NANDHA ENGINEERING COLLEGE

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

Curriculum and Syllabi
for
B.E- Mechanical Engineering [R13]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2013-2014 and 2014-2015 only)

JUNE 2016

Approved by Fourth Academic council

NANDHA ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

- To be a premier centre for learning in Mechanical Engineering in the country

MISSION

- To offer state-of-the-art undergraduate, postgraduate and research programmes in engineering
- To develop skilled and employable graduates to meet the challenges in emerging fields of Engineering
- To prepare the students for prosperous career in Engineering / Entrepreneurship by inculcating the leadership qualities with professional and ethical responsibilities for the benefit of the society
- To encourage Research & Development in the thrust areas of Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

POE1: Graduates will be successful practitioners in solving industry's technological problems
POE2: Graduates will be entrepreneurs and contribute to the economic growth of the country
POE3: Graduates will pursue higher studies in engineering or management successfully
POE4: Graduates will prefer career paths in teaching or research
POE5: Graduates will function in their career with professional and ethical responsibilities

PROGRAMME OUTCOMES (POs):

On graduation from the Mechanical Engineering programme, our students will have

PO1: an ability to apply knowledge of mathematics, science and engineering
PO2: an ability to design and conduct experiments, as well as to analyze and interpret data
PO3: an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, safety, manufacturability and sustainability
PO4: an ability to function on multidisciplinary teams to solve complex problems
PO5: an ability to use the techniques, skills and modern engineering tools necessary for engineering practice
PO6: an ability to infer societal, health, safety, legal & cultural issues and consequent responsibilities relevant to the professional engineering practice
PO7: an ability to explain, compare and summarize the impact of engineering solutions for sustainable development with societal and environmental perspective
PO8: an understanding of professional and ethical responsibility
PO9: an ability to function effectively as an individual / team in different environments
PO10: an ability to communicate effectively
PO11: an ability to apply knowledge of engineering and management principles to the projects
PO12: an ability to recognize the need for life-long learning

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to update knowledge of faculty members in their area of specialization.
PSO2: Ability to apply strategies for continual improvement of Mechanical Engineering programme.
PSO3: Ability to infuse research activities in Mechanical Engineering.
PSO4: Ability to become aware of environmental and social aspects through extracurricular activities.

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NANDHA ENGINEERING COLLEGE

REGULATIONS 2013 (R-13)

I to VIII - SEMESTER CURRICULUM

B.E. Mechanical Engineering

SEMESTER I

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GE101	English for Engineers - I	3	1	0	4
13GE102	Engineering Mathematics - I	3	1	0	4
13GE103	Engineering Physics - I	3	0	0	3
13GE104	Engineering Chemistry	3	0	0	3
13ME101	Elements of Mechanical Engineering	3	0	0	3
13EE101	Basic Electrical and Electronics Engineering	3	1	0	4
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GE111	Physics and Chemistry Laboratory - I	0	0	3	2
13GE112	Engineering Practices Laboratory	0	0	3	2
13ME111	Engineering Graphics Laboratory	1	0	2	2
	TOTAL	**19**	**3**	**8**	**27**

SEMESTER II

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GE201	English for Engineers - II	3	1	0	4
13GE202	Engineering Mathematics - II	3	1	0	4
13GE205	Materials Science	3	0	0	3
13GE204	Environmental Science and Engineering	3	0	0	3
13ME202	Principles of Energy Conversion	3	0	0	3
13CS101	Problem solving and C Programming	3	0	0	3
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GE211	Physics and Chemistry Laboratory - II	0	0	3	2
13ME211	Computer Aided Modeling and Drafting Laboratory	0	0	3	2
13CS111	Computer Programming Laboratory	0	0	3	2
	TOTAL	**18**	**2**	**9**	**26**

SEMESTER III

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GE301	Transforms and Partial Differential Equations	3	1	0	4
13ME301	Engineering Mechanics	2	1	0	3
13ME302	Engineering Thermodynamics	2	1	0	3
13ME303	Fluid Mechanics	2	1	0	3
13ME304	Manufacturing Processes	3	0	0	3
13ME305	Materials Engineering and Technology	3	0	0	3
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME311	Fluid Mechanics Laboratory	0	0	2	1
13ME312	Manufacturing Processes Laboratory	0	0	3	2
13ME313	Computer Aided Machine Drawing	0	0	4	2
13PT311	Language Competency Development - I	0	0	2	0
	TOTAL	**15**	**4**	**11**	**24**

SEMESTER IV

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GE404	Statistics and Numerical Methods	3	1	0	4
13ME401	Kinematics of Machinery	2	1	0	3
13ME402	Thermal Engineering Systems	2	1	0	3
13ME403	Strength of Materials	2	1	0	3
13ME404	Machining Processes and Metrology	3	0	0	3
13ME405	Fluid Power Systems	3	0	0	3
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME411	Thermal Engineering Systems Laboratory	0	0	3	2
13ME412	Strength of Materials Laboratory	0	0	2	1
13ME413	Machining Processes and Metrology Laboratory	0	0	3	2
13PT411	Language Competency Development - II	0	0	2	0
	TOTAL	**15**	**4**	**10**	**24**

SEMESTER V

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME501	Mechatronics	3	0	0	3
13ME502	Dynamics of Machinery	2	1	0	3
13ME503	Heat and Mass Transfer	2	1	0	3
13ME504	Design of Machine Elements	2	1	0	3
13GEC02	Ethics and Cyber Security	3	0	0	3
E-1	Elective - I (PE)	3	0	0	3
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME511	Mechatronics Laboratory	0	0	3	2
13ME512	Kinematics and Dynamics Laboratory	0	0	3	2
13ME513	Heat Transfer Laboratory	0	0	3	2
13PT511	Verbal Aptitude and Reasoning - I	0	0	2	0
	TOTAL	**15**	**3**	**11**	**24**

SEMESTER VI

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME601	Industrial Robotics	3	0	0	3
13ME602	Design of Transmission Systems	2	1	0	3
13ME603	Turbo Machinery	2	1	0	3
13ME604	Industrial Engineering and Operations Research	2	1	0	3
13GEC06	Engineering Economics and Cost Analysis	3	0	0	3
E-2	Elective - II (PE)	3	0	0	3
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME611	Turbo Machinery Laboratory	0	0	3	2
13ME612	Mini Project	0	0	2	1
13GE611	Comprehension	0	0	2	1
13PT611	Verbal Aptitude and Reasoning - II	0	0	2	0
	TOTAL	**15**	**3**	**9**	**22**

SEMESTER VII

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GEC01	Principles of Management	3	0	0	3
13ME701	Finite Element Analysis	2	1	0	3
13ME702	CAD / CAM / CIM	2	1	0	3
E-3	Elective - III (PE)	3	0	0	3
E-4	Elective - IV (OE)	3	0	0	3
E-5	Elective - V (OE)	2	0	0	2
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME711	Computer Aided Analysis Laboratory	0	0	3	2
13ME712	CAD / CAM Laboratory	0	0	3	2
13GE711	Personality and Character Development	0	0	1	0
	TOTAL	**15**	**2**	**7**	**21**

SEMESTER VIII

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
E-6	Elective - VI (PE)	3	0	0	3
E-7	Elective - VII (OE)	2	0	0	2
PRACTICAL					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13ME831	Project work	0	0	20	10
	TOTAL	**5**	**0**	**20**	**15**

* PE - Professional Elective
* OE - Open Elective

Total Credits: 27 + 26 + 24 + 24 + 24 + 22 + 21 + 15 = 183

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LIST OF PROFESSIONAL ELECTIVES (PE) FOR E - 1

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13MEX01	Rapid Manufacturing Technologies	3	0	0	3
13MEX02	Design for Manufacturing	3	0	0	3
13MEX03	Refrigeration and Air Conditioning	3	0	0	3
13MEX04	Welding Engineering	3	0	0	3
13MEX05	Power Plant Engineering	3	0	0	3

LIST OF PROFESSIONAL ELECTIVES (PE) FOR E - 2

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13MEX06	Non-Destructive Evaluation and Testing	3	0	0	3
13MEX07	Composite Materials	3	0	0	3
13MEX08	Computational Fluid Dynamics	3	0	0	3
13MEX09	Tool Design	3	0	0	3
13MEX10	Automobile Engineering	3	0	0	3

LIST OF PROFESSIONAL ELECTIVES (PE) FOR E - 3 & E - 6

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13MEX11	Product Design	3	0	0	3
13MEX12	Lean and Agile Manufacturing	3	0	0	3
13MEX13	Fuels and Combustion	3	0	0	3
13MEX14	Metal Forming Technology	3	0	0	3
13MEX15	Tribology	3	0	0	3
13MEX16	Mechanical Vibrations	3	0	0	3
13MEX17	New Venture Planning and Management	3	0	0	3
13MEX18	Cryogenic Engineering	3	0	0	3
13MEX19	Metal Casting Technology	3	0	0	3
13MEX20	Nanotechnology	3	0	0	3

GROUP - I

LIST OF THREE CREDIT OPEN ELECTIVES (OE) FOR E-4

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13CEZ01	Industrial Safety Engineering	3	0	0	3
13CEZ02	Human Behaviors at Work	3	0	0	3
13CEZ03	Air Pollution Management	3	0	0	3
13CEZ04	Building Services	3	0	0	3
13CSZ01	Computer Networks	3	0	0	3
13CSZ02	Software Engineering	3	0	0	3
13CSZ03	Data Structures	3	0	0	3
13CSZ04	Open Source Software	3	0	0	3
13CSZ05	Information Security	3	0	0	3
13ECZ01	Avionics	3	0	0	3
13ECZ02	Sensors and transducers	3	0	0	3
13ECZ03	Modern wireless communication system	3	0	0	3
13ECZ04	Radar and Navigational Aids	3	0	0	3
13EEZ01	Renewable Energy Technology	3	0	0	3
13EEZ02	PLC and Automation	3	0	0	3
13EEZ03	Automotive Electronics	3	0	0	3
13EEZ04	Utilization and Conservation of Electrical Energy	3	0	0	3
13EIZ01	Autotronix	3	0	0	3
13EIZ02	Fiber Optic Sensors	3	0	0	3
13EIZ03	Industrial Automation	3	0	0	3
13EIZ04	Ultrasonic Instrumentation	3	0	0	3
13ITZ01	PC Hardware & Trouble Shooting	3	0	0	3
13ITZ02	Essentials of Information Technology	3	0	0	3
13ITZ03	Developing Mobile Apps	3	0	0	3
13ITZ04	Software Project Management	3	0	0	3
13MEZ01	Six Sigma	3	0	0	3
13MEZ02	Essentials of Radio Frequency Identification	3	0	0	3
13MEZ03	Electric Vehicle Technology	3	0	0	3
13MEZ04	Value Engineering	3	0	0	3

GROUP - II

LIST OF TWO CREDIT OPEN ELECTIVES (OE) E - 5 & E - 7

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GEZ01	Sustainable Development	2	0	0	2
13GEZ02	Waste Management	2	0	0	2
13GEZ03	Design Thinking	2	0	0	2
13GEZ04	Big Data Analytics	2	0	0	2
13GEZ05	Robo Design	2	0	0	2
13GEZ06	Creativity Innovation And New Product Development	2	0	0	2
13GEZ07	Energy Auditing	2	0	0	2
13GEZ08	Energy Conservation	2	0	0	2
13GEZ09	Law for Engineers	2	0	0	2
13GEZ10	Advanced Mathematics for Engineers	2	0	0	2
13GEZ11	Disaster Management	2	0	0	2
13GEZ12	Industrial Psychology	2	0	0	2
13GEZ13	Project Management	2	0	0	2
13GEZ14	Quality Management and Economics	2	0	0	2

GROUP - III

LIST OF TWO CREDIT LANGUAGE ELECTIVES*

THEORY					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
13GEY01	Hindi Language	2	0	0	2
13GEY02	German Language	2	0	0	2
13GEY03	Japanese Language	2	0	0	2

***This course is applicable from third semester onwards**

13GE101 ENGLISH FOR ENGINEERS - I
(Common to All B.E/B.Tech Programmes)

L	T	P	C
3	1	0	4

OBJECTIVES :

- To enable students to build a repertoire of functional vocabulary and to move from the lexical level to the syntactic level
- To train students to summon words, phrases relevant to the immediate communication tasks
- To sensitize students to the nuances of the four basic communication skills - Listening, Speaking, Reading and Writing
- To prepare students acquire the ability to speak effectively in English in real life situations and work related situations

COURSE OUTCOMES :

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

CO1: Develop communicative competence by enunciating words and sentences clearly and effectively.
CO2: Interpret different accents and modulations through active listening.
CO3: Build the habit of reading thereby acquiring knowledge on vide range of vocabulary.
CO4: Improve the ability to speak effectively in English in real life situations and work related situations
CO5: Compose cohesively and coherently avoiding grammatical errors

UNIT I : RECAP OF LANGUAGE SKILLS (9+3)

Prefixes and Suffixes - General Vocabulary - antonym, synonyms, Analogy - Different Grammatical Forms of the Same Word - Tenses - Active and Passive Voices - Troublesome Articles and Prepositions - Adverbs and Phrasal Verbs - Modal Verbs, Compound Nouns and Expanding Nominal Compounds, Framing Wh Questions, Discourse markers

UNIT II : LISTENING FOR EFFECTIVENESS (9+3)

Barriers to Listening - Listening to audio/video lectures - Listening to short conversations or monologues - Taking down phone messages - Listening and note - taking - Listening to role - plays - Listening for verbal and nonverbal communication - Listening to collect Data - Listening to Announcements - Listening to News on the Radio & Television

UNIT III : READING AND LANGUAGE COMPREHENSION (9+3)

Active and Passive Reading- Intensive and Extensive Reading - Reading to understand the usage of Grammar - Skimming and Scanning the text - Interpreting Graphical representations - Reading scientific and Technical text - Reading with a purpose - Reading and note taking

UNIT IV : ACQUISITION OF ORAL AND AURAL SKILLS (9+3)

Basic in Phonetics - Phonetic Transcription - Consonant, Vowel sound - Pronunciation Guidelines related to Consonants and vowels - Stress and Intonation - Developing voice quality - Self Introduction - Welcome address, Vote of Thanks, Master of Ceremony, Short conversations, Dialogue and Debate

UNIT V : PROFESSIONAL WRITING (9+3)

Business Letters - letter writing skills, Parts of a letter - (Calling for Quotation, Placing Orders, Seeking Permission for Industrial Visit, Complaint Letters, Adjustment letters) - Email Writing - Free Writing on any given topic - Instructions and Recommendations

TOTAL: 60 PERIODS

Note:

Listening and speaking activities will be done using Communication Lab and teaching materials will be elicited from various resources with required worksheets to be used in the class

Exercises to be completed in communication lab

1. Listening to role-plays and rewriting the script in reported speech.
2. Extensive listening to a passage to attend multiple choice questions.
3. Listening to the pre-recorded voice, the student can record his/her own voice and compare correctness of his/her pronunciation.
4. Listening to the list of words and marking Stress, Intonation and Phonetic transcription.
5. Listening to audio/video lectures and reproducing in own words.
6. Listening to a text and attending True or False questions
7. Vocabulary Puzzles

TEXT/REFEENCE BOOKS

1. Rizvi and M.Ashraf, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
2. Norman Whitby, "Business Benchmark – Pre-Intermediate to Intermediate", Students Book, Cambridge University Press, 2006
3. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", Orient Blackswan, Chennai. 2012
4. S.P.Dhanavel, "English and Communication Skills for Students of Science and Engineering", Orient Blackswan, Chennai. 2011
5. Viswamohan and Aysha, "English for Technical Communication", Tata McGraw-Hill, New Delhi, 2008
6. M.Hewings, "Advanced English Grammar", Cambridge University Press, Chennai, 2000
7. M.Raman and Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 2005

Extensive reading for internal evaluation

Students have to read the text "Selected Short Stories of the World", Maple Press, Noida and do a review presentation for Internal Assessment

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

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13GE102 ENGINEERING MATHEMATICS - I

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

L	T	P	C
3	1	0	4

OBJECTIVES:

To enable students to

- Identify, formulate and solve Engineering problems
- Use the techniques, Skills and Engineering tools necessary for Engineering practice
- Learn further topics of Mathematics in higher semesters in a graded manner
- Appreciate the important role of Mathematical concepts in Engineering applications

COURSE OUTCOMES:

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

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

CO2: Have grasped the method of two and three dimensional analytical geometry to study the properties of lines and planes in space along with sphere as an illustrative curved surface element, providing an elegant tool for enhanced understanding of two & three dimensional materials which is imperative for engineers

CO3: Understand effectively the geometrical aspects of curvature, involutes and evolutes of plane curves, essential concepts for an engineer, as elegant applications of differential calculus

CO4: Understand and handle functions of more than one variable, from the points of view of their differentiation, expansions and extreme values, along with differentiation under integral sign which are encountered in engineering studies

CO5: Have learnt the methods of double and triple integration, which are needed in their studies in other areas and gained confidence to handle integrals of higher orders

UNIT I : MATRICES (9+3)

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

UNIT II : SOLID GEOMETRY (9+3)

Equation of a Sphere - Tangent plane - Plane section of a sphere - Orthogonal sphere - Equation of a Cone - Right circular cone - Equation of a Cylinder - Right circular cylinder

UNIT III : GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS (9+3)

Curvature - Curvature in Cartesian and polar coordinates - Centre and Radius of curvature - Circle of curvature - Evolutes and Involutes - Envelopes - Properties of envelopes and evolutes - Evolute as envelope of normals

UNIT IV : FUNCTIONS OF SEVERAL VARIABLES (9+3)

Partial derivatives - Euler's theorem on homogeneous function - Total differential - Differentiation of implicit functions - Taylor's expansion - Maxima and Minima - Constrained Maxima and Minima by Lagrange's multiplier method - Jacobians

UNIT V : MULTIPLE INTEGRALS **(9+3)**

Double integration in Cartesian and polar coordinates - Change of order of integration - Area as double integral- Change of variables between Cartesian & Polar Coordinates - Triple integration in Cartesian coordinates - Volume as triple integrals - Beta and gamma function

TOTAL (L:45 + T:15) : 60 PERIODS

TEXT BOOKS:

1. N.P.Bali and Manish Goyal "A text book of ,Engineering Mathematics:Sem-I", 3rd ed., Laxmi Publications, 2011
2. T.Veerarajan, "Engineering Mathematics for first year", 3rd ed., Tata McGraw Hill , 2011
3. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Engineering Mathematics for first year", 7th Revised Edition, S.Chand & Co Ltd, 2010

REFERENCES:

1. B.S.Grewal, "Higher Engineering Mathematics", 40th ed., Khanna publications,2007.
2. Erwin Kreyszig, "Advanced Engineering Mathematics, 8th ed., John Wiley & Sons, 2001

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

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13GE103 ENGINEERING PHYSICS - I
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To develop the skills of the students in Physics under various topics
- This will provide the basic ideas in large number of engineering subjects like civil construction with acoustical aids, ultrasonic techniques, laser technology, communication systems, and digital signal processing

COURSE OUTCOMES:

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

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

UNIT I : ACOUSTICS & ULTRASONCIS (9)

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

Ultrasonic Introduction - Properties of Ultrasonics - Production of ultrasonics - magnetostriction - piezo electric methods - Medical application - Sonogram - Engineering Application - Ultrasonic ABC scanning methods

UNIT II : OPTICS & LASER TECHNOLOGY (9)

Interference: Air wedge - theory - uses - testing of flat surfaces - thickness of a thin wire

Types of lasers - Nd - YAG laser - CO_2 laser - semiconductor laser (homojunction & Hetrojuction) - Applications: Determination of particle size using laser - Holography - construction - reconstruction - Medical and Engineering Applications

UNIT III : FIBER OPTICS AND SENSORS (9)

Fiber Optics: Principle of light transmission through fiber - expression for acceptance angle and numerical aperture- Fabrication of optical fibers - Double crucible method - types of optical fibers (refractive Index profile, mode) fiber optic communication system (block diagram only) - Splicing - Medical Endoscope - Applications of optical fiber - Sensors - Temperature - Pressure sensor and displacement sensor

UNIT IV : WAVE AND PARTICLE PHYSICS (9)

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

UNIT V : CRYSTALOGRAPHY (9)

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

TOTAL : 45 PERIODS

Approved by Fourth Academic council

TEXT BOOKS:

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

REFERENCES:

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

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

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13GE104 ENGINEERING CHEMISTRY
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
3	0	0	3

OBJECTIVES :

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

COURSE OUTCOMES:

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

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

UNIT I : WATER TECHNOLOGY (9)

Hardness - types and estimation by EDTA method (problems) - domestic water treatment - disinfection methods (chlorination, ozonation, and UV treatment) - boiler feed water (scale, sludge, priming, foaming and caustic embrittlement) - internal conditioning (carbonate, phosphate and calgon) - external conditioning - demineralization process - desalination - reverse osmosis method - Spectrophotometric determination of Fe in water, Flame emission spectroscopy - determination of sodium in water, Atomic absorption spectroscopy - determination of nickel - BOD and COD - definition, determination and significance

UNIT II : ELECTROCHEMISTRY AND BATTERIES (9)

Introduction - cell terminology - electrode potential - Nernst equation and problems - reference electrode - standard hydrogen electrode (SHE) and calomel electrode - emf series and its applications - measurement of emf - reversible and irreversible cells - potentiometric titration (redox & precipitation) - conductometric titration (acid-base) - Batteries - definition - characteristics and types - lead acid battery - nickel cadmium battery - fuel cells - flow battery

UNIT III : POLYMERS AND NANOMATERIALS (9)

Polymers - definition - polymerization - types - addition, condensation and co polymerization - plastics - thermoplastics and thermosetting plastics - preparation , properties and uses of PVC, PET,Bakelite,epoxy resins, Teflon and nylon - Compounding of plastics - Polymer processing by compression, injection and blow moulding techniques - Nanomaterials - carbon nanotubes - classification, synthesis and their applications

UNIT IV : CORROSION AND CORROSION CONTROL (9)

Chemical corrosion - Pilling - Bedworth rule - electrochemical corrosion - different types - galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors - protective coatings - paints - constituents and functions - metallic coatings - electroplating (Au) and electroless (Ni) plating

UNIT V : FUELS AND COMBUSTION **(9)**

Fuels - Calorific value - classification - Coal - proximate and ultimate analysis metallurgical coke - manufacture by Otto-Hoffmann method - Petroleum processing and fractions - knocking - octane number and cetane number - synthetic petrol - Fischer Tropsch and Bergius processes - Gaseous fuels - water gas, producer gas and LPG - Lubricants - properties - viscosity index, flash and fire points, cloud and pour points, oiliness) - solid lubricants - graphite and molybdenum sulphide - Flue gas analysis - Orsat apparatus - theoretical air for combustion(problems)

TOTAL : 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", 15th ed., Dhanpat Rai Pub.Co, New Delhi, 2009
2. S.S.Dara, "A Text book of Engineering Chemistry", S.Chand & Co.Ltd ., New Delhi, 2005
3. Dr.A.Ravikrishnan, "Engineering Chemistry", 13th ed., Sri Krishna Hitech publishing Co. Pvt.Ltd., Chennai, 2012

REFERENCES:

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

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

13ME101 ELEMENTS OF MECHANICAL ENGINEERING

(For B.E Mechanical Engineering only)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of mechanical engineering and its industrial applications
- To acquire knowledge on the principles of mechanical design and its stages
- To introduce the fundamentals of mechanics of materials, fluids, thermal and energy systems

COURSE OUTCOMES:

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

CO1: Demonstrate the knowledge on elements of Mechanical engineering, career paths and problem solving approach

CO2: Identify the stages of mechanical design and various power transmission elements

CO3: Classify the types of forces, moments, stresses and engineering materials

CO4: Describe the properties of fluids, types of fluid flow, the effects of drag and lift forces

CO5: Summarize the principles of mechanical and electrical energy generation from various energy sources

UNIT I : ENGINEERING BASICS (9)

Mechanical engineering - Elements of Mechanical Engineering, Mechanical Engineers, Career Paths, Typical Program of Study - Technical problem solving and communication skills, General technical problem solving approach, Unit systems and conversions, Base and Derived Units, International System of Units

UNIT II : MECHANICAL DESIGN (9)

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

UNIT III : MECHANICS OF MATERIALS (9)

Forces in structures and machines - Forces in Rectangular and Polar Forms - Resultant of Several Forces - Moment of a Force - Equilibrium of Forces and Moments - Materials and stresses - Tension and Compression, Material Response, Shear, Engineering Materials - Factor of Safety

UNIT IV : FLUIDS ENGINEERING (9)

Overview, Properties of Fluids, Pressure and Buoyancy Force, Laminar and Turbulent Fluid Flows, Fluid Flow in Pipes, Drag Force, Lift Force

UNIT V : THERMAL AND ENERGY SYSTEMS (9)

Mechanical Energy, Work and Power - Heat as Energy in Transit - Energy Conservation and Conversion, Heat Engines and Efficiency, Internal Combustion Engines, Four-Stroke Engine Cycle, two-Stroke Engine Cycle, Electrical Power Generation, Jet Engines

TOTAL : 45 PERIODS

TEXT BOOK:

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

REFERENCES:

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

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

13EE101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(For Non -Circuit Branches BE-Mechanical & Civil Engineering)

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand the basics of Electrical circuits
- To Study the Operation & Principles of Electrical machines
- To understand the concepts of Semiconductor devices and applications
- To develop the knowledge in the area of Digital electronics
- To learn the basics of Communication system

COURSE OUTCOMES:

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

CO1: To understands the basics of Electrical circuits
CO2: To Study the Operation & Principles of Electrical machines
CO3: To understands the concepts of Semiconductor devices and applications
CO4: To develop the knowledge in the area of Digital electronics
CO5: To learn the basics of Communication system

UNIT I : ELECTRICAL CIRCUITS & MEASURMENTS (9+3)

Ohm's Law - Kirchoff's Laws - Steady State Solution of DC Circuits - Introduction to AC Circuits - Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase Balanced Circuits - Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters

UNIT II : ELECTRICAL MACHINES (9+3)

Construction - Principle of Operation - Basic Equations and Applications of DC Generators - DC Motors - Single Phase Transformer - single phase induction Motor

UNIT III : SEMICONDUCTOR DEVICES AND APPLICATIONS (9+3)

Characteristics of PN Junction Diode - Zener Effect - Zener Diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation - Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Elementary Treatment of Small Signal Amplifier

UNIT IV : DIGITAL ELECTRONICS (9+3)

Binary Number System - Logic Gates - Boolean Algebra - Half and Full Adders - Flip-Flops - Registers and Counters - A/D and D/A Conversion (single concepts)

UNIT V : FUNDAMENTALS OF COMMUNICATION ENGINEERING (9+3)

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

TOTAL: 60 PERIODS

TEXT BOOKS:

1. R.Muthusubramanian, S.Salivahanan and K.A.Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2nd ed., Tata McGraw Hill, 2006
2. R.S.Sedha, "Applied Electronics", S. Chand & Co., 2006

REFERENCES:

1. N.Mittle, “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990
2. T.K.Nagsarkar and M.S.Sukhija, “Basics of Electrical Engineering”, Oxford press 2005
3. V.K.Mehta, “Principles of Electronics”, S.Chand & Company Ltd, 1994
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002
5. N.Premkumar, “Basic Electrical Engineering”, Anuradha Publishers, 2003

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

Approved by Fourth Academic council

13GE111 PHYSICS AND CHEMISTRY LABORATORY- I
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
0	0	3	2

PHYSICS LABORATORY – I

OBJECTIVE:

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

COURSE OUTCOMES :

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

CO1: Acquire the fundamental knowledge in optics such as interference, Diffraction and Understand about the spectral instruments etc

CO2: Gain the basic knowledge about handling the laser light and identify the basic parameters of an optical fibre

CO3: Analyze the properties of matter with sound waves

CO4: Apply knowledge of measurement of hardness producing ions, chloride, alkalinity, DO, conductance, EMF and pH

CO5: Understand the impact of water quality and solve engineering problems

LIST OF EXPERIMENTS :

1. (a) Determination of wavelength , particle size using Laser
   (b) Determination acceptance angle in an optical fiber
2. Determination of thickness of a thin wire - Air wedge method
3. Determination of velocity of sound and compressibility of liquid - Ultrasonic interferometer
4. Determination of wavelength of mercury spectrum - spectrometer grating
5. Determination of thermal conductivity of a bad conductor - Lee's Disc method
6. Determination of Hysteresis loss in a ferromagnetic material

CHEMISTRY LABORATORY - I

LIST OF EXPERIMENTS

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

Note:

- **A minimum of FIVE experiments shall be offered in both physics and chemistry lab.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

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

13GE112 ENGINEERING PRACTICES LABORATORY
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
0	0	3	2

GROUP - A (MECHANICAL AND CIVIL ENGINEERING)

OBJECTIVE:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering

COURSE OUTCOMES:

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

CO1: Apply civil engineering practices like plumping, carpentry and relevant tools to fabricate simple parts

CO2: Make use of manufacturing practices like welding, metal removing, sheet metal works to fabricate the given component

I - CIVIL ENGINEERING PRACTICE (9)

Buildings:

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

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings

(b) Study of pipe connections requirements for pumps and turbines

(c) Preparation of plumbing line sketches for water supply and sewage works

(d) Hands-on-exercise:

Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components

(e) Demonstration of plumbing requirements of high-rise buildings

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture

(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting

II MECHANICAL ENGINEERING PRACTICE (13)

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending

(b) Model making - Trays, funnels, etc.

(c) Different type of joints

Machine assembly practice:

(a) Study of centrifugal pump

(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example Exercise - Production of hexagonal headed bolt

(b) Foundry operations like mould preparation for gear and step cone pulley

(c) Fitting - Exercises - Preparation of square fitting and vee - fitting models

GROUP-B (ELECTRICAL AND ELECTRONICS)

OBJECTIVES:

- To understand the basic working principle of electric devices and electronic components
- To understand and operate multimeter for current, voltage and resistance measurements
- Have the knowledge and technical skills required to be and to remain productive in the field of Electrical Engineering

COURSE OUTCOMES:

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

CO3: Demonstrate the knowledge on the working principles of instruments such as CRO, Function generator, single and dual power supply, multimeter, bread board, IC's and components such as diodes, transistors, resistors, capacitors, inductors, etc.

CO4: Elaborate the testing of capacitors, diodes, transistors with Analog multimeter or Digital multimeter

CO5: Explain the principles of electrical circuits and electronics, and analysis, synthesis, and experimental techniques for both analog and digital electronic circuits

ELECTRICAL ENGINEERING PRACTICE

(a). Residential house wiring using switches, fuse, indicator, lamp and energy meter

(b). Fluorescent lamp wiring

(c). Stair case wiring

(d). Measurement of electrical quantities - voltage, current, power & power factor in RLC circuit.

(e). Measurement of energy using single phase energy meter

(f). Measurement of resistance to earth of an electrical equipment

ELECTRONICS ENGINEERING PRACTICE

(a). Study of Electronic components and equipments - Resistor (Colour coding), Inductor, Capacitor

(b). Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO

(c). Study of logic gates AND, OR, XOR and NOT

(d). Study of Clock Signal

(e). Soldering practice - Components Devices and Circuits - Using general purpose PCB

(f). Study of HWR and FWR

(g). Study of Telephone, FM Radio and Cell Phone

TOTAL: 45 PERIODS

REFERENCES:

1. K.Jeyachandran, S.Natarajan and S.Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007
2. T.Jeyapoovan, M.Saravanapandian and S.Pranitha, "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2006
3. H.S.Bawa, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007
4. A.Rajendra Prasad and P.M.M.S.Sarma, "Workshop Practice", Sree Sai Publication, 2002
5. P.Kannaiah and K.L.Narayana, "Manual on Workshop Practice", SciTech Publications, 1999

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

13ME111 ENGINEERING GRAPHICS LABORATORY
(For B.E Mechanical Engineering only)

L	T	P	C
1	0	2	2

OBJECTIVE:

- To introduce the methodology of creating geometrical constructions, plane curves, projection of points, lines and plane surfaces
- To acquire knowledge on the projection of solids, section of solids and development of surfaces
- To introduce the development of isometric, perspective projections and building drawing

COURSE OUTCOMES:

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

CO1: Create manual drawings of geometric constructions and plane curves
CO2: Construct the projection of points, lines and plane surfaces in the drawing sheets
CO3: Adopt the first angle projection to draw the projection of solids
CO4: Construct the orthographic views of section of solids and development of surfaces
CO5: Develop isometric, perspective projections and building drawing from the given specifications

CONCEPTS AND CONVENTIONS

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning

GEOMETRICAL CONSTRUCTIONS AND PLANE CURVES

Geometrical constructions: Dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and a hexagon

Curves used in engineering practices: Conics - Construction of ellipse, Parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of squad and circle - Drawing of tangents and normal to the above curves

PROJECTION OF POINTS, LINES AND PLANE SURFACES

Projection of points and straight lines located in the first quadrant - Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes

PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other - Obtaining true shape of section

Development of lateral surfaces of simple and truncated solids - Prisms, pyramids, cylinders and cones- Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis

ISOMETRIC, PERSPECTIVE PROJECTIONS & BUILDING DRAWING

Principles of isometric projection - isometric scale - isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method

Plan, elevation and section of single storied residential building with flat RCC roof and brick masonry walls having not more than 2 rooms

Free hand sketching in isometric projection

TOTAL: 45 PERIODS

Approved by Fourth Academic council

REFERENCES:

1. K.Venugopal and V.Prabhu Raja, "Engineering Drawing + AutoCAD", 5th ed., New Age International, 2011
2. Basant Agarwal and C.M.Agarwal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008
3. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
4. M.S. Kumar, "Engineering Graphics", D.D. Publications, 2007
5. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 2011

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

Approved by Fourth Academic council

13GE201 ENGLISH FOR ENGINEERS - II
(Common to All B.E/B.Tech Programmes)

L	T	P	C
3	1	0	4

OBJECTIVES :

- To enable students to convert the conceptual understanding of communication into everyday practice
- To sensitize students to the nuance of the basic listening skills and to explain effectively for active reading
- To train students to summon words, phrases relevant to the immediate communication tasks
- To prepare students acquire the ability to write effectively in English in real life situations and work related situations
- To make students reflect and improve their use of body language - posture, gesture, facial expression, tone

COURSE OUTCOMES:

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

CO1: Develop communicative proficiency by articulating words and sentences undoubtedly
CO2: Interpret different accents and modulations through active listening and effective reading
CO3: Prepare, organize, and deliver an engaging oral presentation and articulate their own ideas in relation to other voices and ideas
CO4: Write effectively for a variety of professional and social settings
CO5: Understood the significance of soft skills in the working environment

UNIT I : LANGUAGE SKILLS (9+3)

General Vocabulary - Vocabulary building activities - Subject - Verb Agreement - Error correction - Common Errors in English - If conditionals - Cause and Effect Expressions - Idioms and Phrases - Style - One Word Substitution, Purpose and means, Homophones and Homonyms

UNIT II : PROFESSIONAL LISTENING AND READING (9+3)

Listening to interviews - Intensive listening to fill up gapped text - Listening to criticize information - Drawing inferences and conclusions - Statement and assumption, statement and conclusion-Reading advertisements, newspapers and interpreting

UNIT III : COMMUNICATION BOOSTERS (9+3)

Conversation and oral skills - Improving fluency an self expression - Body Language - Situational role plays - Impromptu speeches - Planning, Preparing and organizing presentation - Group Discussion - advertising and persuading

UNIT IV : PROFESSIONAL WRITING (9+3)

Resumes and Job Applications - Report Writing - Memo, Agenda and minutes - Checklist - Letters inviting dignitaries, accepting and declining invitation

UNIT V : SOFT SKILLS (9+3)

Leadership and interpersonal skills - Time Management - Intercultural Communication - Telephone Etiquettes - Assertive skills - Adaptability skills - Team work - Etiquette in LSRW - Public speaking skills

TOTAL : 60 PERIODS

Note

Listening and speaking activities will be done using Communication Lab and teaching materials will be elicited from various resources with required worksheets to be used in the class

Exercises to be completed in communication lab

1. Listen to a Noble Lecture for non-verbal communication and make a record of observation.
2. Listening to Interview and taking part in Mock Interview
3. Listening to GD and taking part in Mock GD
4. Listening to News on the Radio & Television
5. Reading Newspaper and Interpreting
6. Intensive listening to fill up gapped text.
7. Listen and complete the conversation

TEXT/REFEENCE BOOKS

1. M.Raman and Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 2005
2. M.A.Rizvi, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
3. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", Orient Blackswan, Chennai. 2012
4. S.P.Dhanavel, "English and Communication Skills for Students of Science and Engineering", Orient Blackswan, Chennai. 2011
5. S.P.Dhanavel, "English and Soft skill", Orient Blackswan Pvt. Ltd., 2010
6. Gerson, J.Sharon and Steven M.Gerson, "Technical Writing - Process and Product", Pearson Education, 2001
7. Aeda Abidi and Ritu Chowdary, "English For Engineers Made Easy", Cengage India Learning Limited, New Delhi, 2010

Extensive reading for Internal evaluation

Students have to read the text "You can win" by Shiv Kera and do a review presentation for Internal Assessment.

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

13GE202 ENGINEERING MATHEMATICS - II
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
3	1	0	4

OBJECTIVES:

Apply knowledge of Mathematics in Engineering

- Communicate problem solutions using correct Mathematical terminology
- Apply rigorous and analytic approach to analyze and solve differential equations

COURSE OUTCOMES:

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

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

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

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

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

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

UNIT I : ORDINARY DIFFERENTIAL EQUATIONS AND APPLICATIONS (9+3)

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogeneous equation of Euler's and Legendre's type - System of first order Simultaneous equations - Simple Harmonic Motion - Electric Circuits - Resisting medium

UNIT II : VECTOR CALCULUS (9+3)

Gradient and Directional derivative - Divergence and Curl - Irrotational and solenoidal vector fields - Line integral over a plane curve - Surface integral and volume integral - Green's, Gauss divergence and Stokes theorem (excluding proofs) - Verification and application in evaluating line, surface and volume integrals

UNIT III : ANALYTIC FUNCTIONS (9+3)

Functions of a complex variable - Analytic functions - Necessary and sufficient conditions for analyticity (excluding proofs) - Properties - Harmonic conjugate - Construction of analytic function - Conformal mapping - Mapping by functions: $w = z + c$, cz, $1/z$, z^2 and bilinear transformation

UNIT IV : COMPLEX INTEGRATION (9+3)

Line integrals-Cauchy's integral theorem and integral formula - Taylor's and Laurent's series - Singularities - Classification - Residues - Residue theorem - Application of residue theorem to evaluate real integrals - Use of circular contour and semi contour with no pole on real axis

UNIT V : LAPLACE TRANSFORM (9+3)

Laplace transform - Conditions for existence - Transform of elementary functions - Basic properties - Initial and Final value theorems - Transform of periodic functions and its application

Inverse Laplace transforms - Convolution theorem (excluding proof) - Applications of Laplace transform for differential equations for 2^{nd} order with constant coefficients

TOTAL (L:45+T:15) : 60 PERIODS

Approved by Fourth Academic council

TEXT BOOKS:

1. N.P.Balaji and Manish Goyal, "A text book of, Engineering Mathematics : Sem-II", 5th ed., Laxmi Publications.2011
2. T.Veerarajan, "Engineering Mathematics for first year", 3rd ed., Tata McGraw Hill, 2011
3. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Engineering Mathematics for first year", 7th Revised Edition, S.Chand & Co Ltd, 2010

REFERENCES:

1. B.S.Grewal, "Higher Engineering Mathematics", 40th ed., Khanna publications, 2007
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th ed., John Wiley & sons, 2001

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

Approved by Fourth Academic council

13GE205 - MATERIAL SCIENCE

(For Non -Circuit Branches BE-Mechanical & Civil Engineering)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To develop the skills of the students in Material science under various topics
- Provide the basic ideas in large number of engineering subjects like Electrical conductions, Semiconductors and Devices, Thermal Physics, Non-destructive testing etc

COURSE OUTCOMES:

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

CO1: Analyze different conducting materials and their behavior

CO2: Know the basics about thermal conductivity of various materials

CO3: Examine the materials using different methods during the manufacturing process

CO4: Acquire information regarding new engineering materials and using them to create new Products

CO5: Gain knowledge about nanotechnology and its various applications

UNIT I : CONDUCTING MATERIALS (9)

Introduction - Derivation of microscopic form of Ohm's law - postulates of classical free electron theory - derivation of electrical conductivity of metals (Drude - Lorentz theory) - merits and demerits - Derivation of thermal conductivity - Wiedemann - Franz law – verification - Electron energies in metal and Fermi energy - Fermi- Dirac distribution function and its variation with temperature - density of energy states - calculation of density of electron and fermi energy at 0K - average energy of free electron at 0K- Importance of fermi energy- problems

UNIT II : SEMICONDUCTING MATERIALS & DEVICES (9)

Intrinsic semiconductor - carrier concentration derivation - Fermi level - Variation of Fermi level with temperature- electrical conductivity - band gap determination - extrinsic semiconductors - carrier concentration derivation in n-type and p-type semiconductor - variation of Fermi level with temperature and impurity concentration - compound semiconductors - Hall effect - Determination of Hall coefficient - Applications

UNIT III : DIELECTRIC MATERIALS (9)

Electrical susceptibility - dielectric constant - electronic, ionic, orientational and space charge polarization - frequency and temperature dependence of polarisation - internal field - Claussius - Mosotti relation (derivation) - dielectric loss - dielectric breakdown - uses of dielectric materials (capacitor and transformer) - ferroelectricity and applications

UNIT IV: THERMAL PHYSICS (9)

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

UNIT V: NON DESTRUCTIVE TESTING (9)

Introduction - various steps involved in NDT process - X-ray radiographic technique - displacement method - merits, demerits and applications of X-ray radiography - X-ray fluoroscopy - liquid penetrant method - advantages, disadvantages and applications - ultrasonic flaw detector - block diagram - construction and working - merits and demerits - Thermography: types-block diagram - recording of thermal images - merits, demerits and applications

TOTAL: 45 PERIIODS

Approved by Fourth Academic council

TEXT BOOKS:

1. V.Rajendran, "Engineering Physics", Tata McGraw-Hill, New Delhi.2011
2. P.K.Palanisami, "Physics for Engineers-Volume I", Scitech publications (India) Pvt.Ltd, Chennai, 2002

REFERENCES:

1. K. Tamilarasan and K. Prabu, "Engineering Physics II", 2nd ed., Tata McGraw-Hill. New Delhi. 2011
2. S.O. Pillai, "Solid State Physics", New Age International Publications, New Delhi, 2006
3. G.Senthil kumar "Engineering Physics - II", VRB Publications, 2011
4. P.K.Palanisamy, "Materials science", 2nd ed., Scitech publications (India) Pvt. Ltd., Chennai, 2007

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

Approved by Fourth Academic council

13GE204 ENVIRONMENTAL SCIENCE AND ENGINEERING
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
3	0	0	3

OBJECTIVES :

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

COURSE OUTCOMES:

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

CO1: Design a system, component, or process to meet desired needs

CO2: Identify, formulate, and solve environmental engineering problems

CO3: Understand the professional and ethical responsibility as related to the practice of environmental engineering and the impact of engineering solutions in a global context

CO4: Use the techniques, skills, and modern engineering tools necessary for environmental engineering practice

CO5: Acquire the knowledge of information technology in environmental science

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

Environment: definition - scope - importance - need for public awareness - Forest resources: Use over exploitation-deforestation - mining - effects on forests and tribal people - Water resources: Use-over utilization of surface and ground water - floods-drought - conflicts over water - Mineral resources: Use exploitation - environmental effects of extracting and using mineral resources - Food resources: World food problems changes caused by agriculture and overgrazing - effects of modern agriculture - fertilizer - pesticide problems - water logging - salinity - Energy resources: Growing energy needs - renewable energy sources - use of alternate energy sources - Land resources: Land as a resource - land degradation - man induced landslides - soil erosion and desertification - Role of an individual in conservation of natural resources

UNIT II : ECOSYSTEMS AND BIODIVERSITY (9)

Concept of an ecosystem: structure and function of an ecosystem - Producers - decomposers - Energy flow in the ecosystem - Ecological succession Food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features - Forest ecosystem - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Biodiversity: Introduction-definition (genetic - species - ecosystem) diversity - Value of biodiversity: consumptive use - productive use - social values - ethical values - aesthetic values - Biodiversity level: global - National - local levels - India as a mega diversity nation - Hotspots of biodiversity - Threats to biodiversity: habitat loss - poaching of wildlife - man wildlife conflicts - Endangered and endemic species of India-Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

UNIT III : ENVIRONMENTAL POLLUTION (9)

Pollution: Definition - Air pollution - Water pollution - Soil pollution - Noise pollution - Thermal pollution - Nuclear hazards - Soil waste management: Causes - effects - control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster managements: floods - earthquake - cyclone - landslides

UNIT IV : SOCIAL ISSUES AND THE ENVIRONMENT **(9)**

Sustainable development - form unsustainable development - Urban problems related to energy - Water conservation - rain water harvesting - watershed management - Resettlement and rehabilitation of people: its problems - concerns - Environmental ethics: Issues - possible solutions - Climate change - global warming - acid rain - ozone layer depletion - nuclear accidents - nuclear holocaust - Wasteland reclamation, Consumerism and waste products - Environment production act: Air (Prevention and control of pollution) act - Water (prevention and control of pollution) act - Wildlife protection act - Forest conservation act - Issues involved in enforcement of environmental legislation - public awareness

UNIT V : HUMAN POPULATION AND THE ENVIRONMENT **(9)**

Population growth - variation among nation- Population explosion-Family welfare programme-Environment and human health -Human rights-Value education-HIV/AIDS-Women and child welfare-Role of information technology in environment and human health-Case studies

TEXTBOOKS:

1. Anubha Kaushik and C.P. Kaushik, "Environmental Science and Engineering", New Age International Publishers, New Delhi, 2006
2. Raman Sivakumar, "Introduction to Environmental Science and Engineering", Tata McGraw Hill Education Private Limited, New Delhi, 2011
3. Dr.A Ravikrishnan, "Environmental Science and Engineering", 8th ed., Sri Krishna Hitech publishing Co.Pvt .Ltd., 2012

REFERENCE BOOKS:

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

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

13ME202 PRINCIPLES OF ENERGY CONVERSION
(For B.E Mechanical Engineering only)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the types of energy sources and principles of mechanical energy generation
- To acquire knowledge on conventional methods of electrical energy generation, renewable energy conversion
- To introduce the types of energy storage methods in various forms

COURSE OUTCOMES:

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

CO1: Identify the various energy sources and their potential applications
CO2: Demonstrate the knowledge on mechanical energy generation from various sources
CO3: Summarize the methods of electrical energy generation different types of sources
CO4: Classify the renewable energy conversion methods
CO5: Describe the principles of energy storage methods in various forms

UNIT I : ENERGY SOURCES **(9)**

Energy- Energy classification, units, Energy sources - Principal sources of energy: conventional and non conventional sources - bio-mass, fossil fuels, nuclear fuels, solar energy - Energy conversion - prospecting, extraction, resource assessment and their peculiar characteristics

UNIT II : ENERGY CONVERSION IN THERMAL SYSTEM **(9)**

Production of thermal energy using bio-mass, fossil fuels, nuclear fuels, solar energy - Conversion of thermal energy, electrical energy, electro-magnetic energy and hydraulic energy into mechanical energy - Energy conversion system: steam turbines, hydraulic turbines and wind turbines - Energy conversion system cycles

UNIT III : ELECTRICAL ENERGY GENERATION **(9)**

Production of electrical energy using thermal energy, chemical energy, electro-magnetic energy and mechanical energy - Magneto hydrodynamic conversion - introduction - MHD plasmas - analysis of MHD generators - MHD power applications - Batteries - basic concepts - electro-chemical principles and reactions - selection and application of batteries - fuel cells - general characteristics - low power fuel cell systems - fuel cell power plants

UNIT IV : ENERGY CONVERSION IN RENEWABLE ENERGY SYSTEMS **(9)**

Production of electrical energy using non-conventional sources: solar energy, wind energy, wave energy, tidal energy and ocean thermal energy. Solar thermal energy conversion system - photovoltaic conversion - optical effects of p-n junction - analysis of PV cells - wave energy conversion system - tidal energy conversion system- wind energy conversion system

UNIT V : ENERGY STORAGE **(9)**

Energy storage: requirements and methods - storage of thermal energy - storage of mechanical energy - storage of electrical energy - storage of chemical energy - storage of nuclear energy

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.W.Culp Jr, "Principles of energy conversion", Tata McGraw Hill, 2000
2. Yogi Goswami and Frank Kreith, "Energy Conversion", CRC Press, 2007

REFERENCES:

1. Homas Reddy and David Linden, "Handbook of Batteries", 4th ed., McGraw-Hill Professional 2010
2. Ahmed F. Zobaa and Ramesh Bansal, "Handbook of Renewable Energy Technology" 1st ed., World Scientific Pub Co Inc, 2011
3. Peter Wurfel and Uli Wurfel, "Physics of Solar Cells: From Basic Principles to Advanced Concepts", 1st ed., Wiley-VCH, 2009
4. W Vielstich, H Yokokawa and H A Gasteiger, "Handbook of fuel cells - Part 1, Volume 5", John Wiley & Sons, 2009
5. J.Cleveland Cutler, "Encyclopedia of Energy", 1st ed., Elsevier, 2004
6. Messerle K.Hugo, "Magnetohydrodynamic Electric Power Generation", 1st ed., J. Wiley, 1995

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

Approved by Fourth Academic council

13CS101 PROBLEM SOLVING AND C PROGRAMMING
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
3	0	0	3

OBJECTIVES :

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

COURSE OUTCOMES :

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

CO1: Acquire the basic knowledge of computer hardware and software
CO2: Implement software development tools like algorithms, flowcharts, etc.
CO3: Design programs involving decision structures, loops and functions
CO4: Solution for various problems using the features of C language
CO5: Study the simple structures, pointers, memory allocation and file handling

UNIT I : INTRODUCTION TO COMPUTERS (9)

Computer Basics - Applications of Computer - Computer organization - Number systems - Computer Software- Types of software - Software Development steps - Basic Internet terminologies - Introduction to Office packages

UNIT II : PROBLEM SOLVING & PROGRAMMING (9)

Creative Thinking & Problem solving skills - Problem solving concepts for Computers, Algorithms & Flowchart - Programming languages - Writing the first C Program, IDE, Compiler error, Linker error - Overview of C - Constants, Variables, Data Types and Storage Class- Operators and Expressions

UNIT III : LOOP & CASE LOGIC STRUCTURES AND FUNCTIONS (9)

Managing Input and Output operations - Control structures - Selection structures, Iteration Structures - Nested Loop structures - Control Transfer Statements- Functions - Elements of User defined Functions, Function Prototypes, Parameter Passing Techniques, Passing Array to Functions, Recursive Functions

UNIT IV : POINTERS & ARRAYS (9)

Pointer concepts- Pointers & Arrays - Pointers to Functions - Array concepts - 1-D , 2-D, 3-D & Dynamic Array - Strings - The Preprocessor

UNIT V : STRUCTURES, UNIONS AND FILES (9)

Structure concepts - Defining, Declaring, Accessing Member Variables, Structures using Pointers, Passing Structures to Functions, Structure within Structure - Union - File Management in C - Dynamic Memory Allocation

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Yashavant Kanetkar, "Let us C", 3 rd ed., BPB publications, New Delhi, 2011
2. E.Balagurusamy, "Fundamentals of computing and programming", 2nd ed., Tata McGraw-Hill Publishing Company Limited, 2012

REFERENCE BOOKS:

1. Ashok.N.Kamthane, "Computer Programming", 2nd ed., Pearson Education (India), 2012
2. Byron S Gottfried, "Programming with C", 2nd ed., Schaum's Outlines, Tata McGraw-Hill, 2006
3. Dromey R.G., "How to Solve it by Computer", 4th Reprint, Pearson Education, 2007
4. B.W.Kernighan and D.M.Ritchie, "The C Programming language", 2nd ed., Pearson Education, 2006

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

13GE211 PHYSICS AND CHEMISTRY LABORATORY- II
(Common to All B.E/ B.Tech. Programmes)

L	T	P	C
0	0	3	2

PHYSICS LABORATORY – II

OBJECTIVE:

- To provide the basic practical exposure to all the engineering and technological streams in the field of physics

COURSE OUTCOMES:

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

CO1: Acquire the practical knowledge in various moduli

CO2: Gain the practical knowledge about band gap of a semiconductor and optoelectronic devices and understand about the spectral instruments

CO3: Analyze the properties of matter and determine the thermal conductivity of a material

CO4: Apply knowledge of measurement of conductance, hardness producing ions, alkalinity and conductance, EMF,pH

CO5: Understand the impact of water quality and to solve engineering problems

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material - non uniform bending
2. Determination of Band Gap of a semiconductor material
3. Determination of viscosity of liquid - Poiseuille's method
4. Spectrometer dispersive power of a prism
5. Determination of Young's modulus of the material - uniform bending
6. Tensional pendulum - Determination of rigidity modulus

CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

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

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

13BE211 COMPUTER AIDED MODELING AND DRAFTING LABORATORY
(For B.E Mechanical Engineering only)

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce fundamentals of modeling and drafting
- To acquire knowledge on drafting of various machine components using a modeling package
- To introduce the steps involved in development of isometric projection

COURSE OUTCOMES:

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

CO1: Create two dimensional CAD models of machine elements
CO2: Construct the two dimensional CAD models of an assembly
CO3: Adopt the first angle projection to create orthographic view of given isometric drawing
CO4: Develop the three dimensional CAD models of machine components
CO5: Build the Isometric Projection machine elements

LIST OF EXPERIMENTS:

1. Introduction to modeling and drafting software
2. Creation of 2 D drawing of Gland
3. Creation of 2 D drawing of Forged Link
4. Creation of 2 D drawing of assembly Flanged Coupling- protected type
5. Creation of Orthographic view of given isometric drawing
6. Creation of 2 D drawing of Cotter Joint with sleeve
7. Creation of 2 D drawing of Knuckle Joint
8. Creation of 3 D drawing of Nut & Bolt
9. Creation of Isometric Projection of Bearing Block
10. Creation of Isometric Projection of Dovetail Bracket
11. Creation of 3D drawing of Geneva Gear

• Modeling and drafting software may be used for conducting the laboratory.

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

Approved by Fourth Academic council

13CS111 - COMPUTER PROGRAMMING LABORATORY

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

L	T	P	C
0	0	3	2

OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Use documentation and comparison tools effectively

CO2: Effectively choose programming components that efficiently solve computing problems in real-world

CO3: Apply and practice logical ability to solve the problems

CO4: Understand C programming development environment, compiling, debugging, linking and executing a program using the development environment

CO5: Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems

a) Word Processing

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

.

b) Spread Sheet

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

c) RAPTOR –Tool

6. Drawing - flow Chart

d) **C-Programming**

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

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

Software

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

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

13GE301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all B.E/B.Tech programmes)

L	T	P	C
3	1	0	4

OBJECTIVE:

- The course aims to impact analytical skills to the students in the areas of boundary value problems and transforms techniques

COURSE OUTCOMES:

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

CO1: Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data

CO2: Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results

CO3: Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair and specialization on Fourier transform pair, their properties

CO4: Be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results

CO5: Have learnt the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved

UNIT I : FOURIER SERIES **(9+3)**

Dirichlet's conditions - Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Complex form of Fourier series - Parseval's identity - Harmonic Analysis

UNIT II : PARTIAL DIFFERENTIAL EQUATIONS **(9+3)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients

UNIT III : BOUNDARY VALUE PROBLEMS **(9+3)**

Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two-dimensional heat equation (Insulated edges excluded) - Fourier series solutions in Cartesian coordinates

UNIT IV : FOURIER TRANSFORM **(9+3)**

Fourier integral theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity - Finite Fourier Transform

UNIT V : Z -TRANSFORM AND DIFFERENCE EQUATIONS **(9+3)**

Z transform - Elementary properties - Inverse Z transform (Partial fraction method and Residue method) - Convolution theorem - Formation of difference equations - Solution of difference equations using Z transforms

TOTAL (L:45+T:15) : 60 PERIODS

TEXT BOOKS:

1. T.Veerarajan, "Engineering mathematics", 3rd ed.., Tata Mc Graw Hill, New Delhi, 2005
2. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Engineering Mathematics - Volume III", S.Chand & Co Ltd., 2006

REFERENCES:

1. Goyal. Manish and N.P.Bali, "A Textbook of Engineering mathematics", 6th ed.., Laxmi Publication (P) Ltd. New Delhi, 2012
2. B.S.Grewal, "Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012
3. Kreyszig Erwin, "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2012

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

13ME301 ENGINEERING MECHANICS
(For Non -Circuit Branches BE - MECHANICAL & CIVIL ONLY)

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the principles of statics of particles, rigid bodies and friction
- To acquire knowledge on centre of gravity, centroid and moment of inertia of various shapes
- To introduce the dynamics of particle and rigid bodies

COURSE OUTCOMES:

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

CO6: Apply the principles of equilibrium to find the resultant forces under system forces in plane or space

CO7: Calculate the reaction forces of various supports of different structures and/or solve numerical problems involving dry friction.

CO8: Determine the centroid, centre of gravity and moment of inertia of various surfaces and solids.

CO9: Solve the numerical problems involving dynamics of particles

CO10: Analyse the dynamic equilibrium of rigid bodies under the action of forces

UNIT I : STATICS OF PARTICLE (6+3)

Introduction to Mechanics - Fundamental Principles - Laws of Mechanics, Lame's theorem, Parallelogram and triangular Law of forces, Coplanar forces - Free body diagram - Equilibrium of particles - Equilibrium of particle in space

UNIT II : STATICS OF RIGID BODY AND FRICTION (6+3)

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

Characteristics of dry friction - Problems involving dry friction - Ladder - Wedges

UNIT III : PROPERTIES OF SECTIONS (6+3)

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

UNIT IV : DYNAMICS OF PARTICLES (6+3)

Displacements, Velocity and acceleration, their relationship - relative motion - Curvilinear motion - Newton's law- Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies - Impact - direct and central impact - coefficient of restitution

UNIT V : DYNAMICS OF RIGID BODIES (6+3)

General plane motion - Velocity and Acceleration - Absolute and Relative motion method - Equilibrium of rigid bodies in plane motion - Newton's Law - D'Alembert's Principle - Work Energy Principle - Principle of impulse momentum for rigid bodies in plane motion

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

TEXT BOOKS:

1. Ferdinand P. Beer, E. Russell Johnston, "Vector Mechanics for Engineers: Statics and Dynamics", 10th ed., Tata McGraw-Hill Education, 2013
2. L.G.Kraige, J.L. Meriam, "Engineering Mechanics - Statics SI Version", 7th Wiley Student Edition, 2013
3. L.G.Kraige, J.L. Meriam,"Engineering Mechanics - Dynamics SI Version", 7th Wiley Student Edition, 2013

REFERENCES:

1. Irving H. Shames, Krishna Mohana Rao, "Engineering Mechanics - Statics and Dynamics", Pearson Education, 2005
2. R. C. Hibbeler, Ashok Gupta, "Engineering Mechanics: Statics and Dynamics in SI Units", 11th ed., Pearson Education Singapore Pte Ltd, 2009
3. Anthony M. Bedford and Wallace Fowler, "Engineering Mechanics: Statics and Dynamics", 5th ed., Pearson Education Singapore Pte Ltd, 2007

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

Approved by Fourth Academic council

13ME302 ENGINEERING THERMODYNAMICS

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the basic principles of thermodynamics and basic conversion principles of mass & energy to closed & open systems
- To acquire knowledge on second law of thermodynamics and its application to various systems
- To introduce the gas laws and equations of state to solve problems of gas mixtures in estimating enthalpy, entropy, specific heat and internal energy
- To introduce the types of fuels and combustion phenomenon to solve problems on stoichiometry, complete combustion, gravimetric and volumetric analysis

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics.
CO2: Identify closed & open systems and/or apply the concept of second law to analyze simple systems
CO3: Determine the available energy and irreversibility of a thermodynamic process
CO4: Apply gas laws to mixtures for estimating the thermodynamic properties
CO5: Analyze combustion characteristics of various fuels using various equipments

UNIT I : BASIC CONCEPTS AND FIRST LAWS THERMODYNAMICS (6+3)

Basic concepts of Thermodynamics - Thermodynamics and Energy - Closed and open systems - Properties of a system - State and equilibrium - Processes and cycles - Forms of energy - Work and heat transfer - Temperature and Zeroth law of thermodynamics - First law of thermodynamics - Energy balance for closed systems - First law applied to steady - flow engineering devices

UNIT II : SECOND LAW OF THERMODYNAMICS (6+3)

Limitations of the first law of Thermodynamics - Thermal energy reservoirs - Kelvin-Planck statement of the second law of thermodynamics - Clausius statement - Equivalence of Kelvin-Planck and Clausius statements - Refrigerators, Heat Pump and Air Conditioners - COP - Perpetual Motion Machines - Reversible and Irreversible process - Carnot cycle - Entropy - The Clausius inequality

UNIT III : AVAILABILITY, EXERGY AND IRREVERSIBILITY (6+3)

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

UNIT IV : IDEAL GAS MIXTURES (6+3)

Ideal and real gases - Vander Waals equation - Principle of corresponding states - Ideal gas equation of state - Other equations of state - Compressibility factor - Compressibility charts - Composition of gas mixtures - Mass and mole fractions - Dalton's law of additive pressures - Amagat's law of additive volumes - Relating pressure, volume and temperature of ideal gas mixtures - Evaluating internal energy - enthalpy - entropy and specific heats

UNIT V : FUELS AND COMBUSTION **(6+3)**

Types of fuels - Exothermic and endothermic reactions - Combustion equations - Stoichiometry - Combustion analysis by mass and volume - Conversion of gravimetric to volumetric analysis - Conversion of volumetric to gravimetric analysis - Analysis of exhaust gas - Excess air and air-fuel ratio - Combustion problem by mole method - Complete combustion of fuel - Calorific value - Definition - Types of calorimeter

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

TEXT BOOKS:

1. P. K Nag, "Engineering Thermodynamics", 5th ed., Tata McGraw Hill Education, 2013
2. Michael A. Boles, Yunus A. Cengel, "Thermodynamics: An Engineering Approach", 7th ed., Tata McGraw - Hill Education, 2011

REFERENCES:

1. Y.V.C.Rao, "An Introduction to Thermodynamics", Revised Edition, Universities Press, 2009
2. C. P. Arora, "Thermodynamics", 1st ed., Tata McGraw - Hill Education, 2001
3. David R. Gaskell,"Introduction to Thermodynamics of Materials", 5th ed., Taylor & Francis India Pvt Ltd - New Delhi, 2012
4. M. Achuthan, "Engineering Thermodynamics", 2nd ed., PHI Learning Private Limited, (Kindle Edition), 2013
5. T. D. Eastop, A. McConkey, "Applied Thermodynamics for Engineering Technologists", 5th ed., Pearson Education, 2002
6. Howard N. Shapiro Michael J. Moran, "Fundamentals of Engineering Thermodynamics", 6th ed., Wiley India Pvt Ltd, 2010

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

13ME303 FLUID MECHANICS

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the fundamentals of fluid mechanics and the applications in aerodynamics, hydraulics, marine engineering, gas dynamics etc.
- To acquire knowledge on fluid properties, hydrostatic laws, flow measurement and major and minor losses during a fluid flow
- To introduce the concept of development of boundary layers and boundary layer separation

COURSE OUTCOMES:

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

CO1: Describe various fluid properties and flow properties
CO2: Demonstrate the understanding of types of flows and governing equations
CO3: Estimate the losses in pipes during a fluid flow and flow parameters in open channels
CO4: Analyze the model and the prototype using dimensional analysis
CO5: Explain the formation of boundary layer and boundary layer separation

UNIT I : FLUID PROPERTIES AND HYDROSTATICS (6+3)

Density - Viscosity - Surface tension - compressibility - capillarity - Hydrostatic forces on plane - inclined and curved surfaces - buoyancy - centre of buoyancy - metacentre

UNIT II : FLUID DYNAMICS (6+3)

Control volume - Fluid Kinematics - Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows - Streamline and Velocity potential lines - Euler and Bernoulli's equations and their applications - moment of momentum - Momentum and Energy correction factors - Impulse - Momentum equation - Navier-Stokes Equations - Applications

UNIT III : OPEN CHANNEL FLOW (6+3)

Flow through pipes - Open Channels and Measurement pipe flow: Darcy's law - Minor losses - Multi reservoir problems - pipe network design - Moody's diagram - Hagen Poiseuille equation - Turbulent flow

Specific Energy - Critical flow concept - specific force - Hydraulic jump - uniform flow and gradually varying flow concepts - Measurement of pressure - flow - velocity through pipes and open channels

UNIT IV : DIMENSIONAL ANALYSIS (6+3)

Dimensional homogeneity - Raleigh and Buckingham π theorems - Non-dimensional numbers - Model laws and distorted models - Unit quantities - Specific quantities

UNIT V : BOUNDARY LAYERS (6+3)

Boundary layers - Laminar flow and Turbulent flow - Boundary layer thickness - momentum - Integral equation - Drag and lift - Separation of boundary layer - Methods of separation of boundary layer

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

TEXT BOOK:

1. R.K.Bansal, "Fluid Mechanics and Hydraulic Machines", 9th Revised Edition, Laxmi Publications, 2011.\

REFERENCES:

1. P.N.Modi, "Hydraulics and Fluid Mechanics including Hydraulic Machines", 19th Revised and Enlarged Edition, Standard Publishers Distributors, 2013
2. Vijay Gupta and Santosh Kumar Gupta, "Fluid Mechanics and Applications", 2nd ed., New Age International, Reprint 2011
3. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S K Kataria & Sons, New Delhi, 2013
4. Victor Streeter, E. Benjamin Wylie, K.W. Bedford, "Fluid Mechanics", 9th ed., Tata McGraw - Hill Education, 2010

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

Approved by Fourth Academic council

13ME304 MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the types of engineering materials and basic concepts of foundry and casting processes
- To acquire knowledge on various methods of welding, cold & hot working and forming
- To introduce technology of forging, molding, powder metallurgy and manufacturing of plastics & composite materials

COURSE OUTCOMES:

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

CO1: Describe the types of engineering materials, casting processes and inspection methods of casted parts
CO2: Demonstrate an understanding of various welding processes for engineering applications
CO3: Classify the metal forming processes and their industrial applications
CO4: Explain the stages in processing of powder metals, ceramics and glass
CO5: Summarize the manufacturing processes for plastics and composite materials

UNIT I : METAL CASTING PROCESSES (9)

Manufacturing - selecting manufacturing process - global competitiveness of manufacturing costs - Fundamentals of materials - their behavior and manufacturing properties - Ferrous metals and alloys - Non ferrous metals and alloys - Fundamentals of metal casting - Fluidity of molten metal - Solidification time - Sand casting - Shell mold casting - Investment casting - Plaster mold casting - Ceramic mold casting - Die casting - Centrifugal casting - Melting practice and furnaces - Defects in Casting - Testing and inspection of casting

UNIT II : JOINING PROCESSES (9)

Metal fusion welding processes - Oxy-fuel gas welding - Arc welding processes - Consumable electrode: SMAW-SAW - GMAW - FCAW - Electro gas welding - Electro slag welding - Non-consumable Electrode: GTAW-AHW- PAW - Solid state welding processes: Ultrasonic welding - Friction welding - Friction stir welding - Resistance welding - Weld quality - Testing welded joints

UNIT III : METAL FORMING PROCESSES (9)

Cold and Hot working: Rolling - Forging - Extrusion - Drawing - Sheet metal forming processes - High Energy Rate Forming Processes: Explosive Forming - Electro Hydraulic Forming - Electro Magnetic Forming

UNIT IV : PROCESSING OF POWDER METALS, CERAMICS AND GLASS (9)

Production of metal powders: Compaction - Sintering and Finishing - Design considerations for powder metallurgy and Process capability - Shaping of ceramics - Forming and shaping of glass - Design considerations for ceramics and glass - Processing of superconductors

UNIT V : PROCESSING OF PLASTICS AND COMPOSITE MATERIALS (9)

Types of Plastics - Types of Molding: Injection molding - Blow molding - Compression molding - Transfer molding - Thermoforming - Reinforced plastics - Metal Matrix Composites - Ceramic Matrix Composites

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Serope Kalpakjain, Steven R. Schmid, "Manufacturing Engineering and Technology", 5th ed., Dorling Kindersley, Reprint 2009
2. P.N.Rao, "Manufacturing Technology - Foundry, Forging and Welding Volume - 1", 4th ed., Tata McGraw Hill Publishing Company Ltd., New Delhi, 2013

REFERENCE :

1. Hajra Choudhury S.K, "Elements of Manufacturing Technology Volume I - Manufacturing Processes", Media Promoters, 2012

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

Approved by Fourth Academic council

13ME305 MATERIALS ENGINEERING AND TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the structure of materials, crystallography, microstructure, defects and phase transformation of materials under temperature ranges
- To acquire knowledge on heat treatment methods and mechanical behavior of materials
- To introduce the types of non ferrous alloys & advanced materials and their applications

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of types of defects in engineering materials and cooling curves
CO2: Describe the stages of phase transformation of various materials and phase diagrams
CO3: Recommend a volumetric and/or surface heat treatment method for an engineering application
CO4: Analyze the behaviour of various materials under the action of different types of mechanical loading conditions
CO5: Summarize the applications of non ferrous alloys and advanced materials

UNIT I : BASIC CONCEPTS (9)

Introduction to Materials Science, Defects - Point, Line, Planar, Volume - Slip planes and slip systems, Schmid's rule, Polymorphism and allotropy - Solidification - Nucleation and Growth mechanism, Cooling curve of pure metal and alloy

UNIT II : PHASE DIAGRAMS AND PHASE TRANSFORMATION (9)

Phase, Gibbs's Phase rule, Solubility and Solid Solutions - Isomorphous alloy system - Binary Eutectic alloy system (Lead-Tin System), Eutectoid and Peritectic system, Iron-Iron carbide phase diagram - Invariant reactions, Evolution of Microstructure, Phase Transformation - Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation (CCT) Diagrams - Steels, Cast Irons and Stainless steels - types and applications – Effects of alloying elements

UNIT III : HEAT TREATMENT AND SURFACE HEAT TREATMENTS (9)

Heat Treatment - Annealing and its types, Normalizing, Austempering, Mar-tempering, Quenching and Temper heat treatment, Hardenability - Basic concepts of wear and corrosion & their types - Surface hardening processes - Flame and induction hardening, Carburizing, Nitriding and Carbonitriding

UNIT IV : MECHANICAL PROPERTIES OF MATERIALS (9)

Tension, Compression, Shear and Torsional Test of Metals -Stress-strain behavior of ferrous & non-ferrous metals, polymer and ceramics - True stress and strain relations - Flexural Test, Hardness measurement tests, Fracture of metals - Ductile Fracture, Brittle Fracture, Fatigue - Endurance limit of ferrous and non-ferrous metals - Fatigue test - Creep and stress rupture - mechanism of creep - stages of creep and creep test, Strengthening mechanisms

UNIT V : NON FERROUS ALLOYS & ADVANCED MATERIALS (9)

Non Ferrous Alloys of Aluminum, Magnesium, Copper, Nickel, Titanium - Microstructure and mechanical property relationships - Composites - Classification, Processing, Metal Matrix, Ceramic Matrix, polymer matrix - properties and applications - Ceramics - Alumina, Zirconia, Silicon Carbide, Sialons, Reaction Bonded Silicon Nitride(RBSN), Processing, properties and applications of ceramics, Glasses - properties and applications

TOTAL : 45 PERIODS

TEXT BOOK :

1. Balasubramaniam.R, "Callister's Materials Science and Engineering (With CD)", 2nd ed., Wiley India Pvt Ltd 2014

REFERENCES:

1. J.C. Anderson, K.D. Leaver, P. Leavers and R.D. Rawlings, "Materials Science for Engineers", 5th ed., CRC Press, 2003
2. William F. Smith and Javad Hashemi, "Foundations of Materials Science and Engineering", 5th ed., McGraw Hill, 2009
3. Sidney H Avner, "Introduction to Physical Metallurgy", 2nd ed., Tata McGraw Hill Publishing Company Limited, 2008
4. Krishnan K. Chawla, "Composite materials, Science and Engineering", 3rd ed., Springer India Pvt Ltd, 2013
5. Lawrence E.Murr, "Material and Component Failure, Failure Analysis and Litigation", 1st ed., Volume-20, Marcel Dekker Inc. publications, 1986

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

13ME311 FLUID MECHANICS LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

- To introduce the measurement of flow properties using orifice, mouth piece, notches and venturi
- To acquire knowledge on measurement of losses through the pipes
- To introduce the measurement of hydrostatics properties

COURSE OUTCOMES:

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

CO1: Measure the flow parameters using orifice and mouth piece
CO2: Estimate the flow parameters using Triangular and Rectangular Notches
CO3: Calculate the flow velocity using venturi and orifice meters
CO4: Determine the losses of flow through the pipes
CO5: Make use of Reynold's apparatus, Bernoulli's apparatus and impact of jet apparatus to measure hydrostatic properties

LIST OF EXPERIMENTS

1. Flow through Orifice
   a) Constant Head Method
   b) Variable Head Method
2. Flow through Mouth Piece
   a) Constant Head Method
   b) Variable Head Method
3. Flow through Triangular Notch
4. Flow through Rectangular Notch
5. Flow through Venturi meter
6. Flow through Orifice Meter
7. Flow through Pipes
8. Flow through Annulus Double pipe
9. Reynold's apparatus
10. Verification of Bernoulli's Apparatus
11. Impact of jet apparatus.
12. Flow through pitot tube.
13. Metacentric height apparatus.

TOTAL:30 PERIODS

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

13ME312 MANUFACTURING PROCESSES LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce the basic operations in lathe such as turning, thread cutting, drilling, boring etc.,
- To acquire knowledge on simple welding operations using Arc, TIG and MIG welding machines
- To introduce the molding process and the sequence of processes involved in the preparation of green sand mold.

COURSE OUTCOMES:

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

CO1: Create cylindrical parts using the lathe operations
CO2: Measure the cutting forces using Lathe tool dynamometer
CO3: Choose the welding process to join or cut the material
CO4: Make use of Brazing / Soldering to fabricate a joint
CO5: Prepare green sand mold using the given pattern

LATHE OPERATIONS

- Facing, plain turning, step turning and groove cutting
- Taper Turning, Thread cutting, Knurling
- Drilling and boring
- Eccentric Turning
- Determination of cutting forces using Lathe tool dynamometer

WELDING EXERCISES

- Arc welding
- Gas cutting, Gas welding
- Brazing / Soldering

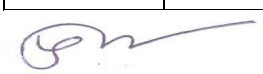
PREPARATION OF SAND MOULD

- Mould with solid pattern
- Mould with split pattern
- Mould with loose piece pattern
- Mould with core and cavity

TOTAL: 45 PERIODS

Mapping of COs and POs

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



13ME313 COMPUTER AIDED MACHINE DRAWING

L	T	P	C
0	0	4	2

OBJECTIVES:

- To introduce the basics and standards of drawing related to machines and components.
- To acquire knowledge on part, assembly drawings, limits, fits and tolerances.
- To introduce the methodology of modelling and drafting of components and assemblies.

COURSE OUTCOMES:

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

CO1: Describe the conventions in machine drawing
CO2: Explain limits, fits and tolerance for various engineering applications
CO3: Select tolerance of mating parts by considering the functional requirements
CO4: Create sectional view of a component with the given cutting plane
CO5: Develop assembly drawing from the given part drawings

UNIT I : DRAWING STANDARDS (20)

Code of Practice for Engineering Drawing - BIS specifications - Conventional representation - Welding symbols - riveted joints - keys - fasteners - Reference to hand book for the selection of standard components like bolts - nuts - screws - keys etc.

UNIT II : LIMITS, FITS AND TOLERANCES (20)

Limits - Fits and tolerances - Allocation of fits for various mating parts – Tolerance data sheet – Tolerance table preparation - Geometric tolerance.

UNIT III : COMPUTER AIDED ASSEMBLY AND DETAILED DRAWING (20)

Solid modeling of simple and intricate machine and automobile components - Surface modeling of automobile body and Appliances(electrical and domestic) - Preparation of assembled and detailed drawings of I.C.Engine components viz: Cylinder head - Piston - Connecting rod and Crankshaft assembly - Carburettor - Fuel pump etc.,

TOTAL: 60 PERIODS

TEXT BOOK:

1. N.D.Bhatt and V.M.Panchal, "Machine Drawing", 46th ed., Charotar Publishing House, 2011

REFERENCES:

1. Brian Griffiths, "Engineering Drawing for Manufacture", Butterworth-Heinemann Publishers, 2002
2. Cecil Jensen, Jay Helsel and Donald D. Voisinet, "Computer-aided engineering drawing using AutoCAD", 2nd ed., McGraw-Hill, New York, 1996
3. N.Sidheswar, P.Kanniah and V.V.S.Sastry, "Machine Drawing", Tata McGraw Hill Education, 2001

Note : Both manual drafting and computer aided drafting have to be given equal weightage for experiments.

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

13PT311 LANGUAGE COMPETENCY DEVELOPMENT – I
(COMMON TO ALL B.E/B.TECH PROGRAMMES)

L	T	P	C
0	0	2	0

OBJECTIVES:

- To make students speak English fluently with emphasis on:
  - Articulation
  - Vocabulary
  - Content
- To develop the habit of self research for learning among students
- To develop behavioral skills among students across all levels
- To develop reading habits
- To develop persuasion and negotiation skills

COURSE OUTCOMES:

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

CO1: Articulate fluently in English on the day to day affairs

CO2: Know the areas from where they can research and learn English

CO3: Exhibit professionalism

CO4: Exhibit expertise on world affairs

CO5: Exhibit persuasion skills

UNIT I : AUXILIARIES **(7)**

am, is, are (statement and questions) - I am doing - are you doing? - I do/work/like - I don't - Do you - I am doing and I do - I have / I've got

UNIT II : TENSE **(10)**

was/were - worked/got/went - I didn't…did you…? - I was doing - I was doing and I did - I have done - I've just…I've already…I haven't…yet - Have you ever…? - How long have you…? - for since ago - I have done and I did - is done was done - is being done has been done - be/have/do

UNIT III : MODALS **(7)**

Regular and irregular verbs - I used to… - What are you doing tomorrow? - I'm going to… - will/shall - will/shall - might - can and could - must - should

TOTAL: 24 PERIODS

TEXT BOOK:

1. English Spoken Course materials from the Speak Easy academy.

REFERENCES:

1. Wren, Martin, "High School English Grammar and Composition", 1st ed., S.Chand & Company Ltd, 2011
2. Dr.B.B.Jain , "UPKAR's Correct English – How to Write it", Upkar Prakashan Publishers, 2005

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

13GE404 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVE:

- To introduce the concept of hypothesis testing and design of experiments
- To acquire knowledge on numerical methods for solution of equations
- To introduce the interpolation, numerical differentiation and numerical integration methods
- To introduce the methods of numerical solution of initial and boundary value problems

COURSE OUTCOMES:

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

CO1: Conduct testing of hypothesis for means, proportions, variances and independence of attributes
CO2: Determine the significance of various parameters using design of experiments
CO3: Apply a numerical method find the solution for an algebraic equation and system of equations
CO4: Make use of numerical methods to carry out interpolation, differentiation and integration
CO5: Solve initial and boundary value problems by using suitable numerical method

UNIT I : TESTING OF HYPOTHESIS (9+3)

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small Samples - t, F, chi square test) - Tests for single variance and equality of variances - chi-square test for goodness of fit (Binomial distribution only) - Independence of attributes

UNIT II : DESIGN OF EXPERIMENTS (9+3)

Completely randomized design - Randomized block design - Latin square design - 2^2 factorial design

UNIT III : SOLUTION OF EQUATIONS (9+3)

Newton Raphson method - Single variables - Regula falsi method - Gauss Elimination method - Pivoting - Gauss-Jordan methods - Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method- Relaxation method.

UNIT IV : INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION (9+3)

Introduction of operators - Newton's forward and backward difference interpolation for equal intervals - Lagrange's and Newton's divided difference interpolation for unequal intervals - Approximation of derivatives using interpolation polynomials - Numerical Integration using Trapezoidal rule, Simpson's 1/3 rule and 3/8 rule

UNIT V : INITIAL AND BOUNDARY VALUE PROBLEM IN ORDINARY DIFFERENTIAL EQUATIONS (9+3)

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

TOTAL (L:45+T:15): 60 PERIODS

TEXT BOOKS:

1. A. Johnson Richard and C.B.Gupta, "Miller & Freund's Probability and Statistics for Engineers", 7th ed., Pearson Education, 2006
2. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Numerical Methods – Vol: IV", S.Chand & Co. Ltd. New Delhi, 2003

REFERENCES:

1. Walpole, Ronald. E, Myers, Sharon. L, and Ye. Keying, "Probability and Statistics for Engineers and Scientists", 8th ed., Pearson Education, 2007
2. Spiegel, M.R. J. Schiller and Srinivasan. R.A, "Schaum's Outlines Probability and Stastistics", 3rd ed., Tata McGraw Hill, New Delhi, 2010
3. Chapra. C, Steven and Canale. P, Raymond, "Numerical Methods for Engineers", 5th ed., Tata McGraw Hill, New Delhi, 2007
4. Grewal. B.S and Grewal. J.S, "Numerical methods in Engineering and Science", 6th ed., Khanna Publishers, New Delhi, 2004

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

Approved by Fourth Academic council

13ME401 KINEMATICS OF MACHINERY

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the basic types of mechanisms, joints and degrees of freedom to perform position, velocity and acceleration analysis using graphical and analytical methods.
- To acquire knowledge on friction drives power transmission
- To introduce the kinematic analysis of cam-follower motion and gear trains

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of the various mechanisms in engineering applications
CO2: Determine the velocity and acceleration of links in a mechanism using graphical and analytical methods
CO3: Estimate the amount of power transmitted through friction drives
CO4: Examine the displacement of various cam and follower arrangements
CO5: Analyze the amount of transmitted power using various gear arrangements

UNIT I : BASICS OF MECHANISMS (6+3)

Introduction to mechanisms and its terminologies - Degree of freedom - Mobility - Kutzbach criterion - Grubler's criterion for planar mechanisms - Grashoff's law - Kinematic Inversions of 4-bar chain - Single slider and double slider crank chains - Quick return mechanism - Limiting positions - Mechanical advantage - Transmission angle - Ratchets and escapements - Indexing Mechanisms - Rocking Mechanisms - Straight line generators

UNIT II : KINEMATIC ANALYSIS OF SIMPLE MECHANISMS (6+3)

Displacement, velocity and acceleration analysis in simple mechanisms having turning, sliding and rolling pair - Coriolis acceleration using graphical relative motion method - Instantaneous center method - Four bar and slider crank mechanisms - Analytical method for four bar and slider crank mechanisms

UNIT III : FRICTION DRIVES (6+3)

Torque transmitted in Plate clutches - Screw jack - calculation of torque and power - Limiting ratio of belt and rope tensions, centrifugal tensions - Condition for maximum power transmission, corresponding speed in belt drives, Basics of shoe and band brakes

UNIT IV : KINEMATICS OF CAMS (6+3)

Types of cams and followers - Definitions related cam profile - Derivatives of follower motion - High speed cams - Undercutting - Graphical disk cam profile design - Simple harmonic motion, Constant acceleration and deceleration, constant velocity, Cycloidal motion for knife edge and roller (in-line and offset), flat faced and oscillating followers - Tangent cam with roller follower - circular arc cam with flat faced follower

UNIT V : KINEMATICS OF GEARS AND GEAR TRAIN (6+3)

Spur gear terminology and definitions - Law of toothed and involute gearing - Interchangeable gears - Gear tooth action - Interference and undercutting - Basics of nonstandard gear teeth - Helical - Bevel - Worm - Rack and pinion gears, cycloidal tooth properties - Comparison of involute and cycloidal tooth forms - Gear trains - Speed ratio, train value - Parallel axis gear trains - Epicyclic Gear Trains - Sun and Planet Gear - Differentials - Automobile gear box.

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

TEXT BOOKS:

1. S.S. Rattan, "Theory of Machines", 3rd ed., Tata McGraw-Hill, 2009
2. A.G.Ambekar, "Mechanism and Machine Theory", 1st ed., Prentice Hall of India, New Delhi, 2009

REFERENCES :

1. John J. Uicker, Jr., Gordon R. Pennock and Joseph E. Shigly, "Theory of Machines and Mechanisms", 3rd ed., Oxford University Press, 2009
2. Hamilton H Mabie and Charles F Reinholtz, "Mechanisms and Dynamics of Machinery", 4th ed., John-Wiley and Sons, Inc, New York, 1987
3. A.Ghosh and A.K.Mallick, "Theory of Mechanisms and Machines", 3rd ed., East-West Press, New Delhi, 2006
4. Kenneth J Waldron and Gary L Kinzel, "Kinematics, Dynamics, and Design of Machinery", 2nd ed., Wiley India Pvt Ltd, 2011

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

Approved by Fourth Academic council

13ME402 THERMAL ENGINEERING SYSTEMS

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the principles, working and performance of IC engines.
- To acquire knowledge on analysis of stages in vapour and gas power cycles
- To introduce the flow characteristics in types of compressors and nozzles
- To introduce the types of refrigeration, air conditioning and waste heat recovery systems

COURSE OUTCOMES:

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

CO1: Identify the types, components of IC engines and explain the function of each components
CO2: Solve numerical problems on vapour and gas power cycles
CO3: Estimate the performance characteristics of positive displacement compressors and/or flow parameters of steam nozzles
CO4: Recommend a specification of refrigeration system and/or explain the basics of cryogenic systems
CO5: Demonstrate the knowledge of air conditioning systems, waste heat recovery and thermal storage

UNIT I : IC ENGINES (6+3)

Review of construction and working of two stroke and four stroke engines - SI engines - Fuel systems - Types of carburetor - Simple carburetor - Ignition systems - Combustion - Detonation factors and remedies - CI engines - Fuel injection system - Fuel pump - Combustion - Knocking Factors and remedies - Rating of fuels - Cooling and lubrication - Supercharging and turbocharging - Stratified charged engines - Lean burn engines

UNIT II : VAPOUR AND GAS POWER CYCLES (6+3)

Properties of pure substance - Property diagram for phase - change processes - Carnot vapour cycle - Rankine cycle- Methods for improving the efficiency of Rankine cycle - Ideal Reheat and Regenerative cycles - Binary vapour cycles - Combined gas - vapour power cycles - Analysis of power cycles - Carnot cycle - Air standard assumptions - Otto cycle - Diesel and Dual cycles - Brayton cycle - Stirling and Ericsson cycles

UNIT III : POSITIVE DISPLACEMENT COMPRESSORS AND STEAM NOZZLES (6+3)

Reciprocating compressors - Construction - Working - Effect of clearance volume - Multi staging - Volumetric efficiency - Isothermal efficiency

Steam Nozzle - One-dimensional steady flow of steam through a convergent and divergent nozzle - Equilibrium and Meta stable flow

UNIT IV : REFRIGERATION (6+3)

Reverse Carnot cycle- Bell-Colman's cycle - Air craft refrigeration cycles - Vapor compression cycle - Components - Working - P-H and T-S diagrams - Calculation of COP - Effect of sub-cooling and super-heating - Vapour absorption system - Ideal and actual cycles - Cryogenic engineering - Introduction - Liquefaction of gases - Application

UNIT V : AIR CONDITIONING AND WASTE HEAT RECOVERY SYSTEMS (6+3)

Psychometric - Processes - Chart - Summer and winter air conditioning - Cooling load calculations - SHF - RSHF - GSHF - ESHF components used in air conditioner - Types of air conditioning units

Sources of waste heat - Heat recovery for industrial application - Thermal storage - principles and applications of hot and cold systems - Sensible heat and latent heat system - Phase change storage materials

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

TEXT BOOKS :

1. R.K.Rajput, "Thermal Engineering", 9th ed., Laxmi Publications Ltd, 2010
2. M.L.Mathur and R.P.Sharma, "Internal Combustion Engines", Dhanpat Rai Publications, 2010

REFERENCES :

1. Manohar Prasad, "Refrigeration and Air Conditioning", 2nd ed., New Age International publications, 2012
2. K.Soman, "Thermal Engineering", Kindle Edition, PHI Learning Private Limited, 2013

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

Approved by Fourth Academic council

13ME403 STRENGTH OF MATERIALS

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the fundamentals of stresses and strain under various loading conditions
- To acquire knowledge on construction of shear force and bending moment diagram for different types of beams and/or determine the deflection of beams using appropriate methods
- To introduce the concept of torsion of shafts, theory of columns and the concept of biaxial stresses

COURSE OUTCOMES:

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

CO1: Determine the stresses and strains under various loading conditions and/or thermal stresses
CO2: Construct shear force and bending moment diagrams for different types of beams
CO3: Solve problems on deflection of beams to find slope and deflection
CO4: Estimate the stresses in the shafts under torsion and/or stresses in the columns
CO5: Construct Mohr's circles to find principle stresses and strains and/or find the stresses in thin cylinders

UNIT I : STRESSES AND STRAINS (6+3)

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

UNIT II : SIMPLE BENDING (6+3)

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

UNIT III : DEFLECTION OF BEAMS (6+3)

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

UNIT IV : TORSION AND COLUMNS (6+3)

Introduction to Torsion - derivation of shear strain - Torsion formula - stresses and deformations in circular and hollow shafts - Stepped shafts - shafts fixed at the both ends - Stresses in helical springs

Theory of columns - Long column and short column - Euler's formula - Rankine's formula - Secant formula - beam column

UNIT V : BI-AXIAL STRESS SYSTEM (6+3)

Biaxial state of stress - Stress at a point - stresses on inclined planes - Principal stresses and Principal strains and Mohr's circle of stress, Theories of failure

Thin cylinders and shells - deformation of thin cylinders and shells - Thick Cylinders, Shrink fits, Compounding. Fundamentals of theory of elasticity

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

TEXT BOOKS :

1. S. Ramamrutham and R. Narayanan, "Strength of Materials", 14th ed., Dhanpat Rai Publications, 2011

REFERENCES :

1. Rowland Richards, "Principles of Solid Mechanics", CRC Press, 2000
2. S.P.Timoshenko and D.H.Young, "Elements of Strength of Materials", 5th ed., East West Press Ltd, 2011
3. R.K. Bansal, "A textbook of Strength of Materials : Mechanics of Solids (SI Units)", 5th ed., Laxmi Publications, 2010

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

Approved by Fourth Academic council

3ME404 MACHINING PROCESSES AND METROLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the theory of metal cutting, mechanism of machining and the parameters influencing the machining processes
- To acquire knowledge on different operations that can be performed in machines such as turning, shaping, slotting, milling, grinding etc.
- To introduce the different gear generation methods and principles of non traditional machining processes
- To introduce the measurement methods using various instruments

COURSE OUTCOMES:

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

CO1: Demonstrate the knowledge of theory of metal cutting and methods of cutting force measurement
CO2: Identify the operations that can be performed in lathe, shaping machine, planning, slotting, drilling machines
CO3: Describe the machining operations that can be performed in milling and grinding machines
CO4: Recommend a gear generation method and/or explain the working principles of non conventional machining processes
CO5: Select an instrument for measuring the dimension of the manufactured components

UNIT I : THEORY OF METAL CUTTING (9)

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

UNIT II : LATHE AND BASIC MACHINE TOOLS (9)

Lathe - Types - Operating Parameters - lathe operations - Tool nomenclature - Work holding devices
Shaping - Planing - Slotting - Drilling - Boring - Reaming - Tapping - Broaching

UNIT III : MILLING AND GRINDING MACHINES (9)

Milling machines - Cutters - Milling operations - Indexing.
Grinding – Types of grinding machines - Grinding wheel designation and selection - Bond and Bonding processes.

UNIT IV : GEAR GENERATION AND NONTRADITIONAL MACHINING PROCESSES (9)

Gear generating principles - Gear Hobber - Gear finishing methods - Bevel gear generator.
Classification of Nontraditional Machining process - Principle of AJM, WJM, USM, EDM, ECM, EBM, LBM - Process characteristics - Applications

UNIT V : METROLOGY AND INSTRUMENTATION (9)

Measurement standards - Linear, angular and form measuring instruments - Comparators - Gauge blocks - Gauges- Optical instruments - Profilometer - Coordinate measuring machine - laser interferometer - Gear Measurement, Introduction to Nano-Measurement

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Serope Kalpakjain, Steven R. Schmid, "Manufacturing Engineering and Technology", 5th ed., Dorling Kindersley, Reprint 2009
2. P. N. Rao, "Manufacturing Technology", Vol. 2, 3rd ed., Tata McGraw Hill Publications, 2013

REFERENCES :

1. P.C. Sharma, "Text book of Production Technology : Manufacturing Processes", 7th ed., S.Chand & Company Ltd, New Delhi, 2008
2. O.P. Khanna and M. Lal, "A Text book of Production Technology", Dhanpat Rai Publications, New Delhi, 2006

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

13ME405 FLUID POWER SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the operating principle of fluid power systems and power sources for hydraulic and pneumatic systems
- To acquire knowledge on hydraulic and pneumatic components and their working principles
- To introduce the methods of constructing the circuits for the given requirements
- To introduce the steps involved in fluid power maintenance and troubleshooting

COURSE OUTCOMES:

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

CO1: Describe the concept of fluid power and its applications
CO2: Identify the sources of power for hydraulic and/or pneumatic systems
CO3: Demonstrate the knowledge to select appropriate controlling devices based on the applications
CO4: Construct the fluid power circuits by the functional requirements
CO5: Summarize the steps involved in maintenance and troubleshooting of fluid power systems

UNIT I : INTRODUCTION TO FLUID POWER (9)

Definition - Hydraulics Vs Pneumatics - Standards - Application - Basic Principle of Hydraulics - Pascal's Law - Transmission and multiplication of force - Basic properties of hydraulic fluids - liquid flow - static head pressure - pressure loss - Power - Basic principle of pneumatics: absolute pressure and Temperature - gas laws - vacuum

UNIT II : HYDRAULIC AND PNEUMATIC POWER SUPPLY SOURCE (9)

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

UNIT III : HYDRAULIC AND PNEUMATIC CONTROL COMPONENTS (9)

Cylinders - accumulators - FRL-Directional control Valves - Pressure control valves - Flow control Valves - electronic control components - symbols

UNIT IV : BASIC CIRCUITS (9)

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

UNIT V : FLUID POWER SYSTEM MAINTENANCE (9)

Introduction, Sealing Devices - Reservoir System - Filters and Strainers - Beta Ratio of Filters -Wear of Moving Parts - Gases in Hydraulic Fluids - Temperature Control - Troubleshooting

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Antony Esposito, "Fluid Power with applications", 6th ed., Pearson Education Singapore Pte Ltd, 2008

REFERENCES:

1. James L.Johnson, "Introduction to Fluid power", Delmar Cengage Learning, 2001
2. "Hydraulic systems Hand book", Utility Publications Ltd, Secunderabad, 1988

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

13ME411 THERMAL ENGINEERING SYSTEMS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce the methods to study the performance characteristics of IC engines, air blower and air compressor
- To acquire knowledge on the operating characteristics of Refrigeration and Air conditioning systems
- To introduce the measurement of aerodynamic properties of airfoil

COURSE OUTCOMES:

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

CO1: Conduct the performance test on IC engines
CO2: Determine the performance of reciprocating air compressor and air blower
CO3: Analyze the performance of Refrigeration and Air conditioning systems
CO4: Measure the power generated from steam and boiler setup
CO5: Estimate the aerodynamic properties of airfoil

LIST OF EXPERIMENTS

1. Performance and Heat balance test on S.I & C.I engines
2. Morse test
3. Measurement of Frictional power using retardation
4. Determination of calorific value of fuels
5. Performance test on reciprocating air compressor
6. Performance test on air blower
7. Performance test on vapour compressor refrigeration system
8. Performance test on air-conditioning system
9. Test on Boiler
10. Test on Steam turbine
11. Measurement of lift and drag of an aerofoil
12. Measurement of static pressure distribution around an aerofoil using wind tunnel apparatus

TOTAL : 45 PERIODS

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

Approved by Fourth Academic council

13ME412 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

- To introduce the functional aspects of universal testing machine
- To acquire knowledge on various hardness, fatigue and impact testing methods
- To introduce the brick compression testing, deflection testing and spring testing methods
- To introduce the methods of load and strain measurement

COURSE OUTCOMES:

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

CO1: Construct stress-strain diagram for a given specimen under different loading conditions
CO2: Apply a testing methods to find compression strength and/or deflection of given material
CO3: Measure the hardness and/or impact strength of the given specimen using suitable testing method
CO4: Estimate the spring constant for the given spring by using suitable testing method
CO5: Determine the load and strain on the specimen for the given loading conditions

LIST OF EXPERIMENTS

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

TOTAL : 30 PERIODS

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

Approved by Fourth Academic council

13ME413 MACHINING PROCESSES AND METROLOGY LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce the basic operations that can be performed in lathe, shaping, slotting, milling, grinding machine etc.
- To acquire knowledge on methods of measurement of cutting forces, average chip-temperature and surface finish during turning process
- To introduce the methods of measuring the dimensions using various measuring instruments

COURSE OUTCOMES:

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

CO1: Measure the temperature, cutting forces, flank wear and surface finish of a manufacturing process
CO2: Create a prismatic part which involves operations in slotting, shaping and grinding machines
CO3: Develop a physical model of the gear using gear cutting and generation methods
CO4: Make use of tool and cutter grinding machine to grind the worn out single point cutting tool
CO5: Conduct the calibration of measuring instruments and/or measure linear, angular and gear parameters using a measuring instrument

LIST OF EXPERIMENTS

I. MACHINING EXPERIMENTS

1. Experiments on Lathe to establish the cutting speed, feed and depth of cut on cutting forces
2. Measurement of flank wear using Tool Maker's microscope and plotting the effect of turning parameters on average flank wear
3. Effect of cutting speed, feed and depth of cut on average surface roughness for a given work and tool material during turning process
4. Measurement of cutting tool temperature in turning and plotting effect of turning parameters on average temperature
5. Machining slots using shaping and slotting machines
6. Gear cutting using milling and gear hobbing machines
7. Surface grinding and measurement of surface roughness for different feed rate
8. Grinding of single point cutting tool as per given specifications (to check the tool angles)
9. Study on Electrical discharge die sinking and wire-EDM. (Only demonstration)

II. METROLOGY EXPERIMENTS

1. Calibration of the following instruments:
   i. Calibration of Micrometer ii. Calibration of Mechanical Comparator
   iii. Calibration of Vernier Caliper iv. Calibration of Dial Gauge
2. Measurement of taper angle using
3. i. Bevel Protractor ii. Dial Gauge iii. Sine-Bar
4. Alignment tests:
   i. Parallelism of the spindle ii. Circularity & Concentricity of the spindle
5. Gear parameters Measurement
   i. Diameter, pitch/module ii. Pitch circle diameter
   iii. Pressure angle iv. Tooth thickness

TOTAL: 45 PERIODS

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

13PT411 LANGUAGE COMPETENCY DEVELOPMENT - II
(COMMON TO ALL B.E/B.TECH PROGRAMMES)

L	T	P	C
0	0	2	0

OBJECTIVES:

- To make students speak English fluently with emphasis on:
  - Articulation
  - Vocabulary
  - Content
- To develop the habit of self research for learning among students
- To develop behavioral skills among students across all levels
- To develop reading habits
- To develop persuasion and negotiation skills

COURSE OUTCOMES:

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

CO1: Articulate fluently in English on the day to day affairs
CO2: Know the areas from where they can research and learn English
CO3: Exhibit professionalism
CO4: Exhibit expertise on world affairs
CO5: Exhibit persuasion skills

UNIT I : QUESTIONS PATTERNS AND TAGS (10)

I have to… - Would you like …? I'd like… - there is there are - there was/were there has/have been there will be - It… - I am I don't etc - Have you? Are you? Don't you? Etc. - too/either so am I / neither do I etc. - isn't haven't don't etc. - Is it? Have you…? Do they…? Etc. - Who saw you? Who did you see? - Who is she talking do? What is it like? - What…? Which…? How…? - How long does it take…? - Do you know where…? I don't know what…etc.

UNIT II : REPORTED SPEECH - SAID, TOLD, WANT SERIES (10)

She said that… He told me that… Work/working go/going do/doing - to…(I want to do) and ing (I enjoy doing) - I want you to… I told you to… - I went to the shop to… go to… go on… go for… going - get - do and make - have.

UNIT III : SELF DESCRIPTIONS (10)

I/me he/him they/them etc. - My/his/their etc. - Whose is this? It's mine/yours/hers etc. - I/me/my/mine.

TOTAL: 30 PERIODS

TEXT BOOK:

1. English Spoken Course materials from the Speak Easy academy

REFERENCES:

1. Wren, Martin, "High School English Grammar and Composition", 1st ed., S.Chand & Company Ltd, 2011
2. Dr.B.B.Jain, "UPKAR's Correct English - How to Write it", Upkar Prakashan Publishers, 2005

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

13ME501 MECHATRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

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

UNIT I : INTRODUCTION (9)

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

UNIT II : SENSORS AND SIGNAL CONDITIONING (9)

Terminologies - displacement, position and proximity sensors - velocity and motion sensors - force sensors - pressure and temperature sensors - signal conditioning processes - operational amplifier - inverting, non inverting, summing, integrating, difference and logarithmic amplifiers.

UNIT III : ACTUATORS IN MECHATRONICS SYSTEMS (9)

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

UNIT IV : MICROPROCESSOR AND PLC (9)

Microprocessor systems - architecture of Intel 8085A microprocessor and Intel 8051 microcontroller - basic PLC structure - ladder programming - latching and internal relays - sequencing - timers and counters - shift registers - master and jump controls - data handling - analog input / output.

UNIT V : DESIGN OF MECHATRONICS SYSTEM (9)

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

TOTAL: 45 PERIODS

TEXT BOOK:

1. Bolton .W, "Mechatronics", 4th ed., Pearson Education, 2010

REFERENCES:

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

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

Approved by Fourth Academic council

13ME502 DYNAMICS OF MACHINERY

L	T	P	C
2	1	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of turning moment diagrams and/or design flywheel for an IC engine with the consideration of geometrical constraints
CO2: Conduct static and dynamic balancing of rotary and reciprocating machines
CO3: Analyze longitudinal vibrations of systems with single degree of freedom
CO4: Determine the frequency of transverse and torsional systems
CO5: Calculate gyroscopic couple on various vehicles and/or demonstrate knowledge of governors

UNIT I : FORCE ANALYSIS AND FLYWHEELS (6+3)

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

UNIT II : BALANCING (6+3)

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

UNIT III : LONGITUDINAL VIBRATION (6+3)

Definitions - types of vibrations - basic features of vibratory systems - degrees of freedom - inertia effect of the mass of spring - damped vibrations - logarithmic decrement - Forced vibrations - forced damped vibrations - magnification factor - vibration isolation and transmissibility - forcing due to unbalance, support motion - governing equations - expressions for amplitude and phase angle

UNIT IV : TRANSVERSE, TORSIONAL VIBRATIONS AND VIBRATION MEASUREMENT (6+3)

Transverse vibrations - Single concentrated load - uniformly loaded shaft - shaft carrying several loads - whirling of shafts - Torsional vibrations - free torsional vibrations - single rotor system, two rotor system, three rotor system - torsionally equally shaft - geared system - Vibration measuring instruments- accelerometers - frequency measurement - Fullarton, Frahm Tachometers

UNIT V : MECHANISMS FOR CONTROL (6+3)

Governors - Types - Watt, Porter, Proell, Hartnell Governors - sensitiveness, hunting, isochronisms, stability - Effort and power of governors - coefficient of Insentiveness - Gyroscope - angular velocity, acceleration - gyroscopic torque - gyroscopic effect on aeroplanes, naval ships - stability of an automobile, two wheel vehicle

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

TEXT BOOKS:

1. Rattan.S.S, "Theory of Machines", 4th ed., Tata McGraw Hill Education Pvt. Ltd, 2014

REFERENCES:

1. Joseph E. Shigley, Gordon R. Pennock, John J. Uicker. Jr, "Theory of machines and mechanisms", 4th ed., Oxford university press, New Delhi, 2014
2. Singh.V.P, "Mechanical Vibrations", 4th ed., Dhanpat Rai& Co Pvt. Ltd, 2014
3. Bansal.R.K, "Theory of Machines", 5th ed., Laxmi Publications, New Delhi, 2011
4. Khurmi.R.S, Gupta.J.K, "Theory of Machines", 14th ed., S.Chand & Company Pvt.Ltd, Reprint 2013.

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

Approved by Fourth Academic council

13ME503 HEAT AND MASS TRANSFER

L	T	P	C
2	1	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Determine the amount of heat transferred in various systems under steady state
CO2: Solve numerical problems on heat transfer with internal heat generation and/or transient heat transfer
CO3: Estimate the heat transfer coefficient and the amount of heat transferred under convection
CO4: Analyse the radiation heat transfer and/or heat transfer by boiling & condensation
CO5: Examine heat transfer in heat exchangers and/or diffusion & convective mass transfer

UNIT I : STEADY STATE HEAT CONDUCTION (6+3)

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

UNIT II : CONDUCTION WITH HEAT GENERATION (6+3)

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

UNIT III : CONVECTION (6+3)

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

UNIT IV : RADIATION, BOILING AND CONDENSATION (6+3)

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

UNIT V : HEAT EXCHANGERS AND MASS TRANSFER (6+3)

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

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

(Use of Heat and Mass transfer Data book and Steam tables is permitted in the examination)

TEXT BOOK:

1. Sachdeva.R.C, "Fundamentals of Engineering Heat and Mass transfer", 4th ed., New age international publishers, Reprint 2014

DATA BOOKS:

1. Kothandaraman.C.P, "Heat and mass transfer data book", 8th ed., New age international publishers, Reprint 2014
2. Khurmi.R.S, "Steam tables with Mollier chart", S.Chand publications 2011

REFERENCES:

1. Yunus A Cengel, "Heat and Mass Transfer", 4th ed., McGraw Hill Education (India) Pvt Ltd, 2011
2. Incropera and Dewitt, "Fundamentals of Heat and Mass Transfer", Wiley India Pvt Ltd, 2012
3. Holman.J.P, "Heat Transfer", 10th ed., McGraw Hill Education (India) Pvt Ltd, 2011
4. Ozisik.M.N, "Heat Transfer: A Basic Approach", Mcgraw-hill Companies, 1984

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

Approved by Fourth Academic council

13ME504 DESIGN OF MACHINE ELEMENTS

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the design methodology of machine elements
- To acquire knowledge on analyzing the forces acting on a machine element and apply the suitable design methodology
- To introduce the various standards and methods of standardization.

COURSE OUTCOMES:

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

CO1: Describe the stages in design, material selection, failure theories and/or determine the stresses acting on given components

CO2: Estimate the variable stresses acting on the machine elements under cyclic loading and/or Recommend the dimensions of shaft for the loading condition with selected material

CO3: Apply the design procedure to create temporary and permanent joints

CO4: Design the couplings and spring by considering the operating conditions

CO5: Select the design specification of bearings, connecting rod and crank shaft

UNIT I : STRESSES IN MACHINE ELEMENTS (6+3)

Procedure in design process - Factors influencing machine design, selection of materials based on mechanical properties - Fits and tolerance - Direct, bending and Torsional stress equation - bending stress in curved beams - crane hook and 'C' frame - Stress concentration factor - load factor - surface finish factor - Size factor - Factor of safety - Theories of failures

UNIT II : VARIABLE STRESSES AND DESIGN OF SHAFTS (6+3)

Variable stresses in machine parts - cyclic stresses - Fatigue and endurance limit- SN curve - Goodman and Soderberg methods - combined normal stress and variable stress - Design of solid and hollow shafts based on strength and rigidity.

UNIT III : TEMPORARY AND PERMANENT JOINTS (6+3)

Welded joints - types - basic weld symbols - strength of transverse and parallel fillet welded joints - axially loaded unsymmetrical welded sections - eccentrically loaded welded joints - Design of Screwed joints- Design of knuckle joints - design of riveted joints

UNIT IV : DESIGN OF COUPLINGS AND SPRINGS (6+3)

Couplings - types- Design of muff coupling, Flange coupling, Design of bushed pin flexible coupling - Springs - terminology, types, materials - Design of helical and leaf springs-End Conditions

UNIT V : MACHINE ELEMENTS (6+3)

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings - Sommerfeld Number - Selection of Rolling contact bearings - Connecting rod and crank shafts.

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

(Use of PSG Design Data book is permitted in the examination)

TEXT BOOKS:

1. Khurmi.R.S and Gupta.J.K, "A textbook of Machine Design", S.Chand publications, Reprint 2014

DATA BOOKS:

1. Design Data, compiled by PSG College of Technology, Kalaikathir Achchagam, Coimbatore, Reprint 2010.

REFERENCES:

1. Bhandari V.B, "Design of Machine Elements", 3rd ed., Tata McGraw-Hill Book Co, 2010
2. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003
3. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett, "Mechanical Engineering Design", 8th ed., Tata McGraw-Hill, 2008
4. Ganesh Babu.K, Srithar.K, "Design of Machine Elements", 2nd ed., McGraw Hill Education (India) Private Limited, 2009

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

13GEC02 ETHICS AND CYBER SECURITY
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of engineering ethics and social aspect of ethics
- To acquire knowledge on ethical issues, behaviours and responsibilities
- To introduce the ethics in global perspective and overview of cyber security

COURSE OUTCOMES:

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

CO1: Describe the importance of ethical issues, theories and applications
CO2: Summarize the need of ethical behaviour in engineering by considering the safety aspects
CO3: List the ethical responsibilities and Intellectual Property Rights
CO4: Relate the ethical issues in global perspective
CO5: Explain the necessity for cyber security and its stages

UNIT I : ENGINEERING ETHICS (9)

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories - Case studies - cellular phones and cancer, cellular phones and automotive safety.

UNIT II : ENGINEERING AS SOCIAL EXPERIMENTATION AND SAFETY (9)

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Case studies - The Challenger disaster, automobile crash testing.

UNIT III : RESPONSIBILITIES AND RIGHTS (9)

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination - Case studies - Three Mile Island, Chernobyl.

UNIT IV : GLOBAL ISSUES (9)

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership - Case studies - Bhopal Gas Tragedy, Kumbakonam School Fire Tragedy

UNIT V : CYBER SECURITY (9)

Cyber Security - Cyber Security policy - Cyber Security Evolution - Cyber Security Management - Arriving at Goals - Cyber Security Documentation - The Catalog Approach - Catalog Format - Cyber Security Policy Taxonomy - Risk Management

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Naagarajan.R.S, "A textbook on Professional Ethics and Human Values", New age International publishers, 1st ed., Reprint 2013

REFERENCES:

1. Kiran.D.R, "A textbook on Professional Ethics and Human Values", Tata McGraw Hill publishing company, 2007
2. Charles D. Fleddermann, "Engineering Ethics", 2nd ed., Pearson Education Singapore, 2007
3. Douglas Jacobson and Joseph Idziorek, "Computer Security Literacy - Staying Safe in a Digital World", CRC Press, 2013
4. Govindarajan M, Natarajan S, and Senthil Kumar V. S, "Engineering Ethics", 1st ed., Prentice Hall of India, New Delhi, 2009
5. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, Auerbach Publications 2010.

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

13ME511 MECHATRONICS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES

- To introduce the elements of Mechatronics systems
- To acquire knowledge on working principles of various mechatronics systems
- To introduce the concepts of computerized data logging system

COURSE OUTCOME:

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

CO1: Create the control circuits for mechanical actuators using various controls in trainer kits
CO2: Develop the control circuits using the simulation package
CO3: Apply the concepts of mechatronics in control of AC servo motor and stepper motor
CO4: Adopt the concept of control system to control the process variables
CO5: Compile the real time data of a mechatronics system using the computerized data logging system

LIST OF EXPERIMENTS:

1. Manual Control of single acting and double acting cylinders using direction control valves
2. Control of single acting cylinder using timer and push button with solenoid operated valves
3. Control of double acting cylinder using DPDT relay and two way switch with solenoid operated valves.
4. Design and testing of fluid power circuits to control direction, velocity and force in double acting cylinder using hydraulic trainer kit.
5. Simulation of cylinder sequencing using hydraulic and electrical controls
6. Hydraulic cylinder sequencing using cascade method
7. Pneumatic cylinder sequencing using Internal Relay
8. Design of meter-in and meter-out circuits
9. Speed - Torque characteristics of AC Servo motor
10. Stepper motor interfacing with microprocessor
11. Process control using PID controller
12. Computerized data logging system for process control variables like pressure, flow, level and temperature.

TOTAL: 45 PERIODS

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

Approved by Fourth Academic council

13ME512 KINEMATICS AND DYNAMICS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce the measurement methods of moment of inertia, frequency of vibration, deflection and critical speed of shaft
- To acquire knowledge on mechanism for control namely governors and gyroscopic couples
- To introduce the velocity, acceleration analysis and balancing methods

COURSE OUTCOMES:

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

CO1: Determine the moment of inertial of the given component and/or frequency of vibration of spring mass system

CO2: Estimate the critical speed of the shaft with rotating disc experimentally

CO3: Measure the deflection of various beams with different loading conditions

CO4: Demonstrate the knowledge on mechanism for control namely governors and gyroscopic couples

CO5: Analyse the velocity, acceleration of mechanisms and/or measure the unbalance mass experimentally

LIST OF EXPERIMENTS:

1. Determination of moment of inertia of an object by oscillation method
2. Determination of the natural frequency of vibration (spring mass system)
3. Determination of the whirling speed of shaft
4. Deflection of beam- fixed-free (cantilever) beam
5. Determination of the jump speed and drawing profile of cam
6. Determination of the gyroscopic couple using motorized gyroscope
7. Determination of the time period and natural frequency of the free torsional vibration of the single rotor of system
8. Determination of the radius of gyration of the bar using bifilar suspension system
9. Studying the characteristics and to plot the characteristic curves for various governors - Watt, Porter
10. Determination of the slider velocity, slider acceleration and angular velocity of connecting rod in a slider crank mechanism
11. Dynamic balancing of rotating shafts

TOTAL: 45 PERIODS

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

Approved by Fourth Academic council

13ME513 HEAT TRANSFER LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce the concepts of estimating the amount of heat transfer experimentally
- To acquire knowledge on radiation heat transfer
- To introduce the type of heat transfer in heat exchangers

COURSE OUTCOMES:

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

CO1: Measure the thermal conductivity of given material using guarded plate and lagged pipe
CO2: Estimate the convection heat transfer coefficient for inside tube and pin fin under forced convection
CO3: Determine the heat transfer coefficient in vertical cylinder under natural convection
CO4: Evaluate the Stefan - Boltzman constant and emissivity the real surface experimentally
CO5: Predict the amount of heat transfer in a parallel and counter flow heat exchanger

LIST OF EXPERIMENTS:

HEAT TRANSFER

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

TOTAL: 45 PERIODS

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

Approved by Fourth Academic council

13PT511 VERBAL, APTITUDE AND REASONING - I

L	T	P	C
0	0	2	0

OBJECTIVES :

- To develop students to workout solution for problems that involves mathematics aptitude
- To develop students to workout solutions for problems that involving general reasoning
- To develop students to become sharp in usage of English grammar

COURSE OUTCOMES:

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

CO1: Solve aptitude problems with ease

CO2: Solve reasoning problems with ease

CO3: Improve written communication skills in English

UNIT I : VERBAL **(10)**

Tense - Articles - Preposition - Subject Verb agreement - Sentences completion - Sentence Improvement - Incorrect sentences - Jumble sentence

UNIT II : REASONING **(10)**

Odd man out - Number series - Diagrammatic question - Non verbal reasoning - Venn Diagram - Syllogism - Coding & decoding - Seating arrangement, Height arrangement

UNIT III : APTITUDE **(10)**

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

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Verbal Book by Kaushal.B.Shah
2. Reasoning & Aptitude Book by Vignesh.D

REFERENCES:

1. Quantitative Aptitude by Dinesh Khattar
2. Objective English by Hari Mohan Prasad & Uma Rani Sinha
3. A Modern approach to verbal &non verbal reasoning by R.S.Aggarwal
4. High school English Grammar & Composition by Wren & Martin

Mapping of COs and POs

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

Approved by Fourth Academic council

13ME601 INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the constructional features and basics of robotics
- To acquire knowledge on various sensors used in robotics
- To introduce the steps involved in developing robot programming

COURSE OUTCOMES:

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

CO1: Describe the specifications of robot configurations and/or the use of control systems in robots
CO2: Develop the expression for robot movements and/or identify the types of end effectors
CO3: Demonstrate the knowledge on working principles of various sensors and machine vision
CO4: Identify the steps involved in robot programming using programming languages
CO5: Apply the principles of robotic material handling in a work space and/or determine the economic factors of robot opeations

UNIT I : FUNDAMENTALS OF ROBOTICS AND CONTROL SYSTEMS (9)

Robot anatomy - work volume - robot drive systems - control systems and dynamic performance - precision movement - basic control systems concepts and models - controllers - control system analysis- robot activation and feedback components - position and velocity sensors - power transmission - robot joint control design

UNIT II : MOTION ANALYSIS AND END EFFECTORS (9)

Manipulator kinematics - homogeneous transformations - robot kinematics - manipulator path control - robot dynamics - configuration of robot controller - End effectors - types - mechanical grippers - other types of grippers - tools as end effectors - robot end effectors interface - considerations in gripper selection and design

UNIT III : SENSORS AND MACHINE VISION (9)

Transducers and sensors - sensors in robotics - tactile sensors - proximity and range sensors - miscellaneous sensors - sensor based systems - uses of sensors in robotics - machine vision - sensing and digitizing - image processing and analysis - training and vision system - robotic applications

UNIT IV: ROBOT PROGRAMMING AND LANGUAGES (9)

Programming methods - leadthrough programming - methods, capabilities, limitations - program as a path in space - motion interpolation - WAIT, SIGNAL, DELAY commands - branching - Textual languages - structure - constants, variables, other data objects - motion commands - computations & operations - program control & subroutines - communications & data processing - monitor mode commands

UNIT V : ROBOT CELL DESIGN AND ECONOMIC ANALYSIS (9)

Robot cell layouts - multiple robots - machine interference - other considerations - work cell control - interlocks - work cell control - interlocks - error detection and recovery - work cell controller - cycle time analysis - graphical simulation - economic analysis - methods - differences in production rates - other factors - project analysis form

TOTAL: 45 PERIODS

TEXT BOOK:

1. Mikell P Groover, "Industrial Robotics: Technology, Programming, and Applications", 2nd ed., McGraw Hill Education (India) Private Limited, 2012

REFERENCES:

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", 1st ed., McGraw Hill Book Co., 2008
2. Richard D.Klafter, Thomas A.Chmielewski and MichealNegin, "Robotic engineering - An Integrated Approach", Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 2005
3. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
4. Deb.S.R, "Robotics Technology and Flexible Automation", 2nd ed., McGraw Hill Education (India) Private Limited, 2009

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

Approved by Fourth Academic council

13ME602 DESIGN OF TRANSMISSION SYSTEMS

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the design procedure of flexible power transmission systems
- To acquire knowledge on design of gears and gear boxes
- To introduce the design requirements of clutches and brakes

COURSE OUTCOMES:

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

CO1: Design belt drives and chain drives for transmitting power in engineering application
CO2: Recommend the design specifications of spur and helical gears by considering the loading conditions
CO3: Select the dimensions of bevel and worm gears by taking the speed requirements
CO4: Construct the layout of gearbox for the given speed ranges and design considerations
CO5: Determine the dimensions of clutches and brakes by employing the design procedures

UNIT I : DESIGN OF FLEXIBLE POWER TRANSMISSION SYSTEMS (6+3)

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

UNIT II : SPUR GEAR AND PARALLEL HELICAL GEARS (6+3)

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

UNIT III : BEVEL AND WORM GEARS (6+3)

Straight bevel gears - kinematics - force analysis - stresses in straight bevel gear tooth - design of bevel gear - worm gearing - forces - friction and efficiencies - stresses in worm gear tooth

UNIT IV : DESIGN OF GEAR BOXES (6+3)

Design of speed reducers - design of multi speed gear boxes for machine tools - structural and ray diagrams

UNIT V : MOTION CONTROL: CLUTCHES AND BRAKES (6+3)

Internal expanding rim clutches and brakes - external contracting rim clutches and brakes - band type clutches - cone clutches and brakes - energy considerations - temperature rise - friction materials

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

(Use of PSG Design Data book is permitted in the examination)

TEXT BOOKS :

1. Bhandari V.B, "Design of Machine Elements", 3rd ed., Tata McGraw-Hill Book Co, 2010
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th ed., Tata McGraw-Hill, 2008

DATA BOOKS:

1. Design Data, compiled by PSG College of Technology, Kalaikathir Achchagam, Coimbatore, Reprint 2010.

REFERENCES:

1. Gitin M Maitra, "Hand Book of Gear Design", 2nd ed.,McGraw Hill Education (India) Private Limited, 2004
2. Sundararajamoorthy T. V, Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003
3. Gitin Maitra, L. Prasad, “Hand book of Mechanical Design”, 2nd ed., Tata McGraw-Hill, 2004
4. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000

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

13ME603 TURBOMACHINERY

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the principles and operation of different types of turbo machinery components
- To acquire knowledge on velocity triangles, losses in turbomachines and pumps
- To introduce the working principles of fans, turbines, pumps etc.,

COURSE OUTCOMES:

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

CO1: Identify the components of turbo machines and/or analysis the gas turbine power plants
CO2: Solve analytical problems in centrifugal compressors to find the performance characteristics
CO3: Determine the velocity profiles by drawing the inlet and outlet velocity triangles of hydraulic pumps
CO4: Estimate the performance characteristics of hydraulic turbines using velocity triangles
CO5: Demonstrate the knowledge of compressible flow parameters

UNIT I : INTRODUCTION AND GAS TURBINE PLANTS (6+3)

Turbo Machines - Turbines, Pumps and Compressors and Stages - Fans and Blowers - Compressible and Incompressible flow machine - Extended turbo machines - Axial, Radial, Mixed flow, impulses, reaction variable reaction stages - multistage machines - stage velocity triangles - design and off design conditions - Applications - Open and closed gas turbine plants - Gas turbine power plants

UNIT II : CENTRIFUGAL COMPRESSOR (6+3)

Elements of Centrifugal compressor stages - Stage Velocity triangles - Enthalpy - Entropy diagrams - Nature of impeller flow - Slip factor - Diffuser - Volute casing - Stage losses - performance and characteristics

UNIT III : HYDRAULIC PUMPS (6+3)

Pumps: Definition and classifications - Centrifugal pump - classifications - working principle - Work done - Reciprocating pump: Classification - Working principle - Indicator diagram - Work done - Air vessels - Working principle

UNIT IV : HYDRAULIC TURBINES (6+3)

Definition and Classification of hydraulic turbines - Pelton turbine - Francis turbine - Kaplan turbine - Working principles - Velocity triangles and work done - Specific speed - Efficiency - Governing of turbines

UNIT V : COMPRESSIBLE FLUID FLOW (6+3)

Adiabatic energy equation - stagnation velocity of sound, stagnation pressure, stagnation density - stagnation state- various regions of flow - reference velocities - effect of mach number on compressibility

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

TEXT BOOKS:

1. Yahya, S.M., "Turbines, Compressors and Fans", 4th ed., Tata McGraw Hill Publishing Company, 2011
2. Bansal.R.K, "Fluid Mechanics and Hydraulic Machines", 9th ed.,Laxmi Publication (P) Ltd., New Delhi, 2011
3. Yahya, S.M, "Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion", 4th ed., New Age International Publishers, 2010

REFERENCES:

1. Douglas J.F., Gasiorek, J.M and SwaffieldJ.A., "Fluid Mechanics", 5th ed., Pearson India, 2008
2. Dixon, S.L, "Fluid Mechanics and Thermodynamics of Turbomachinery", 7th ed., Elsevier India Pvt. Ltd, 2014
3. Kadambi and Prasad, "Energy conversion Vol. III – Turbomachines", 2nd ed., Wiley Eastern, 2011.
4. Arasu.A.V, "Turbo Machines", 2nd ed., Vikas Publishing House, 2012

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

Approved by Fourth Academic council

13ME604 INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

L	T	P	C
2	1	0	3

OBJECTIVES:

- To introduce the concepts of industrial engineering, work study and work measurement
- To acquire knowledge on facility layouts, line balancing and inventory control
- To introduce linear programming, transportation and assignment models
- To introduce the concept of project management using CPM/PERT

COURSE OUTCOMES:

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

CO1: Demonstrate an understanding of the concept of industrial engineering, production systems and productivity

CO2: Describe the steps involved in work study and work measurement

CO3: Recommend a facility layout for the manufacturing operations and/or solve numerical problems on line balancing and inventory control

CO4: Determine the optimum parameters using linear programming, transportation and assignment models

CO5: Estimate the duration of a project using Critical Path Method and/or Program Evaluation and Review Technique

UNIT I : INDUSTRIAL ENGINEERING AND PRODUCTION SYSTEM (6+3)

Industrial Engineering - historical development - role of industrial engineer - applications - types of production system - life cycle approach - supply chain management - value chain - productivity - introduction, definition, difference between productivity and production - productivity, efficiency and effectiveness - productivity measurement - base period - productivity index - productivity improvement

UNIT II : WORK STUDY AND WORK MEASUREMENT (6+3)

Work study - introduction, objectives, steps in work study, purpose and procedure of method study - recording methods and facts - process chart symbol - examine, develop & define, install & maintain - motion economy - working area - work measurement - purpose and organizational suitability - stop watch time study - ILO definitions - performance rating - standard time - work sampling - PMTS - MTM - comparison, job evaluation and merit rating

UNIT III : FACILITY LAYOUT, LINE BALANCING AND INVENTORY CONTROL (6+3)

Objective of facility layout - principles - types of common layouts - part machine incidence matrix - comparison of layouts - objectives and constraints in Line Balancing problem - methods of line balancing - Largest Candidate Rule, Kilbridge-Wester Heuristic, Ranked Positional Weight - Inventory control - inventory costs - deterministic models - other observations of basic EOQ model - gradual replacement model - ABC analysis

UNIT IV : LINEAR PROGRAMMING, TRANSPORTATION AND ASSIGNMENT MODEL (6+3)

Introduction and definition - Graphical method - maximization case - multiple optimum solution - infeasible solution - unbounded problem - simplex method to solve LPP - transportation model initial solution - least cost, North-West corner and Vogel's approximation methods - optimization of initial assignment - assignment model - mathematical formulation - solution methods, algorithm

UNIT V : PROJECT MANAGEMENT AND CPM/PERT (6+3)

Critical Path Method - methodology of critical path analysis - terminology in project management - symbols used in network planning - common flaws in network - Dummy activity and dummy nodes - rules for constructing network diagram - numbering of events in network - AON Vs AOA approaches for diagramming - float or slack – illustration for floats - Program Evaluation and Review Technique

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

Approved by Fourth Academic council

TEXT BOOKS:

1. Ravishankar, "Industrial Engineering and Management ", 2nd ed., Galgotia Publications, 2009

REFERENCES:

1. Khanna.O.P, "Industrial Engineering and Management", 17th ed.,Dhanpat Rai Publications,2010.
2. Srinivasan.G, "Operations Research", 2nd ed., PHI Learning Private Limited, 2011.
3. ILO, "Introduction to work study", 4th ed., Universal Publishing Corporation, 2010.
4. Kanti Swarup, Gupta P K and Manmohan, "Operations Research", 17th ed., S.Chand and Sons New Delhi, 2014.

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

13GEC06 ENGINEERING ECONOMICS AND COST ANALYSIS
(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of economics, value engineering and interest formulas
- To acquire knowledge on evaluation of alternatives by considering the economic factors
- To introduce the methods of replacement, maintenance analysis and depreciation

COURSE OUTCOMES:

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

CO1: Acquire the skills to apply the basics of economics and cost analysis to engineering applications
CO2: Know the decision making with economic feasibility
CO3: Evaluate an alternative by considering the economic factors
CO4: Conclude the replacement and maintenance policies of industrial equipments
CO5: Determine the depreciation of industrial equipments over the operating periods using appropriate method

UNIT I : INTRODUCTION TO ECONOMICS (9)

Economics - Flow in an economy, Law of supply and demand - Concept of Engineering Economics - types of efficiency, Scope of engineering economics - Element of costs - other costs/revenues - Break even analysis - profit/volume ratio - Make or buy decision, Elementary economic Analysis - examples for simple economic analysis - introduction to activity based costing

UNIT II : VALUE ENGINEERING AND INTEREST FORMULAS (9)

Value analysis / value engineering - Interest formulae and their applications - Time value of money, Single payment compound and present worth amount, Equal payment series - compound amount, sinking fund, Present worth and capital recovery amount - Uniform gradient series annual equivalent amount, Effective interest rate - case studies on balance sheet and profit & Loss account.

UNIT III : CASH FLOW (9)

Present worth method - Revenue dominated cash flow diagram, cost dominated cash flow diagram - Future worth method - Revenue dominated cash flow diagram, cost dominated cash flow diagram - Annual equivalent method - Revenue dominated cash flow diagram, cost dominated cash flow diagrams - rate of return method

UNIT IV : REPLACEMENT AND MAINTENANCE ANALYSIS (9)

Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return, concept of challenger and defender - Simple probabilistic model for items which fail completely.

UNIT V : DEPRECIATION (9)

Straight line method, declining balance method, Sum of the years-digits method, sinking fund method, service output method - Evaluation of public alternatives - Inflation adjusted decisions - procedure to adjust inflation - Inflation adjusted economic life of machine

TOTAL: 45 PERIODS

(Use of Interest tables is permitted in the examination)

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", 2nd ed., PHI learning Pvt. Ltd, New Delhi, 2014.

DATA BOOKS:

1. Panneer Selvam, R, "Interest Tables for Engineering Economics", 2nd ed., PHI learning Pvt. Ltd, New Delhi, 2006.

REFERENCES:

1. Chan S.Park, "Contemporary Engineering Economics", 5th ed., Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis", 10th ed., Oxford University Press, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy",14th ed., Pearson India, 2010.
4. Zahid A Khan, "Engineering Economy", 1st ed.,Pearson Education, 2012

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

13ME611 TURBOMACHINERY LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To introduce the methods of performance test on pumps
- To acquire knowledge on performance test on hydraulic turbines

COURSE OUTCOMES:

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

CO1: Conduct performance test on centrifugal pumps
CO2: Determine the performance of the submergible and reciprocating pumps
CO3: Measure the flow characteristics of gear oil pump
CO4: Compare the performance parameters of jet pump and vane pump
CO5: Estimate the performance of hydraulic turbines using the experimental setup

LIST OF EXPERIMENTS:

1. Performance characteristics of Single Stage Centrifugal Pump
2. Performance characteristics of Multi Stage Centrifugal Pump
3. Performance characteristics of Submergible pump
4. Performance characteristics of Reciprocating Pump
5. Performance characteristics of Gear oil pump
6. Performance characteristics of Jet pump
7. Performance characteristics of Vane pump
8. Performance characteristics of Pelton Wheel
9. Performance characteristics of Francis Turbine
10. Performance characteristics of Kaplan Turbine

TOTAL: 45 PERIODS

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

Approved by Fourth Academic council

13ME612 MINI PROJECT

L	T	P	C
0	0	2	1

OBJECTIVES:

- To apply the concepts of mechanical engineering to design and fabricate a component
- To develop the attitude of team work among the technical professionals

COURSE OUTCOMES:

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

CO1: Identify the team members for the project considering the functional area
CO2: Formulate the problem definition for the project
CO3: Make use of the design principles and develop engineering design of the component
CO4: Create the physical models by fabrication
CO5: Summarize the project outcomes by project report and presentation

The mini-project involves the following stages:

Stage 1 : Preparing a project - brief proposal including

- Problem Identification
- A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
- List of possible solutions including alternatives and constraints
- Cost benefit analysis
- Time Line of activities

Stage 2 : A report highlighting the design finalization based on functional requirements & standards

Stage 3 : A presentation including the following:

- Implementation Phase (Hardware / Software / both)
- Testing & Validation of the developed system

Stage 4 :Consolidated report preparation

TOTAL: 30 PERIODS

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

Approved by Fourth Academic council

13GE611 COMPREHENSION

L	T	P	C
0	0	2	1

OBJECTIVES:

- To comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise

COURSE OUTCOMES:

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

CO1: Recall the fundamentals of mechanical engineering
CO2: Summarize the concepts of engineering design
CO3: Demonstrate an understanding on manufacturing practices
CO4: Identify the types of thermal systems for energy generation
CO5: Relate the concepts of management with applications

METHOD OF EVALUATION:

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

TOTAL: 30 PERIODS

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

Approved by Fourth Academic council

13PT611 VERBAL, APTITUDE AND REASONING - II

(Common to All Branches)

L	T	P	C
0	0	2	0

OBJECTIVES :

- To develop students to workout solution for problems that involves mathematics aptitude
- To develop students to workout solutions for problems that involving general reasoning
- To develop students to become sharp in usage of English grammar

COURSE OUTCOMES:

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

CO1: Solve aptitude problems with ease

CO2: Solve reasoning problems with ease

CO3: Improve written communication skills in English

UNIT I : VERBAL **(10)**

Error spotting - Confusable words - Idioms & phrases - Synonyms & Antonyms - Statement & Arguments - Reading comprehension - Theme detection

UNIT II : REASONING **(10)**

Logical Puzzle - Cube problems - Analogy - Blood Relations - Directions - Data Interpretation - Data sufficiency - Statement & Assumption

UNIT III : APTITUDE **(10)**

Simple and Compound Interest - Probability - Permutation and Combination - Speed & Distance - Train-Time & Work - Pipes & cisterns - Calendar - Clock - Volume & surface areas

TOTAL: 30 PERIODS

TEXT BOOKS:

- Verbal Book by Kaushal.B.Shah
- Reasoning & Aptitude Book by Vignesh.D

REFERENCES:

- Quantitative Aptitude by Dinesh Khattar
- Objective English by Hari Mohan Prasad & Uma Rani Sinha
- A Modern approach to verbal &non verbal reasoning by R.S.Aggarwal
- High school English Grammar & Composition by Wren & Martin

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

Approved by Fourth Academic council

13GEC01 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give exposure on management concepts
- To provide knowledge on Planning and decision making at different conditions
- To give exposure on organising
- To familiarize the concept of directing
- To provide knowledge of quality control and cost control techniques

COURSE OUTCOMES:

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

CO1: Have a comprehensive knowledge on management concepts
CO2: Plan under different conditions and situations
CO3: Do organizing of the human resources
CO4: Motivate employees and manage the projects
CO5: Do budgetary and non-budgetary control of projects

UNIT I : OVERVIEW OF MANAGEMENT (9)

Organization - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors - Managing globally - Strategies for International Business.

UNIT II : PLANNING (9)

Nature and purpose of planning - Planning process - Types of plans - Objectives - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

UNIT III : ORGANIZING (9)

Nature and purpose of organizing - Organization structure - Formal and informal groups *I* organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages - Training - Performance Appraisal.

UNIT IV : DIRECTING (9)

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Leadership theories - Communication - Hurdles to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity.

UNIT V : CONTROLLING (9)

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, 8th Edition
2. Charles W L Hill, Steven L Mc Shane, "Principles of Management", Mc Graw Hill Education, Special Indian Edition, 2007

REFERENCES:

1. Hellriegel, Slocum & Jackson, "Management - A Competency Based Approach", Thomson South Western, 10th edition, 2007
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, "Management - A global & Entrepreneurial Perspective", Tata Mc Graw Hill, 12th ed., 2007
3. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 7th ed., 2007

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

Approved by Fourth Academic council

13ME701 FINITE ELEMENT ANALYSIS

L	T	P	C
2	1	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

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

UNIT I : BASIC CONCEPTS AND 1D ELEMENTS (6+3)

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

UNIT II : 2D ELEMENTS (6+3)

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

UNIT III : AXISYMMETRIC PROBLEMS (6+3)

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

UNIT IV: ISOPARAMETRIC ELEMENTS (6+3)

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

UNIT V : DYNAMIC ANALYSIS (6+3)

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

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

TEXT BOOKS:

1. Chandrupatla.T.R and Belegundu.A.D, "Introduction to Finite Elements in Engineering", Pearson Education, New Delhi, 2012.
2. Seshu. P, "A Text book on Finite Element Analysis", PHI Learning Pvt. Ltd., New Delhi, 2010

REFERENCES:

1. David V Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill International Edition, 2009
2. Logan D.L, "A First course in the Finite Element Method", 3rd ed., Thomson Learning, 2012
3. Rao S.S, "The Finite Element Method in Engineering", Elsevier, 2011.
4. Reddy J.N, "An Introduction to Finite Element Method", 3rd ed., McGraw Hill International Edition, 2005.
5. Zienkiewicz. O.C and Taylor, R.L, "The Finite Element Method: Its basis and fundamentals", 6th ed., McGraw Hill International Edition, Physics Services, 2011.

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

13ME702 CAD/CAM/CIM

L	T	P	C
3	0	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

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

UNIT I : GEOMETRIC MODELLING TECHNIQUES (9)

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

UNIT II : PRINCIPLES OF COMPUTER GRAPHICS (9)

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

UNIT III : COMPUTED AIDED MANUFACTURING (9)

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

UNIT IV : CNC MACHINE TOOLS (9)

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

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

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ibrahim Zeid and Sivasubramanian, R, "CAD/CAM Theory and Practice", Tata McGraw Hill Publications, New Delhi, 2009.
2. Radhakrishan.P, Subramanyan.S, Raju.V, "CAD/CAM/CIM", 2nd ed., New Age International Publishers Ltd., 2000

REFERENCES:

1. Chris McMohon and Jimmie Browne, "CAD/CAM Principles, Practice and Manufacturing Management", 2nd ed., Pearson Education (singapore) Pvt. Ltd., 2000
2. David F. Rogers, J. A. Adams, "Mathematical Elements for Computer Graphics", Tata McGraw Hill Publications, 2008.
3. Donald Hearn and M. Pauline Baker, "Computer Graphics" Eastern Economy Edition, 2007.
4. Groover, M. P. and Zimmers, E. W., "CAD/ CAM", Dorling Kingsley, 2008
5. Mikell P. Groover and Zimmers.W, "CAD/CAM - Computer Aided and Manufacturing", 1st ed., Pearson India, 2003

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

Approved by Fourth Academic council

13ME711 COMPUTER AIDED ANALYSIS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

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

COURSE OUTCOMES:

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

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

LIST OF EXPERIMENTS

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

TOTAL: 45 PERIODS

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

Approved by Fourth Academic council

13ME712 CAD / CAM LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To gain practical experience in handling 2D drafting and 3D modelling software
- To study the features of CNC Machine Tool and modern control systems
- To know the application of various machine tools like CNC lathe, CNC Vertical Machining Centre

COURSE OUTCOMES:

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

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

LIST OF EXPERIMENTS

1. 3D Modelling **21 PERIODS**

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

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

* Students are required to make minimum one component by manual drawing in the above.

2. Manual Part Programming. **21 PERIODS**

(i) Part Programming - CNC Machining Centre

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

(ii) Part Programming - CNC Turning Centre

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

3. Computer Aided Part Programming **3 PERIODS**

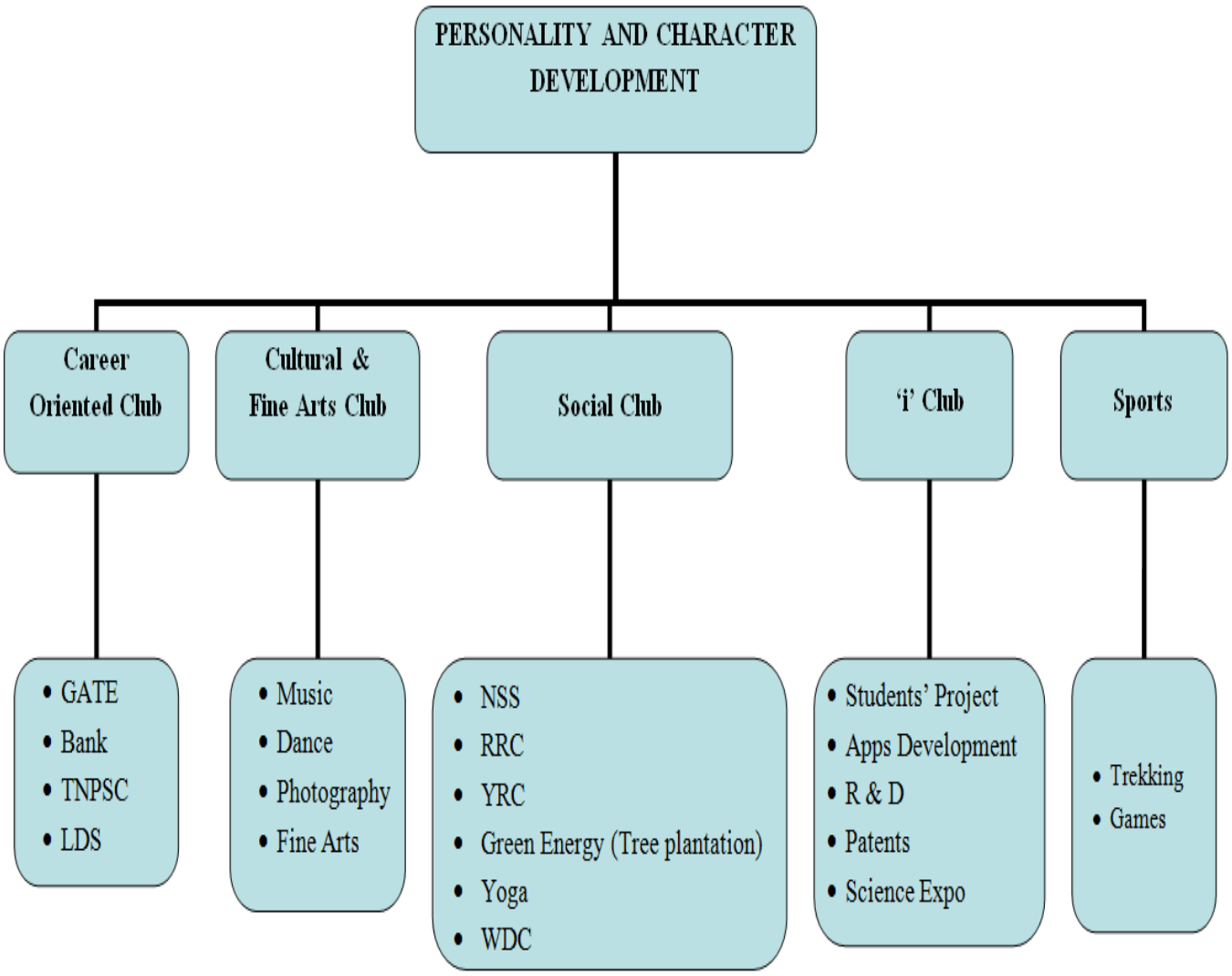
11. Creation of CL Data and Post process generation using CAM packages.

TOTAL: 45 PERIODS

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

13GE711 PERSONALITY AND CHARACTER DEVELOPMENT

L	T	P	C
0	0	1	0



***LDS - Leadership Development Skills**

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

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

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

(Cumulatively for Four Semesters)

13ME831 PROJECT WORK

L	T	P	C
0	0	20	10

OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Formulate a problem definition in the field of Mechanical Engineering through literature survey
CO2: Identify the objectives of the project by thorough understanding of the problem
CO3: Develop methodology using appropriate tools for the problem
CO4: Analyze the problem based on the methodology and tabulate the results
CO5: Conclude the results and submit the project report

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

TOTAL: 300 PERIODS

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

13MEX01 RAPID MANUFACTURING TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basics of rapid prototyping technologies and the steps involved in model development in rapid prototyping
- To acquire knowledge on liquid, solid and powder based additive manufacturing processes
- To introduce the steps involved in creating stl file and the applications of additive manufacturing

COURSE OUTCOMES:

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

CO1: Demonstrate the knowledge of various Rapid Prototyping technologies and step involved in model development
CO2: Describe the working principles of liquid and solid based processes
CO3: Explain the working principle of powder based processes
CO4: Identify the steps involved in generation of stl file
CO5: Summarize the application of rapid prototyping technology in various industries

UNIT I : RAPID PROTOTYPING PROCESS CHAINS (9)

Prototype fundaments - fundamentals of rapid prototyping - classification - Fundamental automated processes - process chain - 3D modeling - data conversion and transmission - checking and preparing - building - post processing

UNIT II : LIQUID BASED AND SOLID BASED SYSTEMS (9)

Liquid based systems - stereo lithography apparatus - Solid Ground Curing - Solid based systems - Laminated Object Manufacturing - Fused Deposition Modeling - Multi jet modeling system

UNIT III : POWDER BASED SYSTEMS (9)

3D systems' Selective laser sintering - Z Corporations' Three dimensional printing - Optomec's Laser engineered Net shaping - Acram's Electron Beam Melting - 3D printing

UNIT IV : DATA FORMATS (9)

STL formats - STL file problems - consequences of building a valid and invalid Tessellated model - STL file repair

UNIT V : APPLICATIONS OF RAPID PROTOTYPING (9)

Typical application areas - finishing processes - application in design - analysis and planning - application in manufacturing and tooling - Aerospace industry - Automotive industry

TOTAL: 45 PERIODS

TEXT BOOK:

1. Chua.C.K, Leong.K.F, Lim.C.S, "Rapid Protopying - Principles and Applications", 3rd ed., Cambridge University Press India Pvt Ltd, 2010

REFERENCES:

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.
2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.
3. Hari Prasad, Badrinarayanan.K.S, "Rapid Prototyping and Tooling", Surya Publishers 2012
4. Ian Gibson, David Rosen, Brent Stucker, "Additive Manufacturing Technologies", 2nd ed., Springer, 2015

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

13MEX02 DESIGN FOR MANUFACTURING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the manufacturing processes for various engineering materials
- To acquire knowledge on design for manual assembly, sand and die casting
- To introduce the concepts on design for forming and machining

COURSE OUTCOMES:

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

CO1: Describe the manufacturing processes for various engineering materials
CO2: Recommend the design specifications for manual assembly of a product
CO3: Select the design specifications for sand and die casting
CO4: Apply the concept of DFMA in designing products that can be manufacturing by using metal forming
CO5: Adopt the concept of DFMA for the components produced by machining processes

UNIT I : INTRODUCTION AND MANUFACTURING PROCESSES FOR MATERIALS (9)

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

UNIT II : DESIGN FOR MANUAL ASSEMBLY (9)

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

UNIT III : DESIGN FOR SAND AND DIE CASTING (9)

Design for sand casting - sand casting alloys - basic characteristics and mold preparation - sand cores- melting and pouring - cleaning and cost estimation - design for die casting - die casting alloys - die casting cycle - die casting machines - dies - finishing - equipment for automation - optimum number of cavities - machine size - cycle time and cost estimation - assembly techniques- design principles

UNIT IV : DESIGN FOR METAL FORMING (9)

Sheet metal working - dedicated dies and press working - press selection - turret press working - press brake operations - design rules - Design for Hot forging - characteristics - flash and its removal - allowances - performing - classification of materials, forgings - forging equipment - die life - forging costs - die, tool replacement , flash removal, other costs

UNIT V : DESIGN FOR MACHINING (9)

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

TOTAL: 45 PERIODS

TEXT BOOK:

1. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, "Product Design for Manufacture and Assembly", 3rd ed., CRC Press, 2010

REFERENCES:

1. Bralla, J.G, "Design for Manufacturability Handbook", 2nd ed., McGraw-Hill, 1998
2. Chitale.A.K, Gupta.R.C, "Product Design and Manufacturing", 5th ed.,PHI Learning, 2011
3. Vijay Gupta, Lal.G.K, VenkataReddy.N, "Fundamentals of Design and Manufacturing", 1st ed., Narosa Book Distributors Pvt Ltd, 2010
4. Karl T Ulrich, Steven D Eppinger, Anita Goyal, "Product Design & Development", 4th ed., McGraw Hill Education (India) Private Limited, 2009

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

Approved by Fourth Academic council

13MEX03 REFRIGERATION AND AIR CONDITIONING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the refrigerants & refrigeration cycles and working principles of vapour compression & vapour absorption refrigeration systems
- To acquire knowledge on non conventional refrigeration systems and/or explain the operating principle of cryogenics systems
- To introduce the psychrometric processes, air conditioning systems and load estimation

COURSE OUTCOMES:

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

CO1: List the types of refrigerants and refrigeration cycles

CO2: Analyze the performance of vapour compression and vapour absorption refrigeration systems

CO3: Demonstrate an understanding on working principles of non conventional refrigeration systems and cryogenics systems

CO4: Classify the psychrometric processes during the analysis of air conditioners

CO5: Identify the components and working principles of Air conditioning systems and/or estimate the loads during the design of air conditioner

UNIT I : REFRIGERANTS AND AIR REFRIGERATION CYCLES (9)

Reversed Carnot cycle - reversed Brayton cycle - Refrigerants - introduction, classification - primary refrigerants – halocarbon and its compounds, azeotrapes, inorganic compounds, unsaturated organic compounds - designation - desirable properties of ideal refrigerant - properties and uses of commonly used refrigerants - secondary refrigerants - comparison and application of refrigerants

UNIT II : VAPOUR COMPRESSION AND ABSORPTION REFRIGERATION SYSTEMS (9)

Simple vapour compression system - functions of parts - T-s diagrams - P-h chart - factors affecting the performance - actual vapour compression cycle - volumetric efficiency - mathematical analysis - methods of improving simple saturation cycle - Simple vapour absorption system - practical vapour absorption system - COP - Lithium Bromide system

UNIT III : NON CONVENTIONAL REFRIGERATION SYSTEMS AND CRYOGENICS (9)

Thermoelectric refrigeration system - thermoelectric effects, analysis of thermoelectric refrigeration, comparison between thermoelectric and vapour compression refrigeration - vortex tube and pulse tube refrigeration - Cryogenics - cascade refrigeration system - dry ice - liquefaction of gases - Linde and Claude system - liquefaction of hydrogen and helium

UNIT IV : PSYCHROMETRICS (9)

Psychrometrics - definitions - Psychrometric relations - adiabatic saturation process - psychrometers - psychrometric charts - psychrometric processes - mixing of air streams, sensible heating, sensible cooling, cooling and dehumidification, heating and dehumidification, heating and humidification

UNIT V : AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION (9)

Air conditioning cycle - classification of air conditioning systems - central system - zoned system - unitray system- unitary central system - selection of system - RSHF - GSHF - applications of air conditioning - Load estimation - cooling and heating load estimate - solar radiation and heat gain - thermal barriers - infiltration - internal heat gains - cold storage

TOTAL: 45 PERIODS

(Use of approved Refrigeration Tables and charts is permitted in the examination)

TEXT BOOK:

1. Rajput.R.K, "A textbook of Refrigeration and Air conditioning", S.K.Kataria & Sons, 2nd ed., Reprint 2013

REFERENCES:

1. Khurmi.R.S, Gupta.J.K, "Textbook of Refrigeration And Air Conditioning", 1st ed., S. Chand Publications, 2006
2. Arora, C.P., "Refrigeration and Air Conditioning", 3rd ed., McGraw Hill, New Delhi, 2008.
3. Wilbert Stoecker, "Refrigeration and Air Conditioning", 2nd ed., McGraw Hill, New Delhi, 2002
4. Ramesh Chandra Arora, "Refrigeration and Air Conditioning", PHI Learning Pvt. Ltd, New Delhi, 2010

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

Approved by Fourth Academic council

13MEX04 WELDING ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basics of welding and types of welding processes
- To acquire knowledge on welding metallurgy and mathematical analysis of heat affected zone
- To introduce the welding methodology for various materials, pipelines and underwater welding
- To introduce the steps involved in process planning and inspection methods for welding processes

COURSE OUTCOMES:

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

CO1: Demonstrate the knowledge on welding technology for various materials
CO2: Describe the welding metallurgy and/or mathematical analysis of heat affected zone
CO3: Identify a welding method for joining materials and pipelines
CO4: Explain the procedures in welding, stepes in process planning and inspection methods
CO5: Summarize the steps involved in underwater welding processes

UNIT I : WELDING TECHNOLOGY AND SCIENCE (9)

Definition and classification - conditions for obtaining satisfactory welds - importance of welding and its applications - welding quality and performance - Characteristics of welding power sources - arc welding power supply equipments - selection criteria - energy input - energy sources - arc characteristics - metal transfer and melting rates - welding parameters and their effects

UNIT II : WELDING METALLURGY AND MATHEMATICAL ANALYSIS (9)

General and welding metallurgy - thermal and mechanical treatment of welds - residual stress and distortion in welds - Heat input to weld - relation between weld cross section and energy input - heat input rate - heat flow equations with practical application - width of Heat Affected Zone (HAZ) - cooling rates - contact resistance heat source

UNIT III : WELDING OF MATERIALS AND PIPELINES (9)

Welding of cast irons - aluminium and its alloys - low carbon HY pipe steels - stainless steels - welding of dissimilar metals - hard surfacing and cladding - welding of plastics - hot air welding of PVC plastics - welding action - equipments - testing of joints - welding of pipelines - piping - joint design - backing rings- heat treatment - offshore pipe work - pipeline welding

UNIT IV : WELDING PROCEDURE, PROCESS PLANNING AND QUALITY (9)

Welding symbols - welding procedure and sheets - joint preparations in fusion welding - welding positions - summary chart - submerged arc welding procedure sheets - welding procedure of MIG/CO_2 welding - Welding quality - undercuts - cracks - porosity - slag inclusion - lack of fusion - lack of penetration - faulty weld size and profile - corrosion testing of welded joints

UNIT V : UNDERWATER WELDING (9)

Comparison of underwater welding and normal air welding - welding procedure - types of underwater welding - underwater welding process development - developments in underwater welding - characteristics desired in electrodes for MMA wet welding - polarity - salinity of sea water - weld shape characteristics - microstructure of underwater welds

TOTAL: 45 PERIODS

TEXT BOOK:

1. Ibrahim Khan, “Welding Science and Technology”, New Age International (P) Limited, 2007

REFERENCES:

1. Parmer.R.S., "Welding Engineering and Technology", 1st ed., Khanna Publishers, New Delhi, 2008.
2. Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2001
3. Garg.G.D, "A textbook of Welding Technology", S. K. Kataria & Sons, 2011
4. Khanna.O.P, "A textbook of Welding Technology", 22nd ed., Dhanpat Rai Publications, 2008

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

Approved by Fourth Academic council

13MEX05 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

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

UNIT I : INTRODUCTION AND HYDROELECTRIC POWER PLANTS (9)

Classification - energy - types - power - fuels and combustion - steam generators, prime movers - steam condensers - surface condensers, jet condensers - Hydro electric power plant - run-off - selection of site - essential features - calculations - classification - storage plants

UNIT II : STEAM POWER PLANT (9)

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

UNIT III : DIESEL POWER PLANT (9)

Diesel engines - heavy oil engines - duel fuel engines - high compression gas engines - general layout of diesel power plant - performance of diesel engine - characteristics - fuel system - common rail injection, individual pump injection, distributor system - diesel plant operation, efficiency - heat balance of a diesel engine power plant - heat balance sheet

UNIT IV: GAS TURBINE POWER PLANT (9)

Classification - open cycle and closed cycle power plants - Helium cooled fast reactor - elements of gas turbine power plants - Elements of gas turbine power plant compressors, intercoolers, heat exchangers, combustion chambers, gas turbines - cogeneration - auxiliary systems - starting, ignition, lubrication, fuel system and controls - control of gas turbines - applications

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

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

TOTAL: 45 PERIODS

TEXT BOOK:

1. Rajput.R.K, "A Textbook of Power Plant Engineering", 4th ed.,Laxmi Publications, New Delhi, 2007.

REFERENCES:

1. Raja.A.K, Amit Prakash Srivastava, Manish Dwivedi, "Power Plant Engineering", New Age International (P) Limited, 1st ed., Reprint 2010
2. Nag.P.K., "Power Plant Engineering", Tata McGraw Hill Publishing Company Ltd, 4th ed., 2014.
3. Arora.S.C, Domkundwar.A.V, "Power Plant Engineering", 6th ed., Dhanpat Rai & Co, 2013
4. Manoj Kumar Gupta, "Power Plant Engineering", Prentice Hall India, 2012

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

Approved by Fourth Academic council

13MEX06 NON DESTRUCTIVE TESTING AND EVALUATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study and understand the various Non Destructive Testing and Evaluation methods
- To know the various applications of Non Destructive testing methods

COURSE OUTCOMES:

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

CO1: Differentiate various defect types and select the appropriate NDT methods for better evaluation.
CO2: Summarize theoretical understanding of the penetrants, penetrant testing and safety precautions.
CO3: Demonstrate the fundamentals of magnetization methods and magnetic testing techniques.
CO4: Apply radiation property for inspecting materials.
CO5: Select an inspection method among the various types of ultrasonic and eddy current methods for material testing.

UNIT I : OVERVIEW OF NDT AND VISUAL INSPECTION (9)

Non destructive testing - scope, destructive methods of testing - comparison between destructive and non destructive testing - notable events - common NDT Methods, flows and defects, applications - Visual inspection - basic terms, equipments used - machine vision - Ringing test - chalk test - visual inspection of welding defects - introduction to thermography

UNIT II : PENETRANT TESTING (9)

Principle of penetrant testing - tests and standards, test stations - accessories - illustrative examples - types of penetrants, techniques - characteristics of good penetrants - developer and its types - quality and process control - health and safety precautions in Liquid penetrant Inspection, standards - Leak test - Zyglo Fluorescent Penetrant Test

UNIT III : MAGNETIC PARTICLE TESTING (9)

Principle of Magnetic particle testing - scope - basic terms associated with magnetic materials, classification of magnetic materials- domains and hysteresis - magnetic field orientation - methods of magnetization - DC and AC magnetization - skin effect - equipments - lights - magnetic field indicator - testing techniques - applications

UNIT IV : RADIOGRAPHIC INSPECTION (9)

Types of radiations - basic properties - Radiation sources - X-Ray radiography, Gamma radiography - scattered radiations - X-Ray film and accessories - film interpretation and viewing radiographs - beam geometric principles - digital radiography - applications - types of radiographic techniques - precautions against radiation hazards and health

UNIT V : ULTRASONIC AND EDDY CURRENT TESTING (9)

Principle of ultrasonic testing - notable events - basic terms - equipments - ultrasonic probes - radiated fields of ultrasonic transducers - Ultrasonic inspection techniques - Eddy current testing - working principle - basic terms - factors affecting eddy currents - eddy current flow characteristics, instruments, probes - scope and applications

TOTAL: 45 PERIODS

TEXT BOOK:

1. Osama Lari, Rajeev Kumar, "Basics of Non-Destructive testing", 1st ed., S.K.Kataria & Sons, 2013

REFERENCES:

1. Baldev Raj, Jayakumar.T, Thavasimuthu.M, "Practical Non-Destructive Testing", Narosa Publishing house, 2nd ed., Eight Reprint 2013
2. Ravi Prakash, "Non-Destructive Testing Techniques", First Revised edition, New Age International (P) Limited, 2010
3. Prasad.J, Nair.C.G.K, "Non-Destructive Test and Evaluation of Materials", 2nd ed., Tata McGraw-Hill Publishing company Limited, 2011
4. Yoshida Kenichi , Laodeno Rem N, "Non-Destructive Testing Technique", LAP Lambert Academic Publishing, 2013

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

Approved by Fourth Academic council

13MEX07 COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the types of reinforcing materials and their selection processes during the manufacturing of composites
- To acquire knowledge on mechanical behaviour of composites and design considerations
- To introduce the dynamic behaviour and manufacturing consideration of composites

COURSE OUTCOMES:

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

CO1: List the types reinforcing materials and their applications
CO2: Analyze the behaviour of composites under given loading conditions
CO3: Recommend the design parameters for types of composites
CO4: Interpret the dynamics behaviour composites under dynamic loading conditions
CO5: Demonstrate the knowledge on manufacturing processes for different composites

UNIT I : INTRODUCTION (9)

Definition - need - general characteristics, applications - fibers - glass, carbon, ceramic, aramid, natural fibers - selection of matrix - epoxy, polyester, vinyl ester, nylon, ceramic, metal matrices - fiber surface treatments, glass fiber, carbon fiber - fibers and additives - fiber content - density - void content

UNIT II : MECHANICS (9)

Fiber matrix interactions in a unidirectional lamina - rule of mixture, continuous parallel fiber, discontinuous parallel fiber - Micro failure modes in longitudinal tension - transverse tensile loading - longitudinal compression loading - characteristics of fiber reinforced lamina, coordinates axes, notation, stress transformation - Evaluation of four elastic moduli based on strength of materials approach - longitudinal Young's modulus - transverse Young's modulus - major Poisson's ratio - laminated structure - Lamination theory

UNIT III : DESIGN (9)

Failure Predictions, Unidirectional Lamina, Unnotched Laminates, Notched Laminates - Laminate Design Consideration, Design criteria, Design allowable, Design guidelines - Joint design - Bolted and Bonded Joints. Metal Matrix Composites - Mechanical Properties - Manufacturing process.

UNIT IV : PERFORMANCE (9)

Static Mechanical Properties - fatigue and impact properties - damping properties - environmental effects - thermal, degradation, creep - Fundamentals of Fracture Behavior of composites.

UNIT V : MANUFACTURING (9)

Prepeg - sheet molding compounds - bag molding - compression molding - pultrusion - filament winding - resin transfer molding - SRIM process - ERM process - tube rolling - quality inspection methods

TOTAL : 45 PERIODS

TEXT BOOK:

1. Mallick, P.K., "Fiber Reinforced Composite: Materials, Manufacturing and Design",3rd ed.,CRC Press, 2007

REFERENCES:

1. Kaw Autar K, "Mechanics of Composite Materials, 2nd ed., CRC Press, London, 2005
2. Bhagwan D. Agarwal, Lawrence J. Broutman, Chandrashekhara.K, "Analysis and Performance of Fiber Composites", 3rd ed.,Wiley India Private Limited, 2012
3. Gibson and Ronald, "Principles of Composite Materials Mechanics", 2nd ed.,Taylor & Francis, 2007
4. Chawla K.K, "Composite Materials and Engineering", Springer Verlag, 2nd ed., Bsp Books Pvt. Ltd., 2006

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

Approved by Fourth Academic council

13MEX08 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the governing equations of fluid flow with heat transfer and discretization methods
- To acquire knowledge on numerical methods for solving heat conduction, convection and diffusion problems
- To introduce the types of turbulent models, solution techniques and algorithms for solving fluid flow problems

COURSE OUTCOMES:

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

CO1: Recall the governing differential equation for solving fluid flow
CO2: Recommend a discretization method to divide the complex geometry into number of known elements
CO3: Solve conduction, convection and diffusion problems using CFD methods
CO4: Model fluid flow problems and heat transfer using different techniques
CO5: Select a turbulent model to analyze the particular problem using a solution technique

UNIT I : GOVERNING DIFFERENTIAL EQUATIONS (9)

Methods of prediction - Mathematical description - conservation of a chemical species, energy equation, momentum equation, time averaged equations for turbulent flow, turbulence kinetic energy equation, general differential equation - Nature of coordinates

UNIT II :DISCRETIZATION METHODS (9)

Nature of numerical methods - task, discretization concept, structure of discretization equations - Methods of Deriving the Discretization Equations - Taylor Series formulation - variational formulation - Method of weighted residuals - Control volume formulation - Four basic rules

UNIT III : HEAT CONDUCTION, CONVECTION AND DIFFUSION (9)

Steady one dimensional conduction - two and three dimensional conduction - unsteady one dimensional conduction - steady one dimensional convection and diffusion - discretization equation for two dimensions - one way space coordinate

UNIT IV : CALCULATION OF FLOW FIELD (9)

Need for special procedure - representation of pressure gradient term and continuity equation - staggered grid - momentum equations - pressure and velocity corrections - pressure-correction equation - SIMPLE and SIMPLER algorithms

UNIT V : TURBULENCE MODELS AND SOLUTION TECHNIQUES (9)

Reynold's averaged Navier-Stokes equations and classical turbulent models - mixing length model, k-ε model, Reynolds stress equation models - advanced turbulence models - Solution of discretized equations - TDMA, Point iterative methods

TOTAL: 45 PERIODS

TEXT BOOK:

1. John D Anderson Jr, "Computational Fluid Dynamics - The Basics with Applications", 1st ed., McGraw Hill Education (India) Private Limited, 2012

REFERENCES:

1. Suhas V Patankar, "Numerical Heat Transfer and Fluid Flow", CRC Press, 1980
2. Versteeg.H and Malalasekara.W, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method", 2nd ed., Pearson India, 2009
3. Muralidhar.K and Sundararajan.T, "Computational Fluid Flow and Heat Transfer", 2nd ed., Narosa Publishing House, 2003
4. Chung.T.J, "Computational Fluid Dynamics", 2nd Revised edition, Scholastic Press, 2010

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

Approved by Fourth Academic council

13MEX09 TOOL DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design procedure for cutting tools, gauges, fixtures and clamps
- To acquire knowledge on design jigs and fixtures by considering the geometry of component
- To introduce the design procedure of dies for press work and forging

COURSE OUTCOMES:

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

CO1: List the types of cutting tools and/or Recommend the design specifications of single point cutting tools
CO2: Determine tolerances for design of gauges and/or clamping methods using various actuators
CO3: Design the jigs for various manufacturing operations by considering the component geometry
CO4: Develop fixtures for lathe, milling, boring, broaching, grinding, assembly, inspection and Welding
CO5: Recommend the design specifications of dies for metal forming processes

UNIT I : DESIGN OF CUTTING TOOLS (9)

Metal cutting process - General consideration for metal cutting - machinability - Single point cutting tools - Milling cutters - Types of drills - Classification - Reamers, Taps - Selection of carbide cutting - Problems on design of single point cutting tools

UNIT II : GAUGE DESIGN, LOCATING AND CLAMPING METHODS (9)

Fixed gauges - Gauge tolerance - The selection of materials for gauges - Indicating gauges - Automatic gauges - Basic Principles of Location - Locating methods and devices - Principles of clamping - Mechanical, Pneumatic and Hydraulic actuation - Design problems

UNIT III : DESIGN OF JIGS (9)

Types of drill jigs - General considerations in design of drill jigs - Drill bushings - Types, methods of construction- Drill jigs and modern manufacturing - Design problems on drill jigs

UNIT IV : DESIGN OF FIXTURES (9)

Types of fixtures - Fixtures for machine tools: Lathe, Milling, Boring, Broaching and grinding - Assembly fixtures- Inspection and Welding fixtures

UNIT V : DESIGN OF DIES (9)

Fundamentals of die - cutting operations - Cutting action in punch and die operations - Die clearance - Blanking and Piercing Die construction - Pilots -Strippers and Pressure Pads - Press work materials - Strip layout - Dies - Bending, forming and drawing

(Use of PSG design data book is permitted in the examination)

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donaldson C., Lecain.G.H. and Goold.V.C, "Tool Design", 4th ed., Tata McGraw- Hill Publishing Company Ltd., New Delhi, 2012

DATA BOOK:

1. Design Data, compiled by PSG College of Technology, Kalaikathir Achchagam, Coimbatore, Reprint 2010

REFERENCES:

1. Joshi.P. H, "Jigs and Fixtures", 3rd ed., McGraw Hill Education (India) Private Limited, 2010
2. Edward.G.Hoffman, "Jigs and Fixtures Design", 5th ed., Cengage learning, 2008
3. Jeff Lantrip, David.A.Smith and John.G.Nee, " Fundamentals of Tool Design", 6th Revised edition, Society of Manufacturing Engineers, 2010
4. Central Machine Tool Institute, "Machine Tool Design Handbook", 1st ed., McGraw Hill Education (India) Private Limited, 2001

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

13MEX10 AUTOMOBILE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the constructional features of vehicles and types of engines
- To acquire knowledge on auxiliary, transmission, steering, braking and suspension systems
- To introduce the types of emissions from engines, emission control methods and alternate fuels

COURSE OUTCOMES:

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

CO1: Demonstrate the constructional features, engine types, cooling and lubrication systems
CO2: Identify the components of types fuel supply systems and ignition systems
CO3: Describe the working principle of different types transmission systems
CO4: Summarize the constructional details of steering, braking and suspension systems
CO5: List the types of emissions from engines, emission control methods and types of alternate fuels

UNIT I : VEHICLE STRUCTURE AND ENGINES (9)

Types of automobiles - vehicle construction - chassis - frame and body - aerodynamics - component of IC engines- their forms, function and materials - cooling system - lubrication system

UNIT II : ENGINE AUXILIARY SYSTEM (9)

Carburetor - electronically controlled gasoline injection system for SI engines - Mono point and multi point fuel injection system - electronically controlled diesel injection system - unit injector system, rotary distributor type, CRDI - Ignition system - battery coil ignition system, magneto coil ignition system, electronic coil ignition system- Turbo charger - super charger - electronic engine management system

UNIT III : TRANSMISSION SYSTEM (9)

Clutch - Types and construction - single plate, multi plate, cone clutch, diaphragm clutch - gear box - sliding mesh, constant mesh, synchromesh - gear shifting mechanism - overdrive - fluid flywheel - torque converter - propeller shaft - slip joint - universal joint - differential - hotchkiss drive and torque tube drive

UNIT IV: STEERING, BRAKES AND SUSPENSION SYSTEM (9)

Principle of steering - steering geometry - steering linkages - steering gear box - power steering - brakes - types and construction - drum brake, disc brake, pneumatic braking system, hydraulic braking system, anti lock braking system - types of front axle - suspension system - types and construction - coil spring, leaf spring, air suspension - shock absorber

UNIT V : EMISSION CONTROLS AND ALTERNATIVE FUELS (9)

Automobile emissions - source of formation - Control techniques - exhaust gas recirculation - 3 way catalytic converter - emission norms - safety & ARAI standards - properties and applications of natural gas, LPG, Bio diesel, Bio ethanol, gasohol and hydrogen in automobiles - hybrid vehicle - fuel cell

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Rajput.R.K, "A textbook Automobile Engineering" Laxmi Publishers, 2nd ed., New Delhi, 2014

REFERENCES:

1. Kirpal Singh, "Automobile Engineering Vol.1 & 2", Standard Publishers, New Delhi, 2011
2. Srinivasan.S, "Automotive Mechanics", 2nd ed., McGraw Hill Education (India) Private Limited, 2003
3. Jain K.K and Asthana.R.B, "Automobile Engineering", 1st ed., McGraw Hill Education (India) Private Limited, 2002
4. Babu.A.K and Ajit Pal Singh, "Automobile Engineering", 1st ed., S.Chand Publications, 2013

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

Approved by Fourth Academic council

13MEX11 PRODUCT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of product development, product planning and customer needs
- To know concept generation, selection, testing and product architecture
- To acquire knowledge on concepts of Design for manufacturing and prototyping

COURSE OUTCOMES:

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

CO1: Describe the steps involved in product development process and product planning

CO2: Demonstrate the process of converting the customer requirements into technical requirements and methods of converting the requirement into product

CO3: Examine the ideas of concept generation for a new product and the development stages

CO4: Choose the architecture of the product considering various functional requirements

CO5: Identify the design and manufacturing constraints during product design and development process

UNIT I : PRODUCT DEVELOPMENT PROCESSES AND PRODUCT PLANNING (9)

Generic product development process - concept development - product development process flows - product planning process - types of product development projects - identification of opportunities, evaluation and prioritization of projects, allocation of resources and planning, completion of pre-project planning, reflection on the results and the process

UNIT II : CUSTOMER NEEDS AND PRODUCT SPECIFICATION (9)

Identifying customer needs - gathering raw data from customers - interpretation of raw data in terms of customer needs - organizing the needs into a hierarchy - establishment of the relative importance of the needs - reflection on the results and the process - product specifications and establishment - target and final specifications

UNIT III : CONCEPT GENERATION, SELECTION AND TESTING (9)

Activity of concept generation - clarification of the problem - external and internal search - systematic exploration - reflection on the solution and the process- concept selection - structured method for choosing a concept - screening and scoring - concept testing - defining purpose, survey population and format, communication, measure customer response - interpretation and reflection on the result and the process

UNIT IV : PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN (9)

Product architecture - implications of the architecture product change - establishing the architecture - delayed differentiation - platform planning - related system level design issues - industrial design - assessing the need - impact of industrial design - management of industrial design process - assessing the quality of industrial design

UNIT V : DESIGN FOR MANUFACTURING AND PROTOTYPING (9)

Estimation of manufacturing costs - reduction of the costs of components, costs of assembly, supporting production - impact of DFM decisions on other factors - prototyping - understanding prototypes - principles of prototyping and technologies - planning for prototypes

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Karl T. Ulrich and Steven D. Eppinger, "Product Design and Development", 5th ed., Tata McGraw-Hill Publishing Company Limited, 2016.
2. Kevin N.Otto and Kristin L.Wood "Product Design", 1st ed., Pearson Education, 2003

REFERENCES:

1. Corrodo Poli, "Design for Manufacturing: A structured approach", Butterworth- Heinemann, 2001.
2. Ibrahim Zeid, "Mastering CAD/CAM" Tata McGraw-Hill, 2005.
3. John W. Priest and Jose M. Sanchez, "Product development and design for manufacturing", Marcel Dekker Publications, 2001.
4. Richard Crowson, "Product Design and Factory Development", 2nd ed., Taylor and Francis Groups, 2005.
5. Stephen C. Armstrong, "Engineering and Product development Management - The Holistic Approach" Cambridge University Press, 2001.

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

Approved by Fourth Academic council

13MEX12 LEAN AND AGILE MANUFACTURING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the principles and tools of lean manufacturing
- To explore various visual management techniques, TPM and Lean practices
- To know the concept of agile manufacturing and its drivers

COURSE OUTCOMES:

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

CO6: Demonstrate the lean manufacturing principles to find and eliminate wastes
CO7: Identify the lean manufacturing tools and their potential applications
CO8: Summarize the usage of visual management, TPM and lean practices
CO9: Compare the technology drivers of agile manufacturing
CO10: Explain the technology drivers of agile manufacturing

UNIT I : LEAN MANUFACTURING PRINCIPLES (9)

Lean and Agile manufacturing paradigms - lean manufacturing - origin - Toyota Production System - wastes to be eliminated - tools and techniques applied to eliminate wastes - value stream mapping - primary icons - secondary icons - developing the VSM

UNIT II : LEAN MANUFACTURING TOOLS (9)

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

UNIT III : VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION (9)

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

UNIT IV : MANAGEMENT AND TECHNOLOGY DRIVERS OF AGILE MANUFACTURING (9)

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

UNIT V : MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF AGILE MANUFACTURING (9)

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Devadasan.S.R, Mohan Sivakumar.V, Murugesh.R, Shalij.P.R, "Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities", PHI Learning Private Limited, 2012
2. Pascal Dennis, "Lean Production Simplified", 2nd ed., Productivity Press, 2007

REFERENCES:

1. Bill Carreira, "Lean Manufacturing That Works", 1st ed., PHI Learning Private Limited, 2007.
2. Dennis P. Hobbs, "LEAN Manufacturing Implementation", 1st ed., Cengage Learning, 2009
3. Charles Grantham, James Ware, Cory Williamson, "Corporate Agility.: A Revolutionary New Model for Competing in a Flat World", PHI Learning Private Limited, 2007.
4. Gopalakrishnan.N, "Simplified Lean Manufacture : Elements, rules, tools and implementation", PHI Learning Private Limited, 2010.
5. Steven L Goldman, Roger N Nagel, Kenneth Preiss, "Agile Competitors and Virtual Organizations", John Wiley & Sons, 1994

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

Approved by Fourth Academic council

13MEX13 FUELS AND COMBUSTION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge on types of fuels and their combustion characteristics
- To introduce the combustion principles and the environmental impacts
- To know the equipments for measuring the combustion properties of fuel and safety aspects

COURSE OUTCOMES:

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

CO1: List the type of fuels and their combustion characteristics
CO2: Summarize the combustion principles of various fuels and estimation methods
CO3: Identify the various types of emissions during combustion process and ways to minimizing emissions
CO4: Describe the working principle of measuring devises for combustion characteristics
CO5: Select the safety equipment for a particular industrial application

UNIT I : FUELS (9)

Fuels - gaseous fuels - heating values, ignition temperature and limits, laminar flame velocity, Wobbe index, methane number - liquid fuels - chemical and physical characteristics - sulfur, ash and water content, carbon residue - solid fuels - characterization, proximate and ultimate analysis, physical properties

UNIT II : COMBUSTION PRINCIPLES (9)

Basic combustion calculations - calculation of the volume and the composition of the flue gas - determination of the combustion temperature - heating values, laminar flame velocity - heat, mass and momentum transport and balance - elementary reactions and radicals - ignition

UNIT III : ENVIRONMENTAL IMPACTS (9)

Pollutants - formation and impact - relevant pollutants - concepts for pollutant reduction - combustion and climate change - primary energy production - combustion and global warming by sectors - mitigation of global warming in the context of combustion - carbon sequestration

UNIT IV : MEASUREMENT METHODS (9)

In situ versus ex situ measurements - fuel characterization - investigation of combustion processes - selection of non-optical methods - selection of optical techniques - particle, spray and other techniques - test beds - advanced combustion control

UNIT V : APPLICATION AND SAFETY (9)

Industrial boilers - fluidized bed combustion - dust firing - metal, ceramic and furnaces used in various industries - gasification and pyrolysis - safety issues - mechanism of fire extinguishing media - fire detectors - deflagrations and detonations - dust explosions - fire suppression by oxygen reduction - safety by process design

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Maximilan Lackner, Arpad B. Palotas, Franz winter, "Combustion", 4th ed., Wiley-VCH Verlag GmbH & Co, 2012
2. Samir Sarkar, "Fuels and Combustion", 2nd ed., Orient Longman, 1990

REFERENCES:

1. Jacques Buchetti, "Fuels, Evaporation and Combustion", Nabu Press, 2010
2. Mishra D.P, "Fundamentals of Combustion", Prentice Hall India, Kindle Edition, 2008
3. Mukunda H.S, "Understanding Combustion", 2nd ed., Universities Press, 2009
4. Saha S.N, "Elements of Fuel Combustion and Energy Technology", Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2008
5. Sharma S.P, Mohan Chander, "Fuels and Combustion", Tata Mcgraw Hill, 1984

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

Approved by Fourth Academic council

13MEX14 METAL FORMING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the theory of metal forming, techniques of forging and extrusion
- To acquire knowledge on operation sequence of rolling and drawing processes
- To know the techniques of sheet metal forming

COURSE OUTCOMES:

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

CO1: Discuss the principles of metal forming, mechanical behaviour of materials and grain structure of materials during forming processes

CO2: Identify the components and explain the working principles of forging and extrusion equipments

CO3: Recommend the process parameters of rolling or drawing for a particular engineering product

CO4: Illustrate the steps involved in sheet metal forming processes considering stress strain relations

CO5: Classify the newer forming processes and describe the working principles of various equipments

UNIT I : FUNDAMENTALS OF METAL FORMING (9)

Classification and methods in forming - tensile test and metallurgy - theory of plasticity - effect of temperature, strain rate, metallurgical microstructure, chemical elements and mechanical properties - friction and lubrication - deformation zone geometry - workability - mechanics of metal forming - flow stress determination

UNIT II : FORGING AND EXTRUSION (9)

Classification of forging - forging equipment - plane strain forging with coulomb friction - residual stresses in forgings - forging defects - open and closed die forging - forging die design - extrusion - principal variables - calculation of extrusion load - defects in extrusion - deformation and flow pattern- extrusion of tubing

UNIT III : ROLLING AND DRAWING (9)

Classification - rolling mills - rolling of bars and shapes - forces and geometrical relationship - cold rolling - frictional forces in the arc of contact - rolling - process variables - defects - cold rolling theory - roll flattening - roll camber - theory of strip - drawing - rod and wire drawing - lubrication - patenting heat treatment - defects - variables in wire drawing.

UNIT IV : SHEET METAL FORMING (9)

Metal spinning - manual spinning - power spinning - spinnability of metals - blanking - rubber pad forming - Marform process - deep drawing process - stress pattern - drawability - defects - stretch forming operation - plastic stress strain relation - deep drawing tools design

UNIT V : NEWER FORMING PROCESSES (9)

Explosive Forming - electro hydraulic forming - magnetic pulse forming - petro forge hammer - drop hammer and dynapak - forming by laser beam - die-less forming

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Fritz Klocke, "Manufacturing Processes 4 - Forming", 1st ed., Springer-Verlag Berlin Heidelberg, 2013.
2. Narayanasamy.R, "Metal Forming Technology", 1st ed., Ahuja Book Publishers & Distributors, 1997

REFERENCES:

1. George E. Dieter, "Mechanical Metallurgy", 3rd ed., Tata McGraw Hill India, 2013.
2. Juneja.B.L, "Fundamentals of Metal Forming Processes", 2nd ed., New Age International Publishers, 2010.
3. Rao.P N, "Manufacturing Technology : Foundry, Forming & Welding",4th ed., Tata McGraw-Hill Education, 2013.
4. Surender Kumar, "Technology of Metal Forming Processes", Prentice Hall India Publications, 2008.
5. William F. Hosford, Robert M. Caddell, "Metal Forming: Mechanics and Metallurgy", 4th ed., Cambridge university press, 2014.

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

Approved by Fourth Academic council

13MEX15 TRIBOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of tribology in design of products
- To acquire knowledge on the different types of bearings, modeling and performance considerations
- To know the concepts of friction and wear phenomena

COURSE OUTCOMES:

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

CO1: Select tribological elements based on design considerations
CO2: Demonstrate the understanding of friction and wear
CO3: Demonstrate skills to select lubricant
CO4: Summarize the importance of proper choice of tribological elements
CO5: Apply the knowledge of wear and lubricants for different applications

UNIT I : ENGINEERING SURFACES (9)

Measurement methods - statistical and fractal description - non conforming surface contact geometry - stresses in non-conforming contacts - contact of rough surfaces- adhesion - solid-solid contacts- adhesion models - influencing factors - adhesion by surface tension and contact between rough surfaces - stiction

UNIT II : FRICTION AND WEAR (9)

Friction measurement methods - origin of friction - friction theories - other mechanisms - friction of metals and non-metals - wear - types - adhesive, abrasive, corrosive, fatigue wear - minor forms of wear - delamination theory - debris analysis and testing methods - wear of metals, ceramics, polymers - systems approach for wear reduction, Wear maps

UNIT III : LUBRICATION AND LUBRICANTS (9)

Oil lubricants - natural and synthetic organics - greases - viscosity - effect of temperature, pressure and shear rates on viscosity, measurement of viscosity - relative density, specific heat and thermal conductivity - acidity and alkalinity - oxidation stability - flash point - foaming - pour point - demulsibility - extreme pressure properties - additives

UNIT IV : TRIBOLOGICAL CONSIDERATIONS IN MACHINE DESIGN (9)

Rolling contact bearing - plain bearing - gears - wire ropes - seals and packing - conveyor belts - tribological design of machine components - material selection - surface engineering - introduction of system approach - tribological systems - operating variables - systems structure - tribological characteristics

UNIT V : APPLICATIONS OF TRIBOLOGY (9)

Tribology in metal working processes - effect of friction, wear, lubrication in metal working - classification of physical deformation processes - rolling - drawing - extrusion - forging - sheet metal working - metal removal – case studies - tribology in maintenance of transport units - biotribology

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Bharat Bhushan, “Introduction to Tribology”, John Wiley and Sons, 2013.
2. Prasanta Sahoo, “Engineering Tribology”, PHI Learning Private Limited, 2013.

REFERENCES:

1. Basu S. K, Sengupta S. N, Ahuja B. B, "Fundamentals of Tribology", PHI Learning Pvt. Ltd, 2010.
2. Gohar Ramsey, Rahnejat Homer , "Fundamentals of Tribology", World Scientific Publishing Co. Pvt Ltd, 2008.
3. Ian M. Hutchings, "Tribology: Friction and Wear of Engineering Materials", Butterworth-Heinemann Ltd, 1992.
4. Kumar A , "A Textbook of Tribology", S K Kataria & Sons-New Delhi, 2014.
5. Sushil Kumar Srivastava, "Tribology in Industries", S.Chand & Company Ltd, 2012.

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

15MEX16 MECHANICAL VIBRATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

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

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

Basic Concepts - Importance and scope - definition and terminology - representation of harmonic motions - types of vibrations - undamped free vibration - derivation of differential equation of motion - solution of differential equation - simple and compound pendulum - torsional vibrations, equivalent springs -springs in series and parallel- multifilar systems - effect of spring mass on natural frequency of undamped system

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

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

UNIT III : TWO DEGREES OF FREEDOM SYSTEM (9)

Undamped vibrations two degrees of freedom system - free vibration analysis of undamped systems - mode shapes- semi definite systems - forced vibration analysis of undamped systems - torsional vibrations of two rotor systems - torsionally equivalent shaft - lagrange's equations - applications - dynamic vibration absorber, centrifugal pendulum absorber, torsional vibration absorber, untuned vibration damper, gyroscopic effect on rotation shaft

UNIT IV : MULTI DEGREE OF FREEDOMS (9)

Matrix method -matrix iteration method - Stodola method - Dunkerley method -Rayleigh method - Rayleigh-Ritz method, Holzer method

UNIT V : CONTINUOUS SYSTEMS AND VIBRATION MEASUREMENT (9)

Continuous systems - transverse vibration of string - longitudinal vibration of a bar - transverse vibration of shaft - longitudinal vibration of a beam - vibration Measurement - vibration measuring instruments - vibrometer - accelerometer - frequency and velocity measuring device - transmissibility - vibration isolation - transducers - classification - displacement transducers - velocity transducers - active and passive transducers - accelerometer - selection of sensors

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Metha J.S and Kailey A.S, "Mechanical Vibrations", 1rd ed., S.Chand & Co. Ltd, 2012.
2. Singiresu S. Rao, "Mechanical Vibrations", 4th ed., Pearson India Publishers, 2014

REFERENCES:

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

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

13MEX17 NEW VENTURE PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept, theories of entrepreneurship and functions of entrepreneur
- To know the steps involved in new venture promotion and fund management
- To acquire knowledge on entrepreneurial behavior, development programme roles of entrepreneur

COURSE OUTCOMES:

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

CO1: Explain the concept of entrepreneurship and functions of an entrepreneur
CO2: Describe various theories of entrepreneurship
CO3: Identify the steps involved during new venture establishment and fund requirements
CO4: Summarize the entrepreneurial behavioural aspects and types entrepreneurship development programmes
CO5: Demonstrate the idea of Women and Rural entrepreneurship roles of entrepreneur

UNIT I : FUNCTIONS OF ENTREPRENEUR (9)

Entrepreneur - definition and concept - characteristics of entrepreneur - entrepreneurship - definition and characteristics - emergence of entrepreneurial class - comparison of entrepreneur with entrepreneurship - enterprise and manager - Danhofis classifications, other classifications - intrapreneurs - ultrapreneurs - functions of entrepreneurs

UNIT II : THEORIES OF ENTREPRENEURSHIP (9)

Sociological theories - economic theories - cultural theories - psychological theories - specialistsi views on entrepreneurship - walker on entrepreneurship - Harbison Entrepreneurship - Drucker on entrepreneurship - Peter kilby on entrepreneurship - models on entrepreneurship

UNIT III : PROMOTION OF A VENTURE (9)

Opportunity analysis - environment and entrepreneurship - technological environment - competitive factors - small scale industrial undertakings - steps in setting up a small scale industrial enterprise - legal requirements - important acts - policies of government - raising of funds - internal and external sources of finance - capital structure - capitalization - export finance - venture capital - concept, aims, features of venture capital and financing steps - sources of venture capital and criteria to provide venture capital finance

UNIT IV : ENTREPRENEURIAL BEHAVIOUR AND DEVELOPMENT PROGRAMME (9)

Innovation and entrepreneur - Schumpeteris and Druckeris theories - entrepreneurial behaviour and psychological theories - social responsibility - entrepreneurship development programmes - meaning and objectives - Indian EDP model - phase of EDPs - EDP Curriculum - Common denominators of success of EDPs - Role, Relevance and Achievements of EDPs - Role of government in organizing EDPs

UNIT V : ENTREPRENEURSHIP AND ROLE OF ENTREPRENEUR (9)

Role of entrepreneur - as an innovator in economic growth - generation of employment opportunities - complementing and supplementing economic growth - bringing about social stability and balanced regional development of industries - export promotion and import substitution - foreign exchange earnings and augmenting and meeting local demand - rural entrepreneur - major challenges in the way of development of rural industries - women entrepreneurship

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Robert D Hisrich, Mathew J Manimala, Michael P Peters and Dean A Shepherd, "Entrepreneurship", 6th ed., Tata Mcgraw Hill Education Private Limited, 2013.
2. Shangram Keshari Mohanty, "Fundamentals of Entrepreneurship", Prentice Hall India Pvt ltd, 2005

REFERENCE BOOKS:

1. Bruce R. Barringer and Duane Ireland.R, "Entrepreneurship: Successfully Launching New Ventures", 3rd ed., Pearson Education, 2011
2. Jain.P.C, "Handbook of New Entrepreneur", Oxford University Press, 2003
3. Khanka.S.S, "Entrepreneurial Development", 4th ed., S.Chand and Company Limited, New Delhi, 2007.
4. Rao.T.V and Donald F. Kuratko, "Entrepreneurship : A South-Asian Perspective", 1st ed., Cengage Learning India publications, 2012
5. Srinivasan.N.P and Gupta, C.B, "Entrepreneurial Development", Sultan Chand & Sons Publications, 2015

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

13MEX18 CRYOGENIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basics of Cryogenics Engineering
- To acquire knowledge on the analysis and design of cryogenic systems
- To know the principles of cryogenic instrumentation

COURSE OUTCOMES:

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

CO1: Describe the thermodynamic analysis of cryogenic systems and their types
CO2: Classify the liquefaction processes for various gases
CO3: Explain the fundamentals of separation and purification processes
CO4: Select a measuring instrument to measure the parameters of cryogenic systems
CO5: Identify suitable Cryogenic storage and handling system for engineering applications

UNIT I : THERMODYNAMIC ANALYSIS (9)

Importance - applications of cryogenics - Refrigeration - thermodynamic minimum work - Production of low temperatures - Joule Thomson expansion - adiabatic reversible turbine expansion - cooling by an external refrigerant - Philips, Solvay, Pulse tube, adiabatic magnetic and helium dilution refrigerator

UNIT II : CRYOGENIC LIQUEFACTION PROCESSES (9)

Thermodynamically ideal system for liquefaction - Liquefaction processes for nitrogen, oxygen, argon, methane, neon and hydrogen

UNIT III : SEPARATION AND PURIFICATION PROCESSES (9)

Cryogenic separation processes of air, hydrogen, helium - noncryogenic separation processes of air, hydrogen, helium - gas purification processes - sorption for hydrogen storage

UNIT IV : MEASUREMENT DEVICES AND PROPELLANTS (9)

Temperature - sub atmospheric pressure - Liquid level in a storage vessel - Propellants - nature of propellants - challenges - performance analysis of rocket propulsion - selection of propellants

UNIT V : STORAGE AND TRANSPORTATION (9)

Storage vessel, thermal shields and insulation - transportation of cryogenics fluids - transfer of cryogenics fluids - mechanical design of vessels - safety of storage and transfer of fluids

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mamata Mukhopadhyay, "Fundamentals of Cryogenic Engineering", PHI Learning Private Limited, 1st ed., 2010.
2. Thomas M.Flynn, "Cryogenic Engineering", CRC Press, 2nd ed., 2009

REFERENCES:

1. Herold Weinstock, "Cryogenic Technology", 1st ed., Boston Tech, 1969
2. Klaus D. Timmerhaus, Richard P.Reed., "Cryogenic Engineering", Springer, 2007
3. Randall F. Barron, "Cryogenic Systems", 2nd ed., Oxford University Press, New York, 1999.
4. Robert W. Vance, "Cryogenic Technology", 1st ed., John Wiley & Sons, 1966
5. Russell B. Scott., "Cryogenic Engineering", 4th ed., Met Chemical Research, 1988.

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

Approved by Fourth Academic council

13MEX19 METAL CASTING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of foundry technology, molding processes and melting furnaces
- To acquire knowledge on casting design and finishing operations.
- To know the quality control, mechanization and management aspects in foundries

COURSE OUTCOMES:

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

CO1: Explain the principles of foundry technology and steps involved in sand molding process
CO2: Describe the types of metal molding processes and working principle of melting furnaces
CO3: Select the design parameters in casting and finishing operation for a casting process
CO4: Identify the inspection procedure and scope for mechanization
CO5: Summarize the steps involved management aspects and new developments in foundry

UNIT I : FOUNDRY TECHNOLOGY AND SAND MOLDING PROCESSES (9)

Metal casting - classification of foundries - challenges in foundry - industrial sectors - sand molding processes - function of molding sand, classification, ingredients, core sands, testing and control, pattern equipment, types of molding, practical aspects, mold coatings, casting defects due to sand, molding and pattern

UNIT II : METAL MOLDING PROCESSES AND MELTING FURNACES (9)

Die casting - centrifugal, continuous casting - selection of molding processes - furnaces - classification, common melting furnaces - melting procedure, practical aspects - refractories, pouring ladles - selection of melting furnace - casting defects due to improper melting

UNIT III : CASTING DESIGN AND FINISHING OPERATIONS (9)

Solidification process - running and gating system - risering / feeding systems - design of castings - finishing operations - fetling and cleaning - heat treatment of castings - salvaging of defective castings

UNIT IV : INSPECTION, QUALITY CONTROL AND MECHANIZATION (9)

Specification and inspection of castings - analysis of casting defects - quality control and assurance - foundry mechanization - mechanical equipments in foundry - plant site location, layouts - plant engineering, maintenance and services - practical aspects

UNIT V : PLANNING, MANAGEMENT AND NEW DEVELOPMENTS IN FOUNDRY (9)

Planning a new foundry project - organization, management information system - production planning control - practical aspects and case studies - new materials, processes and inspection methods - computer and IT applications - energy conservation - environmental pollution control

TOTAL: 45 PERIODS

TEXT BOOKS :

1. Ramana Rao.T.V, "Metal Casting - Principles and Practice", 1st ed., New Age International Publishers, Reprint 2010
2. Richard W Heine, Carl L Loper and Philip C Resenthal, "Principles of Metal Casting", 2nd ed., McGraw hill education, 2011

REFERENCES :

1. Alexandre Reikher and Michael R Barkhudarov, "Casting: An Analytical Approach", 1st ed., Springer-Verlag London, 2007
2. Jain, P.L, "Principles of Springer-Verlag London", 5th ed., Tata McGraw Hill Pub., Co. Ltd., 2009.
3. Khanna.O.P, "Foundry Technology", Dhanpat Rai Publications", 17th ed., 2011
4. Mahi Sahoo and Sam Sahu, "Principles of Metal Casting", 3rd ed., McGraw hill education, 2014
5. Ravi. B, "Metal Casting : Computer-Aided Design and Analysis", 1st ed., Phi Learning Pvt. Ltd., 2010

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

Approved by Fourth Academic council

13MEX20 NANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the science of nanotechnology, nanomaterials and their synthesis routes
- To acquire knowledge on the characterization methods of nanomaterials
- To know the types of nanostructured materials and applications of nanomaterials

COURSE OUTCOMES:

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

CO1: Summarize the concept of nanotechnology, classification and metallurgical aspects
CO2: Identify the synthesis routes of various nanomaterials
CO3: Select a characterization method for different type of nanomaterials
CO4: Describe the type of nanostructured materials and applications
CO5: Identify the engineering applications of various nanomaterials

UNIT I : INTRODUCTION TO NANOMATERIALS (9)

Science of small things - Classification of Nanostructured Materials - Fascinating Nanostructures - Applications of Nanomaterials - Nanotechnology and nature - Challenges and Future Prospects - Unique Properties of Nanomaterials - Microstructure and Defects in Nanocrystalline Materials - Effect of Nano-dimensions on Materials Behaviors

UNIT II : SYNTHESIS ROUTES (9)

Bottom Up Approaches - PVD, CVD, Spray conversion processing, Sol-gel process, Wet chemical synthesis, Self assembly - top down approaches - mechanical alloying , equal channel angular extrusion, High pressure torsion, Accumulative roll bonding, Nanolithography - consolidation of nano powders

UNIT III : TOOLS TO CHARACTERIZE NANOMATERIALS (9)

X-ray Diffraction - Small Angle X-ray Scattering - Scanning Electron Microscopy - Transmission Electron Microscopy - Atomic Force Microscopy - Scanning Tunnelling Microscope - Field Ion Microscope - Three-dimensional Atom Probe - Nanoindentation

UNIT IV : NANOSTRUCTURED MATERIALS (9)

Quantum Dots - Fabrication and application - carbon nanotubes - types, Chirality, Synthesis, Characterization techniques, physical sensors - GaN nanowires and applications – nanocrystalline ZnO - Crystal structure and properties, Synthesis, Applications - nanocrystalline titanium oxide - Titania-nanopowders, nanotubes - multilayered films - Concerns and Challenges

UNIT V : APPLICATIONS OF NANOMATERIALS (9)

Nano-electronics - Micro and Nano-electromechanical systems - Nanosensors - Nanocatalysts - Food and Agriculture Industry - Cosmetics and Consumer Goods - Structure and Engineering - Automotive Industry - Water Treatment and the Environment - Nano-medical - Textiles - Paints - Energy - Defense, Space and Structural Applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ben Rogers, Jesse Adams and Sumita Pennathur, "Nanotechnology: Understanding Small Systems", 3rd ed., CRC Press, 2014
2. Murty.B.S, Shankar.P, Baldev Raj, Rath. B.B and James Murday, "Textbook of and Nanoscience Nanotechnology", 1st ed., Orient Blackswan Private Limited, New Delhi, 2012

REFERENCES:

1. Charles P Poole Jr. and Frank J Owens, "Introduction to Nanotechnology", Wiley India Publications, 2007
2. Chattopadhyay K.K and Banerjee.A.N, "Introduction to Nanoscience and Nanotechnology", Prentice Hall India, 2009
3. Lynn E. Foster, "Nanotechnology : Science, Innovations and Opportunity", 1st ed., Pearson Education, 2007
4. Pradeep.T, "Nano: The Essentials Understanding Nanoscience and Nanotechnology", 1st ed., McGraw Hill Education (India) Private Limited, 2007
5. Suhas Bhattacharya, "A Textbook of Nanoscience and Nanotechnology", Wisdom Press, 2013

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

Approved by Fourth Academic council

13CEZ01 INDUSTRIAL SAFETY ENGINEERING

(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- To achieve an understanding of principles of safety engineering.
- To enable the students to learn about various functions and activities of safety department.
- To have knowledge about various hazard identification and risk assessment techniques.

COURSE OUTCOMES:

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

CO1: Understand the functions and activities of safety engineering department.
CO2: Prepare an accident investigation report.
CO3: Estimate the accident cost using supervisors report and data.
CO4: Evaluate the safety performance of an organization from accident records.
CO5: List out requirements mentioned in factories act for the prevention of accidents.

UNIT I : CONCEPTS OF SAFETY MANAGEMENT AND ACCIDENT PREVENTION (10)

History of Safety movement – Evolution of modern safety concept - safety management functions –safety organization & safety department- safety committee - line and staff functions for safety - budgeting for safety - safety policy – accident causes - unsafe act and condition - principles of accident prevention – accident investigation and analysis – records for accidents - cost of accident.

UNIT II : HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL (10)

Hazard - classification - chemical, physical, mechanical, ergonomic & biological hazards - hazard evaluation techniques - job safety analysis, safety survey, safety inspection, safety sampling, - fault tree analysis – event tree analysis – failure modes and effect analysis and relative ranking techniques – past accident analysis - estimation of likelihood - consequence analysis – risk estimation – Hierarchy of Hazard control.

UNIT III : SAFETY IN ENGINEERING INDUSTRY (10)

Safety in use of machinery - turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines & wood working machinery - Principles of machine guarding -Guarding during maintenance, zero mechanical state (ZMS), definition, policy for ZMS – safety in welding and gas cutting- safety in cold forming and hot working of metals - safety in finishing, inspection and testing - occupational diseases - Lead –Nickel, Chromium &Manganese toxicity.

UNIT IV : SAFETY PERFORMANCE MONITORING (8)

Work injury experience – permanent total disabilities, permanent partial disabilities & temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate & safety "t" – Total Injury score, illness incidence rate & Lost workday cases –Incidence rate (LWDI) & Number of lost workdays rate – problems - safety audit.

UNIT V : SAFETY AND HEALTH REGULATION (7)

History of legislations related to safety - Factories act 1948 with special reference to safety, Health and welfare provisions - Indian boiler act – smpv rules -The environmental protection act – Electricity act –Explosive act - Health and Safety at work act (HASAWA)UK, - Occupational Safety health act (OSHA) - OHSAS 18001:2007.

TOTAL: 45 PERIODS

Approved by third Academic council

TEXT BOOKS:

1. RayAsfahl.C, David W. Rieske "Industrial Safety and Health management", Prentice Hall, 5th ed., 2009.
2. Mishra.R.K., "Safety Management ", AITBS Publishers, 2012

REFERENCE BOOKS:

1. Dan Petersen, "Techniques of Safety Management", McGraw-Hill Company, Tokyo, 2001.
2. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 2003.

13CEZ02 HUMAN BEHAVIOURS AT WORK

(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course will help the student to understand about ergonomics and Human behaviour.
- To know the importance of anthropometry and designing the machine for man.

COURSE OUTCOMES:

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

CO1: Understand about ergonomics, anthropometry, designing a job for the worker.
CO2: Student will have a deep knowledge about human behaviour.
CO3: Know the fundamental aspects of standing and sitting, an ergonomics approach.
CO4: Gain knowledge about man Vs machine handling task
CO5: Know about a general information about human skill and performance

UNIT I : ERGONOMICS AND ANATOMY (**9)**

Introduction to ergonomics: - The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics. Anatomy, Posture and Body Mechanics: - Some basic body mechanics, anatomy of the sprine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioral aspects of posture, effectiveness and cost effectiveness, research directions.

UNIT II : HUMAN BEHAVIOR **(9)**

Individual differences - Factors contributing to personality - Fitting the man to the job - Influence of difference on safety - Method of measuring characteristics - Accident Proneness – Motivation - Complexity of motivation - Job satisfaction - Management theories of motivation - Job enrichment theory - Frustration and Conflicts - Reaction to frustration - Emotion and Frustration - Attitudes-Determination of Attitudes - Changing attitudes Learning - Principles of Learning – Forgetting - Motivational requirements.

UNIT III : ANTHROPOMETRY AND WORK DESIGN FOR STANDING AND SEATED WORKS (9)

Designing for a population of users, percentile - sources of human variability, anthropometry and its uses in ergonomics - principals of applied anthropometry in ergonomics - application of anthropometry in design, design for everyone - anthropometry and personal space, effectiveness and cost effectiveness - Fundamental aspects of standing and sitting, an ergonomics approach to work station design - design for standing workers, design for seated workers - work surface design - visual display units, guidelines for design of static work**.**

UNIT IV : MAN MACHINE SYSTEM AND REPETETIVE WORKS AND MANUAL HANDLING TASK

(9)

Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Man vs Machine - Ergonomics interventions in Repetitive works, handle design, key board design measures for preventing in work related musculoskeltal disorders (WMSDs) - reduction and controlling - training Anatomy and biomechanics of manual handling - prevention of manual handling injuries in the work place - design of manual handling tasks - carrying, postural stability.

UNIT V : HUMAN SKILL AND PERFORMANCE **(9)**

A general information-processing model of the users - cognitive system, problem solving – effectiveness - Principles for the design of visual displays - auditory displays - design of controls combining displays and controls- virtual (synthetic) environments - research issues.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Bridger.R.S, “Introduction to Ergonomics", CRC Press, Third Edition, 2012.

REFERENCES :

1. Michael O’Neill. “Ergonomic design for organizational effectiveness”, CRC Press, 2004.
2. Mark S Sanders, Ernest J. McCormick. “Human factors in engineering and design”, Tata McGraw Hill 2006.
3. Dan Macleod, Roderick MacLeod. “The Ergonomics Edge: Improving Safety, Quality and Productivity”, John Wiley and Sons, 2008.

13CEZ03 AIR POLLUTION MANAGEMENT
(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same.
- The student is expected to know about source inventory and control mechanism.

COURSE OUTCOMES:

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

CO1: Understand about nature and characteristics of air pollutants.
CO2: Understand the basic elements of atmosphere and its stability.
CO3: An ability to design stacks and particulate air pollution control devices to meet applicable standards.
CO4: Understand the basic concepts of air quality management.
CO5: An ability to identify, formulate and solve air and noise pollution problems.

UNIT I : SOURCES AND EFFECTS OF AIR POLLUTANTS (9)

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

UNIT II : DISPERSION OF POLLUTANTS (9)

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

UNIT III : AIR POLLUTION CONTROL (12)

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV : AIR QUALITY MANAGEMENT (8)

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality.

UNIT V : NOISE POLLUTION (7)

Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata McGraw Hill, New Delhi, 1996.

REFERENCES:

1. Heumann. W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.
2. Mahajan S.P., "Pollution Control in Process Industries", Tata McGraw Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. "Environmental Engineering", McGraw Hill, New Delhi, 1985.
4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi, 1998
5. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw Hill, New Delhi, 1991.
6. Thod Godesh, "Air Quality, Lewis India Edition, 2013.

13CEZ04 BUILDING SERVICES

(*Common to All branches except Civil Engineering)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course will help the student to understand about ergonomics and Human behaviour.
- To know the importance of anthropometry and designing the machine for man.
- Planning and scheduling the frequency of inspection and maintenance of building

COURSE OUTCOMES:

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

CO1: Student will know about the basic electrical systems in buildings
CO2: Gain knowledge about the modern lighting systems.
CO3: Study about the HVAC systems.
CO4: know the concept of planning considerations and fire safety installation in buildings
CO5: Study about the concepts of plumbing and drainage in building.

UNIT I : ELECTRICAL SYSTEMS IN BUILDINGS (9)

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations.

UNIT II : PRINCIPLES OF ILLUMINATION & DESIGN (9)

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour –Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT III : REFRIGERATION PRINCIPLES & APPLICATIONS (9)

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems.

UNIT IV FIRE SAFETY INSTALLATION (9)

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers.

UNIT V PLUMBING AND DRAINAGE (9)

Plumbing fixtures and fixture fittings – Water conserving fittings – Over flows – Strainers and connectors – Prohibited fixtures – Special fixtures – Installation of water closet – Urinals - Flushing devices – Floor drains – Shower stall – Bath tub – Bidets – Minimum plumbing facilities – Rain water harvesting systems – Necessity – Construction – Different types .

Total: 45 PERIODS

REFERENCES:

1. E.R.Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
4. R.G.Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London,
5. 1969.
6. William H.Severns and Julian R.Fellows, “Air-conditioning and Refrigeration”, John
7. Wiley and Sons, London, 1988.
8. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, the Architectural Press, London, 1980.

13CSZ01 COMPUTER NETWORKS
(*Common to All branches except CSE Branch)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the division of network functionalities into layers.
- To be familiar with the components required to build different types of networks.
- To be exposed to the required functionality at each layer.
- To learn the flow control and congestion control algorithms.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Identify the components required to build different types of networks
CO2: Choose the required functionality at each layer for given application
CO3: Identify solution for each functionality at each layer.

UNIT I : FUNDAMENTALS & PHYSICAL LAYER (9)

Building a network – Requirements - Layering and protocols - Network software – Performance –Encoding schemes-Ethernet (802.3) –Wireless LANs – 802.11.

UNIT II : DATA LINK LAYER (9)

Link layer Services – Framing – Error Detection –Flow control –Media access control –Flow and error control Protocils– Connecting LANS: Connecting devices.

UNIT III : NETWORK LAYER (9)

Internetworking-IPV4 – Address Mapping – ARP – RARP – ICMP – IGMP – Forwarding –Routing – Unicast and multicast routing – RIP – OSPF – DVR–LSR.

UNIT IV : TRANSPORT LAYER (9)

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management – Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V : APPLICATION LAYER (9)

Traditional applications –Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – FTP – Web Services – DNS .

TOTAL: 45 PERIODS

TEXT BOOK:

1. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw Hill,2011.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
3. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.

13CSZ02 SOFTWARE ENGINEERING
(*Common to All branches except CSE Branch)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Understand the life cycle models of software process
- To Understand fundamental concepts of requirements engineering and Analysis Modeling
- To learn the systematic procedure for software design
- To Implement the strategies for software testing
- To explore the significance of project planning and management.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Identify the key activities in managing a software project.
CO2: Compare different process models.
CO3: Implement the Concepts of requirements engineering and Analysis Modeling.
CO4: Apply systematic procedure for software design and deployment.
CO5: Compare and contrast the various testing and maintenance.

UNIT I: SOFTWARE PROCESS (9)

Introduction –Software Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation.

UNIT II: SOFTWARE REQUIREMENTS (9)

Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping -Software document. Analysis and modeling – data, functional and behavioral models – structured analysis and data dictionary.

UNIT III: SOFTWARE DESIGN (9)

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV: SOFTWARE TESTING (9)

Taxonomy of software testing – levels – test activities – types of software test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large - software testing strategies - testing using extreme programming.

UNIT V: SOFTWARE PROJECT MANAGEMENT (9)

Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II - Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM - Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics

. **TOTAL: 45 PERIODS**

TEXT BOOK:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", 7th ed., Mc Graw-Hill International Edition, 2010.

REFERENCES :

1. Ian Sommerville, "Software Engineering", 9th ed., Pearson Education Asia, 2011.
2. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI COURSE Private Limited, 2009.
3. Pankaj Jalote, "Software Engineering - A Precise Approach", Wiley India, 2010.
4. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
5. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company.

13CSZ03 DATA STRUCTURES
(*Common to All branches except CSE Branch)*

L	T	P	C
3	0	0	3

OBJECTIVES :

- To learn the basics of abstract data types.
- To learn the principles of linear and non linear data structures.
- To learn various searching and sorting techniques.
- To learn different tree traversals.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Demonstrate the concept of linear and non linear data structures.
CO2: Determine the efficiency of algorithms.
CO3: Design of algorithms for various searching and sorting techniques.

UNIT I: INTRODUCTION (9)

Pseudo code–Abstract data types-Model for an ADT-ADT Implementations-Algorithm efficiency-Time complexity and space complexity-Designing recursive algorithms-Recursive examples.

UNIT II: STACKS, QUEUES AND LISTS (9)

Arrays – Basic stack operation- Stack ADT - Applications of stack – Queues operations- Queue ADT – Queue applications -List ADT - Circular - Doubly linked list.

UNIT III: SORTING AND SEARCHING TECHNIQUES (9)

Sorting: Insertion Sort- Selection Sort- Bubble Sort - Merge sort – Quick sort –Heap sort-shell sort-Searching: Sequential search- Binary Search – Hashed list searches.

UNIT IV: NON LINEAR LIST (9)

Basic Tree concepts - Binary Trees – Tree Traversals – Expression Trees - Binary Search Trees – AVL Search Trees- Splay Trees.

UNIT V: GRAPHS (9)

Definitions – Traverse Graph: Depth first Traversal-Breadth first Traversal-Shortest Path Algorithms: Unweighted Shortest Paths – Dijkstra‘s Algorithm. Minimum Spanning Tree: Prim‘s Algorithm– Kruskal‘s Algorithm.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures – A Pseudocode Approach with C,Thomson 2009.
2. M.A.Weiss, Data Structures and Algorithm Analysis in C, Pearson Education Asia, 2007.

REFERENCE BOOKS:

1. Y.Langsam, M.J.Augenstein and A.M.Tenenbaum, Data Structures using C, PHI, 2004
2. Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010
3. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, 2007.

13CSZ04 OPEN SOURCE SOFTWARE
(*Common to All branches except CSE Branch)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of open source operating systems.
- To gain the knowledge of working with Linux platform and open source database.
- To be familiar with programming languages PHP, Perl, Python.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Ability to install and run open-source operating systems.

CO2: Ability to gather information about Free and Open Source Software projects from software releases and from sites on the internet.

CO3: Develop programs using PHP, Perl, Python and MySQL.

UNIT I: INTRODUCTION (9)

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources –Application of pen Sources. Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals –Development with Linux.

UNIT II: OPEN SOURCE DATABASE (9)

MySQL: Introduction – Setting up account –Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings –Date and Time – Sorting Query Results – Generating Summary – Working with metadata – Using sequences –MySQL and Web.

UNIT III: OPEN SOURCE PROGRAMMING LANGUAGES (9)

PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP –String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security –Templates.

UNIT IV: PYTHON (9)

Syntax and Style – Python Objects – Numbers – Sequences – Strings –Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output –Errors and Exceptions – Functions – Modules – Classes and OOP –Execution Environment.

UNIT V: PERL (9)

Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures –Subroutines, Packages, and Modules- Working with Files –Data Manipulation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003.
2. Steve Suchring, "MySQL Bible", John Wiley, 2002

REFERENCE BOOKS:

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002
2. Wesley J. Chun, "Core Phython Programming", Prentice Hall, 2001
3. Martin C. Brown, "Perl: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
4. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.

13CSZ05 INFORMATION SECURITY

(*Common to All branches except CSE branch)*

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Understand the basics of Information Security
CO2: Know the legal, ethical and professional issues in Information Security
CO3: Know the aspects of risk management
CO4: Become aware of various standards in this area
CO5: Know the technological aspects of Information Security

UNIT I: INTRODUCTION (9)

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

UNIT II: SECURITY INVESTIGATION (9)

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

UNIT III: SECURITY ANALYSIS (9)

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk

UNIT IV: LOGICAL DESIGN (9)

Blueprint for Security, Information Security Poicy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V: PHYSICAL DESIGN (9)

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL: 45 PERIODS

TEXT BOOK:

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003

REFERENCES:

1. Micki Krause, Harold F. Tipton, “ Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw Hill, 2003
3. Matt Bishop, “ Computer Security Art and Science”, Pearson/PHI, 2002.

13ECZ01 - AVIONICS (OE)
(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the needs for avionics for both Civil and military aircraft.
- To introduce various digital electronic principles and working operations of digital circuit.
- To integrate the digital electronics with cockpit equipments.
- To understand the various principles in flight disk and cockpit panels.

COURSE OUTCOMES:

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

CO1 : Describe the hardware required for aircraft.
CO2 : Explain the communication and navigation techniques used in aircrafts.
CO3 : Discuss about the autopilot and cockpit display related concepts.

UNIT- I INTRODUCTION TO AVIONICS (9)

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT- II DIGITAL AVIONICS BUS ARCHITECTURE (9)

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable sped arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT- III AVIONICS SYSTEMS (9)

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of gripers – design considerations.

UNIT- IV ON BOARD NAVIGATION SYSTEMS (9)

Solution of inverse kinematics problem – multiple solution Jacobian work envelop – hill Climbing Techniques – robot programming languages.

UNIT- V CASE STUDY (9)

Multiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

TOTAL: 45 PERIODS

TEXT BOOK:

1. R.P.G. Collinson, "Introduction to Avionics", Chapman & Hall Publications, 1996.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES:

1. Cary R .Spitzer, “The Avionics Handbook”, CRC Press, 2000.
2. Middleton, D.H. “Avionics Systems”, Longman Scientific and Technical, Longman Group UK.Ltd., England, 1989.
3. Spitzer, C.R. “Digital Avionics Systems”, Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.
4. Brain Kendal, “Manual of Avionics”, The English Book House, 3rd Edition, New Delhi, 1993
5. Jim Curren, “Trend in Advanced Avionics”, IOWA State University, 1992.

13ECZ02 SENSORS AND TRANSDUCERS

(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on various types of sensors and transducers for Automation in science, Engineering and medicine.

COURSE OUTCOMES:

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

CO1 : Know basic concepts of various sensors and transducers.

CO2 : Develop knowledge in selection of suitable sensor based on requirement and applications.

UNIT- I INTRODUCTION (9)

Definition, classification, static and dynamic parameters, Characterization – Electrical, mechanical, thermal, optical, biological and chemical, Classification of errors – Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors.

UNIT-II MECHANICAL AND ELECTROMECHANICAL SENSORS (9)

Resistive Potentiometer, strain gauge, Inductive sensors and transducer, capacitive sensors, ultrasonic sensors.

UNIT-III THERMAL SENSOR (9)

Thermal Sensors: Gas thermometric sensors, acoustic temperature sensors, magnetic thermometer, resistance change -type thermometric sensors, thermo emf sensors, junction semiconductor types.

UNIT-IV MAGNETIC SENSOR (9)

Magnetic Sensors: Force and displacement measurement, magneto resistive sensors, Hall Effect sensor, Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flow meter, squid sensor.

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UNIT-V SENSORS AND THEIR APPLICATIONS (9)

Automobile sensor, Home appliance sensor, Aerospace sensors, sensors for manufacturing, medical diagnostic sensors, environmental monitoring.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Patranabis D, “Sensor and Actuators”, Prentice Hall of India (Pvt) Ltd., 2006

REFERENCES:

1. Ian Sinclair, “Sensor and Transducers”, Elsevier India Pvt Ltd, 3rd Edtion, 2011.
2. A.K. Sawhney, Puneeth sawhney, “A Course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai Publications, 2012.
3. Ernest O. Doeblin, “Measurement System, Application and Design”, Tata McGraw Hill Publishing Company Ltd., 5 th Edition, 2008.

13ECZ03 MODERN WIRELESS COMMUNICATION SYSTEMS (OE)

(Common to All Branches except ECE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course is to provide comprehensive background knowledge of wireless and mobile communication.
- This course is intended for anyone who wants to learn about the new wave of wireless networks.

COURSE OUTCOMES:

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

CO1 : Discuss the fundamentals of cellular mobile wireless networks.

CO2 : Provide an overview of various approaches to communication networks.

CO3 Study the numerous different-generation technologies

CO4 : Know about the principles of operation of the different access technologies like FDMA, TDMA, SDMA and CDMA

UNIT- I TRANSMISSION FUNDAMENTALS (9)

Cellphone Generations: 1G, 2G, 2.5G, 3G & 4G Transmission Fundamentals: Time domain & Frequency domain concepts, Radio, Analog Vs Digital, channel capacity, transmission media, carrier-based signaling, spread-spectrum signaling.

UNIT –II NETWORK CONCEPTS (9)

Communication Networks: LANs, MANs, WANs, circuit switching, packet switching, ATM Cellular Networks: Cells, duplexing, multiplexing, voice coding Multiple Access Techniques: FDMA, TDMA, SDMA, CDMA, spectral efficiency.

UNIT- III PERSONAL COMMUNICATION SERVICES (9)

GSM, HSCSD, GPRS, D-AMPS, CDMA One, CDMA Two, Packet Data Systems.

UNIT- IV 3G & BEYOND (9)

IMT-2000, W-CDMA, CDMA 2000, EDGE, Wi-Fi, WiMAX, OFDM.

UNIT- V MOBILE DATA SERVICES & SHORT-RANGE NETWORKS (9)

Mobile Data Services: Messaging, wireless web, WAP, site design Short-Range Wireless Networks: Unlicensed spectrum, WLANs, cordless telephony, IrDA, Bluetooth .Smart Phones: Future phones, mobile OSs, smart phone applications.

TOTAL : 45PERIODS

TEXT BOOKS:

1. Andy Dornan, "The essential guide to wireless communications applications: from cellular systems to Wi-Fi", 2nd Edition, Prentice Hall, 2002.
2. Misra, "Wireless Communications and Networks: 3G & Beyond", Tata McGraw-Hill, 2013.

REFERENCES:

1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2009.
2. William Stallings, "Wireless communications and networking", Prentice Hall, 2005.

13ECZ04 RADAR AND NAVIGATIONAL AIDS (OE)
(Common to All Branches except ECE branch)

OBJECTIVES:

L	T	P	C
3	0	0	3

- To make the student understand the principles of Radar and its use in military and civilian environment
- Also to make the student familiar with navigational aids available for navigation of aircrafts and ships.

COURSE OUTCOMES:

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

CO1 : Derive and discuss the Range equation and the nature of detection.
CO2 : Apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
CO3 : Refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
CO4 : Understand principles of navigation, in addition to approach and landing aids as related to navigation

UNIT I INTRODUCTION TO RADAR (9)

Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar

UNIT II MTI AND PULSE DOPPLER RADAR (9)

Introduction to Doppler and MTI Radar- Delay –Line Cancelers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar

UNIT III DETECTION OF SIGNALS IN NOISE (9)

Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure – Superheterodyne Receiver

UNIT IV HYPERBOLIC SYSTEMS OF NAVIGATION (9)

Loran-A - Loran-A Equipment- Range and precision of Standard Loran - Loran-C - The Decca Navigation System -Decca Receivers - Range and Accuracy of Decca - The Omega System

UNIT V DME AND TACAN (9)

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment Aids to Approach and Landing - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System Satellite Navigation System - The Transit System - Navstar Global Positioning System(GPS)

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003.
2. N.S.Nagaraja, Elements of Electronic Navigation Systems, 2nd Edition, TMH, 2000.

REFERENCES:

1. Peyton Z. Peebles:, "Radar Principles", Johnwiley, 2004
2. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004

13EEZ01 RENEWABLE ENERGY TECHNOLOGY

(Common to All Branches except EEE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To emphasis the current energy status and role of renewable energy
- To know about the various concept of solar and wind energy
- To know about the various concept of biomass and other renewable energy sources

COURSE OUTCOMES:

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

CO1: Plan appropriate kind of energy for the future development

CO2: Know basics of solar energy

CO3: Understand the concepts of wind energy

CO4: Understand and apply concepts of biomass energy

CO5: Understand other renewable energy sources

UNIT I : INTRODUCTION **(9)**

World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment-Economy - Energy and Sustainable Development, Energy planning. Reserves of Energy resources - Renewable energy resources - Potentials - Achievements - applications - Technical and social implications, issues in grid integration of power from renewable energy sources.

UNIT II : SOLAR ENERGY **(9)**

Basic concepts, Solar radiation – Measurement, Solar thermal systems – Flat plate and concentrating collectors, Solar passive space – Solar heating and cooling techniques – Solar desalination – Solar Pond – Solar cooker – Solar dryers – Solar furnaces – Solar pumping – Solar green house- Solar thermal electric power plant – Solar photo voltaic conversion – Solar cells – PV applications – Hybrid systems.

UNIT III : WIND ENERGY **(9)**

Introduction – Availability- Wind power plants, Power from the wind, Wind energy conversion systems, site characteristics – Wind turbines types – Horizontal and vertical axis – Design principles of wind turbine – Blade element theory - Magnus effect – Performance – Wind energy Applications – Hybrid systems – Wind energy storage – Safety and environmental aspects.

UNIT IV : BIOMASS ENERGY **(9)**

Biomass – Usable forms- composition – Fuel properties – Applications – Biomass resource – Biomass conversion technologies – Direction combustion – Pyrolysis – Gasification – Anaerobic digestion –Bioethanol and Biodiesel Production – Economics – Recent developments – Energy farming – Biogas technology – Family biogas plants – Community and institutional biogas plants – design consideration – Applications

UNIT V : OTHER RENEWABLE ENERGY SOURCES **(9)**

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Social and environmental aspects – Fuel cell technology: Types, principle of operation, applications –Hydrogen energy production – Storage – Transportation – Utilization.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Godfrey Boyle, "Renewable Energy", Power for a Sustainable Future, Oxford University Press, U.K, 1996.
2. Twidell.J.W & Weir.A, "Renewable Energy Sources", EFN Spon Ltd., UK, 1986.
3. Tiwari.G.N, "Solar Energy - Fundamentals Design", Modelling and applications, Narosa PublishingHouse, NewDelhi, 2002.

REFERENCES:

1. Kothari P, K C Singal and Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Pvt. Ltd.,New Delhi, 2008.
2. G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.
3. S.P. Sukhatme, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

13EEZ02 PLC AND AUTOMATION

(Common to All Branches except EEE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on Programmable Logic Controller and Automation
- To design controller for industrial automation system

COURSE OUTCOMES:

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

CO1: Select the right hardware for a given application

CO2: Consider such aspects of the automation system as network communication and human machine interface

UNIT I : PROGRAMMABLE LOGIC CONTROLLERS (9)

Basics of PLC - Architecture of PLC - Advantages - Types of PLC - Introduction to PLC Networking- Networking standards - Protocols - Field bus - Process bus and Ethernet IEEE Standard.

UNIT II : PROGRAMMING OF PLC & HMI SYSTEMS PROGRAMMING OF PLC (9)

Types of Programming - Simple process control programs using Relay Ladder Logic and Boolean logic methods - PLC arithmetic functions - Introduction to advanced programming methods.

HMI systems: Necessity and Role in Industrial Automation, Text display - Operator panels - Touch panels - Panel PCs – Integrated displays (PLC & HMI).

UNIT III : DISTRIBUTED CONTROL SYSTEMS (DCS) (9)

Difference between SCADA system and DCS - Architecture - Local control unit - Programming language – communication facilities - Operator interface - Engineering interfaces.

UNIT IV : APPLICATIONS OF PLC & DCS (9)

Case studies of Machine automation - Process automation - Introduction to SCADA - Comparison between SCADA and DCS.

UNIT V : AUTOMATION (9)

Factory Automation: Flexible Manufacturing Systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection – Computer Integrated Manufacture – CNC - Intelligent automation - Industrial networking, - Bus standards - HMI Systems - DCS and SCADA - Wireless controls.

TOTAL: 45 PERIODS

TEXTBOOK:

1. John.W.Webb & Ronald A. Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall of India, 2003.

REFERENCES:

1. Michael P. Lukas, "Distributed Control systems", Van Nostrand Reinfold Company, 1995.
2. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson Press, USA, 2005.
3. W. Bolton, "Programmable Logic Controllers", Elsevier India Private Limited, New Delhi, 2008.
4. Mikell P. Groover, "Automation Production systems and Computer Integrated Manufacturing", Prentice Hall of India, New Delhi, 2007.

13EEZ03 AUTOMOTIVE ELECTRONICS

(Common to All Branches except EEE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the electronic instruments for automobiles
- To study the advanced electronics instruments for ignition and braking systems

COURSE OUTCOMES:

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

CO1: Provide an introduction and a deep knowledge in various ignition and instrumentation systems in vehicles

CO2: Model and stimulate the various modern electronics automotive systems by using various numerical analysis and simulation tools

CO3: Formulate and solves electronic engineering challenges related to the most representative automotive systems using the classical and modern methodologies in electronics engineering

UNIT I : INTRODUCTION (9)

Automotive component operation - Electrical wiring terminals and switching - Multiplexed wiring systems - Circuit diagrams and symbols - Charging Systems and Starting Systems: Charging systems principles, alternations and charging circuits - Basic starting circuit.

UNIT II : IGNITION SYSTEMS (9)

Ignition fundamental, Electronic ignition systems - Programmed ignition distribution less ignition direct ignition spark plugs - Electronic Fuel Control - Basics of combustion Engine fuelling and exhaust emissions - Electronic control of carburetion - Petrol fuel injection Diesel fuel injection.

UNIT III : INSTRUMENTATION SYSTEMS (9)

Introduction to instrumentation systems - Various sensors used for different parameters sensing - Driver instrumentation systems - Vehicle condition monitoring trip - Different types of visual display

UNIT IV : ELECTRONIC CONTROL OF BRAKING AND TRACTION (9)

Introduction and description control elements - control methodology - electronic control of automatic transmission - Introduction and description Control of gear shift and torque converter lockup - Electric power steering - Electronic clutch.

UNIT V : ENGINE MANAGEMENT SYSTEMS (9)

Combined ignition and fuel management systems - Exhaust emission control - Digital control techniques - Complete vehicle control systems - Artificial intelligence and engine management - Automotive microprocessor uses.

Lighting and Security Systems:

Vehicles lighting Circuits - Signaling Circuit Central locking and electric windows security systems - Airbags and seat belt tensioners - Miscellaneous safety and comfort systems.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Tom Denton, "Automobile Electrical and Electronic Systems", Edward Arnold publications, 1995

REFERENCES:

1. Don Knowles, Don Knowles, Prentice Hall, Englewood Cliffs, "Automotive Electronic and Computer controlled Ignition Systems", New Jersey 1988.
2. William, T.M., "Automotive Electronic Systems", Heiemann Ltd., London ,1978.
3. Ronald K Jurgen, "Automotive Electronics Handbook", McGraw Hill, Inc, 1999.

13EEZ04 UTILIZATION AND CONSERVATION OF ELECTRICAL ENERGY

(Common to All Branches except EEE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on Generation of electrical power by conventional and non – conventional methods
- To expose students to the main aspects of generation, utilization and conservation
- Electrical energy conservation, energy auditing and power quality
- Principle and design of illumination systems and methods of heating and welding

COURSE OUTCOMES:

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

CO1: Design the wiring circuits and protection schemes for various types of electrical installations

CO2: Apply the electric drives and their power supply systems used in various types of electric traction applications

CO3: Acquire software development skills and experience in the usage of standard packages necessary for analysis

UNIT I : ILLUMINATION, HEATING AND WELDING (9)

Nature of radiation – definition – laws – Photometry – Lighting calculations – Design of illumination systems (for residential, industrial, commercial, health care, street lightings, sports, administrative complexes) - Types of lamps - energy efficiency lamps. Methods of heating, requirement of heating material – Design of heating element –Furnaces – Welding generator – Welding transformer and its characteristics.

UNIT II : ELECTRIC TRACTION (9)

Introduction – requirements of an ideal traction system – Supply systems – Mechanics of train movement – Traction motors and control – Multiple units – Braking – Current collection systems – Recent trends in electric traction.

UNIT III : DRIVES AND THEIR INDUSTRIAL APPLICATIONS (9)

Introduction – motor selection and related factors – Loads – Types – Characteristics – Steady state and transient characteristics – Load equalization – Industrial applications – Modern methods of speed control of industrial drives.

UNIT IV : CONSERVATION (9)

Economics of generation – definitions – load curves – number and size of units – cost of electrical energy – tariff – need for electrical energy conservation – methods – energy efficient equipment – energy management – energy auditing. Economics of power factor improvement – design for improvement of power factor using power capacitors – power quality – effect on conservation.

UNIT V : DEMAND SIDE MANAGEMENT (9)

Introduction - Automated demand response - Peak saving - Load Leveling - Load control- Issues Involving the Implementation Demand Side Management Solutions - Public Benefits Programs, Rate Schedules, Time-of-Use Rates, Power Factor Charges, and Real - Time Pricing - Solar investment tax credit.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. E. Openshaw Taylor, Utilization of Electrical Energy in SI Units, Orient Longman Pvt.Ltd, 2003.
2. B.R. Gupta, Generation of Electrical Energy, Eurasia Publishing House (P) Ltd, New Delhi, 2003.

REFERENCES:

1. H. Partab, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2. Gopal.K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2002.
3. C.L. Wadhwa, Generation, "Distribution and Utilization of Electrical Energy", New Age International Pvt.Ltd, 2003.
4. J.B. Gupta, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2002.

13EIZ01 AUTOTRONIX

(Common to All Branches except EIE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course focuses on the extent and nature of electronic circuitry in automotive systems including monitoring and control circuits for engines, emission control system, ignition systems and fuel systems.
- The course imparts applications of sensors on automotive systems

COURSE OUTCOMES:

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

CO1: Understand the application of electronics in automotive industry.
CO2: Identify different control systems in automotives and their control.
CO3: Design and implement various control algorithms in automotives.
CO4: Demonstrate different instrumentation systems in automotives.
CO5: Identify, formulate and solve real time engineering problems.

UNIT I : FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (9)

Electronic Engine Management System – Components – Open and Closed Loop Control Strategies – PID Control – Look Up Tables – Introduction – Modern Control Strategies Like Fuzzy Logic and Adaptive Control – Controlled Parameters – SI and CI Engines.

UNIT II : SENSORS AND ACTUATORS (9)

Introduction – Basic Sensor Arrangement – Types Of Sensors – Hall Effect Sensor – Hot Wire Anemometer – Thermistor – Piezo-Electric Sensor – Piezo-Resistive Sensors – Oxygen Concentration Sensor – Lambda Sensor – Crankshaft Angular Position Sensor – Cam Position Sensor – Mass Air Flow (MAF) Rate – Manifold Absolute Pressure (MAP) – Throttle Plate Angular Position – Engine Oil Pressure Sensor – Vehicle Speed Sensor – Stepper Motors – Relays – Detonation Sensor – Emission Sensors .

UNIT III : SPARK IGNITION ENGINE MANAGEMENT (9)

Feedback Carburetor System – Throttle Body Injection – Multi Point Fuel Injection System – Injection System Controls –Advantage of Electronic Ignition Systems – Three Way Catalytic Converter – Conversion Efficiency Versus Lambda – Group and Sequential Injection Techniques – Fuel System Components – Advantages of Electronic Ignition Systems –Solid State Ignition Systems – Principle Of Operation – Types – Contact Less Electronic Ignition System – Electronic Spark Timing Control.

UNIT IV : COMPRESSION IGNITION ENGINE MANAGEMENT (9)

Fuel Injection System – Parameters Affecting Combustion – Noise and Emissions in CI Engines – Pilot, Main, Advanced – Post Injection and Retarded Post Injection – Electronically Controlled Unit Injection System – Layout of the Common Rail Fuel Injection System – Fuel Injector – Fuel Pump – Rail Pressure Limiter – Flow Limiter – Working Principle – EGR Valve Control in Electronically Controlled Systems.

UNIT V : DIGITAL ENGINE CONTROL SYSTEM (9)

Open Loop and Closed Loop Control System – Engine Cooling and Warm Up Control – Idle Speed Control – Acceleration and Full Load Enrichment – Deceleration Fuel Cut-off – Fuel Control Maps – Open Loop Control of Fuel Injection – Closed Loop Lambda Control – Exhaust Emission Control – On Board Diagnostics: Diagnostics – Future Automotive Electronic Systems.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Arthur Primrose Young, Leonard Griffiths, "Automobile Electrical and Electronic Equipment", London Butterworths, 9th ed, 1986.
2. William Ribbens, "Understanding Automotive Electronics: An Engineering Perspective", Butterworth-Heinemann, 7th ed., 2013.

REFERENCES:

1. Allan Bonnick, "Automotive Computer Controlled Systems" Taylor & Francis, Fifth Edition, 2001.
2. Tom Denton, "Automobile Electrical and Electronics Systems", Butterworth- Heinemann, Fourth Edition, 2004.
3. Robert Bosch GmbH, "Diesel-Engine Management", John Wiley & Sons, Fourth Edition, 2006.
4. Robert Bosch GmbH and Horst Bauer, "Gasoline-Engine Management", Bentley Publishers, Second Edition, 2006.
5. Robert. N, Brady, "Automotive Computers and Digital Instrumentation", Prentice Hall, First Edition, 1988.
6. V.A.W Hillier, "Fundamentals of Automotive Electronics", Nelson Thornes Limited, Sixth Edition, 2012.

(Common to All Branches except EIE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course introduces fundamental physical principles of both classical and modern optics as well as principles of optical design used in the engineering of optical systems.
- The course also provides exposure to practical aspects of optical materials and devices.
- The intention of the course is to provide foundation of basic principles, design methodology, and practical considerations needed to design or use optical and laser instruments in engineering practice.

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of optical fibres and their properties.
CO2: Have adequate knowledge about the Industrial applications of optical fibres.
CO3: Relate and identify different types interferometric optical fibre sensors and their applications.
CO4: Demonstrate fibre components.
CO5: Understand fibre optic sensor multiplexing.

UNIT I : OPTICAL SOURCES AND DETECTORS (9)

Light-emitting diode-Principles, Structures, LED characteristics, Modulation of LED. Lasers-Principles, Laser diode structures and radiation pattern, Laser characteristics, Modulation of Semiconductor Laser. Photo detectors-Principles, Quantum efficiency, Responsitivity of P.I.N photodiode, and Avalanche photodiode.

UNIT II : OPTICAL FIBER SENSORS AND DEVICES (9)

Overview of fibre optic sensors – advantages over conventional sensors, broadband classification. Intensity Modulated Optical Fibre Sensors-Introduction, intensity modulation through light interruption shutter/ schlieren multimode fibre optic sensors – reflective fibre optic sensors, evanescent wave fibre sensors -microbend optical fibre sensors – fibre optic refractometers, intensity modulated fibre optic thermometers, distributed sensing with fibre optics.

UNIT III : INTERFEROMETRIC OPTICAL FIBRE SENSORS (9)

Introduction, basic principles of interferometric optical fibre sensors, components and applications of interferometric sensors. Fused Single Mode Optical Fibre Couplers-Introduction, physical principles (coupling coefficient) polarization effect, experimental properties, theoretical modelling, and comparison with experiment.

UNIT IV : SINGLE MODE ALL FIBRE COMPONENTS (9)

Introduction, directional couplers, polarizes, polarization splitters polarization controllers, optical isolators, single mode fibre filters wave length multiplexers and demultiplexers, switches and intensity modulators, phase and frequency modulators.

UNIT V : FIBRE OPTIC SENSOR MULTIPLEXING (9)

Introduction, general topological configuration, and incoherent and coherent detection. Signal Processing in Monomode Fibre Optic Sensor Systems-Introduction, Transduction mechanisms, Optical Signal Processing, Electronic Processing.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Dr. M. Arumugam, "Optical Fiber Communications and Sensors". Anuradha Publications, 3rd ed., 2014.

REFERENCES:

1. Gerd Keiser, " Optical Fiber Communications" , McGraw Hill, 3rd ed., 2001
2. Bishnu, P PAL "Fundamentals of Fibre Optics in Telecommunication and Sensor Systems" Wiley Eastern Ltd, 1994.

13EIZ03- INDUSTRIAL AUTOMATION
(Common to All Branches except EIE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course produces students who can use their multidisciplinary skills to meet growing demand from an industry that is pushing the limits of technology by exploiting the growing convergence of these fields.
- The course aims to provide knowledge on fundamentals of robots, robot programming, and its vision system and apply to demonstrate their knowledge in real time application.

COURSE OUTCOMES:

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

CO1: Demonstrate the concepts of robotic principles and various robot configurations.
CO2: Develop solutions for the robot position and orientation for given application.
CO3: Identify the appropriate configuration for the application.
CO4: Design intelligence systems incorporating real time data capturing using vision systems.
CO5: Understand robotic programming and develop simple robotic systems.

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UNIT I : BASIC CONCEPTS **(9)**

Definition and origin of robotics –different types of robotics–various generations of robots –degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II : POWER SOURCES AND SENSORS **(9)**

Hydraulic, pneumatic and electric drives–determination of HP of motor and gearing ratio–variable speed arrangements –path determination –micro machines in robotics–machine vision–ranging –laser –acoustic– magnetic, fiber optic and tactile sensors.

UNIT III : MANIPULATORS, ACTUATORS AND GRIPPERS **(9)**

Construction of manipulators–manipulator dynamics and force control–electronic and pneumatic manipulator control circuits–end effectors–U various types of grippers–design considerations.

UNIT IV : KINEMATICS AND PATH PLANNING **(9)**

Solution of inverse kinematics problem–multiple solution jacobian work envelop–hill climbing Techniques – robot programming languages

UNIT V : CASE STUDIES (**9)**

Mutiple robots–machine interface–robots in manufacturing and non-manufacturing applications –robot cell design–selection of robot.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Industrial Robotics (SIE): Technology, Programming and Applications Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger Nagel, Ashish Dutta , Mcgrawhill, 2012.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1999.

REFERENCES:

1. S.R. Deb, Robotics technology and flexible Automation, John Wiley, USA 1992.
2. C.R. Asfahl., Robots and manufacturing Automation, John Wiley, USA 1992.
3. R.D. Klafter, T.A. Chimielewski, M. Negin, Robotic Engineering –An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. P.J. Mc Kerrow, Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

13EIZ04 ULTRASONIC INSTRUMENTATION

(Common to All Branches except EIE branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides adequate knowledge about the properties of ultrasonic wave and the method of generation.
- It also gives the knowledge about the testing and applications of ultrasonic waves.

COURSE OUTCOMES:

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

CO1: Demonstrate properties and characteristics of ultrasonic wave.
CO2: Generate and test ultrasonic waves using different methods.
CO3: Measure the properties of ultrasonic wave and apply to various real time applications
CO4: Analyze Gyroscopic Instruments and engine Instruments.

UNIT I : ULTRASONIC WAVES CHARACTERISTICS (9)

Ultrasonic waves – Principle and propagation of various waves – Characterization of ultrasonic transmission – Reflection and transmission coefficients – Intensity and attenuation of sounds beam Power level – Medium parameters.

UNIT II : ULTRASONIC WAVE GENERATION (9)

Generation of ultrasonic waves – Magnetostrictive and piezoelectric effects – Search unit types – Construction and characteristics

UNIT III : ULTRASONIC TEST METHODS (9)

Ultrasonic test methods – Pulse echo – Transit time – Resonance – Direct contact and immersion type – Ultrasonic methods of flaw detection.

UNIT IV : ULTRASONIC MEASUREMENTS (9)

Ultrasonic measurements – Ultrasonic methods of measuring thickness, depth and flow – Variables affecting ultrasonic testing in various applications.

UNIT V : ULTRASONIC APPLICATIONS (9)

Ultrasonic applications – Ultrasonic applications in medical diagnosis and therapy, acoustical holography.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J David and N Cheeke, " Fundamentals and Applications of Ultrasonic Waves", CRC Press 2002.
2. Dale Ensminger, " Ultrasonic: Fundamentals, Technology and Applications", CRC press 1988.

REFERENCES:

1. Baldev Raj Palanichamy and V Rajendran, "Science and Technology of Ultrasonic", Alpha Science 2004.
2. Emmanuel P Papadakis, " Ultrasonic Instruments and Devices: Reference for Modern Instrumentation Techniques, and Technology", Academic Press, 1999.

13ITZ01 PC HARDWARE AND TROUBLE SHOOTING

(Common to All Branches except IT branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course will provide participant a much needed knowledge of computer hardware and networking, enabling them to identify and rectify the onboard computer hardware, software and network related problems.
- upgrading of existing hardware / software as and when required. The main aspect of this program is to eliminate cost for the computer engineer boarding the vessel for troubleshoot, install / configure the application program and network related problems and there by charging exorbitant fees to ship owners / managers.

COURSE OUTCOMES:

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

CO1: Disassemble and reassemble a working computer Handle and repair

CO2: Establish a local computer network & Load and configure a working Windows Operating System

CO3: Make minor repairs and upgrades to a laptop computer& evaluate a computer system for individual customers, making suggestions to optimize the system for the individual

CO4: Implement the design using Objective C and iOS

CO5: Configure the power management features on a computer system,Troubleshoot, configure and repair printers

UNIT I : INTRODUCTION (9)

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers - Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II : PERIPHERAL DEVICES (9)

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III : PC HARDWARE OVERVIEW (9)

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV : INSTALLATION AND PREVENTIVE MAINTENANCE (9)

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V : TROUBLESHOOTING (9)

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

TOTAL: 45 PERIODS

TEXT BOOK:

1. B. Govindarajalu, “IBM PC Clones Hardware, Troubleshooting and Maintenance”, 2/E, TMH, 2002.

REFERENCES:

1. Peter Abel, Niyaz Nizamuddin, “IMB PC Assembly Language and Programming”, Pearson Education, 2007.
2. Scott Mueller, “Repairing PC's”, PHI,1992

13ITZ02 ESSENTIALS OF INFORMATION TECHNOLOGY

(Common to All Branches except IT branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide extensive knowledge on IT Essentials including client-server modeling, designing data store, and working with Internet.
- To document artifacts using common quality standards.

COURSE OUTCOMES:

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

CO1: Understand fundamentals computer hardware and operating system concepts.

CO2: Use techniques, skills and apply algorithmic principles to Identify, formulate and solve problems.

CO3: Understand and apply object oriented concepts.

UNIT : I : **(9)**

Fundamentals of Computer architecture-introduction-organization of a small computer-Central Processing Unit - Execution cycle – Instruction categories – measure of CPU performance Memory – Input/output devices - BUS-addressing modes. System Software –Assemblers – Loaders and linkers – Compilers and interpreters. Operating system – introduction – memory management schemes Process management Scheduling – threads.

UNIT : II **(9)**

Problem solving with algorithms- Programming styles – Coding Standards and Best practices - Introduction to C Programming Testing and Debugging. Code reviews System Development Methodologies – Software development Models User interface Design – introduction – The process – Elements of UI design and reports.

UNIT : III **(9)**

RDBMS- data processing – the database technology – data models. ER modeling concept – notations – Extended ER features. Logical database design – normalization SQL – DDL statements – DML statements – DCL statements. Writing Simple queries – SQL Tuning techniques – Embedded SQL – OLTP.

UNIT : IV **(9)**

Objected oriented concepts – object oriented programming. UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism Object Oriented Design methodology - Common Base class Alice Tool – Application of OOC using Alice tool.

UNIT : V **(9)**

Client server computing - Internetworking – Computer Networks – Working with TCP/IP – IP address – Sub netting – DNS – VPN – proxy servers World Wide Web – Components of web application - browsers and Web Servers URL – HTML – HTTP protocol – Web Applications - Application servers – Web Security.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Andrew Tanenbaum, Modern Operating Systems, Pearson Education, Third Edition, 2007.
2. Elmasri, Navathe, Fundamentals of Database Systems, Addison Wesley, Fifth Edition, 2006.

REFERENCES:

1. Sivasubramanyam Y, Deepak Ranjan Shenoy, Foundation Program - Computer Hardware & System Software Concepts, version 1.0 Vol-1, Infosys: Campus Connect 2008.
2. Hanumesh V.J.,Seema Acharya, Foundation Program - Relational Database Management System, Client Server Concepts, Introduction to Web technologies version 1.0 Vol-2, Infosys: Campus Connect 2008.
3. Sundar K.S., Foundation Program - Analysis of Algorithms, Object Oriented Concepts, System Development Methodology, User Interface Design version 1.0 Vol-3, Infosys: Campus Connect 2008.

13ITZ03 D**EVELOPING MOBILE APPS**

(Common to All Branches except IT branch)

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks .
- Generate mobile application design.
- Implement the design using specific mobile development frameworks .
- Deploy the mobile applications in marketplace for distribution.

COURSE OUTCOMES:

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

CO1: Describe the requirements for mobile applications
CO2: Explain the challenges in mobile application design and development
CO3: Implement the design using Android SDK
CO4: Implement the design using Objective C and iOS
CO5: Deploy mobile applications in Android and iPone marketplace for distribution

UNIT I : INTRODUCTION (5)

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II : BASIC DESIGN (8)

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III : ADVANCED DESIGN (8)

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV : TECHNOLOGY I - ANDROID (12)

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V : TECHNOLOGY II - IOS (12)

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. http://developer.android.com/develop/index.html
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

REFERENCES :

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech,2012
2. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.

13ITZ04 SOFTWARE PROJECT MANAGEMENT

(Common to All Branches except IT branch)

L	T	P	C
3	0	0	3

OBJECTIVES :

- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
- To understand successful software projects that support organization's strategic goals.

COURSE OUTCOMES:

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

CO1: Evaluate and select the most desirable projects & Identify desirable characteristics of effective project managers.

CO2: Apply appropriate approaches to plan a new project.

CO3: Apply appropriate methodologies to develop a project schedule.

CO4: Develop a suitable budget for a new project & Identify important risks facing a new project.

UNIT I : INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT (9)

Project Definition – Contract Management – Activities Covered By Software Project Management – Overview Of Project Planning – Stepwise Project Planning.

UNIT II : PROJECT EVALUATION (9)

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT III : ACTIVITY PLANNING (9)

Objectives – Project Schedule – Sequencing and Scheduling Activities –NetworkPlanning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT IV : MONITORING AND CONTROL (9)

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Priortizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT V : MANAGING PEOPLE AND ORGANIZING TEAMS (9)

Introduction – Understanding Behavior – Organizational Behaviour: A Background –Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation– The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress – Health And Safety – Case Studies.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Bob Hughes, Mikecotterell, “Software Project Management”, Third Edition, Tata McGraw Hill, 2004.

REFERENCES:

1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Royce, “Software Project Management”, Pearson Education, 1999.
3. Jalote, “Software Project Management in Practice”, Pearson Education, 2002.

13MEZ01 SIX SIGMA

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop a comprehensive set of skills that will allow the engineers to function effectively as six sigma team members.
- To introduce the techniques and various phases of six sigma for professionals

COURSE OUTCOMES:

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

CO1: Understand and apply the five-step DMAIC model as a framework to organize process or business improvement activity

CO2: Employ Six Sigma skills to lead a successful process or business improvement project.

UNIT I : INTRODUCTION (9)

Overview of Six Sigma and Lean Manufacturing - 6 sigma, TQM & MBNQA - common terms - organizational success factors - leadership, strategic initiative - internal communication - launching of 6 sigma - organizational structure - six sigma training plan - project selection - assessing organizational readiness - common pitfalls - work as a process - vertical functions and horizontal processes

UNIT II : PREPARATION PHASE (9)

Voice of the customer - importance, identify the customer, collect VOC data, Critical-to-Quality customer requirements - project management - challenges - project culture - project management processes - team typing-team stages - understanding team dynamics - forming, storming, norming, performing, characteristics of effective teams

UNIT III : DEFINE AND MEASURE PHASE (9)

DMAIC Phases - define phase overview - project charter - voice of the customer - high level process map - project team - measure phase overview - statistical methods - normal distribution - Population Parameters Vs Sample Statistics - sampling plan - data collection plan - choosing statistical software - measure tools - measurements - cost of poor quality - probability distributions - measurement system analysis - Process Capability

UNIT IV : ANALYZE AND IMPROVE PHASE (9)

Overview - process analysis - hypothesis testing - statistical tests and tables - tools for analyzing relationships among variables - survival analysis - improve phase overview - process redesign - generating improvement alternatives - design of experiments - pilot experiments - Cost/Benefit Analysis - implementation plan - card one case study improve phase results

UNIT V : CONTROL PHASE, DESIGN FOR SIX SIGMA AND LEAN SERVICING (9)

Control phase overview - control plan - process scorecard - failure mode and effects analysis - SPC Charts - final project report and documentation - design for six sigma overview - DFSS Tools - Quality Function Deployment – TRIZ - Lean Production Overview - lean servicing concepts - getting started with lean - continuous flow production - case study

TOTAL: 45 PERIODS

TEXT BOOK:

1. Betsi Harris Ehrlich, “Transactional Six Sigma and Lean Servicing”, St. Lucie Press, 2002

REFERENCES:

1. Michael L George, David T Rowlands, and Bill Kastle, “What is Lean Six Sigma”, McGraw Hill, New York, 2004.
2. Kai Yang and Basem El Haik, “Design for Six Sigma”, McGraw Hill, New York, 2004.
3. Thomas Pyzdek, “Six Sigma Handbook: Complete Guide for Green belts, Black belts and Managers at All Levels”, Tata McGraw Hill Companies Inc, 2003.
4. Donald W Benbow and Kubiak T M, “Certified Six Sigma Black Belt Handbook”, Pearson Education, 2007.

13MEZ02 ESSENTIALS OF RADIO FREQUENCY IDENTIFICATION

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the physical principle of RFID system.
- To get knowledge on information processing through RFID system.

COURSE OUTCOMES:

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

CO1: Demonstrate various components of RFID system

CO2: Apply the methodology in engineering applications like inventory management, material handling etc.,

UNIT I : INTRODUCTION AND RFID ARCHITECTURE (9)

Case for RFID - Eras of RFID - applications - RFID Architecture - confluence of technologies - key functionalities- system components - systemic quality considerations - architecture guidelines - System Management

UNIT II : TAGS AND PROTOCALS (9)

Basic tag capabilities - physical characteristics - power source - air interface - information storage and processing capacity - standards - protocol terms and concepts - how tags store data - singulation and anti-collision procedures- tag features for security and privacy - learn to troubleshoot tag communications

UNIT III : READERS, PRINTERS AND READER PROTOCOLS (9)

Physical and logical components of RFID reader - parts of RFID printer and applicator - types of readers - layout for readers and antennas - configuring readers - parts of a reader protocol - vendor protocols - EPC global protocol overview - simple lightweight RFID reader protocol - future protocols

UNIT IV : MIDDLEWARE AND INFORMATION SERVICE (9)

Motivations - logical architecture - application level events specification - commercial RFID middleware - RFID Data - EPC global network - object naming service - EPC information services

UNIT V : MANAGEABILITY, PRIVACY AND SECURITY (9)

Edge deployment options - capabilities needed for edge management - standards and technologies - privacy and security issues - RFID Privacy - RFID Security - EPC identity encodings

TOTAL : 45 PERIODS

TEXT BOOK:

1. Himanshu Bhatt, Bill Glover, “RFID Essentials”, O'Reilly Media publications, 2006

REFERENCES:

1. Klaus Finkenzeller, “RFID Handbook”, John Wiley & Sons, Ltd, 2010
2. Stephen B. Miles, Sanjay E. Sarma, John R. Williams, “RFID Technology and Applications”, Cambridge University Press, 2008
3. Patrick J Sweeney, “RFID for DUMMIES”, Wiley India Publications, 2005
4. Elaine Cooney, “RFID + The Complete review of Radio Frequency Identification”, 1st ed., Delmar Cengage Learning 2007

13MEZ03 ELECTRIC VEHICLE TECHNOLOGY

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the various components of electric vehicles and their working principles.
- To get knowledge on types of batteries and fuel cell

COURSE OUTCOMES:

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

CO1: Identify the elements of an electric vehicle for a particular application.

CO2: Apply the knowledge on mathematical modelling to find out the operating characteristics of an electric vehicle.

UNIT I : INTRODUCTION AND BATTERIES (9)

Types of electric vehicle - battery parameters - lead acid batteries - nickel based batteries - battery charging - designer's choice of battery - use of batteries in hybrid vehicles - battery modelling

UNIT II : ALTERNATIVE ENERGY SOURCES AND FUEL CELLS (9)

Solar photovoltaics - wind power - flywheels - super capacitors - supply rails - hydrogen fuel cells - fuel cell thermodynamics - connecting cells in series - water and thermal management in PEM fuel cell

UNIT III : HYDROGEN SUPPLY AND STORAGE (9)

Introduction - fuel reforming - fuel cell requirements, steam reforming, partial oxidation and autothermal reforming, further fuel processing, mobile applications - storage as hydrogen - chemical methods

UNIT IV : ELECTRIC MACHINES AND CONTROLLERS (9)

Brushed DC electric motor - DC regulation and voltage conversion - brushless electric motors - motor cooling, efficiency, size and mass - electrical machines for hybrid vehicles

UNIT V : ELECTRIC VEHICLE MODELLING AND DESIGN CONSIDERATIONS (9)

Introduction - tractive effort - modelling vehicle acceleration and electric vehicle range - simulations - aerodynamic considerations - rolling resistance - transmission efficiency - vehicle mass - general issues

TOTAL : 45 PERIODS

TEXT BOOK:

1. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd 2012

REFERENCES:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles", 2nd ed., CRC Press 2009
2. Chau.K.T, "Electric vehicle machines and drives", Wiley-IEEE Press, 2015
3. James D Halderman, "Hybrid and Alternative Fuel Vehicles", 3rd Revised edition, Pearson Education, 2012
4. Jingyu Yan , Huihuan Qian , Yangsheng Xu, "Hybrid Electric Vehicle Design and Control", McGraw-Hill Professional Publishing, 2013

13MEZ04 VALUE ENGINEERING

(Common to All Branches except Mechanical Engineering)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the concept of value engineering and its applications.
- To get knowledge on various stages of value engineering implementation

COURSE OUTCOMES:

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

CO1: Identify and prioritize functions of the products.

CO2: Apply the techniques of cost reduction to minimize the product cost by maintaining the required performance

UNIT I : VALUE AND FUNCTION (9)

Seven types values - economic value - cost, use, esteem and exchange values - mathematical model of value - types and levels of functions - function identification - method of finding functions of a product - case study - vocabulary of verbs and nouns

UNIT II : COST AND WORTH (9)

Cost and price - elements of cost - direct material, direct labour, direct expenses, overheads - calculation of cost - case study - method of determining function cost - evaluation of worth - guidelines to find out worth - value gap and value index

UNIT III : VALUE ENGINEERING TECHNIQUES (9)

Brainstorming and Gordon techniques - feasibility ranking - morphological analysis technique - ABC analysis - probabilistic approach - make or buy - function-cost-worth analysis - FAST - weighted evaluation method - evaluation matrix - life cycle cost

UNIT IV : TEAM DYNAMICS AND JOB PLAN (9)

Team structure - team building - physical, intellectual, spiritual transformations - job plan - orientation phase – information phase - function phase - creative phase - evaluation phase - recommendation phase - implementation phase - audit phase

UNIT V : FINANCIAL ASPECTS AND HUMAN RELATION (9)

Break-even point - payback period - return on investment - discounted cash flows - balance sheet and profit and loss account - human aspects in value engineering - individual ego states - techniques of transactions - human interactions - Managerial grid

TOTAL : 45 PERIODS

TEXT BOOK:

1. Mukhophadhyaya A K, “Value Engineering”, Sage Publications Pvt. Ltd., New Delhi, 2003

REFERENCES:

1. Mukhophadhyaya A K, “Value Engineering Mastermind”, Sage Publications Pvt. Ltd., New Delhi, 2009
2. Richard J Park, “Value Engineering – A plan for inventions”, St.Lucie Press, London, 1998.
3. Larry W Zimmesman. P E , “VE –A Practical approach for owners designers and contractors”, CBS Publishers, Delhi, 1992
4. Arthus E Mudge, “Value Engineering”, McGraw Hill book company, 1971

GROUP II OPEN ELECTIVES LIST

13GEZ01- SUSTAINABLE DEVELOPMENT
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the principle of sustainable d-evelopment and resource degradation.
- To know the concepts of international contribution on sustainable engineering & legal system in sustainable development.
- To gain knowledge on public participation on economic growth and resource protection management.

COURSE OUTCOMES:

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

CO1: Know the principle of sustainable development and resource degradation.
CO2: Know the concepts of legal system in sustainable development.
CO3: Gain knowledge on international contribution on sustainable engineering.
CO4: Identify the public participation on economic growth.
CO5: Understand the approach on resource protection and management.

UNIT I : PRINCIPLES OF SUSTAINABLE DEVELOPMENT (6)

History and emergence of the concept of Sustainable Development – Definitions – Environmental issues and crisis – Resource degradation – green house gases – desertification – social insecurity – Industrialization – Globalization and Environment.

UNIT II : INDIANS JUDICIARY SYSTEM & SUSTAINABLE DEVELOPMENT (6)

Judicial System in India – Induction of sustainability concepts through legal systems – concepts – principles – doctrines – case laws.

UNIT III : SUSTAINABLE DEVELOPMENT AND INTERNATIONAL CONTRIBUTION (6)

Components of sustainability – Complexity of growth and equity – International Summits – Conventions – Agreements – Trans boundary issues – Action plan for implementing sustainable development – Moral obligations and Operational guidelines.

UNIT IV : SOCIO-ECONOMIC SUSTAINABLE DEVELOPMENT SYSTEMS (6)

Socio-economic policies for sustainable development – Strategies for implementing eco-development programmes – Sustainable development through trade – Economic growth – Carrying Capacity – Public participation.

UNIT V : AGENDA FOR FUTURE GLOBAL SUSTAINABLE DEVELOPMENT (6)

Role of developed countries in the sustainable development of developing countries – Demographic dynamics and sustainability – Integrated approach for resource protection and management.

TOTAL: 30 PERIODS

REFERENCES:

1. Kirkby, J., O' Keefe, P. and Timberlake, Sustainable Development, Earth scan Publication, London, 1996.
2. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.
3. Bowers, J., Sustainability and Environmental Economics – an alternative text, Longman, London, 1997.
4. Revelle CS, Whitlach EE & Wright JR. *Civil & Environmental Systems Engineering*, **1st or 2nd** Edition, Prentice Hall of India.

13GEZ02 - WASTE MANAGEMENT

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand of the basic principles of waste and resource management will be supplemented, where appropriate, by practical problem-solving exercises.
- To provide detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes.
- To provide details on resource efficiency plays in conserving resources and contributing to a low carbon economy.

COURSE OUTCOMES:

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

CO1: Understand and apply the basic for solving practical waste management challenges.
CO2: Understand the collection of waste and recycling.
CO3: Understand the fundamental principles of existing and emerging technologies for the treatment of waste.
CO4: Appreciate the role of decision-making tools in the critical assessment of major waste issues.
CO5: Understand the economy and financial aspects of waste management.

UNIT I : INTRODUCTION & TYPES OF SOURCES (6)

Problems and need of solid and hazardous waste management - Waste management planning - Toxicology and risk assessment - Legislations on management and handling of different types of wastes.

UNIT II : WASTE GENERATION RATES (6)

Composition - Hazardous Characteristics – TCLP tests – waste sampling- reduction of wastes at source – Recycling and reuse. Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations -labeling and handling of hazardous wastes.

UNIT III : WASTE PROCESSING (6)

Processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies - energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

UNIT IV : DISPOSAL (6)

Site selection - design and operation of sanitary landfills - secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – landfill remediation

UNIT V : ECONOMY AND FINANCIAL ASPECTS (6)

Elements of integrated waste management - Economy and financial aspects of waste management. Other Waste Types: Nuclear and Radio Active Wastes.

TOTAL: 30 PERIODS

REFERENCES:

1. Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, Integrated Solid Waste Management, McGraw- Hill, New York, 1993
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000
3. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.
4. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.
5. Charles A. Wentz, Hazardous Waste Management, Second Edition, Pub: McGraw Hill International Edition, New York, 1995.

13GEZ03 DESIGN THINKING

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquire Design Thinking skills.
- To learn by doing projects.
- To solve so called "wicked problems" (problems for which neither question nor answer is well defined)

COURSE OUTCOMES:

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

CO1: Have a sense of self-efficacy & creative confidence

CO2: Know how to manage a Design Thinking workshop: Layout, roles, times and process.

CO3: Apply Design thinking tools to increase research output.

UNIT I : INTRODUCTION TO DESIGN THINKING (6)

Overview - Use of Design Thinking – Design Process. Getting Started: Define Challenges – Create a Project Plan. Design Thinking Tools.

UNIT II : DISCOVERY (6)

Understand the Challenge: Review the Challenge - Build your Team - Refine your Plan. Prepare Research: Identify Sources of Inspiration - Select Research Participants - Prepare For Fieldwork. Gather Inspiration: Immerse Yourself in Context - Seek Inspiration In Analogous Settings - Learn From Experts - Learn From Users.

UNIT III : INTERPRETATION (6)

Tell Stories: Capture Your COURSEs- Share Inspiring Stories. Search for meaning: Find Themes - Make Sense of Findings - Define Insights. Frame Opportunities: Create a Visual Reminder - Make Insights Actionable.

UNIT IV : IDEATION (6)

Generate Ideas: Prepare for Brainstorming - Facilitate Brainstorming - Select Promising Ideas - Sketch to Think. Refine Ideas - Do a Reality Check - Describe Your Idea.

UNIT V : EXPERIMENTATION AND EVOLUTION (6)

Make Prototypes: Create a Prototype. Get Feedback: Identify Sources for Feedback - Select Feedback Participants - Facilitate Feedback Conversations - Capture Feedback COURSEs - Integrate Feedback.
Track COURSEs: Define Success - Document Progress. Move Forward: Plan Next.

TOTAL: 30 PERIODS

REFERENCES:

1. http://www.designthinkingforeducators.com/toolkit
2. https://hbr.org/2008/06/design-thinking
3. http://asimetrica.org/wp-content/uploads/2014/06/design-thinking.pdf

13GEZ04 BIG DATA ANALYTICS

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To know the fundamentals of big data analytics.
- To learn about Hadoop components and storage
- To understand Hadoop operations.
- To use Map-Reduce programming model for processing large sets of data in parallel.
- To work with tools like HBase and Hive..

COURSE OUTCOMES:

On completion of this course the student will be able to

CO1. Identify the need for big data analytics for a domain.
CO2. Explore Hadoop distributed system and its components.
CO3. Install and utilize Hadoop tool.
CO4. Design applications using Map Reducing Concepts.
Implement Big Data concepts using tools like HBase and Hive

UNIT - I BIG DATA INTRODUCTION (6)

Introduction – Characteristics of Big Data – Various V's of Data – Data in Warehouse and Hadoop – Need of Big Data Solution – Use Cases: Patterns for Big Data Deployment, IT for IT Log Analytics, The Fraud Detection Pattern, Social Media Pattern – The Call Center Mantra – Risk –Energy Sector

UNIT - II HADOOP (6)

History of Hadoop – Components – Distributed File System – Basics of Map Reduce – Hadoop Common Components – HDFS Shell Commands – Application Development in Hadoop – Other Hadoop Components

UNIT- III HADOOP OPERATIONS (6)

Setting up a Hadoop Cluster – Cluster Specification – Cluster Setup and Installation – Hadoop Configuration – Case Study: Installing Apache Hadoop.

UNIT - IV MAPREDUCE (6)

The Configuration API – Setting up the Development Environment – Writing a Unit Test With MR Unit – Running Locally on Test Data – Running on a Cluster – Anatomy of a Map Reduce Job Run – Failures – Shuffle and Sort – Task Execution

UNIT- V HBASE AND HIVE (6)

HBASE: HBasics –Concepts – Installation – Clients – Building an Online Query Application – HBase versus RDBMS – Praxis; HIVE: Installing Hive – Running Hive – Comparison with Traditional Databases – HiveQL – Tables – Querying Data.

TOTAL: 30 PERIODS

REFERENCES:

1. Chris Eaton, Dirk Deroos et al., "Understanding Big Data: Analytics For Enterprise Class Hadoop And Streaming Data", The McGraw-Hill Companies, 2012.
2. Tom White, "Hadoop: The Definitive Guide ",O Reilly 2012.
3. Frank J. Ohlhorst, Big Data Analytics ,1st Edition, Wiley, 2012

13GEZ05 ROBO DESIGN
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To impart knowledge about the engineering aspects of Robots and their applications.

LEARNING OUTCOMES:

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

CO1: End effectors and sensors.

CO2: Robots cell design and programming.

CO3: Industrial application of robot

UNIT I : INTRODUCTION (6)

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 (6)

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 (6)

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 (6)

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 (6)

Application of robots - Material handling - Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Mobile robot, Microbots - Recent developments in robotics- safety considerations.

TOTAL : 30 PERIODS

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.

13GEZ06 CREATIVITY INNOVATION AND NEW PRODUCT DEVELOPMENT

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- The students should develop their leadership qualities and creative thinking capability in product development.

LEARNING OUTCOMES:

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

CO1: Improve their creativity and problem solving methods.

CO2: Improve their knowledge in project selection.

CO3: Understand the Patent Laws

CO4: Know the Quality standards

UNIT I : PROJECT SELECTION **(6)**

Collection of ideas and purpose of project - Selection criteria.

UNIT II : PROJECT EVALUATION **(6)**

Screening ideas for new products (evaluation techniques).

UNIT III : NEWP RODUCT DEVELOPMENT **(6)**

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).

UNIT IV : NEW PRODUCT PLANNING **(6)**

Design of proto type - testing - quality standards - marketing research - introducing new products.

UNIT V : LABORATORY **(6)**

Creative design - Model Preparation - Testing - Cost evaluation - Patent application.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Harry Nystrom; Creativity and innovation, John Wiley & Sons, 1979.
2. Brain Twiss; Managing technological innovation, Pitman Publishing Ltd., 1992.
3. Paul Sloane; The leader's guide to lateral thinking skills kogan page india, 2008.

REFERENCES:

1. Harry B, Watton, "New Product Planning", Prentice Hall Inc., 1992.
2. Khandwalla, RN.,- "Fourth Eye (Excellence through Creativity) - Wheeler Publishing",Allahabad, 1992. I.P.R. Bulletins, TIFAC, New Delhi, 1997.

13GEZ07 ENERGY AUDITING

(*Common to All branches*)

L	T	P	C
2	0	0	2

COURSE OBJECTIVE:

- To familiarize the students about energy management and energy audit

COURSE OUTCOMES:

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

CO1: Fa miliarize about forms of energy

CO2: Un derstand energy management concepts

CO3: An alyze and report the outcome of energy audit

UNIT I : FUNDAMENTALS OF ENERGY **(6)**

Basics of energy and its various forms: Conventional and non-conventional sources - Different fuels and its energy contents - Renewable energy: solar energy, wind energy, bio energy, hydro energy, geothermal energy, wave energy, tidal energy and OTEC.

UNIT II : ENERGY MANAGEMENT **(6)**

Energy management: various approaches, cost effectiveness, bench marking, optimization of energy requirement and maximization of system efficiencies - Fuels and energy substitution

UNIT III : ENERGY AUDIT **(6)**

Energy audit : need, preliminary audit, detailed audit, methodology and approach - Instruments for audit, monitoring energy and energy savings.

UNIT IV : ASSESSMENT AND REPORTING **(6)**

Evaluation of saving opportunities – Determining the savings in INR, Non-economic factors, conservation opportunities, estimating cost of implementation - Energy audit reporting: Plant energy study report, importance, effective organization, report writing and presentation.

UNIT V : ENERGY SAVINGS CASE STUDY **(6)**

Case study: Simple calculations of energy savings and conservation in process equipments like boilers, heat exchangers only.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Paul. O. Callaghan., "Energy Management", McGraw-Hill Professional Publishing, 2003.
2. Albert Thumann, "Handbook of energy audits", 6th ed., The Fairmount Press, 2003.

REFERENCES:

1. Murphy.W.R and McKay.G, "Energy Management" , Butterworths, London, 2007.
2. Steve Doty, Wayne C.Turner, " Energy Management Handbook", Fairmont Press, 7th ed., 2009.
3. Barney L. Capehart, Wayne C.Turner, William J.Kennedy, "A Guide to Energy Management", The Fairmont Press, 6th ed., 2008.

13GEZ08 - ENERGY CONSERVATION

(*Common to All branches*)

L	T	P	C
2	0	0	2

COURSE OBJECTIVE:

- To enable the students to acquire the knowledge of energy conservation measures in thermal and electrical energy systems.

COURSE OUTCOMES:

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

CO1: Understand the concepts of energy management

CO2: Measure the electrical energy conservation

UNIT I :ENERGY CONSERVATION PRINCIPLES **(6)**

Energy scenario - Principles of energy conservation - Resource availability - Energy savings - Current energy consumption in India - Roles and responsibilities of energy managers in industries.

UNIT II : ENERGY CONSERVATION IN STEAM SYSTEMS **(6)**

Power plant components - Conservation measures in steam systems, losses in boiler - Methodology of upgrading boiler performance - Blow down control, excess air control - Pressure reducing stations - Condensate recovery - Condensate pumping - Thermo compressor - Recovery of flash steam - Air removal and venting - Steam traps - Cooling towers.

UNIT III : ENERGY CONSERVATION IN FLUID MACHINERY **(6)**

Centrifugal pumps - Energy consumption and energy saving potentials - Design consideration - Minimizing over design - Fans and blowers : specification, safety margin, choice of fans, controls and design considerations - Air compressor and compressed air systems: selection of compressed air layout, energy conservation aspects to be considered at design stage.

UNIT IV : ELECTRICAL ENERGY CONSERVATION **(6)**

Potential areas for electrical energy conservation in various industries: conservation methods, energy management opportunities in electrical heating, lighting system, cable selection - Energy efficient motors - Factors involved in determination of motor efficiency - Adjustable AC drives - Variable speed drives - Energy efficiency in electrical system.

UNIT V : ENERGY MANAGEMENT **(6)**

Organizational background desired for energy management persuasion – Motivation - Publicity role - Tariff analysis - Industrial energy management systems energy monitoring - Auditing and targeting - Economics of various energy conservation schemes – Energy policy and energy labeling.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Reay.D.A, "Industrial energy conservation", Pergamon Press, 1st ed., 2003.
2. White.L.C, "Industrial Energy Management and Utilization", Hemisphere Publishers, 2002.

REFERENCES:

1. Smith.C.B, "Energy Management Principles", Pergamon Press, 2006.
2. Hamies, "Energy Auditing and Conservation; Methods, Measurements, Management and Case study", Hemisphere, 2003.
3. Trivedi. P.R and Jolka .K.R, " Energy Management", Common Wealth Publication, 2002.

13GEZ09 LAW FOR ENGINEERS

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVE

- To familiarize the students with fundamental knowledge of laws that would be of utility in their profession.
- Enable the students to understand the new areas of law like IPR.

LEARNING OUTCOMES :

CO1: Evaluate and select the most desirable projects & Identify desirable characteristics of effective project managers.

CO2: Apply appropriate approaches to plan a new project.

CO3: Apply appropriate methodologies to develop a project schedule.

CO4: Develop a suitable budget for a new project & Identify important risks facing a new project.

UNIT 1 INTRODUCTION TO INDIAN CONSTITUTION (6)

Introduction to Constitution, Longest known Constitution, Preamble, Importance of Preamble, Justice, Liberty, Equality, Fraternity, Secular, Origin of Secularism.

UNIT 2 FUNDAMENTAL RIGHTS AND DUTIES (6)

Inalienable Human Rights, Fundamental Rights: Definition, Need, History, Suspension, Classification and Amendments, Fundamental Duties: General, Comparison with Directive Principles, List of Duties.

UNIT 3 INTELLECTUAL PROPERTY RIGHTS (IPR) (6)

Introduction to IPR, Main forms of IP, Copyrights, Trademarks, Patents and Designs, Protection in Foreign Countries, Protection inside Country, Patentable inventions, Process of obtaining patent - application, examination, opposition and sealing of patents, Duration of patents.

UNIT 4 COLLECTIVE BARGAINING (6)

Concept and Meaning of Collective Bargaining, Prerequisites of Collective Bargaining, Advantages and Disadvantages, Collective Bargaining in India.

UNIT 5 INDUSTRIAL AND INDIVIDUAL DISPUTE (6)

Industrial Dispute: Overview, Factum of Industrial Dispute, Parties to the Dispute, Subject Matter of the Dispute, Origin of the Dispute, Individual Dispute.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Brij Kishore Sharma (2011), Introduction to the Constitution of India, PHI Learning Private Limited.
2. S C Srivastava (2008), Industrial Relations and Labour Laws, VIKAS Publishing House Pvt Ltd.

REFERENCE BOOKS:

1. Agarwal H. O.(2008), International Law and Human Rights, Central Law Publications.
2. S.K. Awasthi & R.P. Kataria(2006), Law relating to Protection of Human Rights, Orient Publishing.
3. S.K. Kapur(2001), Human Rights under International Law and Indian Law, Central Law Agency.

13GEZ10 - ADVANCED MATHEMATICS FOR ENGINEERS
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

The main objective of this paper is to gain familiarity with the application of statistics and graph theory.The paper is oriented towards the techniques needed to solve research problems.This paper is intended to help students to build the skill necessary to analyze the research oriented problems in their course of study.

UNIT I: STATISTICS **(6)**

Linear Correlation and Regression - Curve fitting - Method of least squares - Multiple Regression.

UNIT II: DISTRIBUTIONS **(6)**

Discrete and Continuous distributions: Binomial – Poisson - Geometric Distributions and Uniform – Exponential Distributions.

UNIT III: TEST OF HYPOTHESIS **(6)**

Testing hypothesis Involving Means and Proportions - Small Samples t – Test and Chi Square test.

UNIT IV: GRAPH THEORY **(6)**

Basic definitions in graphs, walk, path, circuits – Connected and Disconnected - Components - Euler graphs - Operations on graph.

UNIT V: TREES **(6)**

Properties of Trees – Distance and Centers in a tree – Rooted and Binary trees, Spanning trees - Adjacency matrix – Incidence matrix.

TOTAL : 30PERIODS

TEXT BOOKS

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics ", Sultan Chand & Co, 2002.
2. T.Veerarajan, " Probability and Random Processes", TMH,2006.
3. NarsinghDeo, "Graph Theory", Prentice – Hall of India,2004.

REFERENCES

1. P.Kandasamy, K.Thilagavathy,K.Gunavathy," Probability and Random Variable and Random Processes", S.Chand& Co Ltd, 2004.
2. V.K.Balakrishnan,"Theory and Problems of Graph Theory", Schaum'sOutlines,Tata McGraw-Hill Publishing Company ltd, New Delhi,2004.

13GEZ11 - DISASTER MANAGEMENT
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities
- Identify the organizations that are involved in natural disaster assistance

LEARNING OUTCOMES:

On completion of this course the students will be able to

CO1: Know the key personnel or specialists related to disaster management and associate them with the types of disasters and phases in which they are useful.
CO2: Understand the six elements of disaster management.

UNIT I : INTRODUCTION **(6)**

Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management –Alternative to dominant approach – disaster-development linkages -Principle of risk partnership

UNIT II : APPLICATION OF TECHNOLOGY IN DISASTER RISK REDUCTION **(6)**

Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing-an insight – contribution of remote sensing and GIS - Case study.

UNIT III : AWARENESS OF RISK REDUCTION **(6)**

Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness

UNIT IV : DEVELOPMENT PLANNING ON DISASTER **(6)**

Implication of development planning – financial arrangements – areas of improvement – disaster preparedness – community based disaster management – emergency
response.

UNIT V : SEISMICITY **(6)**

Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Pardeep Sahni, Madhavi malalgoda and ariyabandu, "Disaster risk reduction in south asia", PHI
2. Amita sinvhal, "Understanding earthquake disasters" TMH, 2010.

REFERENCES

1. Pardeep sahni, Alka Dhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI

13GEZ12 - INDUSTRIAL PSYCHOLOGY

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To develop an awareness of the history and major perspectives underlying and driving the field of Industrial and Organizational (I/O) Psychology.
- To develop an understanding for the potential I/O Psychology has for society and organizations now and in the future.

LEARNING OUTCOMES:

On completion of this course the students will be able to

CO1: Understand and work effectively with a diversity of individuals and groups.

CO2: Apply theory and research to contemporary problems.

UNIT I : INTRODUCTION **(5)**

Introduction to Industrial Psychology – Definitions & Scope**.** Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments

UNIT II : INDIVIDUAL IN WORKPLACE-I **(5)**

Motivation and Job satisfaction, stress management. Organizational culture, Leadership & group dynamics.

UNIT III : INDIVIDUAL IN WORKPLACE-II **(5)**

Performance Management: Training & Development.

UNIT IV : WORK ENVIRONMENT & PSYCHOLOGY **(7)**

Work Environment & Psychology-fatigue. Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests

UNIT V: DYNAMICS OF INDUSTRIAL BEHAVIOUR **(8)**

Organizational culture and climate – Factors affecting organizational climate – Importance. Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change. Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational development – Characteristics – objectives –. Organizational effectiveness Developing Gender sensitive workplace

TOTAL: 30 PERIODS

REFERENCES:

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.
3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach (5th edition) Wadsworth/Thompson : Belmont, C.A.
4. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi : Tata McGraw Hill.

13GEZ13 PROJECT MANAGEMENT

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To know stages of project management in an organization
- To understand the roles and responsibilities of a project manager

COURSE OUTCOMES:

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

CO1: Demonstrate the skill set of a project manager

CO2: Apply project management concepts by identifying and carrying out a real time project

UNIT I : PROJECTS, PROJECT MANAGEMENT AND PROJECT MANAGER (6)

Project Management - process context - interpersonal and behavioral context - organizational context - defining project success - responsibilities of project manager - common challenges expected to face - skill requirements and functional competencies - unofficial job duties - value of introspection and self awareness to the soft side

UNIT II : PROJECT DEFINITION, EFFECTIVE TEAM BUILDING (6)

Evolution of projects - understanding the problem - identification of optimum solution - development of solution and preliminary plan - formal launching of project - evaluation of political environment - mechanics of building a team - team leadership - fostering teamwork and synergism - getting the most from team members

UNIT III : PROJECT PLANNING, RISK AND UNCERTAINTY (6)

Project Planning - estimating - scope management - time management - cost management - project management software - understanding risk and uncertainty - managing risk - identifying what can hurt you - quantifying how badly you can get hurt - analyzing the biggest threats - responding to high-threat problems - accommodating uncertainty

UNIT IV : PROJECT CONTROL AND INTERFACES (6)

Project Control - Establishing a Baseline of Measurement - Information Needs - Information Gathering - ensuring Good Information - Analyzing the Information - Reacting to the Information - Project Interfaces - Roles of Internal Stakeholders and External Stakeholders - Other Interfaces - Considerations in Interface Management

UNIT V : PROJECT COMMUNICATION, DOCUMENTATION AND CONCLUSION (6)

Configuration plan - documentation and communication road map - methods of communicating - guidelines for effective communication - conducting high quality meetings - communication skills - key project documentation - early termination - key elements in project closure - punch list approach - project completion checklist

TOTAL : 30 PERIODS

TEXT BOOK:

1. Gary R. Heerkens, "Project Management", 2nd ed., McGraw-Hill Book Company , 2013

REFERENCES:

1. Harold Kerzner, "Project Management", 10th ed., Wiley India Pvt Ltd., 2013
2. John M Nicholas, Herman Steyn, "Project Management for Engineering, Business and Technology", Routledge Publications, 2012
3. Prasanna Chandra, "Projects : Planning, Analysis, Selecting, Financing, Implementation and Review", 7th ed., Tata McGraw Hill Education Private Ltd., 2009
4. Clifford F Gray, Eric W Larson, Gautam V Desai, "Project Management: The Managerial Process", 4th ed., Tata McGraw Hill Education Private Ltd., 2011

13GEZ14 QUALITY MANAGEMENT AND ECONOMICS

(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To know the stages of quality management in an organization and economic aspects
- To understand the roles and responsibilities of an engineer in quality management.

COURSE OUTCOMES:

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

CO1: Demonstrate the skill set of engineer in quality management

CO2: Apply quality management concepts in an organization for process improvement

UNIT I : ORGANIZING AND PLANNING FOR QUALITY (6)

Categorizing duties - breaking categories into classifications - basic functional structure - authority, accountability and responsibility - authority principles - revise and adjust - communication - planning for quality - objectives - setting business metrics - planning - business quality, process and product quality, project, product verification and validation - policies, procedures and objectives - forms and records - blueprints - process flowcharting

UNIT II : CONTROLLING, STAFFING, MOTIVATING FOR QUALITY (6)

Introduction - organizational responsibility - role of quality management - quality report - activity reporting - journalizing procedure - posting - product performance reporting - analysis - controlling nonconformance identification - segregation - disposition - CAPA methodology - forecasting human resources needs - job descriptions - education and training - lead, coach and guide - leadership styles - rewards based upon performance-praise and censure fairly - motivating environment

UNIT III : SPECIAL TOPICS IN QUALITY (6)

Overview of statistical methods - risk analysis - reliability engineering - systems analysis - auditing - audit planning and scheduling - sampling plans - audit implementation steps - notification to auditee - opening meeting information, verification and evaluation - audit observations - audit supervision - audit follow up - preparation of the report - content of the report - reporting the audit - cost of quality

UNIT IV : INTRODUCTION TO ECONOMICS AND MARKET EFFICIENCY (6)

Ten principles of economics - people's interest and decision making - interaction of people - economy - Thinking like an economist - economist as scientist - economist as policy advisor - why economists disagree - consumers, producers and efficiency of markets - consumer and producer surplus - market efficiency - Supply, demand and government policies - controls on prices, taxes, subsidies

UNIT V : SUPPLY AND DEMAND (6)

Market forces of supply and demand - markets and competition - demand - supply - supply and demand together - elasticity and its applications - the theory of consumer choice - standard economic model, budget constraint, preferences, optimization, Consumer behavior - firms in competitive markets - production and costs - various measures of cost - Costs in the short run and in the long run - competitive market - profit maximization

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Peter D. Mauch, "Quality Management", CRC Press, 2010
2. Gregory Mankiw N and Mark P. Taylor, "Economics", 3rd ed., Cengage Learning, 2010

REFERENCES:

1. David Hoyle, "Quality Management Essentials", 1st ed., Elsevier, 2007
2. Mohamed Zairi, Total Quality Management for Engineers", Wood Head publishing Limited, 1991
3. Irvin B. Tucker, "Economics for Today", 7th ed., Cengage Learning, 2011

LANGUAGE ELECTIVES

13GEY01 HINDI LANGUAGE
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To impart knowledge in Hindi.
- To introduce the language skills, vocabulary, grammar to the students.
- To introduce themselves and initiate a conversation.
- To develop the ability among the students to read and understand small texts written in Hindi.
- To enable the students to elementary conversational skills.

COURSE OUTCOME:

On completion of this course the students will be able to

CO1: Achieve proficiency in Hindi.
CO2: Develop their different skills in Hindi language.
CO3: Develop their skills in communicative Hindi.
CO4: Express their ideas in Hindi language.

UNIT I : BASIC SOUNDS & LETTERS/LETTER-SOUNDS **(6)**

Letters – Consonants & Vowels - Joining Words – Numbers - Gender.

UNIT II : GRAMMAR **(6)**

Basic Grammatical Structure- Usage of Noun, Pronoun and Verb – Basic sentence Pattern – Tenses – Phrases.

UNIT III : COMPOSITION **(6)**

Short story collections - Lesson – Letter Writing- Filling the blanks.

UNIT IV : READING **(6)**

Poem – Short-story – Newspaper - Letters.

UNIT V: SPEAKING **(6)**

Short Conversation – Self-introduction – Asking questions.

TOTAL : 30 PERIODS

TEXT/ REFERENCES BOOKS:

13GEY02 GERMAN LANGUAGE
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

To enable students

- To introduce the language, phonetics and the special characters in German language
- To introduce German culture and traditions to the students.
- To introduce themselves and initiate a conversation..
- To develop the ability among the students to read and understand small texts written in German.
- To enable the students to elementary conversational skills.

COURSE OUTCOME:

On completion of this course the students will be able to

CO1: Achieve proficiency in German.

CO2: Identify German culture and traditions.

CO3: Read and Understand the text written in German.

CO4: Express their ideas in German.

UNIT I: **(6)**

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)**

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)**

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)**

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)**

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.

TOTAL : 30 PERIODS

TEXT/ REFERENCES BOOKS

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

13GEY03 JAPANESE LANGUAGE
(*Common to All branches*)

L	T	P	C
2	0	0	2

OBJECTIVES:

- To help students learn the Japanese scripts.
- To make the students acquire basic conversational skills.
- To enable students to know about Japan and Japanese culture.
- To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Japan.
- To enable the students to elementary conversational skills.

COURSE OUTCOME:

On completion of this course the students will be able to

CO1: Understand the Japanese scripts.
CO2: Understand the culture and traditions.
CO3: Read and Understand the text written in Japanese.
CO4: Express their ideas in Japanese in Written and Spoken form.

UNIT I: **(6)**

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.

Conversation – audio

UNIT II: **(6)**

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.

Conversation – audio

UNIT III: **(6)**

Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary
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: **(6)**

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: **(6)**

Kanji – hidari, migi, kuchi
Japanese sports and martial arts
Adjectives (present/past – affirmative and negative)
Conversation – audio

TOTAL=30 PERIODS

TEXT/ REFERENCES BOOKS

1. First lessons in Japanese, ALC Japan