P	C
ME1047	2 week practical training in industry	**0**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To provide hands-on experience at industry, site / planning or design office where mechanical engineering projects are carried out

INSTRUCTIONAL OBJECTIVES

1. Students have to undergo two – week practical training in Mechanical Engineering related industry / project site or design / planning office so that they become aware of the practical application of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Mechanical Engineering related industry / project site or design / planning office of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

ME1047 INDUSTRIAL TRAINING I												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student Outcome	a	b	C	d	e	f	g	h	i	j	K
					X		X	X	X	X	X	
2.	Mapping of instructional objectives with student outcome				1	1	1	1	1	1	1	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences & Technical Arts (E)			Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	INDUSTRIAL TRAINING II (Training to be undergone after VI semester)	L	T	P	C
ME1048	2 week practical training in industry	**0**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To provide hands-on experience at industry, site / planning or design office where mechanical engineering projects are carried out

INSTRUCTIONAL OBJECTIVES

1. Students have to undergo two – week practical training in Mechanical Engineering related industry / project site or design / planning office so that they become aware of the practical application of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Mechanical Engineering related industry / project site or design / planning office of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

M**E1048 INDUSTRIAL TRAINING II**												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	I	j	k
					x		x	x	x	x	x	
2.	Mapping of instructional objectives with student outcome				1	1	1	1	1	1	1	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences & Technical Arts (E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

	MINOR PROJECT	L	T	P	C
ME1049	Prerequisite	**0**	**0**	**2**	**1**
	Nil				

An interdisciplinary project to be taken up by a team of maximum of ten students. Hardware/ Numerical/ Theoretical research and development work arepermitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. A presentation is to be made for the reviewers on the work done by the candidate.

	MAJOR PROJECT / PRACTICE SCHOOL	L	T	P	C
ME1050	Prerequisite	**0**	**0**	**24**	**12**
	Nil				

Hardware/ Numerical/ Theoretical research and development work are permitted. A maximum of three students are allotted for each project. However the contribution of the individuals in the project should be clearly brought out. A combined project report is to be submitted as per the university regulations. A seminar has to be presented on the work done. All the students involved in the project will be examined for their contribution. The students are also allowed to do practice school under this course, in any industry identified by the department for this purpose.

PROGRAM ELECTIVES

ME1101	FINITE ELEMENT METHODS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE	
To learn the basics of finite element analysis and its applications in engineering.	
INSTRUCTIONAL OBJECTIVES	
1.	Basics of Finite Element analysis.
2.	Its application to static analysis.
3.	Standard truss, beam, plane triangular and quadrilateral elements.
4.	Analysis of one and two-dimensional problems using software.

UNIT I - GENERAL INTRODUCTION TO FINITE ELEMENT ANALYSIS (7 hours)
Basics of FEA, historical background: General Field problems in engineering - Modeling - Discrete and continuum models - Characteristics - Difficulties faced in obtaining solution - The relevance of FEM based approach to solutions - Initial and boundary value problems- concepts.

UNIT II - VARIATIONAL AND WEIGHTED RESIDUAL APPROACHES (7 hours)
Variational formulation in FEM, weighted residual methods - Galerkin formulation, Point-collocation and Sub-domain collocation, Least-square minimisation

UNIT III - STATIC ANALYSIS (9 hours)
Skeletal structures and Continua: Discretisation, basic types of elements- truss and beam elements- Shape functions, element stiffness matrices.

UNIT IV - ONE-DIMENSIONAL SECOND ORDER EQUATIONS (9 hours)
Generalized coordinate approach, derivation of element matrices - Assembly of elements - Imposition of boundary conditions - Solution of equations - Triangulation and back substitution - Simple applications in heat transfer, solid mechanics - Extension of the method to fourth order equation.

UNIT V - FINITE ELEMENT ANALYSIS IN TWO DIMENSIONS (9 hours)
Global and natural coordinates - Second order equations involving scalar valued functions - Variational formulation - Finite element formulation through generalized coordinate approach - Convergence criteria - Interpolation functions - Plane triangular and rectangular elements - heat transfer and solid mechanics applications.

UNIT VI - INTRODUCTION TO ADVANCED TOPICS **(4 hours)**

(Only preliminaries to be covered. Not included for examination)
Three-dimensional problems, Exposure to software packages.

TOTAL :45

TEXT BOOKS

1. Hutton.D.V, "*Fundamentals of Finite Element Analysis"*, McGraw Hill, International Edition, 2004
2. Chandrupatla.T.R, Belegundu.A.D, "*Introduction to Finite Elements in Engineering"*, Prentice Hall of India, 2011.

REFERENCES

1. Segerlind. L.J, "*Applied Finite Element Analysis"*, John Wiley & Sons, 1984.
2. Zienkiewicz. O.C, "*Finite Elements and Approximation"*, Dover International, 2006.
3. Cook .R.D, Malkus.D.S, Plesha, M.E., Witt, R.J., "*Concepts and Applications of Finite Element Analysis"*, 4th Ed., John Wiley & Sons, 2001.
4. Reddy.J.N, "*An Introduction to Finite Element Method"*, McGraw Hill International Edition, 2006.

ME1101 – FINITE ELEMENT METHODS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	C	d	e	f	g	h	i	j	k
		x	x			x					x	x
2.	Mapping of instructional objectives with student outcome	1-4	1-4			1-4						1-4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1102	**ROBOTICS ENGINEERING AND APPLICATIONS**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To impart knowledge about the engineering aspects of Robots and their applications.

INSTRUCTIONAL OBJECTIVES

1.	End effectors and sensors.
2.	Robots cell design and programming.
3.	Industrial application of robot

UNIT I - INTRODUCTION **(10 hours)**

Basic concepts - Robot anatomy - Manipulators - kinematics: Forward and inverse kinematics - Precision movement, robot specifications and Work volume, Types of Robot drives - Basic robot motions - Point to point control, continuous path control.Robot control - unit control system concept - servo and non-servo control of robot joints, adaptive and optimal control.

UNIT II - END EFFECTORS AND SENSORS (**12 hours)**

End effectors - classification - mechanical, magnetic, vacuum and adhesive gripper - gripper force analysis and design.

Sensor devices, Types of sensors - contact, position and displacement sensors, Force and torque sensors - Proximity and range sensors - acoustic sensors - Robot vision systems - Sensing and digitizing - Image processing and analysis.

UNIT III - ROBOT CELL DESIGN **(8 hours)**

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple.

Robots and machine interference – Robot cycle time analysis.

UNIT IV - ROBOT PROGRAMMING **(8 hours)**

Robot language classification - programming methods - off and on line programming - Lead through method - Teach pendent method - VAL systems and language, simple program.

UNIT V - INDUSTRIAL APPLICATIONS (**7 hours)**

Application of robots - Material handling - Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Mobile robot, Microbots - Recent developments in robotics- safety considerations.

TOTAL :45

TEXT BOOKS

1. Deb .S.R, "*Robotics technology and flexible automation"*, Tata McGraw Hill publishing company limited, New Delhi, 2010.
2. Mikell P. Groover, "*Industrial Robotics Technology Programming and Applications"*, McGraw Hill Co., Singapore, 2008.

REFERENCES

1. Klafter.R.D, Chmielewski.T.A and Noggins,"*Robot Engineering: An Integrated Approach"*, Prentice Hall of India Pvt. Ltd., New Delhi, 2011.
2. Fu K.S, Gonzalez.R.C,& Lee, C.S.G, "*Robotics control, sensing, vision and intelligence"*, McGraw Hill Book Co., Singapore, Digitized 2007.
3. Craig.J.J, "*Introduction to Robotics mechanics and contro"l*, Addison-Wesley, London, 2008.

ME1102 ROBOTICS ENGINEERING AND APPLICATIONS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x					x	x
2.	Mapping of instructional objectives with student outcome	1,3		3		2,3					4	3.4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1103	MECHANISM DESIGN, ANALYSIS AND SYNTHESIS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To study how various mechanisms can be designed.

INSTRUCTIONAL OBJECTIVES

1.	To Study of kinematics of various mechanisms and kinematic synthesis of linkages.
2.	To Study of various graphical constructions of acceleration analysis.
3.	To study Static and dynamic force analysis of linkages.
4.	To study Kinematic analysis and kinematic synthesis of spatial mechanisms.

UNIT I - KINEMATIC ANALYSIS OF MECHANISMS (9 hours)

Review of Fundamentals of Kinematics - Mobility Analysis - Classifications of Mechanisms - Kinematic Inversion - Grashoff's law - Mechanical Advantage - Transmission Angle - Position Analysis - Vector loop Equations for four bar, Slider Crank, Six bar linkages - Analytical and Graphical methods for velocity and acceleration analysis - Four bar linkage jerk analysis. Plane complex mechanism.

UNIT II - KINEMATIC SYNTHESIS OF LINKAGES (9 hours)

Type, Number and Dimensional Synthesis - Function Generation - Path Generation and Motion Generation. - Graphical Methods: Two Position, Three Position and Four Position synthesis of four bar Mechanism, Slider crank Mechanism, Precision positions Over lay Method. Analytical Methods: Blotch's Synthesis - Freudestien's Method - Coupler curve Synthesis - Cognate linkages - The Roberts - Chebyshev theorem.

UNIT III - PATH CURVATURE THEORY **(9 hours)**

Fixed and moving centrodes. - Hartmann's Construction - Inflection Points, The Inflection Circle - The Euler - Savary Equation - The collination axis and Bobiller's theorem - Conjugate points and inverse motion - The cubic Stationary curvature - Ball's Point.

UNIT IV - DYNAMICS OF MECHANISMS **(9 hours)**

Static force analysis - Inertia force analysis - Combined static and inertia force Analysis - Shaking force - Introduction to force and moment balancing of linkages.

UNIT V - SPATIAL MECHANISMS AND ROBOTICS **(9 hours)**

Introduction: Mobility of mechanisms - Description of spatial motions - Kinematic analysis of spatial mechanism - Kinematic sythesis of spatial mechanisms: position, velocity and acceleration analysis. Eulerian Angles - Introduction to Robotic Manipulators - Topological arrangements of robotic arms - Kinematic analysis of spatial mechanism - Denavit - Hartenberg Parameters, Forward and inverse kinematics of robotic manipulators.

TOTAL : 45

TEXT BOOKS

1. Shigley.J.E and Uicker J.J, "*Theory of Machines and Mechanisms"*, McGraw Hill, 1995.
2. Rao.J.S and Dukkipatti.R.V, "*Mechanisms and Machine Theory"*, 2nd Edition, New Age international (P) Ltd., 2007.

REFERENCES

1. Sandor.G.N and Erdman A. G, "*Mechanism Design, Analysis and Synthesis*", Vol: I and Vol: II, Prentice Hall, Digitized 2007.
2. Norton.R. L, "*Design of Machinery"*, McGraw Hill, 2010.
3. Hamilton.H Mabie and Charles F. Reinhofz, "*Mechanisms and Dynamics of Machinery"*, John Wiley & Sons, Digitized 2007.
4. Amitabha Ghose and Ashok Kumar Malik, "*Theory of Mechanisms and Machines"*, EWLP, Delhi, 1999.

ME1103 MECHANISM DESIGN, ANALYSIS AND SYNTHESIS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x					x	x
2.	Mapping of instructional objectives with student outcome	1,3		3		2,3					4	3.4
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects (P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1104	DIGITAL IMAGE PROCESSING AND MACHINE VISION	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To study the basic concepts of image processing techniques and machine vision techniques.

INSTRUCTIONAL OBJECTIVES

1.	Basic concepts of digital image processing.
2.	Enable the students to analyze and appreciate various imaging techniques.
3.	Techniques involved in machine vision.

UNIT I - FUNDAMENTALS OF DIGITAL IMAGE PROCESSING (9 hours)

Elements of digital image processing systems - Elements of visual perception - Image sampling and quantization, - Matrix and singular value representation of discrete discrete image.

UNIT II - IMAGE TRANSFORMS AND EDGE DETECTION (9 hours)

Transformation-1D DFT, 2D DFT, Cosine, Sine, - Hadamard, Haar, Slant, KL, SVD transforms and their properties. Edge detection - Roberts operator, - Sobel operator - Prewitt operator.

UNIT III - IMAGE ENHANCEMENT (9 hours)

Histogram modification and specification techniques - Image smoothing - Image sharpening - Generation of spatial masks from frequency domain specification - Nonlinear filters, Homomorphic filtering - False color, Pseudocolor and color image processing.

UNIT IV - IMAGE RESTORATION AND COMPRESSION (9 hours)

Image degradation models - Unconstrained and constrained restoration - Inverse filtering - Least mean square filter, Pattern classes - Optimal statistical classifiers. Runlength - Huffman coding - Shift codes - Arithmetic coding, bit plane coding, transform coding, JPEG Standard, - Wavelet transform - Predictive techniques - Block truncation coding schemes - Facet modeling.

UNIT V - MACHINE VISION (9 hours)

Machine Vision - Sensing - Low and higher level vision - Image acquisition and digitization - Cameras, CCD,CID, CPD, etc., - Illumination and types - Image processing and analysis - Feature extraction - Applications.

TOTAL : 45

TEXT BOOKS

1. Anil K. Jain, "*Fundamentals Of Digital Image Processing"*, Prentice Hall of India, New Delhi, 1997.
2. Rafel C.Gonzalez and Richard E.Woods, "*Digital Image Processing"*, Addison Wesley, New York, 2009.
3. Vernon, D., "*Machine Vision - Automated Visual Inspection and Robot Vision"*, Prentice Hall International Ltd., New York, 1991.

REFERENCES

1. William K. Pratt, "*Digital Image Processing"*, John Wiley, New York, 2007.
2. Sid Ahmed M. A., "*Image Processing Theory, Alogorithms and Architectures"*, McGraw-Hill, New York, 1995.
3. Umbaugh.S.E, "*Computer Vision and image processing - Practical approach using CVIP tools"*, Prentice Hall of India, New Delhi, 1998.
4. Ramesh Jain, Rangachar Kasturi and Brain G. Schunk, "*Machine Vision"*, McGraw Hill International Editions, Computer Science Series, Singapore, 1995.

ME1104 DIGITAL IMAGE PROCESSING AND MACHINE VISION												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	x
2.	Mapping of instructional objectives with student outcome	1,2				2					3	2,3
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1105	DESIGN FOR MANUFACTURING AND ASSEMBLY	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To study how a design can be made suitable for various manufacturing and assembly process requirements.

INSTRUCTIONAL OBJECTIVES

1. To study the various factors influencing the manufacturability of components and the use of tolerances in manufacturing.
2. Application of this study to various forging, casting, welding and machining processes.
3. To study about the various assembly methods and processes and design for assembly guidelines

UNIT I - INTRODUCTION (9 hours)

Qualities of a designer - Systematic working plan - Factors influencing choice of materials - Manufacturing methods. Process capability. Tolerances - Relevant to manufacturing, assembly. Tolerance stack - effects on assembly - Methods of eliminating tolerance stack.

UNIT II - FORM DESIGN - CASTING AND WELDING (9 hours)

Influence of loading, materials, production methods on form design. Casting considerations - Requirements and rules. Welding considerations - Requirements and rules. Redesign of components for castings. Redesign of components for welding. Case studies.

UNIT III - FORM DESIGN - FORGING AND MACHINING (9 hours)

Forging considerations - Requirements and rules. Choice between casting, forging and welding. Machining considerations - Requirements and rules. Redesign of components for forging. Redesign of components for machining. Case studies.

UNIT IV - DESIGN FOR ASSEMBLY (9 hours)

Distinction between assembly methods and processes. Factors determining assembly methods and processes. Design factors independent of methods and processes. Design factors dependent on methods. Design factors dependent on processes.

UNIT V - DESIGN FOR ASSEMBLY METHODS **(9 hours)**

Approaches to design for assembly - Approaches based on design principles and rules - Qualitative evaluation procedures, knowledge based approach, Computer aided DFA methods. Assemblability measures. Boothroyd - Dewhurst DFA method - Redesign of a simple product. Case studies.

TOTAL : 45

TEXT BOOKS

1. Harry Peck, "*Design for Manufacture"*, Pittman Publication, 1983.
2. Alan Redford and Chal, "*Design for Assembly - Principles and Procedures"*, McGraw Hill International Europe, London, 1994.

REFERENCES

1. Robert Matousek, "*Engineering Design - A Systematic Approach"*, Blackie & Sons Ltd., Digitized 2007.
2. James G. Bralla, "*Hand Book of Product Design for Manufacturing"*, McGraw Hill Co., 1986.
3. Swift.K.G, "*Knowledge Based Design for Manufacture"*, Kogan Page Ltd., 1987.

ME1105 - DESIGN FOR MANUFACTURING AND ASSEMBLY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x					x	
2.	Mapping of instructional objectives with student outcome	1,3		2,3		1-3					3	
3.	Category	General(G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1106	**OPTIMIZATION IN ENGINEERING DESIGN**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				
PURPOSE					
To study the principles of optimization and various techniques which can be used for Mechanical Engineering optimization along with applications.					
INSTRUCTIONAL OBJECTIVES					
1.	Principles of optimization and its need.				
2.	Various conventional optimization techniques.				
3.	Solving multivariable problems.				
4.	Solving problems using Unconventional optimization techniques.				
5.	Applications of optimization to design of machine elements.				

UNIT I - INTRODUCTION (**9 hours)**

Introduction to optimum design - General principles of optimization – Problem formulation & their classifications – Classical optimization techniques - Single variable and multivariable optimization.

UNIT II - UNCONSTRAINED OPTIMIZATION TECHNIQUES (**9 hours)**

Techniques of unconstrained optimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT III - CONSTRAINED OPTIMIZATION TECHNIQUES (**9 hours)**

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions.

UNIT IV - UNCONVENTIONAL OPTIMIZATION TECHNIQUES (**9 hours)**

Genetic algorithms, Simulated Annealing and Ant Colony algorithm.

UNIT V - APPLICATIONS (**9 hours)**

Structural applications – Design of simple truss members - Design applications – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs.

TOTAL : 45

TEXT BOOKS

1. Rao Singaresu.S, "*Engineering Optimization – Theory & Practice*", New Age International (P) Limited, New Delhi, 2009.
2. Kalyanamoy Deb, "*Optimization for Engineering design algorithms and Examples*", Prentice Hall of India Pvt. Ltd.,2006.

REFERENCES

1. Johnson Ray C, "*Optimum design of mechanical elements*", Wiley, John & Sons, Digitized 2007.
2. Goldberg.D.E, "*Genetic algorithms in search, optimization and machine*", Barnen, AddisonWesley, New York, 1989.
3. Rao.C.S, "*Optimization Techniques"*, Dhanpat Rai & Sons, New Delhi
4. Fox.R.L, "*Optimization methods for Engineering Design"*, Addison Wesley Pub, Digitized 2007.
5. Garret N. Vanderplaats, "*Numerical optimization techniques for engineering design: with applications"*, McGraw-Hill Ryerson, Limited, Digitized 2007.

ME1105 - DESIGN FOR MANUFACTURING AND ASSEMBLY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2.	Mapping of instructional objectives with student outcome	1-5		1-5		1-5						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	NEURAL NETWORK AND FUZZY SYSTEMS	L	T	P	C
ME1107	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To study the basic concepts of neural networks techniques and fuzzy logic.

INSTRUCTIONAL OBJECTIVES

1. Techniques involved in neural networks.
2. Techniques involved in fuzzy systems.

UNIT I - INTRODUCTION TO NEURAL NETWORKS (9 hours)

Biological foundations - ANN models - Types of activation functions - Introduction to network architectures : Multi layer feed forward network (MLFFN), Radial basis function network (RBFN), Recurring neural network (RNN)

UNIT II - LEARNING ALGORITHMS (9 hours)

Learning process - Supervised and unsupervised learning - Error-correction learning - Hebbian learning - Boltzmaen learning - Single layer and multiplayer percepturs - Least mean square algorithm - Back propagation algorithm. - Applications in forecasting and pattern recognition and other engineering problems.

UNIT III - INTRODUCTION TO FUZZY LOGIC (9 hours)

Fuzzy sets - Fuzzy relations - Fuzzy conditional statements - Fuzzy rules - Fuzzy algorithm.

UNIT IV - FUZZY LOGIC CONTROL SYSTEM (9 hours)

Fuzzy logic controller - Fuzzification interface - Knowledge base - Decision making logic - Defuzzification interface - Design of fuzzy logic controller - Case study.

UNIT V - NEURO-FUZZY LOGIC CONTROL **(9 hours)**

Optimisation of membership function and rules base of fuzzy logic controller using neural networks - Genetic algorithm - Fuzzy neuron - Adaptive fuzzy systems - Case study.

TOTAL : 45

TEXT BOOKS

1. Jacek.M. Zurada, "*Introduction to artificial Neural Systems"*, Jaico Publishing House, Mumbai, Digitized 2007.
2. Simon Haykins, "*Neural Networks - A comprehensive foundation"*, Macmillan College, Proc. Con. Inc. New York, 1994.
3. Zimmermann.H.J, "*Fuzzy set theory and its applications"*, Allied Publication Ltd., Chennai, 1996.

REFERENCES

1. Tsoukalas.L.H and Robert E. Uhrig., "*Fuzzy and Neural approach in Engineering"*, John Wiley and Sons, New York, 1997.
2. Klir.G.J and Yuan.B.B, "*Fuzzy sets and fuzzy logic"*, Prentice Hall of India, New Delhi, 1997.
3. Driankov.D, Hellendron.H and Reinfrank.M, "*An Introduction to Fuzzy control"*, Narosa publishing House, New Delhi, 1996.

ME1107 - NEURAL NETWORK AND FUZZY SYSTEMS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	x
2.	Mapping of instructional objectives with student outcome	1,2				1,2					1,2	1,2
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1108	**INDUSTRIAL TRIBOLOGY**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To present the engineering concepts of friction, its effects and different lubrication theories and types used in industries.

INSTRUCTIONAL OBJECTIVES

1.	The friction and wear in materials.
2.	The lubricants and their properties.
3.	The preparation of bearing materials

UNIT I - SURFACES AND FRICTION (9 hours)

Topography of Engineering surfaces- Contact between surfaces –Various tribological problems and solutions- Sources of sliding Friction – Adhesion, ploughing- Friction characteristics of metals - Friction of non metals- Friction of ceramic materials and polymers - Rolling friction - Source of rolling friction -Stick slip motion - Measurement of friction.

UNIT II - WEAR (9 hours)

Types of wear - Simple theory of sliding wear mechanism -Abrasive wear - Materials for adhesive and abrasive wear - Corrosive wear - Surface fatigue wear - Wear of ceramics and polymers - Wear measurements.

UNIT III - FILM LUBRICATION THEORY (9 hours)

Coefficient of viscosity-Fluid film in simple shear - Viscous flow between very close parallel plates – Lubricant supply- Lubricant flow rate-Cold jacking-Couette flow- Cavitation- Film rupure-oil whirl-Shear stress variation with in the film-Lubrication theory by Osborne Reynolds – Pressure fields for full sommerfeld-Half sommerfeld, Reynolds boundary conditions.

UNIT IV - LUBRICANTS AND LUBRICATION TYPES (9 hours)

Types and properties of Lubricants – Lubricant additives – Lubricant impurities and contaminants- Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication , Hydrostatic Lubrication.

UNIT V - SURFACE ENGINEERING AND MATERIALS FOR BEARINGS (9 hours)

Surface modifications - Transformation hardening - Surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Materials for rolling element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

TOTAL : 45

TEXT BOOKS

1. Hutchings.I.M, "*Tribology, Friction and Wear of Engineering Material"*, Edward Arnold, London, 1992
2. Williams.J.A, "*Engineering Tribology"*, Oxford University Press, 2005.
3. Gwidon Stachowiak, Andrew W Batchelor., "*Engineering tribology"*, Elsevier Butterworth – Heinemann, USA, 2005.

REFERENCES

1. Stolarski.T.A, "*Tribology in Machine Design"*, Industrial Press Inc., 1991.
2. Bowden.F.P, and Tabor.D, "*Friction and Lubrication"*, Heinemann Educational Books Ltd., 2001.
3. Cameron.A, "*Basic Lubrication theory"*, Longman, U.K., 1981.
4. Neale.M.J, (Editor), "*Tribology Handbook"*, Newnes Butter worth, Heinemann, U.K., 1999.

ME1108 - INDUSTRIAL TRIBOLOGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x					x	x
2.	Mapping of instructional objectives with student outcome	1-3		1-3		1-3					1-3	1-3
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											x	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1121	**MODERN MANUFACTURING TECHNIQUES**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To develop the ability to understand the advanced manufacturing techniques evolved in manufacturing scenario.

INSTRUCTIONAL OBJECTIVES

1. Advanced techniques in casting
2. Advanced forming and powder metallurgy
3. Fabrication of microelectronic devices
4. Manufacturing of composites
5. Rapid prototyping

UNIT I - ADVANCES IN CASTING **(9 hours)**

Newer casting techniques - Expendable pattern casting - Plaster mold and ceramic mold casting – Vacuum casting - Squeeze casting - Rapid solidification for amorphous alloys – Casting techniques for single crystal components.

UNIT II - ADVANCED FORMING AND POWDER METALLURGY PROCESSES **(9 hours)**

High speed forging machines - Die materials - semisolid metal forming- Peen forming of sheet metals - Super plastic forming – Forming and shaping glass. Design consideration for Powder Metallurgy forming - Production of metal powders – Compaction – Sintering – Finishing of sintered parts – Secondary and finishing operations.

UNIT III - FABRICATION OF MICRO ELECTRONIC DEVICES **(9 hours)**

Semiconductors and silicon - Crystal growing and wafer preparation - Film deposition, Oxidation, Lithography, Etching, Diffusion and ion implantation, Metallization and testing - Bonding and packing.

UNIT IV - MANUFACTURING OF COMPOSITES **(9 hours)**

Introduction- Fibre reinforced, Metal matrix, Ceramics matrix composites, Nanocomposites
- structure, Properties, manufacturing processes and applications.

UNIT V - RAPID PROTOTYPING. **(9 hours)**

Rapid prototyping- overview, Techniques-Stereo lithography, Laminated object manufacturing, Selective laser sintering, fused deposition modeling, solid ground curing, 3D ink jet printing-Applications of rapid prototyping-Rapid tooling-Rapid manufacturing-Future development-Virtual prototyping.

TOTAL : 45

TEXT BOOKS

1. Serope Kalpakjian*, "Manufacturing Engineering and Technology",* Third Edition, Addison-Wesley Publishing Co., Boston, 2009.
2. Madou.M.J, "*Fundamentals of micro fabrication"*, CRC Press, USA, 1997.

REFERENCES

1. Amstead.B.H, "*Ostwald Phylips and Bageman.R.L. Manufacturing Processes",* John Wiley & Sons, New York, 1987.
2. Jaeger.R.C, "*Introduction to microelectronic Fabrication",* Addision-Wesley, Boston, 1988.
3. Chua.C.K, "*Rapid Prototyping"*, John Wiley, New York, 1997.
4. Hilton.P.D and Marcel Dekker, "*Rapid Tooling"*, New York, 2000.

ME1121 - MODERN MANUFACTURING TECHNIQUES												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x					x	
2.	Mapping of instructional objectives with student outcome			1-5		1-5					1-5	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1122	PRECISION ENGINEERING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering.

INSTRUCTIONAL OBJECTIVES

1. Accuracy and alignment tests.
2. Influences of static stiffness and thermal effects.
3. Precision machining.
4. Nano measuring systems.
5. Various lithography techniques.

UNIT I - ACCURACY AND ALIGNMENT TESTS (9 hours)

General concept of accuracy – Spindle rotation accuracy – Test methods-Displacement accuracy - Dimensional wear of cutting tools - Accuracy of NC systems - Clamping errors - Setting errors -Location of rectangular prism, cylinder-Basic type of tests – Measuring instruments used for testing machine tools - Alignment tests-Straightness, Flatness, Parallelism, Squareness, Circularity, Cylindricity.

UNIT II - INFLUENCE OF STATIC STIFFNESS, THERMAL EFFECTS (9 hours)

Static stiffness – Nature of deformation in a machine tool – Overall stiffness of a lathe – Compliance of work piece-Errors due to the variation of the cutting force and total compliance – Inaccuracies due to thermal effects – Methods of decreasing thermal effects-Influence of vibration on accuracy.

UNIT III - PRECISION MACHINING **(9 hours)**

Introduction - Top down and bottom up approach - Development of Nanotechnology - Precision and micromachining -Diamond turning of parts to nanometer accuracy- Stereo microlithography- machining of micro-sized components-Mirror grinding of ceramics-Ultra precision block gauges.

UNIT IV - NANO MEASURING SYSTEMS **(9 hours)**

In - process measurement of position of processing point - Post process and online measurement of dimensional features - Mechanical measuring systems - Optical measuring systems - Electron beam measuring systems - Pattern recognition and inspection systems.

UNIT V - LITHOGRAPHY **(9 hours)**

Nano Lithography – Photolithography - Electron beam lithography – Ion Beam lithography - Optical lithography-LIGA process- Dip pen lithography-Deep UV lithography, Nanocoatings.

TOTAL: 45

TEXT BOOKS

1. Murthy.R.L, "*Precision Engineering in Manufacturing"*, New Age International, New Delhi, 2005.
2. Norio Taniguchi, "*Nanotechnology"*, Oxford university press, Cambridge, 1996.

REFERENCES

1. Lee Tong Hong, "*Precision Motion control, Design and Implementation"*, Springer Verlag, U.K., 2001.
2. Liangchi Zhang, "*Precision Machining of Advanced Materials"*, Trans Tech Publications Ltd., Switzerland, 2001.
3. Hiromu Nakazawa, "*Principles of precision engineering"*, Oxford university press, 1994.

ME1122 - PRECISION ENGINEERING													
Course Designed by		**Department of Mechanical Engineering**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
				x		x					x	x	
2.	Mapping of instructional objectives with student outcome			1-5		1-5					1-5	5	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)		
											x		
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1123	PRODUCTION MANAGEMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE
To get acquainted with the basic aspects of Production Management.

	INSTRUCTIONAL OBJECTIVES
1.	Production management.
2.	Inventory Management and Work-study.
3.	Job Evaluation and Scheduling.
4.	Project Management.
5.	Quality Management

UNIT I - INTRODUCTION TO PRODUCTION MANAGEMENT (9 hours)

History and Development of production management, functions & scope - Types of production processes , relationship of production management with other functional areas - Capacity planning-– Types of Capacity, Capacity Decision, Capacity Planning Strategies, Location planning - Layout planning - Productivity management.

UNIT II - INVENTORY MANAGEMENT AND WORK STUDY (9 hours)

Inventory control-Cost-Procurement and consumption cycle -Purchasing methods -Procedure-Records used in stock control -Warehousing, Method study-Definitions, Means of increasing productivity, Role of work study, human factors in work study, Factors affecting work-study , objectives-Basic procedure for method study-Charts and diagrams used in method study, work measurement - objective and techniques of work measurement - Simple problems.

UNIT III - JOB EVALUATION AND SCHEDULING (9 hours)

Job Evaluation -objectives - methods-Factors affecting wages structure - components - Types of wages-methods of wage system -Characteristics - Value analysis and Value Engineering - Forecasting - Aggregate Planning -Strategies - Methods- MPS-Scheduling- Principles, inputs, strategies - Sequencing - Assumptions- Gantt chart -Johnsons Algorithm- Simple problems.

UNIT IV - PROJECT MANAGEMENT (9 hours)

Project Management – Phases - Time Chart –PERT-CPM - Material Requirements Planning (MRP) - Manufacturing Resources Planning (MRP II) - Enterprise resource planning (ERP) -Logistics and Supply Chain Management-Objectives-Decision Phases – Role – Development.

UNIT V - QUALITY MANAGEMENT **(9 hours)**

Quality management systems –Factors controlling quality –Impact of poor quality – Challenges - Quality Cost- Quality Assurance - Quality circle- Statistical process control (SPC) - Control Charts - Total Quality Management -Just in Time-Six Sigma-Maintenance management, Types, Effects of maintenance, - Reliability - Replacement techniques

TOTAL: 45

TEXT BOOKS

1. Ahuja.K.K, "*Production Management"*, CBS Publishers, New Delhi, 2004.
2. Goel.B.S, "*Production Management"*, Pragathi & prakasam publishers, Meerut, 1984.

REFERENCES

1. Hajra Nirjhar Roy,"*Production Management"*, MP Publishers, New Delhi, 1990.
2. Narang.G.B.S and Kumar. V, "*Production Management"*, Khanna publishers, New Delhi, 1989.
3. Agarwal and Jain, "*Production Management"*, Khanna publishers, New Delhi, 1998.
4. Levin and Richard, "*Production and Operation Management"*, Tata McGraw Hill publications, New Delhi, 1990.
5. Martland T.Telsang, "*Production Management*, S.Chand *Publication"*, New Delhi, 2005.

ME1123 - PRODUCTION MANAGEMENT												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x	x	x				x			
2.	Mapping of instructional objectives with student outcome	1	1,3	3-5	1,3				2			
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1124	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To study the basic concepts of artificial intelligence techniques.

INSTRUCTIONAL OBJECTIVES

1. Basic concepts of artificial intelligence.
2. Techniques involved in Problem solving agents.
3. Techniques involved in Knowledge organization and communication.
4. AI programming language.
5. Basic concepts of expert systems.

UNIT I - INTRODUCTION (9 hours)

History - Definition of A.I., - Emulation of human cognitive process. - The knowledge search tradeoff – Stored knowledge - Semantic nets - An abstract view of modeling - Elementary knowledge - Computational logic - Analysis of compound statements using simple logic connectives - Predicate logic - Knowledge organization and manipulation - Knowledge acquisition.

UNIT II - PROBLEM SOLVING AGENTS (9 hours)

Problem Definition - Formulating problems - Searching for solutions - Measuring problem, Solving performance with examples. Search / Strategies - Uninformed or Blinded search - Breadth first search – Uniform cost search - Depth first search, Depth limited search - Iterative deepening - Depth first search – Bi – directional search - Comparing uniformed search strategies - Informed search strategies - Heuristic information – Hill climbing methods – Best First Search, Branch – and - Bound Search - Optimal search and A* and iterative deepening A*

UNIT III - KNOWLEDGE ORGANISATION, COMMUNICATION (9 hours)

Matching Techniques - Need for matching - Matching problem - Partial matching - Fuzzy matching – RETE matching algorithm - Knowledge organization - Indexing and Retrieval techniques – Integration of knowledge in memory organization systems – Perception - Communication and Expert System - Overview of linguistics - Basic semantic analysis and representation structures - Natural language generation.

UNIT IV - INTRODUCTION TO PROGRAMMING LANGUAGE (9 hours)

Introduction to Programming Language of AI and its advantages - Introduction to Lisp and its syntax – Lisp syntax - Numeric function - Lisp syntax – Input statements- Output statements and declaration of local variables - Interaction and recursion functions - Property list and arrays.

UNIT V - EXPERT SYSTEMS (9 hours)

Expert System- Introduction - Difference between expert system and conventional programs - Basic activities of expert system – Interpretation – Prediction – Diagnosis – Design – Planning – Monitoring – Debugging – Repair – Instruction – Control - Basic aspect of expert system - Acquisition module frames - Knowledge base, Production rules - Semantic net, Inference engine - Backward chaining and forward chaining – Explanatory interface.

TOTAL: 45

TEXT BOOKS

1. Elaine Rich and Kelvin Knight, "*Artificial Intelligence"*, Tata McGraw Hill, New Delhi, 2009.
2. Stuart Russell and Peter Norvig, "*Artificial Intelligence: A modern approach"*, Prentice Hall, New Jersey, 2009.

REFERENCES

1. Nilson.N.J, "*Principles of Artificial Intelligence"*, Springer Verlag, Berlin, 2009.
2. Patterson "*Introduction to Artificial Intelligence and Expert systems"*, Prentice Hall of India, New Delhi, 1992.
3. Eugene Charniak and Drew McDermot, "*Introduction to Artificial Intelligence",* Addison Wesley Longman Inc., 2009.

ME1124 - ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
											x	x
2.	Mapping of instructional objectives with student outcome										1-5	4,5
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1125	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart clear knowledge about process planning, costing and estimation of machining time.

INSTRUCTIONAL OBJECTIVES

1.	Process planning.
2.	Different Cost and its components.
3.	Cost estimation in Foundry,Forging shops.
4.	Cost estimation in Fabrication shops.
5.	Machining time calculation for different process

UNIT I - PROCESS PLANNING (9 hours)

Types of production – standardization, simplification – production design and selection -Process planning: - Selection and analysis - Manual/Experience based planning - CAPP - Variant - Generative - Processes analysis –Break even analysis.

UNIT II - COSTING AND ESTIMATION (9 hours)

Aims of costing and estimation - Functions and procedure - Introduction to costs, Computing material cost, Direct labor cost, Analysis of overhead costs - Factory expenses, Administrative expenses, Selling and distributing expenses - Cost ladder - Cost of product - Depreciation - Analysis of depreciation.

UNIT III - ESITMATION OF COSTS IN DIFFERENT SHOPS (9 hours)

Estimation in foundry shop – Pattern cost - Casting cost - Illustrative examples. Estimation in Forging shop – Losses in forging – Forging cost - Illustrative examples.

UNIT IV - ESTIMATION OF COSTS IN FABRICATION SHOPS (9 hours)

Estimation in welding shop – Gas cutting – Electric welding - Illustrative examples. Estimation in sheet metal shop – Shearing and forming - Illustrative examples.

UNIT V - ESTIMATION OF MACHINING TIMES AND COSTS (9 hours)

Estimation of machining time for lathe operations - Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations - Illustrative examples.

TOTAL: 45

TEXT BOOKS

1. Adithan.M.S and Pabla, "*Estimating and Costing"*, Konark Publishers Pvt., Ltd, 1989.
2. Banga.T.R and Sharma.S.C, "*Estimating and Costing"*, Khanna publishers, New Delhi, 1986.

REFERENCES

1. Nanua Singh, "*System Approach to Computer Integrated Design and Manufacturing"*, John Wiley & Sons, New York, 1996.
2. Joseph G. Monks, "*Operations Management, Theory and Problems"*, McGraw Hill Book Company, New Delhi, 1982.
3. Narang.G.B.S and Kumar.V, "*Production and Planning"* , Khanna Publishers, New Delhi, 1995.
4. Chitale.A.K and Gupta.R.C, "*Product Design and manufacturing"*, Prentice Hall of India, New Delhi, 2007.

ME1125 - PROCESS PLANNING AND COST ESTIMATION													
Course Designed by		**Department of Mechanical Engineering**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
				x		x					x	x	
2.	Mapping of instructional objectives with student outcome			1-3		1,3,5					2-4	1-3	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)		
											x		
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1126	**TOOL ENGINEERING DESIGN**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				
PURPOSE					
To develop in the engineering student the ability to design cutting tools and press tools for given condition.					
INSTRUCTIONAL OBJECTIVES					
1.	Tool materials and their properties.				
2.	Design of single point cutting tools and twist drills.				
3.	Design of various types of dies.				
4.	Blank development for different components.				
5.	Design of jigs and fixtures for simple components				

UNIT I - CUTTING TOOL DESIGN **(9 hours)**

Different tool materials: cemented carbides, coated carbides, cermets, ceramics and polycrystalline tool materials - compositions - properties of tool materials - Selection and treatments - Plastics as tooling materials - New tooling materials Design of single point turning and threading tools - Selection of tool holders and inserts for turning - Chip breakers - Design of twist drill and reamers.

UNIT II - PRESS TOOL DESIGN **(9 hours)**

Press working terminology - Presses and press accessories - Computation of capacities and tonnage requirements - Strip layout - Types of dies - Design and development of various types of cutting, forming, bending and drawing dies - Progressive dies, Combination dies and compound dies - Blank development for cylindrical and non cylindrical shells, Simple problems.

UNIT - III DESIGN OF JIGS **(9 hours)**

Principles of jigs and fixtures - Locating elements - Drill bushes - Different types of jigs - Plate, latch, channel, post, angle plate, turn over, and pot jigs - Automatic drill jigs, Design and development of jigs for given components.

UNIT IV - DESIGN OF FIXTURES **(9 hours)**

Design principles of fixtures - Design of fixtures for milling, boring. Design of fixture for assembly, inspection and welding. Design and development of fixtures for given components.

UNIT V - CASE STUDY **(9 hours)**

Case study in Jigs, fixture and press tools.

TOTAL : 45

TEXT BOOKS

1. Sadasivan.T.A, and Sarathy.D, "*Cutting tools for Productive machining"*, 1st edition, Widia (India) Ltd, Bangalore, 1999.
2. Donaldson.C, Lecain.G.H and Goold.V.C, "*Tool Design"*, Tata McGraw Hill publishing company limited, New Delhi, 2002.
3. Edward G. Hoffman, "*Jigs and Fixture design"*, 2nd edition, Galgotia publication Pvt. Ltd., New Delhi, 1987.

REFERENCES

1. Hiram E. Grant, "*Jigs and Fixtures - Non standard clamping device"*, Tata McGraw Hill, New Delhi, 1971.
2. Prakash H. Joshi, "*Press tool design and construction"*, 1st edition, Wheeler Publishing, New Delhi, 2000.
3. Kempster.M.H.A, "*An Introduction to Jig and tool design"*, 3rd edition, ELBS, 1987.
4. Prakash H. Joshi, "*Cutting tools"*, 1st edition, Wheeler Publishing, New Delhi, 1997.
5. Prakash H. Joshi, "*Tooling Data"*, 1st edition, Wheeler Publishing, New Delhi, 2000.

ME1126 – TOOL ENGINEERING DESIGN												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		**x**								
2.	Mapping of instructional objectives with student outcome	1-5		1-5								
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1127	**FLEXIBLE MANUFACTURING SYSTEMS**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To impart knowledge on group technology, Flexible manufacturing system and its implementation.

INSTRUCTIONAL OBJECTIVES

1.	Study of different types of production.
2.	Knowledge of group technology(GT).
3.	Fundamentals and need of FMS.
4.	Detailed study of flexible manufacturing cells and systems.
5.	FMS software.

UNIT I - PRODUCTION SYSTEMS **(6 hours)**

Types of production-Job Shop, Batch and Mass production - Functions in manufacturing - Organization and information processing in manufacturing - Plant layout - Work in progress inventory - Scheduling, problems.

UNIT II - GROUP TECHNOLOGY **(9 hours)**

Formation of part families - Part classification - Coding system - Opitz, Multi Class, Production flow analysis - Machine cell design - Clustering methods - Modern algorithms - Benefits - System planning - Objective, guide line, system definition and sizing - Human resources - Objective, staffing, supervisor role.

UNIT III - FLEXIBLE MANUFACTURING SYSTEMS **(9 hours)**

FMS - Introduction - Evolution - Definition - Need - Economic Justification, Application - Machine tool Selection and Layout - Computer control system - Data files - Reports - Planning the FMS - Analysis Methods for FMS - Benefits and limitations.

UNIT IV - FLEXIBLE MANUFACTURING CELLS **(9 hours)**

Introduction - Cell description and classifications - Unattended machining - Component handling and storage system - Cellular versus FMS - System - Simulation, Hardware configuration - Controllers - Communication networks - Lean production and agile manufacturing.

UNIT V - FMS SOFTWARE **(9 hours)**

Introduction - General Structure and requirements - Functional descriptions - Operational overview - Computer simulation - FMS installation - Objective - Acceptance testing - Performance goals - Expectations - Continued support.

TOTAL : 45

TEXT BOOKS

1. William W. Luggen, "*Flexible Manufacturing Cells and Systems"*, Prentice Hall, New Jersey, 1991.
2. Mikell P. Groover, "*Automation Production Systems &Computer Integrated manufacturing"*, Prentice Hall of India, New Delhi, 2007.
3. Jha.N.K, "*Handbook of Flexible Manufacturing Systems*", Academic Press Inc., 1991.

REFERENCES

1. David J. Parrish, "*Flexible Manufacturing"*, Butterworth-Heinemann, Newton, MA, USA, 1990.
2. Radhakrishnan.P and Subramanyan.S, "*CAD/CAM/CIM"*, Wiley Eastern Ltd., New Age International Ltd., 1994.
3. Raouf.A and Ben-Daya.M, Editors, "*Flexible manufacturing systems: recent development"*, Elsevier Science, 1995.
4. Kalpakjian, "*Manufacturing engineering and technology"*, Addison-Wesley Publishing Co., 1995.
5. Taiichi Ohno, "*Toyota production system: beyond large-scale production"*, Productivity Press (India) Pvt. Ltd. 1992.

ME1127- FLEXIBLE MANUFACTURING SYSTEMS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				**x**						
2.	Mapping of instructional objectives with student outcome	1-5				2-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1128	**NON TRADITIONAL MACHINING TECHNIQUES**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To impart clear knowledge about different unconventional processes and the latest developments to the students.

INSTRUCTIONAL OBJECTIVES

1. Basic concepts of non traditional machining techniques.
2. Factors influencing the processes and their applications

UNIT I - BASICS OF NON TRADITIONAL MACHINING TECHNIQUES (9 hours)

Need for non - traditional machining - Classification on the basis of energy sources – Consideration in process selection, materials, applications.

UNIT II - MECHANICAL ENERGY TECHNIQUES (9 hours)

Ultra Sonic Machining - Elements of the process, mechanism of metal removal, process parameters, economic considerations, Benefits and Applications - Advantages and limitations, recent developments Abrasive Jet Machining, Water Jet Machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanism of material removal, applications and limitations.

UNIT III - ELECTRICAL ENERGY TECHNIQUES (9 hours)

Electro Chemical process: Fundamentals of Electro chemical machining, electro chemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, surface finish and accuracy, economic aspects of ECM-simple problems for estimation of metal removal rate, applications and limitations, recent developments.

UNIT IV - THERMO ELECTRICAL ENERGY TECHNIQUES (9 hours)

General principles of Electrical discharge machining, Electrical discharge grinding and wire cut EDM process-power circuits for EDM, metal removal rate in EDM, process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection, recent developments.

UNIT V - THERMAL ENERGY TECHNIQUES (9 hours)

Electron beam machining, Plasma Arc Machining and laser beam machining - Operating principles - Equipment and sub systems - Parameters influencing metal removal - Benefits - Applications - Advantages and limitations, recent developments.

TOTAL : 45

TEXT BOOKS

1. Vijay K Jain, "*Advanced machining processes"*, Allied publishers, 2005.
2. Mishra.P.K, "*Non-Conventional Machining"*, The Institution of Engineers (India), Text Book Series, New Delhi, 1997.
3. Bennedict.G.F, "*Non Tradtional Machining Techniques"*, Marcel Decker, New York, 1990.

REFERENCES

1. Sharma.P.C, "*A Text book of Production Engineering"*, New Delhi, 1995.
2. Pandey and Sha, "*Modern Manufacturing Process"*, Prentice Hall, New Jersey.

ME1128 NON TRADITIONAL MACHINING TECHNIQUES												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1,2				1,2						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1129	OPERATIONS RESEARCH	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To enlighten the students with the various optimization techniques to understand and apply in industrial operations.

INSTRUCTIONAL OBJECTIVES

1.	Concepts of Linear programming technique.
2.	Applications of Transportation and Replacement models.
3.	Techniques of PERT, CPM and sequencing.
4.	Detailed knowledge of Inventory control and Queuing theory.
5.	Decision theory and Game theory techniques.

UNIT I - LINEAR PROGRAMMING (9 hours)

Basics of Operations research - Linear programming - Simplex method (Analytical & Graphical) - Artificial variable techniques- Assignment models.

UNIT II - TRANSPORTATION MODELS AND REPLACEMENT MODEL (9 hours)

Transportation problem - MODI Method - Replacement of items that deteriorate, gradually, fail suddenly, group replacement policy analysis.

UNIT III - SCHEDULING AND NETWORK ANALYSIS (9 hours)

Sequencing Problems - Processing 'n' jobs through two machines and three machines . Network analysis - PERT and CPM-Floats, Probability of achieving completion date - Cost analysis and Crashing the Network.

UNIT IV - INVENTORY CONTROL AND QUEING THEORY (9 hours)

Variables in an inventory problem - Deterministic Inventory models - Storage quantity discount, Safety stock. Poisson arrivals and exponential service times - Waiting time and idle time cost - Single channel, multi channel problem.

UNIT V - DECISION THEORY AND GAME THEORY (9 hours)

Steps in decision theory approach - Decision making conditions - Decision trees - Decisions under uncertainityconditions.Optimal solution of two person zero sum games mixed strategies, graphical solution of (2xn) and (mx2) games .

TOTAL : 45

TEXT BOOKS

1. Premkumar Gupta and Hira, "*Operation Research"*, Third Edition S Chand Company Ltd., New Delhi 2003.

REFERENCES

1. Fredric.S.Hilleer and Gerold J. Lieberman, "*Introduction to Operation Research"*, 2nd Edition, CBS, 1974.
2. Handy, "*A. Taha, Operations Research"*, 5th Edition, Prentice Hall of India, New Delhi, 1997.
3. Philip and Ravindran, "*Operational Research*", John Wiley, 2000.
4. Sundaresan.V, Ganapathy Subramanian.K.S, *"Resource Management Techniques: Operations Research"* A.R Publications, 2003.
5. Panneerselvam.K*, "Operation Research"*, Prentice Hall of India, 2002.

ME1129 - OPERATIONS RESEARCH												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x			x			
2.	Mapping of instructional objectives with student outcome	1-5				1,3			3			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1130	FOUNDRY ENGINEERING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart the students clear knowledge about foundry engineering.

INSTRUCTIONAL OBJECTIVES

1. patterns and pattern making.
2. different methods of moulding, casting processes.
3. modernization of foundry shop.

UNIT I - PATTERNS AND PATTERN MAKING (9 hours)

Introduction to foundry - Steps involved in casting, advantages, limitations and applications of casting processes. Pattern types, allowances for pattern - Pattern materials colour coding and storing of patterns.

UNIT II - MOULDING (9 hours)

Moulding methods and process - Materials, equipment moulding, Sand ingredients, Essential requirements - Sand preparation and control testing, Cores and core making.Design considerations in casting gating and risering and directional solidification in castings.

UNIT III - CASTING PROCESS (9 hours)

Sand casting - Pressure die casting - Permanent mould casting - Centrifugal casting - Precision investment casting - Shell moulding - CO_2 moulding, continuous casting - Squeeze casting - Electroslag casting - Fettling and finishing - Defects in castings - Near Net Techniques.

UNIT IV - MELTING, POURING AND TESTING (9 hours)

Foundry furnaces - Selection of furnaces - Crucibles oil fired furnaces - Electric furnaces - Cupola furnace, Calculation of cupola charges - Hot blast cupola - remelting- Degasification - Inoculation - Pouring equipment - Inspection of castings.

UNIT V - MODERNIZATION AND MECHANIZATION IN FOUNDRY SHOP (9 hours)

Need - Areas for mechanization - Typical lay out - Sand reclamation techniques - Material handling, Pollution control in foundry shop - Computers in castings.

TEXT BOOKS

1. Banga.T.R and Agarwal.R.L, "*Foundry Engineering"*, Khanna publishers, New Delhi, 1992.
2. Jain.P.L, "*Principles of Foundry Technology"*, Dhanpat Rai & sons, New Delhi, 1996.

REFERENCES

1. Taylor.H.F, Flemings.M.C and Wulff. J, "*Foundry Engineering"*, Wiley Eastern Ltd., New Delhi, 1993.
2. Gupta.R.B, "*Foundry Engineering"*, Sathyaparkasam, New Delhi, 1989.
3. ASM Metals, "*Hand Book on Castings"*, Vol. 15, 14th Edition, 2002.

ME1130 - FOUNDRY ENGINEERING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x				**x**			**x**	
2.	Mapping of instructional objectives with student outcome			1-3				1-3			1-3	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											x	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1131	**FATIGUE, FRACTURE MECHANICS AND CREEP**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To bring awareness and education of very important topic of fatigue, fracture mechanics and creep to students of school of Mechanical engineering in general, and Mechanical engineering in particular.

INSTRUCTIONAL OBJECTIVES

1.	fatigue(cyclic stress conditions).
2.	creep (high temperature conditions).
3.	fracture and fracture mechanics and
4.	application of the above to design

UNIT I - INTRODUCTION TO FATIGUE

Introduction, stress cycles , strain cycles, S-N curves , High Cycle fatigue(HCF) – endurance limit, fatigue life and fatigue strength, Basquin equation ,effects of stress concentration, size , surfaces , type of loading on fatigue .;

UNIT II - FATIGUE OF METALS

Statistical nature of fatigue, cumulative fatigue , low Cycle Fatigue(LCF) – Coffin-Manson equation ; strain-life equation , characteristics of fatigue fracture, design for fatigue.

UNIT III - FRACTURE MECHANICS

Introduction, Energy approach of Griffith for brittle fracture, Stress Intensity factors and modes of crack, Linear Elastic (LE)FM, Plane strain fracture toughness - K_{IC} & determination methods.

UNIT IV - APPLICATIONS OF FRACTURE MECHANICS

Application of FM to fatigue crack growth, life prediction and design (in brief)- Elastic Plastic FM - J-integral and CTOD.

UNIT V - CREEP, STRESS RUPTURE AND HIGH TEMPERATURE MATERIALS

High temperature materials problems, Creep and creep rupture curves and tests, Andrade creep and Garofalo creep, Mechanisms of creep(brief), Creep resistant alloys, Presentation of creep data, Parametric approach for long-term life, Creep-fatigue interaction, Fracture at high temperature.

TEXT BOOK

1. George E. Dieter, *"Mechanical Metallurgy*, McGraw-Hill, SI metric edition", ISBN 0-07-100406-8.

REFERENCES

1. Robert P. Wei, Fracture Mechanics, "*Integration of Mechanics, Materials Science and chemistry"*, Cambridge University Press, ISBN 978-0-521-19489-1 (hardback), 2010 Edition.
2. Richard W. Hertzberg, "*Deformation and Fracture Mechnic of Engineering Materials"*, John Wiley & sons.
3. Prashant Kumar, "*Elements of Fracture Mechanics"*, Tata McGraw-Hill, New delhi, 2009.
4. Suryanarayana.A.V.K, "*Testing of Metallic Materials"*, BS Publication , Hyderabad.
5. DavisH.E, Troxell.G.E, Hauck.G.E.W, "*Testing of Engineering Materials"*, McGraw Hill, Int. Students.

ME1131 - FATIGUE , FRACTURE MECHANICS AND CREEP												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x							x		
2.	Mapping of instructional objectives with student outcome	1-5	1-5							1-5		
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1132	LINEAR ELASTICITY	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To introduce the concepts of the theory of elasticity and familiarize the student with the fundamental solutions of elasticity theory.

INSTRUCTIONAL OBJECTIVES

1. To learn the formulation of elasticity boundary value problems
2. To learn techniques by which some classical solutions in elasticity theory are obtained

UNIT I - FOUNDATIONS

Mathematical Preliminaries, Tensors, Index Notation, Coordinate Transformations, Deformation and Strain, Strain Transformation, Principal Strains, Strain Compatibility, Concept of Stress, Traction Vector, Stress Transformation, Equilibrium Equations, Generalized Hooke's law.

UNIT II - GENERAL RESULTS

Field Equations of Elasticity, Boundary Conditions, Stress Formulation, Beltrami-Michell equations, Displacement Formulation, Principle of Superposition, Uniqueness Theorems, Reciprocal Theorem, Principle of Virtual Work, Principle of Minimum Potential and Complementary Energy, Saint-Venant's Principle.

UNIT III - ANTI-PLANE ELASTICITY PROBLEMS

Anti-plane Strain, Field Equations and Boundary Conditions, Complex Variable Solutions to Anti-plane Strain Problems, Solution using Taylor and Laurent Series, Solution using Cauchy Integral Formula, Solution using Conformal Mapping.

UNIT IV - PLANE ELASTICITY PROBLEMS

Plane Stress and Plane Strain, Airy Stress Function, Cartesian Coordinate Solutions Using Polynomials, Cartesian Coordinate Solutions Using Fourier Methods, Solutions in Polar Coordinates.

UNIT V - TORSION AND FLEXURE OF ELASTIC CYLINDERS

Torsion Formulation, Prandtl Stress Function, Torsion Solutions Derived from Boundary Equation, Torsion Solutions Using Fourier Methods, Torsion of Hollow Cylinders, Torsion of Circular Shafts of Variable Diameter, Flexure Formulation, Flexure Problems without Twist.

TEXT BOOKS

1. Martin H. Sadd, Elasticity: Theory, "*Applications and Numeric's"*, Elsevier India, 2006.
2. Timoshenko.S.P, Goodier.J.N, "*Theory of Elasticity"*, Tata McGraw-Hill Education, 2010.

REFERENCES

1. England.A.H, "*Complex Variable Methods in Elasticity"*, Dover Publications, 2003.
2. Malvern.L.E, "*Introduction to the Mechanics of a Continuous Medium"*, Prentice Hall, 1977.
3. Love.A.E.H, "*The Mathematical Theory of Elasticity"*, Dover, 2011.
4. Landau.L.D and Lifshitz.E.M, "*Theory of Elasticity, Butterworth-Heinemann"*, 1986.
5. Atkin.R.J and Fox.N, "*An Introduction to the Theory of Elasticity"*, Dover, 2005.
6. Barber.J.R, "*Elasticity"*, Springer, 2009.

ME1132 –LINEAR ELASTICITY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x								
2.	Mapping of instructional objectives with student outcome	1,2		1,2								
3.	Category	General (G)		Basic Sciences(B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1141	COMBUSTION ENGINEERING	L	T	P	C
	Prerequisite	3	0	0	3
	Thermodynamics, Internal Combustion Engines				

PURPOSE

To study the concepts of combustion of fuel and flames..

INSTRUCTIONAL OBJECTIVES

1. Acquire the fundamental knowledge of combustion.
2. Understand the thermodynamics of combustion.
3. Understand the kinetics of combustion.
4. Understand the types of flames.
5. Understand the combustion aspects in SI and CI Engines

UNIT I - COMBUSTION OF FUELS (9 hours)

Combustion equations - Theoretical air, excess air - Air fuel ratio, equivalence ratio - Exhaust gas composition - Air fuel ratio from exhaust gas composition and heating value of fuels.

UNIT II - THERMODYNAMICS OF COMBUSTION (9 hours)

Thermo-chemistry, first law analysis of reacting systems - Adiabatic combustion temperature - Second law analysis of reacting systems - Criterion for chemical equilibrium - Equilibrium constant for gaseous mixtures - Evaluation of equilibrium composition - Chemical availability.

UNITIII - KINETICS OF COMBUSTION (9 hours)

Rates of reaction - Reaction order and molecularity complex reactions - Chain reactions - Arrhenius rate equation, collection theory - Activated complex theory - Explosive and general oxidative characteristics of fuels.

UNIT IV - FLAMES (9 hours)

Laminar and turbulent flames - Premixed and diffusion flames - Burning velocity and its determination - Factors affecting burning velocity - Quenching, flammability and ignition - Flame stabilization in open burners.

UNIT V - ENGINE COMBUSTION (9 hours)

Combustion in SI and CI engines - Stages of combustion in SI and CI engines, normal combustion and abnormal combustion - Emissions from premixed combustion - Emission from non premixed combustion - Control of emissions.

TOTAL: 45

TEXT BOOKS

1. Stephen.R.Turns, "*An Introduction to Combustion concepts and applications"*, 2nd Edition, McGraw Hill Book Company, Boston, Edition 3, 2011.
2. Ganesan.V, "*Internal Combustion Engines"*, Tata McGraw-Hill, New Delhi, 2009.
3. Ramalingam.K.K, "*Internal Combustion Engines - Theory and practice"*, SciTech Publications India Pvt. Ltd., Chennai, 2010.

REFERENCES

1. Thipse.S.S, "*Internal Combustion Engines"*, Jaico Publication House, 2010.
2. Thipse.S.S, "*Alternate Fuels"*, Jaico Publication House., 2010.
3. Mathur.M.L, and Sharma.R.P, "*A course in Internal Combustion Engines"*, Dhanpat Rai & Sons, New Delhi, 2010.
4. Heywood.J.B, "*Internal Combustion Engine Fundamentals"*, McGraw Hill International, New York, 2008.
5. Domkundwar.V.M, "*A course inInternal Combustion Engines"*, Dhanpat Rai & Sons, 2010.

ME1141 – COMBUSTION ENGINEERING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x					x	
2.	Mapping of instructional objectives with student outcome			1-5		1-5					5	
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1142	**GAS TURBINE TECHNOLOGY**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Thermodynamics, Gas dynamics and space propulsion				

PURPOSE	
To familiarize various working principle of gas turbine power plant.	
INSTRUCTIONAL OBJECTIVES	
1.	Familiar with the basic components of gas turbine.
2.	Analyze the power cycles.
3.	Understand centrifugal compressor and axial flow compressor.
4.	Understand flow through Turbines and combustion systems.
5.	Familiar with the performance predictions.

UNIT I - GAS TURBINE BASICS **(9 hours)**

Open cycle single shaft and twin shaft multi speed arrangement - Closed cycle - Aircraft propulsion - Industrial application - Environmental issues - Future - Possibilities.

UN IT II - POWER CYCLES **(9 hours)**

Ideal cycles method of accounting component losses - Design point performance calculations - Comparative performance of practical cycles - Combined cycle - Cognation schemes - Closed cycle - Gas turbine - Reheat - Inter-cooling - Regenerator cycles.

UNIT III - AXIAL FLOW COMPRESSOR **(9 hours)**

Axial flow compressor basic operation - Elementary theory - Factors effecting stage pressure ratio - Blockage in compressor annulus - Degree of reaction - Blade fixing details - Sealing materials - Material selection for compressor blades - Stage performance - Design and off design performance characteristics.

UNIT IV - TURBINES AND COMBUSTION SYSTEMS **(9 hours)**

Operation requirements, type of combustion - Factors affecting combustion process - Combustion chamber performance. Turbine construction - Performance - Impeller blade fixing - Cooling of turbine blades - Blade vibration - Protective coating - Gas turbine turbo chargers - Power expanders - Vortex theory - Estimation of stage performance.

UNIT V - PERFORMANCE PREDICTIONS **(9 hours)**

Prediction performance of gas turbines component characteristics - Off design operation - Equilibrium running of gas generator - Off design operation of free turbine - Methods of displacing of the equilibrium running line - Incorporation of variable pressure losses - Matching procedure for two spool engines - Principle of control systems.

TOTAL: 45

TEXT BOOKS

1. Saravanamuttoo.H.I.H, Rogers.G.F.C, Henry Cohen, *"Gas Turbine Theory",* Pearson Prentice Hall, 2009.
2. Mattingly.J.D, "*Elements of Gas Turbine Propulsion"*, McGraw Hill, 2005.

REFERENCES

1. Ganesan.V, Gas Turbines, "*Axial flow turbine"*, Tata McGraw Hill, 3rd edition, 2010.
2. Yahya S.M, "*Turbines, Fans and Compressors"*, 3rd edition, Tata McGraw Hill Publications, 2010.
3. Gopalakrishnan.G, Prithvi Raj D, "*Treatise on Turbomachines"*, 1st edition, Chennai, SciTech Publications, 2006.
4. Horlock.J.H, "*Advanced Gas Turbine Cycles"*, Elsevier, 2003.
5. Venkanna.B.K, "*Fundamentals of Turbomachinery",* 4th edition, New Delhi, PHI Learning Pvt. Ltd, 2011.

ME1142 – GAS TURBINE TECHNOLOGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1143	**BOUNDARY LAYER THEORY**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Thermodynamics, Gas dynamics and space propulsion				

PURPOSE

To gain knowledge of boundary layer concepts of fluid.

INSTRUCTIONAL OBJECTIVES

1.	Development of boundary layer.
2.	Governing equations of fluid flow.
3.	Behavioral change of laminar boundary layer.
4.	Behavioral change of turbulent boundary layer.
5.	Behavioral change of compressible boundary layer.

UNIT I - DEVELOPMENT OF BOUNDARY LAYER (9 hours)

Flow along a solid surface - Development of boundary layer along a flat plate - Boundary layer thickness - Displacement thickness, momentum, energy thickness - Boundary layer at inlet length of pipes - Flow separation - Flow through diffuser - Motion pivot symmetrical and bluff obstacles - Form drag and skin friction - Turbulence in boundary layer - Sharp fall in drag coefficient - Hot wire and laser Doppler anemometers.

UNIT II - BASIC EQUATIONS OF FLUID FLOW (9 hours)

Equation of continuity, momentum and energy applied to system and control volume - Concept of flow fields - Boundary conditions.

UNIT III - LAMINAR BOUNDARY LAYER (9 hours)

Simplified form of boundary layer equation - Blasius solution for flat plate - Boundary layer temperature profiles for constant plate temperature - Faulkner Sknon wedge flow - Von - Karman integral method - Momentum equation - Energy equation - Application to flow past a flat plate and a circular cylinder - Dohlsausen method - Thermal boundary layer calculations - One parameter and two parameter integral methods.

UNIT IV - TURBULENT BOUNDARY LAYER (9 hours)

Two dimensional turbulent boundary layer equations - Integral relations - Eddy viscosity theories - Velocity profiles - Law of the wall - Law of the wake - Turbulent flow in pipes and channels - Turbulent boundary layer on a flat plate - Boundary layer with pressure gradient.

UNIT V - COMPRESSIBLE BOUNDARY LAYER (9 hours)

Compressible boundary layer equation - Recovery factor - Similarity solutions laminar supersonic cone rule - Shock - Boundary layer interaction.

TOTAL : 45

TEXT BOOKS

1. Schlichting.H, Gersten.K, "*Boundary layer Theory"*, 8th edition, Springer, 2000.
2. White.F.M, "*Viscous Fluid Flow"*, 3rd edition, McGraw Hill Publication, New York, 2011.

REFERENCES

1. Stephan.P.Bope, "*Turbulent flows"*, Cambridge University Press, UK, 1st edition, 2000.
2. Anderson.J.D, "*Fundamentals of Aerodynamics"*, 5th edition, McGraw Hill Book Co., New York, 2010.
3. Lan.J. Sobey, "*Introduction to interactive boundary layer theory"*, Oxford University press, 2000.

ME1143 - BOUNDARY LAYER THEORY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											x	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1144	FUEL CELL TECHNOLOGY	L	T	P	C
	Prerequisite	3	0	0	3
	Chemistry, Thermodynamics				

PURPOSE

To introduce the technology of fuel cells and to familiarize with the research and developmental challenges in fuel cell technology.

INSTRUCTIONAL OBJECTIVES

1.	Understand the basic principles involved fuel cell operation.
2.	Gain knowledge of various fuel cells and their specific operating principles.
3.	Design simple fuel cell systems and
4.	Understand the research and development challenges in various types of fuel cells.
5.	Analyse the performance of Fuel Cells and implement in various application.

UNIT I - FUNDAMENTALS OF FUEL CELLS (9 hours)

Chemoelectricity - what is a fuel cell and how does it work. Electrochemical aspects: Cell potential, reversible potential, Gibbs free energy - Chemical activity and the Nernst equation - Thermo-electrochemical aspects: enthalpy, thermoneutral potential, heat vs. electricity - Real fuel cell behavior: open circuit voltage, polarization curves, over potentials - Fuel cell problem areas: crossover, contamination, leakage currents, partial reactions - Fuel cell efficiencies: voltage, thermodynamic, current, fuel utilization - Types of fuel cells: materials, operating conditions, and applications.

UNIT II - FUELS OF FUEL CELLS **(9 hours)**

Fuel cell reactions - Fuels and fuel properties - Fuel processing: steam, reforming, partial oxidation, auto thermal reforming - Water gas shift reaction - Control of contaminants: CO and sulphur - Process integration

UNIT III - FUEL CELL PROCESS DESIGN **(9 hours)**

Fuel cell applications and systems overview - Operating and design variables - Examination of process flow diagrams - Theoretical and practical efficiencies: trade-off of heat and work - Rankine and Brayton cycles - SOFC - Gas turbine combined cycle system - PEM system: material recycle and heat integration.

UNIT IV -ELECTRODE MODELS **(9 hours)**

Fuel utilization and the envelope of polarization curves - Influence of the Nernst equation (concentration polarization) - Mass balance on SOFC electrode - Energy balance on SOFC electrode - Multiple reactions in fuel cells: reforming, water gas shift, coking - Temperature profiles.

UNIT V - STACK DESIGN AND SYSTEM INTEGRATION **(9 hours)**

Basic geometry approaches: flat plate vs. tubular - Flow field plate and interconnect design - Fluid mechanics: manifolding, pressure drop - Fuel utilization, efficiency, and current distribution - Internal heat exchange and recovery, internal reforming - Seals and insulation - Safety.

TOTAL : 45

TEXT BOOKS

1. Pukushpan, J.T., Stctanopoulon, A.G., Peng, H.,"*Fuel Cell Power Systems"*, Springer, 2006.
2. Viswanathan, B., and Aulice Scibioh, M.,"*Fuel Cells Principles and Applications"*, Universities Press (India) Pvt. Ltd., Hyderabad, 2006.

REFERENCES

1. Larminie.J and Dicks.A, "*Fuel Systems Explained"*, John Wiley & Sons, Ltd., New York, 2001.
2. O'Hayre.R, Suk-Woncha, Whitney Colella, Prinz, F.B., "*Fuel Cell Fundamentals"*, John Wiley & Sons, New York, 2006.
3. Hoogers.G. Edr, "*Fuel Cell Technology Handbook"*, CRC Press, Washington D.C., 2013.

ME1144 – FUEL CELL TECHNOLOGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x			x			x
2.	Mapping of instructional objectives with student outcome	1-3	3			1-5			3,4			4,5
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											x	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1145	ELEMENTS OF SPACE TECHNOLOGY	L	T	P	C
	Prerequisite	3	0	0	3
	Gas dynamics and space propulsion				

PURPOSE

This course is designed to provide a broad overview of the space technology with regard to rocket propulsion.

INSTRUCTIONAL OBJECTIVES

1.	To develop a basic knowledge on earth's atmosphere.
2.	To learn the different orbit bodies.
3.	To study the aspects of satellite injection.
4.	To study the interplanetary and missile trajectories and materials for spacecraft

UNIT I - EARTH AND ATMOSPHERE (9 hours)

The solar system - Reference frames and coordinate systems - The celestial sphere -The ecliptic - Motion of vernal equinox - Sidereal time - Solar time - Standard time - The earth's atmosphere.

UNIT II - THE GENERAL N-BODY PROBLEM (9 hours)

The Many body problem - Lagrange - Jacobi identity - The circular restricted three body problem - Libration points - Relative Motion in the N-body problem - The two - body problem - Satellite orbits - Relations between position and time - Orbital elements.

UNIT III - SATELLITE INJECTION & SATELLITE ORBIT PERTURBATIONS (9 hours)

General aspects of satellite injections - Satellite orbit transfer - Various cases - Orbit deviations due to injection errors - Special and general perturbations - Cowell's Method - Encke's method - Method of variations of orbital elements - General perturbations approach.

UNIT IV - INTERPLANETARY TRAJECTORIES BALLISTIC MISSILE - TRAJECTORIES (9 hours)

Two-dimensional interplanetary trajectories - Fast interplanetary trajectories - Three dimensional interplanetary trajectories - Launch of interplanetary spacecraft - Trajectory about the target plant. The boost phase - The ballistic phase - Trajectory geometry - Optimal flights - Time of flight - Re-entry phase -The position of the impact point - Influence coefficients.

UNIT V - MATERIALS FOR SPACECRAFT (9 hours)

Space environment - Peculiarities - Effect of space environment on the selection of materials of spacecraft.

TEXT BOOKS

1. Sutton.G.P, "*Rocket Propulsion Elements"*, 7th Edition, John Wiley & Sons, New York, 2011.
2. Ramamurthi.K, "*Rocket Propulsion,Macmillan",* Publishers India Ltd. 2010.

REFERENCES

1. Cornelisse.J.W, "*Rocket Propulsion and Space Dynamics"*, W.H. Freeman & Co., New York, 2005.
2. Parker.E.R, "*Materials for Missiles and Spacecraft"*, McGraw Hill Book Co., New York, 2000.
3. Rudolph X. Meyer., "*Elements of Space Technology"*, Acadamic press, London, 2003.

ME1145 – ELEMENTS OF SPACE TECHNOLOGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2.	Mapping of instructional objectives with student outcome	1-4		1-4		1-4						
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1146	ROCKET PROPULSION	L	T	P	C
	Prerequisite	3	0	0	3
	Thermodynamics , Gas dynamics and space propulsion				

PURPOSE

To introduce the principles of rocket propulsion and teach simple design procedures.

INSTRUCTIONAL OBJECTIVES

1.	Understand the performance of rocket propulsion systems.
2.	Understand the different types of rocket propulsion systems.
3.	Familiarize combustion and expansion of propellants.
4.	Know various turbo machineries for rocket propulsion systems.
5.	Know about electrical rocket propulsion

UNIT I - PERFORMANCE OF ROCKET VEHICLES (9 hours)

Introduction - Static performance - Thrust, specific impulse - Vehicle acceleration, gravity, drag, single stage sounding rocket, burning time - Chemical rockets, single stage rockets, multistage rockets.

UNIT II - CHEMICAL ROCKET THRUST CHAMBERS (9 hours)

Introduction - Performance characteristics - Nozzles - Conical nozzles, contoured nozzles, nozzle length, effects of friction, effect of back pressure, plug and expansion deflection nozzles - Rocket heat transfer: regenerative cooling, convective heat transfer, radiative heat transfer, solid propellant rockets - heat sinks - Liquid propellant rocket performance data.

UNIT III - COMBUSTION AND EXPANSION (9 hours)

Equilibrium composition - Non equilibrium expansion - Liquid propellant combustion chambers: fuel and oxidant injection, chamber length, chamber cross sectional area - Solid propellants: burning rates, metal powders, two-phase flow - Solid propellant combustion chambers: combustion pressure, burning stability, erosive burning - Combustion instabilities.

UNIT IV - TURBOMACHINERY FOR LIQUID ENGINES (9 hours)

Feed systems and engine cycles: gas-pressure feed and turbo pump feed, gas-generator cycle, staged combustion, cycle, expander cycle, typical examples - Centrifugal pumps - Inducers and axial pumps: inducers, cavitations, axial pumps - Axial turbines.

UNIT V - ELECTRICAL ROCKET PROPULSION (9 hours)

Introduction - Electrostatic propellant accelerator - Bombardment ionization - The plane diode - Electrostatic thruster performance - The arc jet - Pulsed-magneto plasma accelerators.

TEXT BOOKS

1. Ramamurthy.K, "*Rocket propulsion"*, Macmillan Publishers India Ltd, New Delhi, 1st edition, 2010.
2. Sutton.G.P, and Biblarz.O, "*Rocket Propulsion Elements"*, John Wiley & Sons, Inc., New Jersey, 8th edition, 2010.

REFERENCES

1. Cornelisse, J.W.,"*Rocket Propulsion and Space Dynamics"*, W.H. Freeman & Co., New York, 2005.
2. Parker, E. R.,"*Materials for Missiles and Spacecraft"*, McGraw Hill Book Co., New York, 2000.
3. Rudolph X. Meyer.,"*Elements of Space Technology"*, Academic press, London, 2003.

ME1146 – ROCKET PROPULSION													
Course Designed by		**Department of Mechanical Engineering**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
		x				x							
2.	Mapping of instructional objectives with student outcome	1-5				1-5							
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)		
											X		
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1147	**REFRIGERATION AND AIR CONDITIONING SYSTEM**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Applied thermal engineering				

PURPOSE	
To On completion of this course, the students are expected to gain knowledge about refrigeration and air conditioning system, analysis and design calculations.	
INSTRUCTIONAL OBJECTIVES	
1.	Understand Vapour compression and vapour absorption system Operation.
2.	Analyse the refrigeration cycles and methods for improving Performance.
3.	Familiarize the components of refrigeration systems.
4.	Design air conditioning systems using cooling load calculations.
5.	Know the application of refrigeration and air conditioning systems.

UNIT I - VAPOUR COMPRESSION REFRIGERATION SYSTEMS (9 hours)

Review of thermodynamic principles of refrigeration - Simple vapour compression system - analysis - Method for improving COP - Multistage and multiple evaporator system - Cascade system - COP comparison.

UNIT II - ABSORPTION REFRIGERATION SYSTEMS (9 hours)

Absorption refrigeration cycle - Water lithium bromide systems - Ammonia absorption refrigeration system - COP calculation of single effect absorption system - Refrigerant- absorbent combinations - Comparison of absorption system with vapour compression systems.

UNIT III - REFRIGERATION EQUIPMENTS & CONTROL (9 hours)

Compressors - Condensers and Cooling towers - Evaporators - Expansion devices. Refrigerants: properties - Selection of refrigerants - Alternate refrigerants. Refrigeration plant controls - Testing and charging of refrigeration units.

UNIT IV - DESIGN OF AIR CONDITIONING SYSTEMS (9 hours)

Different heat sources - Conduction and radiation load - Occupants load - Equipment load-fresh air load infiltration-air load - Estimation of total load, bypass factor consideration - Effective sensible heat factor (ESHF) - Cooling coils and dehumidifier air washers.

UNIT V - PPLICATIONS OF REFRIGERATION AND AIR CONDITIONING SYSTEMS (9 hours)

Preservation of different products - Ice factory - Dairy plant refrigeration systems - Air conditioning of hotels and restaurants - Air conditioning of theatres and auditorium - Air conditioning of hospitals.

TOTAL : 45

TEXT BOOKS

1. Arora.S.C and Domkundwar.S, "*A course in Refrigeration and Air conditioning"*, Dhanpat Rai (P) Ltd., New Delhi, 2012.
2. Ananthanarayanan.P.N, "*Basic Refrigeration and Air Conditioning"*, Tata McGraw Hill, 3rd edition, New Delhi, 2006.

REFERENCES

1. Manohar Prasad, "*Refrigeration and Air conditioning"*, New Age International (P) Ltd, New Delhi, 2010.
2. Roy J. Dossat,"*Principles of Refrigeration"*, Pearson Education Asia, 4th edition, 2001.
3. Arora, C. P.,"*Refrigeration and Air Conditioning"*, Tata McGraw Hill, New Delhi, 2006.

ME1147 – REFRIGERATION AND AIR CONDITIONING SYSTEM												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)		Basic Sciences(B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1148	ALTERNATIVE SOURCES OF ENERGY	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To familiarize the students about the utilization of various alternative sources of energy technologies for thermal and electrical needs with environmental merits.

INSTRUCTIONAL OBJECTIVES

1.	Familiarize the biomass energy conversion technologies.
2.	Analyze solar energy technologies.
3.	Understand the wind energy and hybrid energy systems.
4.	Know concepts of hydro, ocean and geothermal energy systems.
5.	Familiarize the operations of direct energy conversion systems.

UNIT I - BIOMASS **(9 hours)**

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - pyrolysis, gasification, combustion and fermentation. Gasifiers - up draft, downdraft and fluidized bed gasifiers. Digesters - Fixed and floating digester biogas plants, economics of biomass power generation.

UNIT II - SOLAR ENERGY **(9 hours)**

Solar radiation and its measurements, types of solar thermal collectors - Flat and concentrating collectors, solar thermal applications - Water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation, thermal energy storage systems, solar photovoltaic components and solar photovoltaic power plants.

UNIT III - WIND ENERGY **(9 hours)**

Basic principle of wind energy conversion system, wind data and energy estimation, Site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill, aerofoil theory, analysis of aerodynamic forces acting on the blade, performance of wind machines. Introduction to solar - Wind hybrid energy systems.

UNIT IV - OCEAN, HYDRO AND GEOTHREMAL ENERGY **(9 hours)**

Wave and tidal energy, ocean thermal energy conversion - Principle, types, power plants - Small, mini and micro hydro power plants. Exploration of geothermal energy, geothermal power plants, challenges - Availability, geographical distribution, scope and economics.

UNIT V - DIRECT ENERGY CONVERSION SYSTEMS **(9 horus)**

Basic principle of thermo-electric and thermo-ionic power generations, fuel cell-principle, types, conversion efficiency, applications. Magneto hydrodynamic power generation - Principle, open cycle and closed cycles, design considerations and recent developments. Hydrogen energy - Production, storage, transportation and applications.

TOTAL : 45

TEXT BOOKS

1. Rai.G.D, "*Non-Conventional Energy Sources"*, Khanna Publishers, 4th edition, New Delhi, 2009.
2. Domkundwar.V.M, Domkundwar.A.V, "*Solar energy and Non-conventional sources of energy"*, Dhanpat rai & Co. (P) Ltd, 1st edition, New Delhi, 2010.

REFERENCES

1. Godfrey Boyle, "*Renewable energy"*, 2nd ed, Oxford University Press, 2010.
2. Khan.B, "*Non-conventional Sources of energy"*, 2nd edition, New Delhi, Tata McGraw Hill, 2009.
3. Tiwari.G.N, Ghosal.M.K, "*Fundamentals of renewable energy sources"*,1st edition, UK, Alpha Science International Ltd, 2007.
4. Twidell.J.W and Weir.A.D, "*Renewable Energy Resources"*,1st edition, UK, E.&F.N. Spon Ltd, 2006.

ME1148 – ALTERNATIVE SOURCES OF ENERGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				**x**						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences andTechnical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	ENERGY ENGINEERING AND MANAGEMENT	L	T	P	C
ME1149	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To familiarize the students with the concept of energy conservation and management.

INSTRUCTIONAL OBJECTIVES

1.	Environmental aspects of energy utilization.
2.	Energy conservation concepts.
3.	Energy savings in thermal systems.
4.	Energy management and Energy economics.

UNIT I - ENERGY AND ENVIRONMENT **(9 hours)**

Introduction to energy and environment, World energy consumption, green house effect, global warming. Renewable energy sources, environment aspects utilization, energy prices and energy policies.

UNITII - ENERGY CONSERVATION **(9 hours)**

Energy conservation schemes, industrial energy use, energy surveying and auditing, energy index, energy cost, cost index, energy conservation in engineering and process industry, thermal systems and buildings.

UNITIII - ENERGY SAVINGS IN THERMAL SYSTEMS **(9 hours)**

Fuels and combustion, boilers, furnaces, waste heat recovery systems, heat pumps and refrigerators, energy storage systems, insulated pipe systems and heat exchangers.

UNIT IV - ENERGY MANAGEMENT **(9 hours)**

Energy management principles, energy resource management, energy management information systems, instrumentation and measurement in energy management, computerized energy management.

UNIT V - ENERGY ECONOMICS **(9 hours)**

Costing techniques, cost optimization, optimal target investment schedule, financial appraisal and profitability, project management, incentives and energy payback and rate of return calculations.

TOTAL 45

TEXT BOOKS

1. Murphy.W.R and McKay G, "*Energy Management"*, Butterworths, London, 2007.
2. Reay.D.A, "*Industrial Energy Conservation"*, Pergamon Press, 2003.

REFERENCES

1. Steve Doty, Wayne C. Turner, "*Energy Management Handbook"*, Fairmont Press, 7th edition, 2009.
2. Barney L. Capehart, Wayne C. Turner, William J. Kennedy, "*Guide to Energy Management"*, The Faimont Press, 6th edition, 2008.
3. Callaghan.P.W.O, "*Design and Management for Energy Conservation"*, Pergamon Press, Oxford, 2003.
4. Hamies, "*Energy Auditing and Conservation; Methods"*, Measurements, Management and Case study", Hemisphere, 2003.
5. Trivedi.P.R and Jolka.K.R, "*Energy Management*", Common Wealth Publication, 2002.

ME1149 – ENERGY ENGINEERING AND MANAGEMENT													
Course Designed by		**Department of Mechanical Engineering**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
		x				x							
2.	Mapping of instructional objectives with student outcome	1-4				1-4							
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)			
										X			
4.	Approval	23rd Meeting of Academic Council, May 2013											

	DESIGN OF PUMPS AND TURBINES	L	T	P	C
ME1150	Prerequisite	3	0	0	3
	Fluid mechanics, Thermodynamics				

PURPOSE

To introduce to the students the basic design aspects, working and operation principle of pumps and turbines.

INSTRUCTIONAL OBJECTIVES

1.	To know design principles of simple radial flow pumps.
2.	To know design principles of various turbines.
3.	To learn the effects of cavitations in hydraulic machines.
4.	To getting familiar with hydro machine applicability from the cavitations point of view.

UNIT I - REVIEW OF PRINCIPLES OF FLUID MACHINERY (4 hours)

Basic equations of energy transfer between fluid and rotor, Performance characteristics.

Dimensionless parameters, specific speed, stage velocity triangles, work and efficiency.

UNIT II - THEORY OF PUMPS (9 hours)

Calculation of tangential and axial thrust methods to minimize axial thrust, impellers, casings, volute pumps, vanes, velocity vector diagrams and work done by pumps, developed head, efficiency and losses in pumps, specific speed, calculation of power requirement, operating characteristics.

UNIT III - DESIGN OF PUMPS (14 hours)

Design procedure and design optimization of pumps. Thermal design - selection of materials for high temperature and corrosive fluids. Hydraulic design - selection of impeller and casing dimension using industrial manuals. Introduction to computer programs for iterative and interactive design.

UNIT IV - THEORY AND DESIGN OF TURBINES (14 hours)

Basic theory, classification and application, construction and approximate calculation of axial flow and radial flow turbines, performance charts. Basic design features of axial flow and radial flow turbines, velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, simple stage of axial and radial flow turbines. Design considerations for hydraulic turbines and draft tubes.

UNIT V - CAVITATION (4 hours)

Cavitation in pumps and turbines - cavitation factor - effect of cavitation on performance - damage to various elements. Design consideration to avoid cavitation.

TOTAL : 45

TEXT BOOKS

1. Dixon.S.L, "*Fluid Mechanics and Thermodynamics of Turbomachinery"*, 6th edition, Butterworth Heinemann, U.K., 2010.
2. Viktor Gelpke, "*Hydraulic turbines-their design and installation"*, Research Press, 2010.

REFERENCES

1. Igor J. Karassik and Terru McGuire, Centrifugal pumps, "*Chapman and Hall"*, Int. Thomson publishing, 2nd Edition, 1996.
2. Raabe.J, "*Hydraulic Turbomachines"*, VDI - Verlag, 1970.
3. Harold H. Anderson, "*Centrifugal pumps and allied machinery"*, Elsevier, 1994.
4. Grigori Krivchenko, "*Hydraulic machines"*, turbines and pumps, Lewis Publishers, CRC Press, 1994.
5. Turton.R.K, "*Principles of Turbomachinery"*, E. & F. N. Spon, London 1995.

ME1150 – DESIGN OF PUMPS AND TURBINES												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		**x**		**x**						
2.	Mapping of instructional objectives with student outcome	1-4		1-3		1-3						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1151	**COMPUTATIONAL FLUID DYNAMICS**	**L**	**T**	**P**	**C**
	Pre requisite	**3**	**0**	**0**	**3**
	Thermodynamics, Fluid mechanics and Heat Transfer				

PURPOSE

To impart knowledge about various computational methods of fluid flow and solve simple fluid flow problems.

INSTRUCTIONAL OBJECTIVES	
1.	The formulation of governing equations for fluid flow and their mathematical behavior.
2.	Various discretization techniques.
3.	Different techniques to solve the numerical equations.
4.	Development of various types of grids to solve the problem.
5.	The finite volume approach to discretize the governing equations

UNIT I - GOVERNING EQUATIONS AND MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS (PDE'S) (9 hours)

Introduction - Governing equations - Continuity - Momentum and energy equations - Conservation and non-conservation form of equations - Physical boundary conditions. Mathematical behavior of partial differential equations (PDE's) - Classification - Hyperbolic, elliptic, parabolic ,well posed problems.

UNIT II - DISCRITIZATION TECHNIQUES (9 hours)

Method of discretization - Finite differences - Various finite difference methods - Discretization of wave equations and Laplace equation, numerical error and stability analysis. Time dependent methods - Explicit, implicit and Crank Nicholson method.

UNIT III - SOLUTUION TECHNIQUES (9 hours)

The LaxWandroff technique - MacCormmaks technique - Relaxation method - TDMA - Thomas algorithm - Alternation direction implicit technique - Pressure correction technique -SIMPLE algorithm.

UNIT IV - GRID GENERATION (9 hours)

General transformation of the equations - Matrices and Jacobians - Stretched grid - Adaptive grid and compressed grid. Boundary fitted coordinate systems - Modern development in grid generation.

UNIT V - INTRODUCTION TO FINITE VOLUME METHODS AND EXAMPLES WITH DIFFERENT METHODS (9 hours)

Finite volume methods of discretisation - Various solutions techniques. Solution of steady and transient one dimensional heat conduction problem using different methods.

TOTAL : 45

TEXT BOOKS

1. Anderson J.D., "*Computational Fluid dynamics"*, McGraw Hill Int., New York, 2010.
2. Versteeg H.K., and Malalasekera W., An introduction to computational fluid dynamics, "*The finite volume method"*, Longman, 2007.

REFERENCES

1. Suhas.V. Patankar, "*Numerical Heat Transfer and Fluid Fl*ow", Hemisphere Publishing Corporation, 2009.
2. Muralidhar.K, and Sundararajan.T, "*Computational Fluid Flow and Heat Transfer"*, Narosa Publishing House, New Delhi, Second Edition, 2008.
3. Ghoshdasdidar.P.S, "*Computer simulation of fluid flow and heat transfer"*, Tata McGraw Hill Publishing Company Ltd., 1998.

ME1151 – COMPUTATIONAL FLUID DYNAMICS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x					x	x
2.	Mapping of instructional objectives with student outcome	1-5		1-5		1-5					1-5	1-5
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1152	**INTERNAL COMBUSTION ENGINES**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

On completion of this course, the students are expected to understand the fundamental principle, operation, performance of IC Engines, auxiliary systems, combustion of SI & CI engines, various fuels used and engine emissions.

INSTRUCTIONAL OBJECTIVES

1.	Acquire the knowledge of engine components and fuel air cycles.
2.	Understand the working of engine auxiliary systems.
3.	Understand the combustion aspects of SI Engines
4.	Understand the combustion aspects of CI Engines.
5.	Know the various alternate fuels, engine emissions, measuring and control techniques

UNIT I - COMPONENTS OF IC ENGINES AND PERFORMANCE (9 hours)

Classification of Internal combustion Engine, Function and operation of Two stroke and Four stroke engines, Comparison of SI and CI and two stroke and four stroke engines, Effects of supercharging and supercharging Types - centrifugal, roots, vane, Types of scavenging process, Design and Performance data, Efficiency, Specific fuel consumption, IMEP determination -Simple calculations - Performance characteristics, Heat balance calculations, Fuel air cycles and their significance, Comparison of air-standard and fuel air cycles.

UNIT II - ENGINE AUXILIARY SYSTEMS (9 hours)

Desirable air- fuel ratios for starting, warm up, acceleration, idling and normal operation, Necessity of Carburetors and their function and types, Function and classification of injection systems, Injection pump, governor and nozzle types, Description of construction and function of Electronic injection system and MPFI systems, Energy requirement of ignition system, need, Types - Battery and Magneto ignition types, Ignition timing and engine parameters, Engine oil properties, lubrication system types - mist, wet sump and dry sump lubrication systems, Types of cooling systems - Direct and Indirect - Coolant and antifreeze solutions.

UNIT III - COMBUSTION IN SI ENGINES (9 hours)

Homogeneous and heterogeneous mixture, Combustion in spark ignition engines, Stages of combustion in spark ignition engines, Flame front propagation, Factors influencing flame speed, Rate of pressure rise, Phenomenon of knock in SI engines, Effect of engine variables on knock, Combustion chambers for SI engines - Smooth engine operation, High power output and thermal efficiency, Stratified charge engine.

UNIT IV - COMBUSTION IN CI ENGINES (9 hours)

Combustion in CI engine, Stages of combustion in CI engines, Factors affecting the delay period - compression ratio, engine speed, output, atomization and duration of injection, quality of fuel, intake temperature, intake pressure, Phenomenon of knock in CI engines, Comparison of knock in SI and CI engines, Air motion - Swirl - Squish.

UNIT V - ALTERNATE FUELS AND EMISSION (9 hours)

Alternate Fuels -Alcohol, Methanol, Ethanol, Gaseous fuel - Hydrogen, CNG, LPG, Biodiesel - production, advantages & disadvantages. Air pollution due to IC engines, Hydrocarbon emission and their reasons, Formation of oxides of nitrogen, CO, Particulates, aldehydes, sulphur, lead and phosphorus emissions, catalytic converter, exhaust gas recirculation, Flame ionization detector, NDIR, smoke types - measuring device. Emission standards.

TOTAL 45

TEXT BOOKS

1. Ganesan.V, *"Internal Combustion Engines"*, Tata McGraw-Hill, New Delhi, 2009.
2. Ramalingam.K.K, "*Internal Combustion Engines- Theory and practice"*, SciTech publications India Pvt. Ltd., Chennai, 2010.

REFERENCES

1. Thipse.S.S, "*Internal Combustion Engines"*, Jaico Publication House., 2010.
2. Thipse.S.S, "*Alternate Fuels"*, Jaico Publication House., 2010.
3. Mathur.M.L and Sharma.R.P, "*A course in Internal Combustion Engines"*, Dhanpat Rai & Sons, New Delhi, 2010.
4. Heywood.J.B, "*Internal Combustion Engine Fundamentals"*, McGraw Hill International, New York, 2008.
5. Domkundwar.V.M, "*A course inInternal Combustion Engines"*, Dhanpat Rai & Sons, 2010.

ME1152 – INTERNAL COMBUSTION ENGINES												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x					x	
2.	Mapping of instructional objectives with student outcome			1-4		1-4					3,5	
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1153	TURBO MACHINES	L	T	P	C
	Prerequisites	3	0	0	3
	Thermodynamics, Fluid Mechanics				

PURPOSE

To familiarize the students about the working principles and flow aspects of turbo machines irrespective of their mechanical and material aspects.

INSTRUCTIONAL OBJECTIVES

1.	Basic flow concepts of turbo machines and their velocity triangles.
2.	Working and performance of centrifugal flow machines.
3.	Working and performance of axial flow fans and compressors.
4.	Working and performance of hydraulic turbines.
5.	Working and performance of axial flow turbines.

UNIT I - BASIC CONCEPTS OF TURBOMACHINES (9 hours)

Definition, classification and stages of turbo machines, estimation of specific work for incompressible and compressible flow machines. Internal and external losses, various efficiencies, representation of specific work on T-s and h-s diagrams, velocity triangles - centrifugal and axial flow machine impellers, Euler's energy equation across the impeller as applicable to all machines, slip and its estimation, degree of reaction, blade angles and their effects, calculations considering slip.

UNIT II - CENTRIFUGAL FLOW MACHINES (9 hours)

Fans - different impeller sizes, shapes, blade angles, speed and construction. Blade shape, blade number, simple design calculations, performance in series and parallel. Compressor - slip, inducers, designs without inducer but with inlet guide vanes (IGV). Simple problems with inducer and IGV's - blade angles, temperature rise and static pressure rise across the impeller. Vaned and vaneless diffuser and volute casing. Pump - system head, priming of pumps, net positive suction head, minimum starting speed and cavitations.

UNIT III - AXIAL FLOW FANS AND COMPRESSORS (9 hours)

Low pressure head rise fans - blade profile, lift and drag coefficients, their variation with incidence, expressions for energy transfer and pressure rise in terms of C_L and C_D, simple design calculations. Compressors - brief introduction to two-dimensional cascade and its application to design, flow deflection and stagnation pressure loss across blade rows, expression for pressure rise coefficient in terms of flow angles and loss coefficient. Design of impeller blades for free vortex and forced vortex. Simple design and performance calculations. Stall and surge phenomenon.

UNIT IV - HYDRAULIC TURBINES (9 hours)

Pelton turbine- impulse wheel, single jet and multiple jet units, velocity triangles at inlet and exit of buckets, performance calculations considering losses in the nozzle and buckets. Francis turbine - reaction, impeller shapes for different shape numbers/ heads, calculations on impeller dimensions, blade angles and performance using velocity triangles, draft tubes. Kaplan / Propeller Turbine - reaction, impeller (adjustable and fixed) blades and guide blades, calculation of performance using velocity triangles / blade angles at different radii for free vortex flow, its suitability for low heads.

UNIT V - AXIAL FLOW TURBINES (9 hours)

Degree of reaction - expression in terms of flow angles, importance of 50 percent reaction stage, effect on the velocity triangles, blade shape and efficiency. Comparison of impulse blades of constant thickness with blades thicker at the centre. Representation on h-s diagram, comparison of impulse and 50 percent reaction stages, stage efficiencies, velocity triangles, blade angle calculations. Steam turbines - condensing and non-condensing, partial admission at inlet, presence of moisture at the low pressure end of condensing turbines, problems associated with moisture - blade erosion and methods to reduce the bad effects.

TOTAL: 45

TEXT BOOKS

1. Yahya.S.M, "*Turbines, Fans and Compressors"*, 3rd edition, Tata McGraw Hill Publications, 2010.
2. Gopalakrishnan.G, Prithvi Raj.D, "*Treatise on Turbomachines"*, 1st edition, Chennai, SciTech Publications, 2006.

REFERENCES

1. Venkanna.B.K, "*Fundamentals of Turbomachinery",* 4th edition, New Delhi, PHI Learning Pvt. Ltd, 2011.
2. Seppo A. Korpela., "*Priniciple of Turbomachinery",* John Wiley and Sons Ltd, 2012.
3. Dixon.S.L, "*Fluid mechanics and Thermodynamics of Turbomachinery*", 5th edition, Elsevier Butterworth Heinemann, 2005.

ME1153 – TURBO MACHINES												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME 1154	**THERMAL POWER SYSTEMS**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Applied Thermal Engineering				

PURPOSE

To familiarize the students about the various auxiliary combustion equipment, steam generation and recovery systems, various conventional and non-conventional sources of energy with power plant economics.

INSTRUCTIONAL OBJECTIVES

1.	Know the functions of various auxiliary combustion equipment
2.	Understand the thermal power plant systems.
3.	Familiarize with operation of nuclear, Diesel and gas turbine power Plants.
4.	Familiarize with renewable energy sources and power plant economics.

UNIT I - FUEL COMBUSTION EQUIPMENTS (9 hours)

Types of combustion, stokers, fuel and ash handling equipments. Draft - forced, induced and balanced drafts. Selection of fans. Heat recovery equipments- economisers, air preheaters and reheaters, different types of superheaters and de-superheaters. Emission control, flue gas cleaning, particulate and gaseous emission control methods.

UNIT II - THERMAL POWER PLANT SYSTEMS (9 hours)

Steam generators - forced circulation, high-pressure boilers and super critical boilers, fluidized bed boiler, boiler accessories and mountings. Boiler testing. Condensers**:** Different types, design factors, air removal, performance calculation. Cooling towers - natural and mechanical draft types.

UNIT III - NUCLEAR, DIESEL AND GAS TURBINE POWER PLANTS (9 hours)

General nuclear fuels used in reactors, elements of nuclear reactor, moderator, control rods, coolants, description of different types of reactors. Radiation hazards, radioactive waste disposal. Diesel power plant **-** Classifications, components, selection of engine type. Gas turbine plant - closed and open cycles. Combined power cycles.

UNIT IV - RENEWABLE ENERGY SOURCES (9 hours)

Solar energy **-** measurement, methods of utilization, flat plate and concentrating collectors, water heater, air driers, photovoltaic cell. Wind energy - Horizontal and vertical axis wind turbines. Geothermal plants, tidal power plant, biomass and biogas plants, OTEC plants.

UNIT V - POWER PLANT ECONOMICS (9 hours)

Plant load factor and utilization factor, cost economics - Tariff rates, demand changes, load distributions. Energy conservation and audit. Maintenance aspects of power plants.

TOTAL : 45

TEXT BOOKS

1. Nag.P.K, "*Power Plant Engineering"*, Tata McGraw Hill, New Delhi, 3rd edition, 2008.
2. Arora.S.C and Domkundwar.S, "*Power Plant Engineering"*, Dhanpat Rai & Sons, New Delhi, 2001.

REFERENCES

1. Ramalingam.K.K, "*Power Plant Engineering"*, Scitech Publication Pvt. Ltd, 2002.
2. Rai.G.D, "*Non-Conventional Energy Sources"*, Khanna Publishers, 4th edition, New Delhi, 2009.
3. El Wakil.M.M, "*Power Plant Technology"*, McGraw Hill Inc., New York, 1985.

ME1154- THERMAL POWER SYSTEMS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2.	Mapping of instructional objectives with student outcome	1-3		4		1-3						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME 1155	SOLAR ENERGY SYSTEMS	L	T	P	C
	Prerequisite	3	0	0	3
	Thermodynamics, Heat and Mass transfer				

PURPOSE

To understand the fundamentals of solar energy and its conversion techniques for both thermal and electrical energy applications.

INSTRUCTIONAL OBJECTIVES

1.	To learn the fundamentals of solar energy conversion systems, available solar energy, solar applications.
2.	To learn about PV technology principles and techniques of various solar cells / materials for energy conversion
3.	Learn how to advance the current technology of the solar energy systems for making the process economical, environmentally safe and sustainable.

UNIT I - SOLAR RADIATION **(9 hours)**

Sun as the source of radiation, Sun-Earth relationships, solar constant, solar radiation at the earth's surface, depletion of solar radiation, measurement of solar radiation, solar radiation data, solar time, solar radiation geometry, solar radiation on tilted surfaces.

UNIT II - SOLAR COLLECTORS (9 hours)

Solar collectors: classification, comparison of concentrating and non-concentrating types. Flat plate collectors: construction, liquid flat-plate collector efficiency, effect of various parameters on performance. Concentrating collectors: Working principle of flat plate collector with plane reflectors - Cylindrical parabolic concentrators - Compound parabolic concentrator (CPC) - linear fresnel lens collector - Paraboloidal dish collector - Central tower receiver.

UNIT III - APPLICATIONS OF SOLAR THERMAL TECHNOLOGY (11 hours)

Electric power generation: Low temperature systems - Low temperature power generation using liquid flat plate collectors - Solar pond electric power plant - Solar chimney power plant. Medium temperature system - Power generation using line focusing cylindrical parabolic concentrating collectors. High temperature systems - Power generation using paraboloid dish collectors - Central tower receiver power plant. Solar water heating system, passive solar space heating and cooling system, solar cooker, solar distillation, solar dryer, solar cooling- Absorption cooling - Solar desiccant cooling. Solar green house.

UNIT IV - SOLAR PHOTOVOLTAIC SYSTEMS (9 hours)

Fundamentals of solar cells, P-N junction photodiode, photovoltaic conversion - description and principle of working of a solar cell, cell structure, solar module and panel, I-V characteristics of a PV module, maximum power point, cell efficiency, fill factor, SPV system classification, SPV system components, SPV applications.

UNIT V - SOLAR ENERGY STORAGE AND ECONOMIC ANALYSIS (7 hours)

Storage of solar energy: thermal storage-sensible and latent heat storage, electrical storage and chemical Storage. Economic Analysis: Initial and annual costs, definition of economic terms for a solar system, present worth calculation, repayment of loan in equal annual installments, annual savings, cumulative savings and life cycle savings, payback period, clean development mechanism.

TOTAL : 45

TEXT BOOKS

1. Sukhatme.S.P, Nayak.J.K, "*Solar Energy, Principles of Thermal Collection and Storage"*, Tata McGraw Hill, Third edition, 2010.
2. Goswami.D.Y, Kreider.J.F, Taylor & Francis, "*Principles of Solar Engineering"*, 2000.

REFERENCES

1. Garg.H.P, Prakash.J, "*Solar Energy: Fundamentals & Applications"*, Tata McGraw Hill, 2000.
2. Duffie.J.A and Beckman.W.A, "*Solar Engineering of Thermal Processes"*, John Wiley, 1991.
3. Alan L. Fahrenbruch and Richard H. Bube, "*Fundamentals of Solar Cells: PV Solar Energy Conversion"*, Academic Press, 1983.
4. Rai.G.D, "*Solar Energy Utilizatio*n", Khanna Publishers, Year 2011.
5. Khan.B.H, "*Non-Conventional Energy Resources"*, Tata McGraw Hill, Second edition, 2011.

ME1155 – SOLAR ENERGY SYSTEMS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-3				1-3						
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1156	**AUTOMOTIVE ELECTRONICS**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To provide knowledge about application of electronics in Automobile engineering.

INSTRUCTIONAL OBJECTIVES

1.	Fundamentals of automotive electronics.
2.	Sensors and actuators for various engine applications.
3.	Electronic fuel injection and ignition systems.
4.	Automobile control system.
5.	Electronics application to security and warning systems.

UNIT I - FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (9 hours)

Current trend in Automobiles - Open loop and closed loop systems - Components for electronic engine management. - Electronic management of chassis system.

UNIT II - SENSORS AND ACTUATORS (9 hours)

Introduction, basic sensor arrangement, types of sensors such as: - Oxygen sensors, crank angle position sensors - Fuel metering, vehicle speed sensor and detonation sensor - Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays.

UNIT III - ELECTRONIC FUEL INJECTION AND IGNITION SYSTEMS (9 hours)

Introduction - Feedback carburetor systems (FBC) - Throttle body injection and multi point fuel injection - Fuel injection systems - Injection system controls - Advantages of electronic ignition system - Types of solid-state ignition systems and their principle of operation - Contact less electronic ignition system - Electronic spark timing control.

UNIT IV - DIGITAL ENGINE CONTROL SYSTEM (9 hours)

Open loop and closed loop control systems - Engine cranking and warm up control - Acceleration enrichment - Deceleration leaning and idle speed control - Distributor less ignition - Integrated engine control system - Exhaust emission control engineering.

UNIT V - VEHICLE MOTION CONTROL AND STABILIZATION SYSTEMS (9 hours)

Vehicle motion control - Adaptive cruise control - Electronic transmission control - Vehicle stabilization system - Antilock braking system - Traction control system - Electronic stability program - Onboard diagnosis system.

TOTAL : 45

TEXT BOOKS

1. William B. Riddens, "*Understanding Automotive Electronics",* 5th Edition, Butterworth, Heinemann Woburn, 2008.
2. Tom Weather Jr. and Cland C. Hunter, "*Automotive Computers and Control system",* Prentice Hall Inc., New Jersey, 2009.

REFERENCES

1. Young.A.P and Griffths.L, "*Automobile Electrical Equipment"*, English Language Book Society and New Press, 2010.
2. Robert N Brady, "*Automotive Computers and Digital Instrumentation"*, A Reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 2008.
3. Bechtold, "*Understanding Automotive Electronics"*, SAE, 2010.

ME1156 – AUTOMOTIVE ELECTRONICS												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x								
2.	Mapping of instructional objectives with student outcome	1-5		1-5								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											x	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1181	INDUSTRIAL ENGINEERING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

to provide the basic features of Industrial Engineering like work study, material handling, production planning control, wages and incentives etc.

INSTRUCTIONAL OBJECTIVES

1. The technique and procedures of work study.
2. To analyse to planning procedures Human effectiveness.
3. To know the methods of wage payment.

UNIT I - WORK MEASUREMENT AND WORK STUDY (9 hours)

Work measurement, Techniques- Production study, Time study, Standard time- Rating factors- Work sampling, Work study, Techniques- Human factors- Work study and productivity-method study, Techniques and procedures- charging Techniques- Motion economy principles- SIMO chart-Ergonomics' and Industrial design.

UNIT II - PLANT LAYOUT AND MATERIAL HANDLING (9 hours)

Plant location, site selection- Plant layout types, need, factors influencing the layout - Tools and techniques for developing layout, process chart, flow diagram, string diagram, Template and Scale models- Layout Planning procedure- Assembly line balancing. Material Handling, scope and importance- Types of material handling systems-factors influencing material handling- methods of material handling.

UNIT III - WORK DESIGN ERGONIMICS,PRODUCTION&PRODUCTIVITY (9 hours)

Introduction to work design-Work design-for increased productivity, the work system design. Introduction to job design- Effective job design-Environmental factors, organizational factors & behavioral factors. Ergonomics-Objectives' system approach of ergonomic model-Man-machine system Production and productivity-Definition of production, function and type of production- Definition of productivity- Productivity measurement.

UNIT IV - PRODUCTION PLANNING AND CONTROL (9 hours)

Objectives of PPC- Functions of PPC- Aspects of product development and design- Process Planning-Principles of Standardization, specialization, Simplification-Group Technology- Optimum Batch size- ABC analysis-Value Engineering.

UNIT V - WAGES AND INCENTIVES (9 hours)

Wages and salary administration- Meaning principles- Techniques of wage fixation- Job evaluation- Merit rating- Methods of wage payment. Incentive scheme, Types, Advantages and disadvantages-Productivity base incentives, Case Example- Evaluation of incentive scheme.

TOTAL : 45

TEXT BOOKS

1. Khanna.O.P, "*Industrial Engineering and Management"*, Dhanpat Rai Publications Pvt Ltd, 2010.
2. Samuel Eilon, "*Elements of Production Planning and Control"*, McMillan and Co., Digitized, 2007.

REFERENCES

1. Kumar.B, "*Industrial Engineering and Management"*, 9th edition, Khanna Publishers, New Delhi, 2005.
2. James M. Apple, "*Principles of Layout and Material Handling"*, Ronald press, 2007.
3. Maynard.H, "*Industrial Engineering Hand Book"*, McGraw Hill Book Co., New York, 2010.

ME1181 – INDUSTRIAL ENGINEERING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
			x				x					
2.	Mapping of instructional objectives with student outcome		1-3				1-3					
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										x		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1182	MATERIALS MANAGEMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

to expose the students to the different components and functions of material management.

INSTRUCTIONAL OBJECTIVES

1. Inventory control procedures.
2. Codification of materials.
3. Purchase policies and procedures.

UNIT I - INTRODUCTION **(9 hours)**

Objectives of materials-the function of purchasing and material management-significance of specification standardization-make or buy decision, buying process.

UNIT II - MATERIALS PLANNING AND CONTROL **(9 hours)**

Material forecasting-selection inventory control-Spare parts management-Inventory systems-lead time analysis, administrative lead time, supplier lead time, transport lead time and inspection lead time-flow charting techniques to reduce various types of lead time- materials requirement planning- aggregate inventory management.

UNIT III - STORAGE AND DISTRIBUTION **(9 hours)**

Codification of materials-storage design-stores layout-storage systems and equipment-stores preservation-stores procedures-stock valuation and verification-ware housing and distribution management.

UNIT IV - PURCHASE FUNCTION **(9 hours)**

Purchasing policies and procedures-legal aspects of purchasing-selection of sources of supply-vendor evaluation and rating, vendor development-price, cost analysis.

UNIT V - MATERIALS ACCOUNTING AND BUDGETING **(9 hours)**

Evaluation of materials management performance-Information systems and computer in materials management.

TOTAL : 45

TEXT BOOKS

1. Gopalakrishnan.P, "*Purchasing and Materials Management"*, Tata Mcgraw Hill, 1990.
2. Learnerr Lee Jr. and Donald.M.Dobbler*,* "*Purchasing and Material Management*", Tata Mcgraw Hill, 1996.

REFERENCES

1. Camer Lee and Donald M Dubbler, "*Purchasing and Materials Management"*, Text and cases, Tata McGraw Hill, 1997.
2. Mark.J.V, "*Operations Management"*, McGraw Hill Publishers, 1984.
3. Westing.J.K, Fine, E.V. and Zone.C.T, "*Purchasing Management Principles"*, John Wiley & Sons, New York, 1986.

ME1182 – MATERIALS MANAGEMENT												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x	x		x					
2.	Mapping of instructional objectives with student outcome			1-3	1-3		1-3					
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1183	**HUMAN RELATIONS MANAGEMENT**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To expose the students to the functions of Human Relations Management.

INSTRUCTIONAL OBJECTIVES

1. Understand the human relations.
2. Understand the recruitment procedures.
3. Acquire the knowledge of Career development and counseling

UNIT I - HUMAN RESOURCE DEVELOPMENT (9 hours)

Meaning - Strategic framework for HRM and HRD - Vision, Mission and Values - Importance - Challenges to Organisations - HRD Functions - Roles of HRD Professionals - HRD Needs Assessment - HRD practices - Measures of HRD performance - Links to HR, Strategy and Business Goals - HRD Program Implementation and Evaluation - Recent trends - Strategic Capability , Bench Marking and HRD Audit.

UNIT II - E-HRM **(9 hours)**

e- Employee profile- e- selection and recruitment - Virtual learning and Orientation - e - training and development - e- Performance management and Compensation design - Development and Implementation of HRIS - Designing HR portals - Issues in employee privacy - Employee surveys online.

UNIT III - CROSS CULTURAL HRM **(9 hours)**

Domestic Vs International HRM - Cultural Dynamics - Culture Assessment - Cross Cultural Education and Training Programs - Leadership and Strategic HR Issues in International Assignments - Current challenges in Outsourcing, Cross border M and A- Repatriation etc. - Building Multicultural Organisations - International Compensation.

UNIT IV - CAREER & COMPETENCY DEVELOPMENT **(9 hours)**

Career Concepts - Roles - Career stages - Career planning and Process - Career development Models- Career Motivation and Enrichment -Managing Career plateaus- Designing Effective Career Development Systems - Competencies and Career Management - Competency Mapping Models - Equity and Competency based Compensation.

UNIT V - EMPLOYEE COACHING AND COUNSELING **(9 hours)**

Need for Coaching - Role of HR in coaching - Coaching and Performance - Skills for Effective Coaching - Coaching Effectiveness- Need for Counseling - Role of HR in Counseling - Components of Counseling Programs - Counseling Effectiveness - Employee Health and Welfare Programs - Work Stress - Sources - Consequences - Stress Management Techniques.- Eastern and Western Practices - Self Management and Emotional Intelligence.

TOTAL : 45

TEXT BOOKS

1. Jeffrey A Mello, "*Strategic Human Resource Management"*, Thomson, Singapore, Southwestern, 2003.
2. Randy L. Desimone, Jon M. Werner and David M. Marris,"*Human Resource Development"*, Thomson Southwestern, Singapore, 2002.

REFERENCES

1. Robert.L Mathis and John H. Jackson, "*Human Resource Management"*, Thomson Southwestern, Singapore, 2003.
2. Rosemary Harrison, "*Employee Development"*, University Press India Ltd., New Delhi, 2003.
3. Srinivas Kandula, "*Human Resource Management in Practice"*, Prentice Hall of India, New Delhi, 2004.

ME1183 – HUMAN RELATIONS MANAGEMENT												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
							x	x	x			
2.	Mapping of instructional objectives with student outcome						1-3	1-3	1-3			
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1184	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

This course provides the basic knowledge on aspects of entrepreneurship and supports extended to entrepreneurs.

INSTRUCTIONAL OBJECTIVES

1. Understand the broad spectrum of entrepreneurship.
2. Know about the prelims of setting up of a business unit.
3. Understand the purchasing and marketing basics of the business.
4. Aware of various supports extended by banks and institutions.

UNIT I - ENTREPRENEURSHIP (9 hours)

Historical perspective of entrepreneurship - Traits of Entrepreneurs - Types of Entrepreneurs - Intrerpreneur - Difference between entrepreneur and intrepreneur - entrepreneurship in Economic growth - Factors affecting entrepreneurial growth, Major motives influencing entrepreneur.

UNIT II - BUSINESS (9 hours)

Small Enterprises: - Definition Classification - Characteristics Web and e business - Ownership structure - Project formulation - Sources of information - Steps involved in setting up a business - Identifying, selecting a good business opportunity - Market survey and research - Techno economic feasibility assessment - Preliminary Project report - Project appraisal - Project implementation - Network analysis - Techniques of PERT/CPM.

UNIT III - FINANCING AND ACCOUNTING (9 huors)

Sources of finance - Institutional Finance - Term loans - Capital structure - Management of working capital - Costing, Break even analysis - Taxation - Income Tax, Excise Duty - Sales Tax - Purchasing Policies and procedures - Methods of purchasing - Stores management - Book keeping.

UNIT IV - MARKETING & GROWTH STRATEGIES (9 hours)

Principles of marketing - Assessment of market needs - Demand forecasting, Product life cycle - Sales promotion Strategies - Product mix - Advertising - Distribution Channels - Growth strategies - Expansion - Diversification - Joint venture, Merger - Sub-contracting.

UNIT V - INSTITUTIONAL SUPPORT TO ENTREPRENEURS (9 hours)

Institutional support to entrepreneurs - Government policy for small scale industries - Institutions for entrepreneurial growth - Various schemes - Self Help Group - Sickness in industry - Causes - Steps for correction and rehabilitation.
(Field work-Collection of information on schemes of Entrepreneurial Support and Presentation).

TOTAL : 45

TEXT BOOKS

1. Khanka.S.S, "*Entrepreneurial Development"*, S.Chand and Co Ltd, New Delhi, 1999.
2. Philip Kotler,"*Principles of Marketing"*, Prentice Hall of India, 1995.
3. Lamer Lee and Donald W. Dobler,"*Purchasing and Materials Management.*, Tata McGraw Hill, 1996.

REFERENCES

1. EDII-Faculty and External Experts, "*A Hand Book of new Entrepreneurs"*, Published by Entrepreneurship Development Institute of India, Ahmedabad, 1986.
2. Saravanavel.P, "*Entrepreneurial Development"*, Ess Pee Kay Publishing House, Chennai, 1997.
3. Gopalakrishnan.P, "*Hand book of Materials Management"*, Prentice Hall of India, 1996.

ME1184 – ENTREPRENEURSHIP DEVELOPMENT												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
							x	x				
2.	Mapping of instructional objectives with student outcome						1-3	1-3				
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1185	FACILITIES PLANNING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

On completion of the course the students are expected to design facilities for an industry to meet specific requirements.

INSTRUCTIONAL OBJECTIVES

1. Facilities planning process.
2. The strategies adopted for designing a facility.
3. Evaluate the existing facility and modify to meet the requirements.

UNIT I - INTRODUCTION (9 hours)

Significance and objectives of facilities planning - Facilities planning process - Developing facilities planning strategies - Influence of product - Process and schedule design - Facilities design.

UNIT II - REQUIREMENTS AND RELATIONSHIPS (9 hours)

Department planning, activity relationship, flow - patterns - Planning and measuring - Space requirements - Personnel requirements - Employee-facility interface - Restrooms, food services, health services - Office facility planning.

UNIT III - ALTERNATIVE CONCEPTS AND TECHNIQUES (9 hours)

Material Handling: Principles and classification. - Designing material handling systems - Estimating material handling costs - Safety consideration.Layout Planning Models: Basic layout types - Layout procedures - Algorithmic approaches - Pair-wise exchange method, graph based approaches - CRAFT, BLOCPLAN, LOGIC, MULTIPLE. Multi floor facility layout. Developing layout alternatives - Computer assisted layout planning - ALDEP, CORELAP, CRAFT - Commercial facility layout packages.

UNIT IV - FACILITY DESIGN **(9 hours)**

Facility design for various functions - Warehouse operation - Manufacturing systems - Services.

UNIT V - EVALUATING, SELECTING AND MAINTAINING **(9 hours)**

Facilities plan - Evaluating, selecting, preparing, presenting, implementing and maintaining.

TOTAL : 45

TEXT BOOKS

1. Tompkins.J.A, White.J.A, Bozer.Y.A, and Tan Choco.J.M.A, "*Facilities Planning"*, 3rd Edition, John Wiley & sons, India, 2003.
2. James M. Apple, "*Principles of layout and material handling"*, Ronald press, 1977.

REFERENCES

1. Francis.R.L, McGinnis.L.F, and White J.A, "*Facility Layout and Location: An analytical approach"*, Prentice Hall, New Jersey, 1992.
2. Gupta and Patel, "*Work study"*, Khanna Publishers, New Delhi.
3. Kanna.O.P, "*Industrial Engineering and management"*, Khanna Publishers, New Delhi.

ME1185 – FACILITIES PLANNING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x				x				
2.	Mapping of instructional objectives with student outcome			1-3				1-3				
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1186	**INDUSTRIAL SAFETY AND ENVIRONMENT**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				
PURPOSE					
On completion of the course the student will be familiarized with the safety issues in design, handling and industrial environment.					

INSTRUCTIONAL OBJECTIVES	
1.	The students will be able to conduct basic safety inspections using strategies that they have developed.
2.	The students will be able to identify and demonstrate a working knowledge of the domain of occupation health and safety.
3.	The students will be able to create a document addressing the principles for developing and implementing a successful occupational health and safety program and evaluation of a work site.

UNIT I - ACCIDENT PREVENTION (9 hours)

Definitions and theories.- Accident - Injury - Unsafe act - Unsafe condition - Dangerous occurrence -Theories and principles of accident causation - Cost of accidents - Accident reporting and investigations - Safety committees - Need - Types - Advantages. Safety education and training - Importance - Various training methods - Accident prevention - Motivating factors - Safety suggestion schemes. Safety performance - Definitions connected with measuring safety performance as per Indian and International standards.

UNIT II - SAFETY IN MATERIAL HANDLING (9 hours)

General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears - Prime movers.Ergonomic consideration in material handling, design, installation, operation and maintenance of conveying equipments, hoisting, traveling and slewing mechanisms. Selection, operation and maintenance of industrial trucks - Mobile cranes - Tower crane.

UNIT III - SAFETY IN CHEMICAL INDUSTRIES (9 hours)

Safety in the design process of chemical plants - Safety in operational and maintenance - Exposure of personnel - Operational activities and hazards - Safety in storage and handling of chemicals and gases - Hazards during transportation - Pipeline transport - Safety in chemical laboratories. Specific safety consideration for cement, paper, pharmaceutical, petroleum, petro - chemical, rubber, fertilizer and distilleries.

UNIT IV - ENVIRONMENTAL IMPACT ASSESSMENT (9 hours)

Evolution of EIA - Concepts - Methodologies - Screening - Scoping - Checklist - Rapid and Comprehensive EIA - Legislative and environmental clearance procedure in India - Prediction tools for EIA. - Assesment of Impact - Air - Water - Soil - Noise- Biological. Socio cultural environment - Public participation - Resettlement and Rehabilitation. - Documentation of EIA .

UNIT V - REGULATIONS FOR HEALTH, SAFETY AND ENVIRONMENT (9 hours)

Factories act and rules; - Indian explosive act - Gas cylinder rules - Environmental pollution act - Indian petroleum act and rules - Oil industry safety directorate (OISD) - Indian Electricity act and rules. - Mines act and rules - Indian motor vehicles act and rules.

TOTAL : 45

TEXT BOOKS

1. Handlin.W, "*Industrial Hand Book"*, McGraw-Hill, 2000.
2. Anton.T.J, "*Occupational safety and health management"*, (2nd Edition). New York, McGraw Hill, 1989.

REFERENCES

1. Heinrich.H.W, "*Industrial Accident Prevention"*, McGraw-Hill, 1980.
2. Rudenko.N, "*Material Handling Equipments"*, Mir Publishers, Moscow, 1981.
3. Lees.F.P, "*Loss "Prevention in Process Industries"*, Butterworths, NewDelhi, 1986.
4. Canter.R.L, "*Environmental Impact Assessment"*, McGraw Hill
5. IS CODES: IS 5903, IS 807, IS 2760, IS 14469, IS 13367-1, IS 5324, IS 7167, IS 7155, IS 1800.1, IS 3521 of Oil Industry Safety Directorate, Govt. of India.

ME1186 – INDUSTRIAL SAFETY AND ENVIRONMENT												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x				x	x			
2.	Mapping of instructional objectives with student outcome			1-3				1-3	1-3			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1187	**SUPPLY CHAIN MANAGEMENT**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				
PURPOSE					
to expose the students to the logistics approaches of supply chain management.					
INSTRUCTIONAL OBJECTIVES					
1.	Understand the role of logistics.				
2.	Understand the phases of supply chain.				
3.	Understand the models and activities of SCM.				

UNIT I - INTRODUCTION TO LOGISTICS (9 hours)

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

UNIT II - PHASES OF SUPPLY CHAIN (9 hours)

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III - EVOLUTION OF SUPPLY CHAIN MODELS (9 hours)

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

UNIT IV - SUPPLY CHAIN ACTIVITIES (9 hours)

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNIT V - SCM ORGANISATION AND INFORMATION SYSTEM (9 hours)

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERP Software's.

TOTAL : 45

TEXT BOOKS

1. Shari.P.B and Lassen.T.S, "*Managing the global supply chain"*, Viva books, New Delhi, 2000.
2. Ayers.J.B, "*Hand book of supply chain management"*, The St. Lencie press, 2000.

REFERENCES

1. Nicolas.J.N, "*Competitive manufacturing management - continuous improvement"*, Lean production, customer focused quality, McGrawHill, New York, 1998.
2. Steudel.H.J and Desruelle.P, "*Manufacturing in the nineteen - How to become a mean, lean and world class competitor"*, Van No strand Reinhold, New York, 1992.

ME1187 – SUPPLY CHAIN MANAGEMENT												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x						
2.	Mapping of instructional objectives with student outcome			1-3		1-3						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1188	TQM AND RELIABILITY ENGINEERING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To provide knowledge about Total Quality Management (TQM), TQM tools and techniques applied to Manufacturing and also about reliability and maintainability of different systems.

INSTRUCTIONAL OBJECTIVES

1.	Meaning of TQM and Theories about TQM.
2.	Planning and manufacturing for quality its tools and techniques.
3.	Human involvement to improve quality and the development and transformation
4.	due to such involvement.
5.	About failure models, component reliability & system reliability.
6.	About mean down time, maintainability of systems & condition monitoring.

UNIT I - BASIC CONCEPTS (9 hours)

Evolution of total quality Management - Definition of quality - Comparison between traditional approach and TQM, Deming - Crosby - Juran - Taguchi, Ishikawa theories - Quality costs - Product quality Vs Service quality Strategic planning - Goal setting - Steps involved in strategic planning - TQM implementation.

UNIT II - TQM PRINCIPLES & BASIC TOOL (9 hours)

Customer Satisfaction - Types of customers, customer supplier chain, Customer perception of quality customer feed back - Customer complaints - Customer retention - Service quality.Employee involvement - Employee motivation - Maslow's hierarchy of needs - Herzberg theory - Empowerment and team work.

Basic Tools: Introduction to seven basic tools - Check sheets, histograms - Control charts, Pareto diagram - Cause and effect diagram - Stratification - Scatter diagrams.

UNIT III - NEW SEVEN MANAGEMENT TOOLS & ADVANCED TOOLS (9 hours)

Affinity diagram - Relations diagram - Tree diagram - Matrix diagram - Matrix data analysis diagram - Process decision program chart - Arrow diagram.

Advanced QC tools: Advanced QC tools like QFD - Root cause analysis - Taguchi method - Mistake proofing (poka-yoke) - Failure mode and effects analysis (FMEAs), failure mode and effects criticality analysis (FMECAs) and Fault tree analysis (FTAs) etc. - Quality Management Systems.

UNIT IV - RELIABILITY (9 hours)

Definition - Probabilistic nature of failures - Mean failure rate - Meantime between failures - Hazard rate - Hazard models, Weibull model - System reliability improvement - Redundancy - Series - Parallel and Mixed configurations.

UNIT V - MAINTAINABILITY (9 hours)

Introduction - Choice of maintenance strategy - Mean time- to repair (MTTR) - Factors contributing to Mean Down Time (MDT) - Fault diagnosis, and routine testing for unrevealed faults - Factors contributing to Mean Maintenance Time - (MMT) on condition maintenance - Periodic condition monitoring - Continuous condition monitoring - Economics of maintenance.

TOTAL : 45

TEXT BOOKS

1. Joel E. Rose, "*Total Quality Management"*, 2nd Edition, Kogan Page Ltd., USA 1993.
2. Srinath.L.S, "*Reliability Engineering"*, Affiliated East West Press, New Delhi 1995.

REFERENCES

1. Balagurusamy.E, "*Reliability Engineering",* Tata McGraw Hill publishing Co., New Delhi, 1984.
2. Greg Bound, et.al, "*Beyond Total Quality Management towards the emerging paradigm"*, McGraw Hill Inc., 1994.
3. Zeiri, "*Total Quality Management for Engineers"*, Wood Head Publishers, 1991.

ME1188 – TQM AND RELIABILITY ENGINEERING												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
							x	x	x			x
2.	Mapping of instructional objectives with student outcome						1-6	1-6	1-6			1-6
3.	Category	General (G)	Basic Sciences (B)				Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1189	MARKETING AND SALES MANAGEMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

The students will be exposed to the hardcore and advance concepts of both marketing and sales management.

INSTRUCTIONAL OBJECTIVES

1. Marketing management.
2. Customer behavior.
3. Sales management.

UNIT I - INTRODUCTION TO MARKETING (9 hours)

Market - definition, types - Kinds of goods, marketing role, characteristics - Marketing interface with other functional areas - Marketing management forces.

UNIT II - UNDERSTANDING CONSUMER BEHAVIOUR (9 hours)

Consumer values, buyer behaviour - influencing factors, models - Consumer and industrial buyers-identifying target customers - market segmentation - positioning.

UNIT III - MARKETING MIX ELEMENTS (9 hours)

Marketing mix- **Product**: - What is product - Consumer and industrial products - New product development - Design - Branding - Packaging-labeling - Product life cycle - Sales forecasting and demand estimation - **Price**: Pricing - **Place**: Nature of distribution channel - Channel design decisions - Retailing - wholesaling. **Promotion**: Advertising and personal selling - Direct selling.

UNIT IV - SALES MANAGEMENT (9 hours)

Marketing management Vs. Sales management - Sales management and business enterprise - The role of personal selling - Skills for successful sales persons - Designing the sales force strategy and structure - Recruitment - selection - training - Compensation - Motivation of sales people.

UNIT V - CURRENT TRENDS IN MARKETING **(9 hours)**

Information technology and its impact in marketing decisions - e - commerce - Multilevel marketing - Consumer protection: awareness of consumer rights, laws and consumerism.

TOTAL : 45

TEXT BOOKS

1. Kotler.P and Armstrong, "*Principles of Marketing"*, 11th edition, Prentice Hall of India.
2. Zikmund d' Amico, "*Marketing"*, South Western, Thomson Learning, 2000.

REFERENCES

1. Still.R.R, Cundiff.E.W and Govoni.N.A.P, "*Sales Management"*, Prentice Hall of India.
2. Sherlekar.S.A, "*Marketing Management"*, 3rd Edition, Macmillan India.
3. Michael R Czinkota and Masaki Kotabe, "*Marketing Management"*, Vikas Thomson Learning, 2001.

ME1189 – MARKETING AND SALES MANAGEMENT													
Course Designed by		**Department of Mechanical Engineering**											
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
				x				**x**					
2.	Mapping of instructional objectives with student outcome			1-3				1-3					
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)			
										X			
4.	Approval	23rd Meeting of Academic Council, May 2013											

ME1190	**PLC AND DATA ACQUISITION SYSTEMS**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				
PURPOSE					
To provide students the fundamentals of PLC and Data acquisition system.					
INSTRUCTIONAL OBJECTIVES					
1.	Understand the basic of data conversion and data acquisition.				
2.	Understand the fundamental of PLC				

UNIT I - COMPUTER CONTROL-INTRODUCTION (9 hours)

Need of computer in a control system - Functional block diagram of a computer control system - Data loggers - Supervisory computer control - Direct digital control - Digital control interfacing - SCADA.(Elementary treatment only).

UNIT II - DATA CONVERTERS (9 hours)

DACs-Basic DAC Techniques-Weighted Resistor, R-2R Ladder and Inverted R-2R ladder type DACs- ADCs - Parallel ADC, Dual slope ADC, Successive approximation ADC-Comparison of A/D conversion techniques-DAC/ADC specifications - Typical IC's for DAC, ADC - Isolation amplifiers.

UNIT III - DATA ACQUISITION SYSTEMS (9 hours)

Sampling theorem - Sampling and digitizing - Aliasing - Sample and hold circuit - Practical implementation of sampling and digitizing - Definition, design and need for data acquisition systems - Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation -Microprocessor/PC based acquisition systems.

UNIT IV - PLC (9 hours)

Evolution of PLCs - Sequential and programmable controllers - Architecture-Programming of PLC - Relay logic - Ladder logic - Gates, Flip flops and Timers.

UNIT V - COMMUNICATION IN PLC's (9 hours)

Requirement of communication networks of PLC - connecting PLC to computer - Interlocks and alarms - Case study of Tank level control system and Sequential switching of motors.

TOTAL : 45

TEXT BOOKS

1. Petrezeulla, "*Programmable Controllers"*, McGraw Hill, 1989.
2. Hughes.T, "*Programmable Logic Controllers"*, ISA Press, 1989.

REFERENCES

1. Clayton.G.B, "*Data Converters"*, The Mac Millian Press Ltd., 1982.
2. Curtis.D.Johnson, "*Process Control Instrumentation Tech"*, 8th Edition, Prentice Hall, June 2005.
3. Roy Choudhury.D and Shail B. Jain, "*Linear Integrated circuits"*, New age International Pvt .Ltd., 2003.

ME1190 – PLC AND DATA ACQUISITION SYSTEMS												
Course Designed by		Department of Mechanical Engineering										
1.	Student Outcome	a	b	C	d	e	f	g	h	i	j	k
				X	x	x						
2.	Mapping of instructional objectives with student outcome			1,2	1,2	1,2						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1191	INSTRUMENTATION AND CONTROL	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To enable the students to understand the fundamentals of instrumentation and control available for monitoring/measuring in domestic / industrial applications.

INSTRUCTIONAL OBJECTIVES

1. To learn fundamentals of various types of Transducers.
2. To acquire basic understanding of principle & working of Transducers
3. To Understand the methods to analyze the stability of systems from transfer function forms

UNIT I - MEASUREMENT OF FORCE, TORQUE VELOCITY (9 hours)

Electric balance - Different types of load cells - Magnets - Elastics load cell - Strain gauge load cell - Different methods of torque measurement - Strain gauge - Relative regular twist- Speed measurement - Revolution counter - Capacitive tacho - Drag up type tacho - D.C and A.C. tacho generators - Stroboscope.

UNIT II - MEASUREMENT OF ACCELERATION,VIBRATIONAND DENSITY (9 hours)

Accelerometers - LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as an accelerometer and vibrometer - Calibration of vibration pick ups - Units of density - Specific gravity and viscosity used in industries - Pressure head type densitometer - Float type densitometer - Ultrasonic densitometer.

UNIT III - MEASUREMENT OF PRESSURE & TEMPERATURE (9 hours)

Units of pressure - Manometers - Different types - Elastic type pressure gauges - Bourdon tube bellows - Diaphragms - Electrical methods - Elastic elements with LVDT and strain gauges - Measurement of vacuum - Different types- McLeod gauge - Testing and calibration of pressure gauges - Dead weight tester. Bimetallic thermometers - Electrical methods of temperature measurement - RTDs and their - Thermocouples, Pyrometers - Optical pyrometers - Two colour radiation pyrometer.

UNIT IV - TRANSFER FUNCTIONS (9 hours)

Definitions, Transfer function - Mathematical modeling of mechanical (translation and rotational), electrical systems- Mechanical - Electrical analogies - Block Diagram reduction technique and Signal flow graphs.

UNIT V - RESPONSE AND STABILITY ANALYSIS (9 hours)

Time response of first order and Second order systems - Concept of stability - Necessary conditions for stability - Routh Stability criterion - Polar and Bode plots - Simple Problems.

TOTAL : 45

TEXT BOOKS

1. Ernest O. Doebelin, "*Measurement systems Application and Design"*, International Student Edition, IV Edition, McGraw-Hill Book Company, 1998.
2. Jain.R.K, "*Mechanical and Industrial Measurements"*, Khanna Publishers, New Delhi, 1999.
3. Katsuhiko Ogata, "*Modern Control Engineering",* 2nd ed., Prentice Hall of India, New Delhi, 1995.

REFERENCES

1. Patranabis.D, "*Principles of Industrial Instrumentation"*, Tata McGraw-Hill Publishing Ltd., New Delhi, 1999.
2. Sawhney.A.K, "*A course in Electrical and Electronic Measurement and Instrumentation*" Dhanpat Rai and Sons, New Delhi, 1999.
3. Nakra.B.C and Chaudary, K. K., "*Instrumentation Measurement and Analysis"*, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1985.
4. Benjamin C Kuo, "*Automatic Control System"*, 7th edition, Prentice Hall of India, New Delhi, 1993.

ME1191 – INSTRUMENTATION AND CONTROL												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x						
2.	Mapping of instructional objectives with student outcome			1-3	1-3	1-3						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1192	MICROPROCESSOR BASED SYSTEM DESIGN	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

this course aims at introducing the need of microcontroller 8 bits and 16 bits in a device/ instrument development.

INSTRUCTIONAL OBJECTIVES

1. Understand the need of Micro-controller family
2. Develop the assembly level programs based on Intel 8083, 8096 & PIC microcontrollers
3. Design the detailed hardware circuits for the given application
4. Identify the need for I/O and memory expansion methods for an application

UNIT I - MICROPROCESSOR (9 hours)

Need for microprocessor based system design - Design cycle - Dimensions of the design problem - Hardware design and software design - System integration. **Structure and Characteristics**: 8253 Timer / Counter 8259 interrupt controller - 8279 keyboard / display controller - 6845 CRT controller 8237 DMA controller - 8272 diskette controller.

UNIT II - INPUT AND OUTPUT ALGORITHMIC PROCESSES (9 hours)

I/O control - I/O timing - Data buffering with FIFOS - Keyboards and switches - Remote instrument control - Self test hardware. Keyboard parsing - Real time programming - Self test algorithm. Multiplication and division algorithms.

UNIT III - TROUBLESHOOTING SYSTEMS - LOGIC ANALYSERS (9 hours)

Logic state analysers, Logic timing analysers - Display modes - Logic analysers features - Signature analysis - Error detection using signature analysis. - Development systems: Basic features - software development aids - Development system architecture - Emulators, system software - Assembler, linker, loader.

UNIT IV - 8086 /8088 BASED MULTIPROCESSING SYSTEM (9 hours)

Review of architecture and instruction set of 8086 Processor - Coprocessor configuration, closely coupled - Configurations, loosely coupled configurations - 8087 coprocessor: Architecture, instruction set - 8089 I/O processor.

UNIT V - SYSTEM DESIGN APPLICATIONS (9 hours)

LCR meter - PID controller - DC motor speed control - Digital weighing machine - Temperature control - Controller for a washing machine.

TOTAL : 45

TEXT BOOKS

1. John B. Peatman, "*Microcomputer Based Interfacing"*, McGraw Hill, 1988.
2. Douglass V. Hall, "*Microprocessor and Interfacing"*, McGraw Hill, 1987.

REFERENCES

1. Williams.G.B, "*Troubleshooting on Microprocessor Based Systems"*, Pergamon Press 1984.
2. Yu-Cheng Liu and Glenn A. Gibson, "*Microcomputer systems, The 8086/8088 family"*, Second edition, Prentice Hall of India, 1990.
3. Ramesh S. Gaonkar, "*Microprocessor Architecture programming and applications with 8085"*, Fourth edition, Penram International publications, 2000.

ME1192 – MICROPROCESSOR BASED SYSTEM DESIGN												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x						
2.	Mapping of instructional objectives with student outcome			1-4	1-4	1-3						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1251	**PRINCIPLES OF ENGINEERING METALLURGY**	**L**	**T**	**P**	**C**
	Prerequisite	**2**	**0**	**0**	**2**
	Nil				
PURPOSE					
The course aims at an overview of basic chemistry, physics & extraction of different metals and heat treatment.					
INSTRUCTIONAL OBJECTIVES					
1.	Extraction of metals				
2.	Heat treatment				
3.	Mechanical properties and testing of metals				

UNIT I - CHEMICAL METALLURGY (9 hours)

Extraction of Non-ferrous metals- Basic principles-Processing of ores and extractive techniques-Pyrometallurgy, Hydrometallurgy and electrometallurgy-Extraction of Copper, Aluminum, Zinc, Nickel and Magnesium.

UNIT II - PHYSICAL METALLURGY (9 hours)

Heat Treatment- Objectives and process-Types of heat treatment-Annealing, Spheroidizing, Normalising, Tempering, Surface hardening-Flame hardening, Induction hardening, Pack carburising,Solid Carburising, Cyaniding, Nitriding - Work(Strain) hardening.

UNIT III - MECHANICAL PROPERTIES AND TESTING (12 hours)

Stress-Strain curve - Concept of load, stress and strain, Tensile, compressive and shear stresses and strains, Concept of Elasticity, Elastic Limit and limit of proportionality, Hook's Law, Young's Modulus of Elasticity, Yield point, plastic stage, Ultimate strength and breaking stress , Mechanism of creep and fatigue; Testing of materials under tension, compression and shear loads – Hardness tests (Brinell,Vickers and Rockwell), Impact test - Izod and Charpy.

TOTAL 30

TEXT BOOKS

1. L.Krishna Reddy, "*Principles of Engineering Metallurgy"*, New Age International Publishers, 2007.
2. Dr.J.T.Winowlin Jappes, A.Alavudeen, "*Engineering Materials and Metallurgy*", Laxmi Publications (P) Limited, 2006.
3. Dieter, G. E., "*Mechanical Metallurgy"*, McGraw Hill, Singapore, 2001.

REFERENCES

1. V.Raghavan, "*Physical Metallurgy"* , second edition Prentice Hall of India Pvt Limited, 2012.
2. O.P.Khanna, "*Material science and engineering"*, Dhanpat Rai publications, 1987.

ME1251 - PRINCIPLES OF ENGINEERING METALLURGY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2.	Mapping of instructional objectives with student outcome	3				3						1,2
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1252	INTRODUCTION TO MANUFACTURING ENGINEERING	L	T	P	C
	Prerequisite	2	0	0	2
	Nil				

PURPOSE

To make the students aware of different manufacturing processes like machining process, metal forming, casting and welding.

INSTRUCTIONAL OBJECTIVES

1. various machining processes.
2. Concept of casting and welding.
3. Mechanical working of metals.

UNIT I - MACHINING **(10 hours)**

Lathe – types – capstan and turret, specification, operations like step turning, facing, parting off, taper turning, knurling.

Drilling – principle, operations like reaming, counter boring, counter sinking, tapping, etc. Types of drills and their features. Milling – principle, classification, tools and their operations, features.

UNIT II - CASTING AND WELDING **(10 hours)**

Introduction to casting, Patterns, Types, Pattern materials, Allowances – Moulding – types– Moulding sand, Gating and Risering, Cores &Core making. Special Casting Process - Shell, Investment, Die casting, Centrifugal Casting.

Special welding– Laser, Electron Beam, Ultrasonic, Electro slag, Friction welding, Electrical resistance welding.

UNIT III - METAL FORMIMG **(10 hours)**

Hot and Cold Working: Rolling, Forging, Wire Drawing, Extrusion – types – Forward, backward and tube extrusion.

Sheet Metal Operations: Blanking– blank size calculation, draw ratio, drawing force, Piercing, Punching, Trimming, Stretch forming, Shearing, Bending– simple problems– Bending force calculation, Tube forming – Embossing and coining, Types of dies: Progressive, compound and combination dies.

TOTAL: 30

TEXT BOOKS

1. Hajra Choudry S.K, Bose S.K, "Elements of *Workshop Technology Vol II", 2010.*
2. Sharma P.C, "*A Text Book of Production Engineering*", S.Chand and Co. Ltd., IV Edition, 2008.
3. Rao.P.N, "*Manufacturing Technology*, *Vol I & II",* Tata McGraw Hill Publishing Co., New Delhi, 2009.

REFERENCES

1. Kalpakjian, "*Manufacturing Engineering and Technology",* Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.
2. De Garmo et al., "*Materials and Processes in Manufacturing*", Prentice Hall of India, Eight Edition, 1998.
3. Jain. R. K., "*Production Technology",* Khanna Publishers, New Delhi, 2001.
4. Chapman W. A. J., "*Workshop Technology Vol. I and II"*, Arnold Publisher, New Delhi, 2001.

ME1252– INTRODUCTION TO MANUFACTURING ENGINEERING												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x				x		x
2.	Mapping of instructional objectives with student outcome	1,3				1,3				2		1-3
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1253	**ROBOTICS TECHNOLOGY**	**L**	**T**	**P**	**C**
	Prerequisite	**2**	**0**	**0**	**2**
	Nil				

PURPOSE

To impart knowledge about basic concepts of robot, programming and their applications.

INSTRUCTIONAL OBJECTIVES

1.	Basics of robot.
2.	Sensors and vision techniques.
3.	Programming and their application.

UNIT I - FUNDAMENTALS OF ROBOT (12 hours)

Robot – Definition, Need for Robots, Robot Anatomy, Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions, grippers-types. Forward kinematics, inverse kinematics- Manipulators with two, three degrees of freedom in 2D - Derivations and problems.

UNIT II - DRIVES AND SENSORS (8 hours)

Drives- hydraulic, pneumatic and electrical. Force sensing, touch and tactile sensors, proximity sensors, non contact sensors and Machine vision sensors. Safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism.

UNIT III - PROGRAMMING AND APPLICATIONS (10 hours)

Robot programming languages – VAL programming – Motion Commands, Sensorscommands. Role of robots in inspection, assembly, material handling, underwater, space, nuclear, defence and medical fields.

TOTAL: 30

TEXT BOOK

1. Deb.S.R, "*Robotics Technology and Flexible Automation*", Tata McGraw-Hill Publishing , 2010.
2. Mikell P Groover, "*Industrial Robotics – Technology, Programming & Applications"*, McGraw-Hill, 2008.

REFERENCES

1. John J. Craig, "*Introduction to Robotics : Mechanics and Control",* 3rd Edition, Pearson , 2008.
2. Saha.S.K, "*Introduction to Robotics"*, 1st Edition, Tata McGraw-Hill Education , 2008.
3. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "*Robotics control, sensing, vision and intelligence"*, McGraw Hill Book co, 1987.
4. Saeed B. Niku, "*Introduction to Robotics : Analysis, Control, Applications"*, 2nd Edition, Wiley, 2011.
5. Yoram Koren, "*Robotics for Engineers"*, Tata McGraw-Hill Education , 1985.

ME1253 – ROBOTICS TECHNOLOGY												
Course Designed by		Department of Mechanical Engineering										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x					x	x
2.	Mapping of instructional objectives with student outcome	1-3		3		1-3					2,3	1-3
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1254	THERMODYNAMICS AND FLUID MECHANICS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

This course provides the basic knowledge about thermodynamics and fluid mechanics.

INSTRUCTIONAL OBJECTIVES

1. Understand the thermodynamic laws and their applications.
2. Understand the principles of air standard cycles and Rankine cycles
3. Understand the principles of refrigeration and air conditioning systems and air compressors.
4. Understand the principles of fluid mechanics and the measurement techniques of fluid properties

UNIT I - BASICS OF THERMODYNAMICS (9 hours)

Systems, zeroth law, first law - concept of internal energy and enthalpy-applications to closed and open systems - second law - concept of entropy - Clausius inequality.

UNITII - CYCLES AND SYSTEMS (9 hours)

Otto, Diesel and Brayton cycles. IC engines - 4 stroke and 2 stroke engines - brake power - efficiencies - heat balance test - simple problems only. Properties of steam - use of steam tables and mollier diagram - Rankine cycle - simple problems.

UNIT III - REFRIGERATION AND AIR CONDITIONING SYSTEMS (9 hours)

Vapour compression refrigeration systems - COP - simple problems – basics and types of air conditioning systems. Reciprocating compressors - volumetric efficiency - power required -simple problems - rotary compressors. Heat transfer - modes of heat transfer - simple problems on conduction-composite wall, cylinder and sphere - convection - flow over flat plate-and radiation.

UNIT IV - BASICS OF FLUID MECHANICS **(9 hours)**

Introduction - properties of fluid - density, viscosity, pressure and velocity - types of fluid flow - continuity equation - energy - head of fluid - Euler's equation - Bernoulli's equation, flow through pipes - Hagen Poiseulli's law - major and minor losses.

UNIT V - FLUID MEASUREMENTS **(9 hours)**

Flow measurements - orifice meter, venturimeter- Rota meter and elbow meter. Pressure measurement - total and static pressure measurements using pitot tube, manometer, mechanical gauges. Velocity measurements - anemometers - cup and vane types, hot wire anemometers, laser anemometers.

TOTAL: 45

REFERENCES

1. Sarkar.B.K, "*Thermal Engineering"*, Tata McGraw Hill Co. Ltd., India, 2005.
2. Rajput.R.K. "*Fluid Mechanics and Hydraulic Machines"*, S.Chand & Co., India 2008.
3. Nag.P.K *"Engineering Thermo Dynamics"*, Tata McGraw Hill Co. Ltd., India, 2005.
4. Rajput.R.K "*Thermal Engineering"*, Laxmi Publications (P) Ltd., New Delhi, Edition. 2010.
5. Kumar.D.S, "*Fluid Mechanics and Fluid Power Engineering"*, S.K.Kataria & Sons Publishers, India, 6th Edition, 2003.

ME1254– THERMODYNAMICS AND FLUID MECHANICS												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-4				1-4						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects (P)	
											X	
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1255	KINEMATICS OF MACHINERY	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To help the students understand the machines and their components so as to enable them manage the machineries in the food industries.

INSTRUCTIONAL OBJECTIVES

1. To understand the basic mechanisms used in machines.
2. To know about the various drives, the actuation, control and conversion from one form to another.

UNIT I - MECHANISMS **(9 hours)**

Basic concept of machines-Kinematics-links-pairs-chain-kutzbach and Grubbler's criterion - mechanisms and uses-Inversion of mechanisms-Four bar chain, single slider crank, double slider crank.

UNIT II - FRICTION **(9 hours)**

Types of friction, friction of a body on a rough plane, ladder friction, Screw friction, clutches – types and single and multiple disc cone and their applications.

UNIT III - POWER DRIVES **(9 hours)**

Belts – Types, Flat Belt drive, V-belt drive, Tension ratio-centrifugal tension – slip – creep. Gears-classification-terminology-profile-law of gearing-arc of contact, path of contact contact ratio, interference. Gear trains – simple – compound - reverted.

UNIT IV - GOVERNORS AND FLYWHEELS **(9 hours)**

Governor – types, Watt, Porter and Proell governor, characteristics of governor. Flywheel – function - fluctuation of speed and energy.

UNIT V - CAM **(9 hours)**

Cam and follower-types-application-profiles for uniform velocity and acceleration-simple harmonic and cycloidal motion

TOTAL: 45

TEXT BOOKS

1. Ratan.S.S, "*Theory of Machines"*, Tata McGraw Hill Publishing company Ltd., 2nd Edition, 2005.
2. Khurni.R.S and Gupta.J.K, "*Theory of Machines*", Eurasia Publishing House, 2005.

REFERENCES

1. Shigley.J.E and Uicker.J. J, "*Theory of Machines and Mechanisms"*, McGraw Hill, 1995.
2. Ghosh.A and Mallick.A.K, "*Theory of Mechanisms and Machines"*, Affiliated East-West Pvt Ltd., New Delhi, 1988.
3. Rao.J.S, and Dukkipati.R.V, "*Mechanism and Machine Theory"*, Wiley-Eastern Ltd., New Delhi, 1995.

ME1255 – KINEMATICS OF MACHINERY												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2.	Mapping of instructional objectives with student outcome	1,2		1,2		1,2						
3.	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1256	**REFRIGERATION AND COLD CHAIN**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

On completion of this course, the students are expected to gain knowledge about refrigeration and cold chain.

INSTRUCTIONAL OBJECTIVES

1.	Understand vapour compression and vapour absorption refrigeration systems.
2.	Familiarize with the cold storage design and construction
3.	Familiarize with operation and maintenance of cold chain
4.	Know chilling and freezing of foods

UNIT I - PRINCIPLES OF REFRIGERATION (9 hours)

Refrigeration cycles, vapour compression and vapour absorption cycles, refrigerants, properties of refrigerants, use of eco-friendly refrigerants, net refrigerating effect, ton of refrigeration. Refrigeration system: Compressor, condenser, evaporator, expansion valves piping and different controls. Atmospheric air and its properties, psychometrics, energy considerations.

UNIT II - COLD STORAGE DESIGN AND CONSTRUCTION (9 hours)

Small and large commercial storages, cold room temperatures, insulation, properties of insulating materials, air diffusion equipment, doors and other openings. Cold load estimation: prefabricated systems, walk-in-coolers, and refrigerated container trucks. Freezer storages, freezer room temperatures, insulation of freezer rooms,pre-cooling and pre freezing. Cold storage practice, stacking and handling of material in and around cold rooms, optimum temperatures of storage for different food materials-meat and poultry products, marine products, fruits and vegetables, spices and food grains

UNIT III - OPERATION AND MAINTENANCE (9 hours)

Controlled atmosphere and modified atmosphere storages, operation and maintenance, cleanliness, defrosting practices, preventive maintenance, safety measures, controlled atmosphere and modified atmosphere storages. Effects of nitrogen, oxygen, and carbon–di–oxide on storage of durable and perishable commodities, principles and basics of their construction.

UNIT IV - CHILLING OF FOODS (9 hours)

Chilling equipment for liquid foods, secondary refrigerants and direct expansion techniques in chilling. Chilled foods transport and display cabinets, basics of chilled foods microbiology, packaging of chilled foods.Hygienic design considerations for chillers and chilled storages, cool storages and their applications, evaporative cooling and its applications.

UNIT V - FREEZING OF FOODS (9 hours)

Freezing equipment, freezing rates, growth rate of ice crystals, crystal size and its effect of texture and quality of foods, freezer types, blast freezers, contact plate freezers, conveyor quick freezers, individual quick freezing. Cryogenic freezing, freezing practice as applied to marine foods, meat and poultry, fruits and vegetables.

TOTAL: 45

TEXT BOOKS

1. Madison A Cooper, "*Practival Cold Storage"*, Rarebooksclub, 2012.
2. Arora.S.C and Domkundwar.S, "*A course in Refrigeration and Air conditioning"*,Dhanpat Rai (P) Ltd., New Delhi, 8th edition, 2012.

REFERENCES

1. Aror.C.P, "*Refrigeration and Air Conditioning"*, Tata McGraw Hill, New Delhi, 3rd Edition, 2008.
2. ERI Board, "*Start your Cold Storage Unit"*, Engineers India Research Institute, 2009.
3. Don Lasseter, "*Cold Storage"*, Hachette Book Group US Agency, 2010.
4. Manohar Prasad, "*Refrigeration and Air conditioning"*, New Age International (P) Ltd, New Delhi, 2nd Edition, 2010.

ME1256 – REFRIGERATION AND COLD CHAIN												
Course Designed by		**Department of Mechanical Engineering**										
1.	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-4				1-4						
3.	Category	General (G)	Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
										X		
4.	Approval	23rd Meeting of Academic Council, May 2013										