K.S. Rangasamy College of Technology

(Autonomous Institution)

Curriculum & Syllabus

of

B.E. Mechanical Engineering

R 2010

Courses Accredited by NBA, Accredited by NAAC with 'A' Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.

KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.

Vision Statement:

To produce the most competent Scientists, Engineers, Entrepreneurs, Managers and Researchers through Quality Education.

Mission Statement:

The Mission of Mechanical Engineering is to offer quality education that gives them knowledge for professional practice and a career of life long learning, prepare the students for their role as engineers in society with an awareness of environmental and ethical values.

Program Educational Objectives (PEOs):

1. Our graduates possess skills to become contributing professionals in their chosen field.
2. Our graduates are able to show their ethical attitude, effective communication skills and team work skills in professional practice.
3. Our graduates exhibit professional competency through lifelong learning.

Program Outcomes (POs):

The Mechanical Engineering graduates must have,

a. Apply the knowledge of mathematics, science, engineering fundamentals, to the solution of complex problems in mechanical engineering.
b. Identify, formulate, research literature, and analyse complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design solutions for complex mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions, related to mechanical engineering.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex mechanical engineering activities with an understanding of the limitations.
f. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

K.S.Rangasamy College of Technology, Tiruchengode – 637 215								
Curriculum for the Programmes under Autonomous Scheme								
Regulation	R 2010							
Department	Department of Mechanical Engineering							
Programme Code & Name	ME : B.E. Mechanical Engineering							
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 EN 101	Technical English	3	0	0	3	50	50	100
10 MA 101	Engineering Mathematics I	3	1	0	4	50	50	100
10 CH 102	Environmental Engineering	3	0	0	3	50	50	100
10 PH 101	Engineering Physics	3	0	0	3	50	50	100
10 GE 101	Fundamentals of Programming	3	1	0	3	50	50	100
10 GE 103	Engineering Drawing (CE, MC, ME, TT)	2	0	3	4	50	50	100
	PRACTICAL							
10 PH 100	Engineering Physics Laboratory	0	0	3	2	50	50	100
10 GE 1P2	Fundamentals of Programming Laboratory	0	0	3	2	50	50	100
Total		17	02	09	24	800		
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 EN 102	Communication Skills	3	0	0	3	50	50	100
10 MA 102	Engineering Mathematics II	3	1	0	4	50	50	100
10 PH 103	Material Science (MC, ME)	3	0	0	3	50	50	100
10 CH 101	Engineering Chemistry	3	0	0	3	50	50	100
10 GE 110	Basics of Electronics Engineering (BT,CE, MC, ME)	3	0	0	3	50	50	100
10 GE 109	Elements of Electrical Engineering(MC, ME)	3	0	0	3	50	50	100
	PRACTICAL							
10 CH 100	Engineering Chemistry Laboratory	0	0	3	2	50	50	100
10 GE 1P1	Engineering Practices Laboratory	0	0	3	2	50	50	100
Total		18	01	06	23	800		

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Regulation	R 2010							
Department	Department of Mechanical Engineering							
Programme Code & Name	ME : B.E. Mechanical Engineering							
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 MA 003	Engineering Mathematics III	3	1	0	4	50	50	100
10 ME 001	Engineering Materials and Metallurgy (MC, ME)	3	0	0	3	50	50	100
10 ME 002	Engineering Mechanics (MC, ME)	3	1	0	4	50	50	100
10 ME 004	Fluid Mechanics and Machinery (MC, ME)	3	1	0	4	50	50	100
10 ME 311	Engineering Thermodynamics	3	1	0	4	50	50	100
10 ME 312	Manufacturing Processes	3	0	0	3	50	50	100
	PRACTICAL							
10 ME 0P2	Fluid Mechanics and Machinery Laboratory(MC, ME)	0	0	3	2	50	50	100
10 ME 3P1	Machine Drawing Laboratory	0	0	3	2	50	50	100
10 ME 3P2	Manufacturing Technology Laboratory I	0	0	3	2	50	50	100
10 TP 0P1	Career Competency Development I	0	0	2	0	100	00	100
Total		18	4	11	28	1000		
Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 MA 004	Probability and Statistics (BT, IT, ME, TT)	3	1	0	4	50	50	100
10 EE 005	Electric Drives and Controls	3	0	0	3	50	50	100
10 ME 005	Strength of Materials (MC, ME)	3	1	0	4	50	50	100
10 ME 411	Thermal Engineering	3	0	0	3	50	50	100
10 ME 412	Kinematics of Machinery	3	1	0	4	50	50	100
10 ME 413	Metrology and Instrumentation	3	0	0	3	50	50	100
	PRACTICAL							
10 EE 0P2	Electric Drives and Controls Laboratory	0	0	3	2	50	50	100
10 ME 4P1	Strength of Materials, Metrology and Instrumentation Laboratory	0	0	3	2	50	50	100
10 ME 4P2	Thermal Engineering Laboratory	0	0	3	2	50	50	100
10 TP 0P2	Career Competency Development II	0	0	2	0	100	00	100
Total		18	3	11	27	1000		

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Department	Department of Mechanical Engineering							
Programme Code & Name	ME : B.E. Mechanical Engineering							
Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 HS 001	Professional Ethics	3	0	0	3	50	50	100
10 ME 511	Heat and Mass Transfer	3	1	0	4	50	50	100
10 ME 512	Dynamics of Machinery	3	1	0	4	50	50	100
10 ME 513	Design of Machine Elements	3	1	0	4	50	50	100
10 ME 514	Machining Processes	3	0	0	3	50	50	100
10 ME 515	Applied Hydraulics and Pneumatics	3	0	0	3	50	50	100
	PRACTICAL							
10 ME 5P1	Heat Transfer Laboratory	0	0	3	2	50	50	100
10 ME 5P2	Dynamics Laboratory	0	0	3	2	50	50	100
10 ME 5P3	Hydraulics and Pneumatics Laboratory	0	0	3	2	50	50	100
10 TP 0P3	Career Competency Development III	0	0	2	0	100	00	100
Total		18	3	11	27	1000		
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 EC 010	Microprocessors and Microcontrollers	3	0	0	3	50	50	100
10 ME 611	Gas Dynamics and Jet Propulsion	3	1	0	4	50	50	100
10 ME 612	CAD/CAM	3	0	0	3	50	50	100
10 ME 613	Design of Mechanical Transmission Systems	3	1	0	4	50	50	100
10 ME E1*	Elective I	3	0	0	3	50	50	100
10 CS 004	Object Oriented Programming (EE, EI, MC, ME)	3	0	0	3	50	50	100
	PRACTICAL							
10 EC 0P5	Microprocessors and Microcontrollers Laboratory	0	0	3	2	50	50	100
10 ME 6P1	Manufacturing Technology Laboratory II	0	0	3	2	50	50	100
10 ME 6P2	CAM Laboratory	0	0	3	2	50	50	100
10 TP 0P4	Career Competency Development IV	0	0	2	0	100	00	100
Total		18	2	11	26	1000		

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Department	Department of Mechanical Engineering							
Programme Code & Name	ME : B.E. Mechanical Engineering							
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 HS 003	Principles of Management	3	0	0	3	50	50	100
10 ME 711	Automobile Engineering	3	0	0	3	50	50	100
10 ME 712	Mechatronics and Robotics	3	0	0	3	50	50	100
10 ME 713	Finite Element Analysis	3	1	0	4	50	50	100
10 ME 714	Optimization Techniques	3	1	0	4	50	50	100
10 ME E2*	Elective II	3	0	0	3	50	50	100
	PRACTICAL							
10 ME 7P1	Analysis and Simulation Laboratory	0	0	3	2	50	50	100
10 ME 7P2	Mechatronics Laboratory	0	0	3	2	50	50	100
10 ME 7P3	Project Work - Phase I	0	0	4	2	100	00	100
10 TP 0P5	Career Competency Development V	0	0	2	0	100	00	100
Total		18	2	12	26	1000		
Semester VIII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
10 HS 002	Total Quality Management	3	0	0	3	50	50	100
10 ME 811	Power Plant Engineering and Energy Audit	3	0	0	3	50	50	100
10 ME E3*	Elective III	3	0	0	3	50	50	100
10 ME E4*	Elective IV	3	0	0	3	50	50	100
	PRACTICAL							
10 ME 8P1	Project Work - Phase II	0	0	16	8	50	50	100
Total		12	0	16	20	500		

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Regulation		R 2010							
Department		Department of Mechanical Engineering							
Programme Code & Name		ME : B.E. Mechanical Engineering							
Course Code	Course Name	Hours / Week			Credit	Maximum Marks			
		L	T	P	C	CA	ES	Total	
Elective I									
10 ME E11	Vibration and Noise Control	3	0	0	3	50	50	100	
10 ME E12	Renewable Sources of Energy	3	0	0	3	50	50	100	
10 ME E13	Cryogenic Engineering	3	0	0	3	50	50	100	
10 ME E14	Design of Heat Exchangers	3	0	0	3	50	50	100	
10 ME E15	Maintenance Engineering	3	0	0	3	50	50	100	
10 ME E16	Thermal Turbo Machines	3	0	0	3	50	50	100	
10 ME E17	Fundamentals of IT	3	0	1	3	50	50	100	
Elective II									
10 ME E21	Refrigeration and Air-conditioning	3	0	0	3	50	50	100	
10 ME E22	Quality Control and Reliability Engineering	3	0	0	3	50	50	100	
10 ME E23	Unconventional Machining Processes	3	0	0	3	50	50	100	
10 ME E24	Production Planning and Control	3	0	0	3	50	50	100	
10 ME E25	Aircraft Systems	3	0	0	3	50	50	100	
10 ME E26	IT Essentials	3	0	0	3	50	50	100	
Elective III									
10 ME E31	Industrial Tribology	3	0	0	3	50	50	100	
10 ME E32	Process Planning and Cost Estimation	3	0	0	3	50	50	100	
10 ME E33	Composite Materials	3	0	0	3	50	50	100	
10 ME E34	Energy Conservation in Thermal Systems	3	0	0	3	50	50	100	
10 ME E35	Internal Combustion Engines	3	0	0	3	50	50	100	
10 ME E36	Aircraft Structure Design	3	0	0	3	50	50	100	
Elective IV									
10 ME E41	Advanced Casting Processes	3	0	0	3	50	50	100	
10 ME E42	Entrepreneurship Development	3	0	0	3	50	50	100	
10 ME E43	Non Destructive Materials Evaluation	3	0	0	3	50	50	100	
10 ME E44	Tool Design	3	0	0	3	50	50	100	
10 ME E45	Supply Chain Management	3	0	0	3	50	50	100	
10 ME E46	Solar Energy	3	0	0	3	50	50	100	

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="2">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester I</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 EN 101</td><td>TECHNICAL ENGLISH</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To improve learners vocabulary and to enable them to use words appropriately in different academic and professional contexts, familiarize learners with different rhetorical functions of Technical English, develop strategies that could be adopted while reading texts, acquire the ability to speak effectively in English in real-life and career related situations and train learners in organized academic and professional writing.</td></tr>
<tr><td>1</td><td colspan="5">GRAMMAR AND VOCABULARY</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Word formation with prefixes and suffixes – synonyms and antonyms – verb patterns- subject-verb agreement – tenses – voices – use of conditionals – comparative adjectives (affirmative and negative) – expanding nominal compounds – articles – use of prepositions - phrasal verbs – British and American vocabulary – error detection – abbreviations and acronyms.</td></tr>
<tr><td>2</td><td colspan="5">LISTENING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Extensive listening – listening for general content – listening to fill up gapped texts – intensive listening – listening for specific information: retrieval of factual information – listening to identify topic, context, function, speaker’s opinion, attitude, etc. – global understanding skills and ability to infer, extract gist and understand main ideas – note-taking: guided and unguided</td></tr>
<tr><td>3</td><td colspan="5">SPEAKING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Verbal and non verbal communication – speech sounds – syllables – word stress (structures and content words) – sentences stress – intonation – pronunciation drills, tongue twisters – formal and informal English – oral practice – developing confidence – introducing oneself – asking for or eliciting information – describing objects – expressing opinions (agreement / disagreement) – giving instructions</td></tr>
<tr><td>4</td><td colspan="5">READING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Exposure to different reading techniques – reading for gist and global meaning – predicting the content – skimming the text – identifying the topic sentence and its role in each paragraph – scanning – inferring / identifying lexical and contextual meanings – reading for structure and detail – transfer of information / guided note-making – understanding discourse coherence – sequencing of sentences – cloze reading.</td></tr>
<tr><td>5</td><td colspan="5">WRITING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Introductions to the characteristics of technical style – writing definitions and descriptions – paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) – process description (use of sequencing connectives) – comparison and contrast – classifying the data – analyzing / interpreting the data – formal letter writing (letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries) – editing (punctuation, spelling and grammar)</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Rizvi M Ashraf, ‘Effective Technical Communication’, 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Dr.M.Balasubraminian and Dr.G.Anbalagan, ‘Performance in English’ Anuradha Publications, Kumbakonan, 2007.</td></tr>
<tr><td>2</td><td colspan="8">Sharon J. Gerson, Steven M. Gerson, ‘Technical Writing – Process & Product’. 3rd Edition, Pearson Education (Singapore) (p) Ltd., New Delhi, 2004.</td></tr>
<tr><td>3</td><td colspan="8">Mitra K. Barun, ‘Effective Technical Communication – A Guide for Scientists and Engineers’, Oxford University Press, New Delhi, 2006.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name	ME : B.E. Mechanical Engineering					
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
10 MA 101	ENGINEERING MATHEMATICS I	3	1	0	4	50	50	100
Objective(s)	The course is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.							
1	MATRICES				Total Hrs	12		
Column matrix as vector – linear independent and dependent of vector –Characteristic equation – Eigen values and Eigen vectors of a real matrix –Properties of eigen values and eigenvectors – Cayley – Hamilton theorem (without proof) – Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.								
2	GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS				Total Hrs	12		
Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes – Properties of envelopes and evolutes –Evolute as envelope of normals.								
3	FUNCTIONS OF SEVERAL VARIABLES				Total Hrs	12		
Functions of two variables – Partial derivatives – Total differential – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians.								
4	ORDINARY DIFFERENTIAL EQUATIONS				Total Hrs	12		
Linear differential equations of Second and higher order with constant coefficient when the R.H.S is e^{ax}, x^n n>0,sin ax , cos ax, e^{ax} x^n , $e^{\alpha x}$ Sinβx, $e^{\alpha x}$ cosβx, x^n sinα x and x^n cosα x – Differential Equations with variable coefficients (Cauchy's Form and Legendre's Linear Equation).								
5	DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS				Total Hrs	12		
Simultaneous first order linear equations with constant coefficients – Method of variation of parameters – Solution of specified differential equations connected with electric circuits, bending of beams and simple harmonic motion (Differential equations and associated conditions need be given)								
Total hours to be taught						60		
Text book :								
1	Veerarajan. T., "Engineering Mathematics (for first year), Fourth Edition Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005.							
2	Grewal. B.S., "Higher Engineering Mathematics", Thirty Eighth Edition, Khanna Publishers, Delhi, 2004.							
References :								
1	Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics" – S.Chand and Co. – New Delhi 2007.							
2	Kreyszig. E., "Advanced Engineering Mathematics," Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2001.							
3	Venkataraman.M.K, "Engineering Mathematics, Volume I & II Revised Enlarged Fourth Edition".							

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Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
10 CH 102	ENVIRONMENTAL ENGINEERING	3	0	0	3	50	50	100
Objective(s)	The student should be conversant with the evolution of environmentalism and the importance of environmental studies, various natural resources and the current threats to their sustainability, significance and protection of bio diversity and various forms of environmental degradation and international conventions and protocols for the protection of environment.							
1	ATMOSPHERE AND ECOSYSTEM				Total Hrs	9		
Atmosphere – composition of atmosphere (troposphere, stratosphere, mesosphere and thermosphere) - Ozone and ozone depletion – Air pollution – sources, effects and control – Green house effect - Global warming – Climate change – Acid rain - Planet Earth – Biosphere – Hydrosphere – Lithosphere. Concept of ecosystem – structure and functions of ecosystem-producers, consumers and decomposers - Energy flow –Ecological succession-Food chains-Food webs- Ecological pyramids-Introduction, types, characteristic features-structures and function of forest, grassland and aquatic ecosystems (ponds and rivers) - Case Studies in current scenario.								
2	WATER RESOURCES AND ITS TREATMENT				Total Hrs	9		
Water – hydrological cycle – ground water – water shed – water use and quality – point and non-point sources of pollution – Oceans and fisheries – salinity – temperature – density – pressure – light – bioluminescence – Tsunamis – Glaciers – Water pollution – dissolved oxygen – surface water treatment – waste water treatment – Thermal pollution, noise pollution and control - Case Studies in current scenario.								
3	LAND RESOURCES AND ITS DEGRADATION				Total Hrs	9		
Land – weathering and erosion - types of weathering – types of soil – soil erosion – land slides – Wet land and deforestation- deserts – types – desertification – land degradation – features of desert – geochemical cycling – solid and hazardous waste, chemical waste, radio active waste – non hazardous waste - Case Studies in current scenario.								
4	FUTURE POLICY AND ALTERNATIVES				Total Hrs	9		
Future policy and alternatives – fossil fuels – nuclear energy – solar energy – wind energy – hydroelectric energy – geothermal energy – tidal energy – sustainability – green power – nano technology – international policy - Case Studies in current scenario.								
5	BIO DIVERSITY AND HUMAN POPULATION				Total Hrs	9		
Introduction to Bio diversity-Definition, genetic species and ecosystem diversity. Biogeographical classification of India – Biodiversity in India – India as mega diversity nation – hotspots of biodiversity in India – threats to biodiversity – endemic and endangered- habitat – conservation of biodiversity – environment protection act – issues and possible solution – population growth - population explosion – environment and human health - HIV-AIDS- Case Studies in current scenario.								
Total hours to be taught						45		
Text book :								
1.	R.Palanivelu and B.Srividhya, “Environmental Engineering: Sakura Publishers, Erode, 4th Edition, 2010.							
References :								
1.	Linda D. Williams – “Environmental Science Demystified”, Tata McGraw Hill Publishing Company Limited, 2005.							
2.	G. Tyler Miller, JR _ “Environmental Science “, Thomson, 2004.							
3.	William P. Cunningham – “Principles of Environmental Science”, Tata McGraHill, New Delhi, 2007.							
4.	Bharucha Erach –“The Biodiversity of INDIA”, Mapin Publishing Private Limited, Ahamedabad, India.							
5.	Trivedi R.K., “Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Volume I & II, Environmedia.							

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Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 PH 101	ENGINEERING PHYSICS	3	0	0	3	50	50	100
Objective(s)	To enhance students' knowledge of theoretical and modern technological aspects in physics, enable the students to correlate the theoretical principles with application oriented studies.							

1	ACOUSTICS OF BUILDING AND SOUND INSULATION	Total Hrs	9

Introduction-Classification of sound – Characteristics of musical sound – sound intensity level – Weber-Fechner law –Bel, Decibel, Phon, Sone – Acoustics of building - Reverberation – Reverberation time – Sabine's formula – Absorption co-efficient (derivation)– Factors affecting the acoustics of buildings and their remedies- Factors to be followed for good acoustics of building.

2	LASER AND APPLICATIONS	Total Hrs	9

Introduction – Principle of spontaneous emission, stimulated absorption and emission – Einstein's co-efficient (derivation)– Types of lasers: Nd:YAG, Semiconductor laser (homo junction and hetro junction), CO_2 laser – Applications: Lasers in welding, cutting, drilling and soldering- medical applications: laser endoscopy, bloodless surgery – Holography: Construction and reconstruction of hologram –applications.

3	FIBER OPTICS AND SENSORS	Total Hrs	9

Principles – cone of acceptance, numerical aperture (derivation)- Modes of propagation – Concept of bandwidth (Qualitative)- Crucible-crucible technique –zone refining (rod and tube method)- Classification based on materials, refractive index and modes– Splicing – Losses in optical fiber – Light sources for fiber optics – Detectors – Fiber optical communication links – Advantage of fiber optical cable over copper cables- Fiber optic sensors: Temperature, Displacement, Voltage and magnetic field measurement.

4	ULTRASONICS AND APPLICATIONS	Total Hrs	9

Introduction: Production of ultrasonic waves – Magnetostriction effect, magnetostriction generator-inverse piezoelectric effect, piezoelectric generator – Ultrasonic detection, properties, cavitation- acoustical grating- Industrial applications: Cleaning, SONAR, depth of sea – Non destructive testing – Pulse echo system, through transmission, resonance system- Medical applications:cardiology, neurology, ultrasonic imaging.

5	QUANTUM PHYSICS AND APPLICATIONS	Total Hrs	9

Development of Quantum theory – Dual nature of matter and radiation – de-Broglie wave length – Uncertainty principle, applications: single slit experiment, electron microscope - Schrodinger's equation time dependent and time independent – Particle in a box(one dimensional and three dimensional)- limitation of optical microscopy –electron microscope- Scanning electron microscope-transmission electron microscope-scanning transmission electron microscope-applications.

Total hours to be taught	45

Text Book:

1.	Dr.Palanisamy P.K, "Engineering Physics", Scitech Publications, Chennai, 2010.

Reference (s) :

1	Pillai S O, "Engineering Physics", New Age International Publishers, New Delhi, 2005.
2	Rajendran V, "Engineering Physics", Tata McGraw-Hill Publishers, New Delhi, 2008
3	www.howstuffworks.com

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2010</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester I</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 GE 101</td><td colspan="2">FUNDAMENTALS OF PROGRAMMING</td><td>3</td><td>1</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To enable students to learn the basic concepts of computer and developing skills in programming using C language.</td></tr>
<tr><td>1</td><td colspan="5">COMPUTER BASICS</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">Evolution of computers- Generations of computers- Applications of computers- - Computer Memory and Storage- Input Output Media – Algorithm- Flowchart- Pseudo code – Program control structures- - Programming languages- - Computer Software- Definition- Categories of Software.</td></tr>
<tr><td>2</td><td colspan="5">C FUNDAMENTALS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Introduction to C- Constants- Variables- Data types- Operators and Expressions- Managing Input and Output operations- Decision Making and Branching- Looping.</td></tr>
<tr><td>3</td><td colspan="5">ARRAYS AND FUNCTIONS</td><td>Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="9">Arrays- Character Arrays and Strings- User defined functions- Storage Classes</td></tr>
<tr><td>4</td><td colspan="5">STRUCTURES AND FILES</td><td>Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="9">Structures- Definition- Initialization- Array of Structures- Structures within structures- Structures and Functions- Unions- File Management.</td></tr>
<tr><td>5</td><td colspan="5">POINTERS</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">Pointer Basics – Pointer Arithmetic – Pointers and array Pointers and character string Pointers and functions – Pointers and structures.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45+15(Tutorial)=60</td></tr>
<tr><td colspan="9">Text book (s):</td></tr>
<tr><td>1</td><td colspan="8">Dr.K.Duraisamy, R.Nallusamy, R.Kanagavalli, S.Ponmathangi, D.Muthusankar, P.Kaladevi, “Fundamentals of Programming”, Techvision Publishers 2008.</td></tr>
<tr><td>2</td><td colspan="8">E.Balagurusamy, “Programming in ANSI C”, TMH, New Delhi, 2002.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Rajaraman V, “Fundamentals of Computers”, Fourth Edition, PHI 2006.</td></tr>
<tr><td>2</td><td colspan="8">Byron Gottfried, “Programming with C”, II Edition, TMH, 2002.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
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Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 GE 103	ENGINEERING DRAWING (CE, MC, ME, TT)	2	0	3	4	50	50	100
Objective(s)	Student's skill in the graphical communication of concepts and ideas in the design of engineering products are to be obtained by training them to understand objects by making sketches of simple engineering objects and introduction to computer 2D and 3D modeling techniques.							
1	INTRODUCTION TO ENGINEERING DRAWING, PLANE CURVES AND ORTHOGRAPHIC PROJECTION					Total Hrs		12
Use of Drawing instruments – BIS conventions and specifications – size, layout and folding of drawing sheets – Lettering and dimensioning – Drawing Sheet Layouts - Title Block – Line types - Studying the method of drawing: ellipse, parabola, and hyperbola by eccentricity method. Construction of cycloids –construction of involutes of square and circle. Introduction to orthographic projections – Conversions of pictorial views to orthographic views of simple machine members.								
2	PROJECTION OF POINTS, LINES AND PLANE SURFACES					Total Hrs		12
Projection of points– Projection of straight lines in the first quadrant (lines parallel to both planes – Inclined to one plane and parallel to other – Inclined to both Planes) – Projection of Planes (Inclined to both the planes).								
3	PROJECTION OF SOLIDS					Total Hrs		12
Projections of simple solids like prism, pyramid, cylinder and cone (Axis parallel to one plane and perpendicular to other, axis inclined to one plane and parallel to other).								
4	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES					Total Hrs		12
Section of solids like prism, pyramid, cylinder, cone and sphere in simple positions (cutting plane is inclined to the one of the principal planes and perpendicular to the other) - True shape of sections for the above. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.								
5	ISOMETRIC PROJECTION, PERSPECTIVE PROJECTION, INTRODUCTION TO COMPUTER AIDED DRAFTING					Total Hrs		12
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of prisms by visual ray method and vanishing point method. Introduction to computer 2D and 3D modeling techniques (Not for examination).								
Total hours to be taught								60
Text book (s) :								
1	Venugopal K., "Engineering Graphics", New Age International (P) Limited, 2002.							
2	Natarajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006							
Reference(s) :								
1	Bhatt N.D., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 49th Edition, Anand, Gujarat, 2006.							
2	Shah M.B. and Rana B.C., "Engineering Drawing", Pearson Education, 2005.							

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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 PH 100</td><td colspan="2">ENGINEERING PHYSICS LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To give exposure for understanding the various physical phenomena’s in optics, acoustics material science and properties of matter in engineering applications, determine the fundamental constants like acceleration due to gravity, viscosity of liquid, wave length of laser, band gap of semiconductor etc.,</td></tr>
<tr><td colspan="9">LIST OF EXPERIMENTS</td></tr>
<tr><td>1</td><td colspan="8">Determination of rigidity modulus of a wire by torsional pendulum.</td></tr>
<tr><td>2</td><td colspan="8">Determination of Young’s modulus of the material of a uniform bar by non-uniform bending method.</td></tr>
<tr><td>3</td><td colspan="8">Determination of Young’s modulus of the material of a uniform bar by uniform bending method.</td></tr>
<tr><td>4</td><td colspan="8">Determination of Viscosity of liquid by Poiseuille’s method.</td></tr>
<tr><td>5</td><td colspan="8">Determination of acceleration due to gravity by compound (bar) pendulum.</td></tr>
<tr><td>6</td><td colspan="8">Determination of wavelength of mercury spectrum by Spectrometer grating.</td></tr>
<tr><td>7</td><td colspan="8">Determination of thickness of fiber by Air-wedge method.</td></tr>
<tr><td>8</td><td colspan="8">Determination of wavelength of laser using grating and particle size determination.</td></tr>
<tr><td>9</td><td colspan="8">Determination of velocity of ultrasonic waves and compressibility using ultrasonic interferometer.</td></tr>
<tr><td>10</td><td colspan="8">Determination of band gap energy of a semiconductor.</td></tr>
<tr><td>11</td><td colspan="8">Determination of radius of curvature of a Plano convex lens by Newton rings method.</td></tr>
<tr><td>12</td><td colspan="8">Determination of acceptance angle numerical aperture using fibre optics.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Lab Manual :</td></tr>
<tr><td>1</td><td colspan="8">“Physics Lab Manual”, Department of Physics, KSRCT.</td></tr>
</table>

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Semester I								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
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10 GE 1P2	FUNDAMENTALS OF PROGRAMMING LABORATORY	0	0	3	2	50	50	100
Objective(s)	To enable the students to apply the concepts of C to solve real time problems							

LIST OF EXPERIMENTS

1. Write a C program to print Pascal's triangle.
2. Write a C program to print the sine and cosine series.
3. Write a C program to perform Matrix multiplication.
4. Write a C program to prepare and print the sales report.
5. Write a C program to perform string manipulation functions like string concatenations, comparison, find the length and string copy without using library functions.
6. Write a C program to arrange names in alphabetical order.
7. Write a C program to calculate the mean, variance and standard deviation using functions.
8. Write a C program to perform sequential search using functions.
9. Write a C program to print the Fibonacci series and to calculate the factorial of the given number using functions.
10. Write a C program to print the mark sheet of n students using structures.
11. Write a C program to merge the given two files.
12. Write a C Program to perform Swap Using Pointers.

Total hours to be taught	45

Modules	**10 EN 101 – Technical English Course Outcomes (COs)**
	At the end of the course, the student will be able to
1	Comprehend the basic grammatical structures and generate new sentences in a given paradigm.
2	Explain and apply the enriched vocabulary in academic and professional contexts.
3	Identify the main idea and integrate it with supporting data to facilitate effective comprehension.
4	Infer, compare and summarize lexical & contextual meaning of various technical / general passages.
5	Recognize the basic phonetic units of language and execute it for better oral competency.
6	Recognize and interpret standard English Pronunciation & use it in diverse situations.
7	Find and classify different reading strategies and demonstrate better articulation / expression
8	Categorize words into different parts of speech and use them in different contexts.
9	Retrieve information from various sources and construct a well designed descriptive writing.
10	Identify the key words of concepts and learn to write definitions.

Modules	10 MA 101 - Engineering Mathematics – I Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Identify various operations on matrices.
2	Apply transformation techniques on matrices.
3	Analyze the properties of curvature using differential calculus.
4	Analyze the properties of envelope using differential calculus.
5	Examine the maxima and minima for functions of two variables.
6	Infer the constrained maxima and minima for functions of two variables.
7	Compute linear differential equations with constant coefficients.
8	Find the solutions of linear differential equations with variable coefficients
9	Solve pair of simultaneous linear differential equations.
10	Solve basic engineering problems represented by differential equations.

Modules	10 CH 102 - Environmental Engineering Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Recognize the environmental problems caused due to pollution.
2	Describe the structure of ecosystem and its impact on environment.
3	Identify the sources of water and its pollutants.
4	Analyse the methods for treatment of water and control its pollution.
5	Explain the various resources of land and its characteristics.
6	Demonstrate the awareness among public about the waste which degrades the land.
7	Discuss the details of policy adopted to use non renewable energy sources for energy conversion.
8	Discuss the details of policy adopted to use renewable energy sources for energy conversion.
9	Describe the importance and conservation of biodiversity in India.
10	Indicate the adverse effects of population explosion and conduct the awareness programme to safeguard human health.

Modules	10 PH 101 - Engineering Physics Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Categorize the sound and analyze its characteristics
2	Design buildings with good acoustics
3	Discuss the principle of laser emission and Classification
4	Identify the applications of lasers
5	Summarize the propagation of lights in fibre optic cables and characteristic parameters
6	Illustrate the fiber optic communication link and its applications
7	Express the production and detection methods of ultrasonic waves
8	Identify the applications of ultrasonic waves
9	Comprehend the development of quantum theory and its applications
10	Categorize the electron microscope and analyze its applications

Modules	10 GE 101 - Fundamentals of Programming Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Recognize the origin and evolution of computers, generations of computers and the applicability of computer system in various fields.
2	Describe about algorithms, Pseudo code, various flow chart symbols, different programming control structures and types of software
3	Capture the fundamentals of C - Constants, Variables and Data types, different operators and Expressions in C language
4	Describe different Input and Output operations with different formats and programs using different Branching and Looping statements
5	Narrate the basic concept of Array, types of array, character arrays and strings and able to write programs using array concepts.
6	Obtain knowledge about user defined functions and scope of variables in C
7	Comprehend basic concept of Structure, nested structures and Union
8	Identify the concept of File, File operations and Types of files
9	Grasp the basics of pointers and its operation and implement the concepts of Pointers and arrays, Pointers and Character Strings
10	Illustrate the concepts of Pointers and functions & Pointers and Structures

Modules	10 GE 103 - Engineering Drawing Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Use the drawing instruments, and recall the drawing standards.
2.	Identify and Construct the conic curves.
3.	Visualize the projection of points and straight lines in the first quadrant.
4.	Demonstrate the projection of plane surfaces kept at different positions.
5.	Draw and demonstrate the projection of simple solid like prism, pyramid, cylinder and cone.
6.	Sketch the section of solids like prism, pyramid, cylinder, cone and sphere in simple positions.
7.	Demonstrate the development of lateral surfaces of simple and sectioned solids.
8.	Distinguish and draw the isometric projections and isometric views of simple and truncated solids.
9.	Construct the isometric projection of combination of two or more solid objects in simple vertical position.
10.	Illustrate the perspective projection of prisms by visual ray and vanishing point method.

Modules	10 PH 100 – Engineering Physics Laboratory Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Calculate the rigidity modulus of a wire by torsional pendulum.
2	Determination of Young's modulus of the material of a uniform bar by non-uniform and uniform bending method.
3	Evaluate the Viscosity of liquid by Poiseuille's method.
4	Calculate acceleration due to gravity by compound (bar) pendulum.
5	Illustrate the wavelength of mercury spectrum by Spectrometer grating.
6	Show the thickness of fiber by Air-wedge method.
7	Estimate wavelength of laser using grating and particle size determination.
8	Determination of velocity of ultrasonic waves and compressibility using ultrasonic interferometer.
9	Identify the band gap energy of a semiconductor.

Modules	10 GE 1P2 – Fundamentals of Programming Laboratory Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Demonstrate the ability to use the editor, compiler, and linker to create source, object, and executable code and debugging of a simple 'C' program.
2	Familiarize with simple programs involving the fundamental programming constructs (variables, data types, expressions, assignment, simple I/O).
3	Gain the knowledge of the data types appropriate to specific programming problems.
4	Demonstrate the use of appropriate conditional and iteration constructs for a given programming task.
5	Use various string handling functions and arrays as part of the problem solution.
6	Implement the concept of structure data type as part of the solution.
7	Elucidate the concept of functions from the portable C library and Mastering the mechanics of parameter passing, Fibonacci series using recursive function
8	Utilize pointers to efficiently solve problems, swap two integers without using third variable
9	Design programs using file concepts
10	Demonstrate the ability to design, develop, and implement a fully functioning 'C' programming using structured techniques and reusable code.

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<tr><td colspan="2">10 EN 102</td><td colspan="2">COMMUNICATION SKILLS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="8">To equip students with effective speaking and listening skills in English, help them develop the soft skills and people skills which will make them to excel in their jobs and enhance to students' performs at placement interviews</td></tr>
<tr><td>1</td><td colspan="6">LISTENING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Barriers in Listening - Listening to academic lectures - Listening to announcements at railway stations, airports, etc - Listening to news on the radio / TV - Listening to casual conversation - Listening to live speech</td></tr>
<tr><td>2</td><td colspan="6">COMMUNICATION</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">What is communication? - What does it involve? Accuracy, fluency and appropriateness - Levels of formality - Differences between spoken and written communication - Greeting and introduction - Making requests - Asking for permission, Giving / Denying permission - Giving directions - Art of small talk - Taking part in casual conversation - Making a short formal speech Describing people, place, things and events</td></tr>
<tr><td>3</td><td colspan="6">CONVERSATION SKILLS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Using the telephone - Preparing for a call - Stages of a call - Handling calls - Identifying self – Asking for repetitions - Spelling out names or words - Giving information on the phone – Making requests - Answering calls - Leaving messages on Answer Machines - Making / changing appointments - Making complaints – Reminding - Agreeing / Disagreeing – Listening - Listening and Taking messages - Giving instructions & Responding to instructions</td></tr>
<tr><td>4</td><td colspan="6">REMEDIAL GRAMMAR & VOCABULARY</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Tenses - 'Do' forms – Impersonal Passive voice - Imperatives – using should form – Direct, Indirect speech – Discourse markers – SI Units – Numerical expressions - Use of negatives – Prepositions - Phrasal verbs - Correct use of words - Use of formal words in informal situations - Commonly confused words – Editing.</td></tr>
<tr><td>5</td><td colspan="6">WRITTEN COMMUNICATION & CAREER SKILLS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Writing e-mails - Writing Reports – Lab Reports - Preparing Curriculum Vitae and cover letters – Facing an Interview - Presentation skills - Persuasion skills – Flow Charts, Tree diagram – Recommendations – Check List – Slide Preparation – Verbal Reasoning (Analogy, Alphabet Test, Assertion & Reason, Situation Reaction Test) – Logical Deduction (Deriving Conclusions from passages, Theme Detection, Cause and Effect Reasoning).</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Rizvi M Ashraf, 'Effective Technical Communication', 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Kiranmai Dutt P, Geetha Rajeevan and Prakash C L N, 'A Course in Communication Skills', by Ebek – Cambridge University Press India Pvt. Ltd.</td></tr>
<tr><td>2</td><td colspan="8">Naterop, cup 'Telephoning in English' – Cambridge University Press India Pvt.Ltd., 2007</td></tr>
<tr><td>3</td><td colspan="8">Richard, 'New Interchange Services (Student's Book)' – Introduction, Level – 1, Level – 2, Level – 3, Cambridge University Press India Pvt. Ltd., 2007.</td></tr>
<tr><td>4</td><td colspan="8">Aggarwal, R.S. "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.</td></tr>
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<tr><td colspan="2">10 MA 102</td><td colspan="2">ENGINEERING MATHEMATICS II</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">An aim of the course is to train the students in additional areas of engineering mathematics necessary for grooming them into successful engineers. The topics introduced will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.</td></tr>
<tr><td>1</td><td colspan="5">MULTIPLE INTEGRALS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Double integration in Cartesian and Polar coordinates – Change of order of integration – Area between two curves – Area as double integrals - Triple integration in Cartesian coordinates – Volume as triple integrals (simple problems only) .</td></tr>
<tr><td>2</td><td colspan="5">VECTOR CALCULUS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Gradient, divergence and curl – Line, surface and volume integrals – Green’s, Gauss divergence and Stoke’s theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.</td></tr>
<tr><td>3</td><td colspan="5">ANALYTIC FUNCTIONS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Function of a complex variable – Analytic function – Necessary conditions –Polar form– Cauchy-equations – Sufficient conditions (excluding proof) – Properties of analytic function – Harmonic c Construction of Analytic functions -Conformal mapping: w = az, 1/z and bilinear transformation.</td></tr>
<tr><td>4</td><td colspan="5">COMPLEX INTEGRATION</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Cauchy’s theorem (without proof) – Cauchy’s integral formula – Taylor and Laurent series (without proof) – Singularities – Classification – Cauchy’s residue theorem – Contour integration – circular and semi-circular contours (excluding poles on real axis).</td></tr>
<tr><td>5</td><td colspan="5">LAPLACE TRANSFORM</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Laplace Transform – Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of unit step function – Transform of periodic functions. Inverse Laplace transform – Convolution theorem – Solution of linear ODE of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transformation.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>60</td></tr>
<tr><td colspan="9">Text book :</td></tr>
<tr><td>1</td><td colspan="8">Veerarajan. T., “Engineering Mathematics (for first year), Fourth Edition Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005.</td></tr>
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<tr><td>2</td><td colspan="8">Venkataraman.M.K, “Engineering Mathematics, Volume I & II Revised Enlarged Fourth Edition”, The National Pub. Co., Chennai, 2004.</td></tr>
<tr><td>3</td><td colspan="8">Widder. D.V., “Advanced Calculus”, Second Edition, Prentice Hall of India, New Delhi, 2000.</td></tr>
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Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 PH 103	MATERIAL SCIENCE (MC, ME)	3	0	0	3	50	50	100
Objective(s)	Impart fundamental knowledge in various engineering materials and applications, knowledge about crystal geometry, vacuum science & technology, magnetic, new engineering and Nanomaterials							

1	CRYSTAL GEOMETRY	Total Hrs	9
Crystal symmetry: centre plane and axis of symmetry- absence of five fold symmetry- HCP structures: coordination number, atomic radius, c/a ratio, packing factor-phase diagram-phase rule-unary, binary and ternary phase diagram (Qualitative)-Fe, Fe-C phase diagram- imperfection of crystals.			
2	VACUUM SCIENCE AND TECHNOLOGY	Total Hrs	9
Introduction-Concepts of vacuum-Throughput-Pumping speed-Effective pumping speed and conductance. Types of pumps: Working principle and construction of rotary pumps, Diffusion pump, Turbo-molecular pump- Operation of pressure gauges-Pressure range, measurement of vacuum using pirani and penning gauges- merits, limitations and applications.			
3	MAGNETIC MATERIALS	Total Hrs	9
Classification of Magnetic materials-properties-Heisenberg and Domain theory of ferromagnetism-Hystersis-Hard and Soft magnetic materials-Ferrites: Structure, preparation and Applications-Applications: Magnetic recording and read out-bubble memory-magnetic tape-floppy disc and magnetic hard disc.			
4	NEW ENGINEERING MATERIALS	Total Hrs	9
Introduction-Shape memory alloys-Principle and working of a shape memory alloy material-Properties of NiTi alloys-applications-microelectronic mechanical system (MEMS)-metallic glasses: properties, preparation and application-metallic glass as transformers core-Fiber reinforced plastics (FRP) and Fiber reinforced metals (FRM).			
5	NANOMATERIALS	Total Hrs	9
Introduction-Properties-Fabrication methods: Top-Down Process – Ball milling-Nanolithography-Bottom-up Process: Vapour Phase Deposition (PVD & CVD)-Molecular Beam Epitaxy (MBE)-Metal Organic Vapour Phase Epitaxy (MOVPE)-Carbon Nano Tube (CNT): Properties, Preparation and applications.			
Total hours to be taught			45

Text Book:

1	Palanisamy P K,"Materials Science", SCITECH Publications, Chennai, 2006.

Reference (s) :

1	Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2007.
2	Arumugam M, "Engineering Physics-II", 6th Anuradha Publications, Kumbakonam, 2010.
3	Gaur R K, Gupta S L, "Engineering Physics", Dhanpat Rai Publications, New Delhi, 2006.
4	www.howstuffworks.com

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="4">R 2010</td></tr>
<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="4">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="10">Semester II</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 CH 101</td><td colspan="2">ENGINEERING CHEMISTRY</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="9">The student should be conversant with the principles involved in electro chemistry, corrosion and its inhibition, treatment of water for industrial purposes and the concept of energy storage devices, knowledge with respect to fuels and combustion and polymer and engineering materials.</td></tr>
<tr><td>1</td><td colspan="5">WATER TREATMENT</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="10">Water - sources and sanitary significance – Hardness of water - Estimation of hardness by EDTA method – Alkalinity. Boiler feed water- scale formation, corrosion, caustic embrittlement, priming and foaming- softening of water - Internal and external treatment - zeolite process – demineralization – desalination – electro dialysis and reverse osmosis. Domestic water treatment.</td></tr>
<tr><td>2</td><td colspan="5">ELECTRO CHEMISTRY</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="10">Introduction – Kohlrausch’s law- applications-conductometric titration-Electrode potential-Nernst equation-problems-Reference electrode-calomel electrode-SHE-weston cadmium cell-Types of electrodes-Measurement of pH using glass electrode-Galvanic series- emf series-applications. Electro chemical cells-concentration cells-reversible and irreversible cell – EMF - measurements – Potentiometric titrations</td></tr>
<tr><td>3</td><td colspan="5">CORROSION & CORROSION CONTROL</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="10">Corrosion – Electrochemical and chemical – Mechanism – factors influencing rate of corrosion - corrosion reaction – types of corrosion – differential aeration – pitting – corrosion control – Sacrificial anode and Impressed current method – Inhibitors – Protective coatings – Preliminary treatment – Electroplating (Cr & Ni) – Paints – Constituents and their functions – Special paints - Mechanism of drying.</td></tr>
<tr><td>4</td><td colspan="5">FUELS & COMBUSTION</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="10">Introduction-solid, liquid and gaseous fuels-Difference among solid,liquid and gaseous fuels-Explosive range(or) limits of inflammability-Calorific values –Spontaneous ignition temperature-flue gas analysis – Coal – analysis of coal– carbonization of coal-metallurgical coke - manufacture of metallurgical coke – hydrogenation of coal – petroleum – Cracking – Catalytic Cracking – Polymerisation - alkylation – Octane number – improving octane number by additives – Diesel – Cetane number –natural gas, water gas, producer gas, gobar gas & LPG.</td></tr>
<tr><td>5</td><td colspan="5">POLYMERS</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="10">Polymer structure – Nomenclature – Polymerization – types – mechanism (free radical only) – co-ordination polymerization – mechanism – individual polymers – Polyethylene, Polypropylene, PVC, Teflon, Acrylics, Nylon6-6, Bakelite, Polyester, Epoxy, Polyurethane – Structure, Preparation, Properties and Uses – Compounding and fabrication – Compression, Injection, Extrusion and Blow moulding– Foamed plastics.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="10">Text book :</td></tr>
<tr><td>1.</td><td colspan="9">R.Palanivelu, B.Srividhya, K.Tamilarasu and P.Padmanaban, “Engineering Chemistry”, Sakura Publishers, Erode, 4th Edition, 2010.</td></tr>
<tr><td colspan="10">References :</td></tr>
<tr><td>1.</td><td colspan="9">Jain P.C. & Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Co. New Delhi, 14th Edition, 2002.</td></tr>
<tr><td>2.</td><td colspan="9">Clair N Sawyer and Perry L Mc Carty, ”Chemistry for Environmental Engineering”, TMH Book Company, New Delhi, 14th Edition, 2002.</td></tr>
<tr><td>3.</td><td colspan="9">Dara S.S. “A text book of Engineering Chemistry, S.Chand & Co. Ltd., 2003.</td></tr>
<tr><td>4.</td><td colspan="9">Uppal M.M. revised by S.C.Bhatia, ”Engineering Chemistry”, Khanna Publishers, New Delhi, 6th Edition, 2001.</td></tr>
<tr><td>5</td><td colspan="9">www.howstuffworks.com</td></tr>
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<tr><td colspan="9">Semester II</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours/ Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 GE 110</td><td>BASICS OF ELECTRONICS ENGINEERING (BT,CE, MC, ME)</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To Introduce fundamentals of Electron Devices, integrated Circuits and Communication Engineering</td></tr>
<tr><td>1</td><td colspan="5">SEMICONDUCTOR THEORY AND PN JUNCTION DIODE</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Energy bands - conduction in solids-conventional current and electron flow - bonding forces between atoms-conductors, insulators and semiconductors - p-type and n-type semiconductors - effects of heat and light-drift current and diffusion current - the PN junction - forward biased junction - reverse biased junction - temperature effects. Diode characteristics and parameters - diode fabrication and packaging -graphical analysis of diode circuits- ideal diode and practical diode</td></tr>
<tr><td>2</td><td colspan="5">APPLICATIONS OF DIODE</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Rectification – half wave, full wave and bridge rectifiers. Ripple factor, output waveforms, average output voltage, RMS voltage and current, simple problems. Diode logic circuits - power dissipation in diodes - diode clipping and clamping circuits - diode testing. Zener diode - Zener diode as voltage regulator.</td></tr>
<tr><td>3</td><td colspan="5">BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Introduction - transistor operation - transistor currents - transistor terminal voltages - common base characteristics - common emitter characteristics - common collector characteristics - transistor voltage amplification - transistor as switch - class A, B, C operations (only definitions), waveforms, applications. Field effect transistors. The n channel JFET - characteristics of an n channel JFET - the p channel JFET- FET voltage amplification- JFET construction - MOSFET.</td></tr>
<tr><td>4</td><td colspan="5">INTEGRATED CIRCUITS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Linear integrated circuits - operational amplifier – circuit symbol – inverting / non inverting amplifier - gain – adder - differentiator – integrator. Digital integrated circuits - Number system – binary, octal, hexadecimal - Boolean algebra - logic gates – flip flops - shift registers - counters.</td></tr>
<tr><td>5</td><td colspan="5">BASICS OF COMMUNICATION</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">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 and Mobile communication. (Block Diagram Approach only)</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">David A.Bell ‘Electronic Devices and Circuit - Oxford University Press, 2008. (Chapter 1,2 ,3, 8,)</td></tr>
<tr><td>2</td><td colspan="8">Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006). (chapter 13)</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.</td></tr>
<tr><td>2</td><td colspan="8">Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd.</td></tr>
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<tr><td colspan="2">10 GE 109</td><td>ELEMENTS OF ELECTRICAL ENGINEERING (MC, ME)</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To expose the students in Electrical Engineering topics like electrical circuits, magnetic circuits, various sources of electrical power, measuring instruments for electrical quantities and utilization of electrical energy to various applications.</td></tr>
<tr><td>1</td><td colspan="6">ELECTRICAL CIRCUITS</td><td>Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Basic definitions & units - current, voltage, Energy, Power – Ohm’s law – Kirchoff’s laws – series and parallel resistances (Simple problems on DC circuits); Introduction to AC circuits - Instantaneous, Rms and average values of sine wave – form factor and peak factor – Power and power factor – Single phase RL, RC and RLC series circuits – phasor diagram; Three phase circuits - Y-Δ connections – Line and phase voltages / currents – Power in 3 phase circuits (simple problems).</td></tr>
<tr><td>2</td><td colspan="6">MAGNETIC CIRCUITS</td><td>Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Ohm’s law of magnetic circuit – Simple and composite magnetic circuits – effect of airgap – leakage factor - Fringing effect (simple problems).
Faraday’s law of electro magnetic induction – self and mutually induced emf – self and mutural inductances – statically and dynamically induced EMF (simple problems).</td></tr>
<tr><td>3</td><td colspan="6">POWER SYSTEM</td><td>Total Hrs</td><td>8</td></tr>
<tr><td colspan="9">Structure of electric power system – Sources of Electric Energy – Power Plants - Steam, Hydroelectric, Nuclear, Gas, Wind and Solar (Qualitative Treatment Only); Indian Electricity rules; Principles of energy conservation.</td></tr>
<tr><td>4</td><td colspan="6">MEASURING INSTRUMENTS</td><td>Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Classification of instruments – Types of torques in instruments – construction and working principle of moving coil and moving iron instruments – Dynamo meter type watt meter – Induction type energy meter – multi meter – megger – three phase power measurement using two wattmeter method – Instrument transformers (CT & PT) (simple problems).</td></tr>
<tr><td>5</td><td colspan="6">UTILIZATION OF ELECTRICAL ENERGY</td><td>Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Wiring materials and accessories - Ratings of wiring materials - Types of wiring – Earthing; Illumination - Street lighting - Factory lighting, Flood lighting; Electric heating - Resistance heating - Dielectric heating - induction heating; Electric welding - Resistance Electric welding - Electric arc welding - Ultrasonic welding, Laser beam welding.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">R.Muthusubramaniam, S.Salivahanan and K A Muraleedharan, “Basic Electrical, Electronics and Computer Engineering”, TMH 2007.</td></tr>
<tr><td>2</td><td colspan="8">Rajput R.K , “Utilization of Electrical Power”, First Edition, Laxmi publications, New Delhi.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Del Tora ‘Electical Engineering Fundamentals’ Pearson Education, New Delhi, 2007.</td></tr>
<tr><td>2</td><td colspan="8">S.P.Bihari and Bhu Pendra Sehgal, “Basic Electrical Engieering – Made Easy”, Cengage learning.</td></tr>
<tr><td>3</td><td colspan="8">Alan S. Moris, Principles of Measurements and Instruments, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 CH 100	ENGINEERING CHEMISTRY LABORATORY	0	0	3	2	50	50	100
Objective(s)	Educate the theoretical concepts Experimentally							
1	Estimation of hardness of water by EDTA.							
2	Estimation of alkalinity of water sample.							
3	Estimation of chloride content in water sample.							
4	Determination of dissolved oxygen in boiler feed water.							
5	Determination of water of crystallization of a crystalline salt.							
6	Conductometric titration of strong acid with strong base.							
7	Conductometric titration of mixture of acids.							
8	Precipitation titration by conductometric method.							
9	Determination of strength of HCl by pH Meter.							
10	Estimation of ferrous ion by potentiometric titration .							
11	Determination of sodium and potassium in a water sample by flame photometry (Demo only).							
12	Estimation of ferric ion by spectrophotometry (Demo only).							
Total hours to be taught						45		
Lab Manual :								
1	R.Palanivelu and B.Srividhya, “Engineering Chemistry Lab Manual”.							
Reference(s) :								
1	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel’s Text book of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2004.							

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<tr><td colspan="2">10 GE 1P1</td><td>ENGINEERING PRACTICES LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical Engineering</td></tr>
<tr><td>1</td><td colspan="5">FITTING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Safety aspects in Fitting, Study of tools and equipments, Preparation of models- Filing, Square, Vee.</td></tr>
<tr><td>2</td><td colspan="5">CARPENTRY</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Safety aspects in Carpentry, Study of tools and equipments, Preparation of models- Planning, Tee Halving, Cross Lap, Wood turning.</td></tr>
<tr><td>3</td><td colspan="5">SHEET METAL</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Safety aspects in Sheet metal, Study of tools and equipments, Preparation of models- Cylinder, Cone, Tray.</td></tr>
<tr><td>4</td><td colspan="5">WELDING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Safety aspects of welding, Study of arc welding equipments, Preparation of models -Lap, butt, T-joints. Study of Gas Welding and Equipments.</td></tr>
<tr><td>5</td><td colspan="5">ELECTRICAL WIRING AND PLUMBING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Safety aspects of Electrical wiring, Study of Electrical Materials and wiring components, Wiring circuit for a lamp using single and stair case switches. Wiring circuit for fluorescent lamps
Study of plumbing tools, Study of pipe connection with coupling and reducer.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
</table>

Modules	10 EN 102 – Communication Skills Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Look for specific details and overcome speech barriers.
2	Pick key points by listening and improve casual conversational skills.
3	Understand different forms of communication with differences among them.
4	Know about formal speech and descriptive techniques, and use specific words in specific contexts.
5	Fine tune language for different conversational contexts and purposes.
6	Learn telephone etiquette by using language for assent and dissent.
7	Understand grammatical structures, its technical aspects and usage
8	Use discourse markers, enhance punctuation and learn discourse coherence
9	Comprehend content, generate different forms of template and enhance reference skills
10	Construct well-knit documents for job readiness and career competence

Modules	10 MA 102 - Engineering Mathematics II Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Perform double integration in Cartesian and polar coordinates.
2	Evaluate the area by using double integration and volume by using triple integration.
3	Compute the line, surface & volume integrals of a vector function
4	Define and verify the theorems of vector calculus.
5	Verify and construct analytic function.
6	Construct conformal mapping in analytic functions.
7	Classify the singularities of complex function
8	Evaluate real definite integrals by choosing integer and the contour
9	State the Laplace transform and inverse Laplace transform of different functions
10	Solve the second order linear ODE with suitable initial conditions

Modules	10 PH 103 - Material Science Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Write the concepts of centre, plane and axis of symmetry, recognize absence of five fold symmetry.
2.	Analyse the HCP structure, crystal imperfection, understand iron-carbide phase diagram.
3.	Describe the concepts of vacuum, throughput, pumping speed, effective pumping speed and conductance.
4.	Acquire knowledge of types of vacuum pumps and pressure gauges, explain their working principle and construction.
5.	Classify and compare the various magnetic materials, knowledge of the Heisenberg and Domain theory of ferromagnetism, analyze ferrites and its applications.
6.	Describe and explain magnetic tape, floppy disk, hard disk and bubble memory.
7.	Recognize smart materials such as Shape Memory Alloys (SMA), metallic glasses and microelectronic mechanical system (MEMS).
8.	Explain the Fiber Reinforced Plastics (FRP) and Fiber Reinforced Metals(FRM).
9.	Acquire knowledge of nanotechnology, explain top-down and bottom-up fabrication methods of nanomaterials like ball milling, nanolithography, PVD and CVD, MBE and MOVPE.
10.	Describe Carbon Nano Tubes, their properties, preparation and applications.

Modules	10 CH 101 - Engineering Chemistry Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Identify the hardness of water and its testing methods
2	Assess the softening and desalination techniques
3	Recognize the principles involved in electrochemistry
4	Describe the measurement of pH and potentiometric titrations
5	Identify the different types of corrosion
6	Interpret the knowledge about corrosion control and mechanism of drying of oil in paints
7	Predict the analysis and combustion of fuels
8	Describe the manufacturing methods of solid, liquid and gaseous fuels
9	Write the preparation, properties and uses of polymeric materials
10	Illustrate the various moulding techniques.

Modules	10 GE 110 - Basics of Electronics Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the basic theory of semiconductors.
2.	Write the fabrication formation of PN junction and its characteristics when biased
3.	Explain the various applications of PN diode.
4.	Describe the characteristics and applications of Zener diode.
5.	Explain the construction and working of bipolar junction transistor in various configurations and as an amplifier.
6.	Discuss the construction and working of FET in various configurations.
7.	Write the characteristics and applications of an Op-Amp
8.	Explain the need for modulation and its types with relevant applications.
9.	Design the concept of AM, FM radio and commercial TV broadcasting and reception.
10.	State the building blocks of communication systems

Modules	10 GE 109 - Elements of Electrical Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Illustrate different combination of circuit elements and solve the circuit by applying basic circuital laws.
2.	Distinguish the various forms of AC voltage and their response.
3.	Outline the important properties of coupled circuits.
4.	Determine the inductance value for dissimilar materials.
5.	Extrapolate how electric power generated from various resources.
6.	Employ the energy conservation techniques in demand side.
7.	Classify and use the different types of electrical measuring instruments in suitable applications.
8.	Apply the suitable measuring instruments in transmission network.
9.	Write the requirement of electrical machines for welding and obtain its characteristics.
10.	Identify, classify, describe the principles and use correct methodology to plan lighting system.

Modules	10 CH 100 - Engineering Chemistry Laboratory Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Estimate the hardness, alkalinity and chloride content of water.
2	Calculate the dissolved oxygen in boiler feed water.
3	Examine the water of crystalline in a crystalline salt.
4	Interpret the conductometric titration with different combinations of acid and base.
5	Test the precipitation titration by conductometric method.
6	Estimate the strength of HCl by pH meter.
7	Calculate the ferrous ion by potentiometric titration.
8	Estimate the sodium and potassium in a water sample.
9	Estimate the ferric ion by spectrophotometry.

Modules	10 GE 1P1 – Engineering Practices Laboratory Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Recognize tools for fitting, carpentry, sheet metal, welding, electrical wiring and plumbing.
2	Demonstrate the safety rules in basic engineering practices laboratory.
3	Prepare models of fitting.
4	Prepare models of carpentry.
5	Make models of sheet metal.
6	Prepare joints by arc welding.
7	Construct electrical wiring circuit and demonstrate.
8	Demonstrate plumbing work.

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<tr><td colspan="9">Semester III</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 MA 003</td><td>ENGINEERING MATHEMATICS III</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">The course objective is to impact analytical skills to the students in the areas of boundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.</td></tr>
<tr><td>1</td><td colspan="5">PARTIAL DIFFERENTIAL EQUATIONS</td><td>Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>2</td><td colspan="5">FOURIER SERIES</td><td>Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval’s Identity – Harmonic Analysis.</td></tr>
<tr><td>3</td><td colspan="5">BOUNDARY VALUE PROBLEMS</td><td>Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Classification of second order quasi linear partial differential equations- Solutions of one dimensional wave equation – One dimensional heat equation - Fourier series solutions in Cartesian coordinates.</td></tr>
<tr><td>4</td><td colspan="5">FOURIER TRANSFORM</td><td>Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Fourier transform pair- Sine and Cosine transforms– Properties – Transforms of simple functions – Convolution theorem- Parseval’s Identity – Problems.</td></tr>
<tr><td>5</td><td colspan="5">Z -TRANSFORM AND DIFFERENCE EQUATIONS</td><td>Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Z-transform - Elementary properties – Initial and final value theorem-Inverse Z – transform – Partial fraction method – Residue method - Convolution theorem - Solution of difference equations using Z - transform.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Veerarajan.T., “Engineering mathematics-III”, Tata McGraw Hill Publishing Company Limited, New Delhi.</td></tr>
<tr><td>2</td><td colspan="8">Grewal, B.S., “Higher Engineering Mathematics”, Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., “Advanced Mathematics for Engineering Students”, Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.</td></tr>
<tr><td>2</td><td colspan="8">Kandasamy, P., Thilagavathy, K., and Gunavathy, K., “Engineering Mathematics Volume III”, S. Chand & Company ltd., New Delhi, 1996.</td></tr>
<tr><td>3</td><td colspan="8">Erwin Kreyszig, “Advanced Engineering Mathematics” 8th Edition, Wiley Publishers, 1999.</td></tr>
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<table>
<tr><td colspan="8">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester III</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 001</td><td colspan="2">ENGINEERING MATERIALS AND METALLURGY (MC, ME)</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To Impart knowledge on the structure, properties, treatment, testing and applications of metals and on non-metallic materials so as to identity and select suitable materials for various engineering applications</td></tr>
<tr><td>1</td><td colspan="5">CONSITITUION OF ALLOYS AND PHASE DIAGRAMS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application</td></tr>
<tr><td>2</td><td colspan="5">HEAT TREATMENT</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test – austempering, martempering – case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening</td></tr>
<tr><td>3</td><td colspan="5">FERROUS AND NON FERROUS METALS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - maraging steels – gray, white, malleable, spheroidal graphite - alloy cast irons
Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminium and Aluminium Alloys– precipitation strengthening treatment – Bearing alloys</td></tr>
<tr><td>4</td><td colspan="5">NON-METALLIC MATERIALS AND POWDER METALLURGY</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Engineering Ceramics – Properties and applications of Al_2O_3, SiC - Fibre and particulate reinforced composites- Powder metallurgy process – characteristics of metal powders – production of metal powder- applications - advantages and limitations</td></tr>
<tr><td>5</td><td colspan="5">MECHANICAL PROPERTIES AND TESTING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) Impact test (Izod and Charpy), fatigue and creep test- metallography - preparation of specimen, metallurgical microscope and scanning electron microscope</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text Book:</td></tr>
<tr><td>1</td><td colspan="8">Khanna O.P, “A Text Book of Martial Science and Metallurgy”, Dhanpat Rai Publishers, 2010.</td></tr>
<tr><td>2</td><td colspan="8">Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.</td></tr>
<tr><td colspan="9">Reference (s) :</td></tr>
<tr><td>1</td><td colspan="8">William D Callister “Material Science and Engineering: An Introduction”, 6th Edition, Wiley Publishers, 2002.</td></tr>
<tr><td>2</td><td colspan="8">Raghavan.V., “Materials Science and Engineering: A First Course”,5th Edition, Prentice Hall of India Pvt. Ltd., 2009.</td></tr>
<tr><td>3</td><td colspan="8">Sidney H.Avner “Introduction to Physical Metallurgy” Tata McGraw-Hill Companies Inc., New York, 2009.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
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Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME 002	ENGINEERING MECHANICS (MC, ME)	3	1	0	4	50	50	100
Objective(s)	At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples							

1	BASICS & STATICS OF PARTICLES	Total Hrs	12
Introduction - Units and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: addition, subtraction, dot product, cross product - Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force			
2	EQUILIBRIUM OF RIGID BODIES	Total Hrs	12
Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Static determinacy - Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions and three dimensions.			
3	PROPERTIES OF SURFACES AND SOLIDS	Total Hrs	12
Determination of Areas and Volumes - Centroid, Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method; T section, I section, Angle section, Hollow section using standard formula) - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principal axes and Principal moments of inertia of plane areas - Mass moment of inertia of thin rectangular section - Relation to area moment of inertia.			
4	DYNAMICS OF PARTICLES	Total Hrs	12
Displacement, Velocity, acceleration and their relationship – Relative motion – Projectile motion in horizontal plane – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.			
5	FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS	Total Hrs	12
Frictional force – Laws of Coloumb friction – Simple contact friction – Ladder friction - Rolling resistance – Ratio of tension in belt. Translation and Rotation of Rigid Bodies: Velocity and acceleration – General Plane motion: Crank and Connecting rod mechanism.			
Total hours to be taught			60

Text Book:

1	Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt. Ltd., 2003.
2	Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 2000.

Reference (s) :

1	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 8th Edition, 5th Reprint 2009.
2	Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
3	Palanichamy M.S. and Nagan S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, 2001
4	Bansal R.K, " Engineering Mechanics" Laxmi Publications (P) Ltd, 2011.
5	Kumar K.L., "Engineering Mechanics", Tata Mc Graw Hill , 2003

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
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		L	T	P	C	CA	ES	Total
10 ME 004	FLUID MECHANICS AND MACHINERY (MC, ME)	3	1	0	4	50	50	100
Objective(s)	To understand the basics of fluid flow concepts, providing the working, concepts of fluid machines and to help the learners to understand the real time problems.							
I	BASIC CONCEPTS AND PROPERTIES				Total Hrs	12		
Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static.								
2	FLUID KINEMATICS AND FLUID DYNAMICS				Total Hrs	12		
Fluid Kinematics - types of flow - velocity field and acceleration - continuity equation - fluid dynamics - equation of motion - Euler's equation along a streamline - Bernoulli's equation - applications - Venturi meter - Orifice meter Pitot tube.								
3	INCOMPRESSIBLE FLUID FLOW				Total Hrs	12		
Viscous flow - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - flow through pipes - Darcy - weisback's equation - pipe roughness- friction factor - minor losses - flow through pipes in series and in parallel - power transmission.								
4	HYDRAULIC TURBINES				Total Hrs	12		
Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - kalpan turbine - working principles - velocity triangles - work done.								
5	HYDRALUIC PUMPS				Total Hrs	12		
Pumps: definition and classifications - Centrifugal pump; classifications, working principle, velocity triangles, Work done - Reciprocating pump: classification, working principle, Basic principles of indicator diagram.								
Total hours to be taught						60		
Text book(s):								
1	Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 9th edition Laxmi publications (P) Ltd, New Delhi, 2005.							
2	Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", 6th Edition, Dhanpat Rai and Sons, Delhi, 1998.							
Reference(s) :								
1	Streeter V.L., and Wylie, E.B., "Fluid Mechanics",4th Edtion, McGraw-Hill, 1983.							
2	Babu.V "Fundamentals of Incompressible Flow", CRC press, First Edition, 2010.							
3	White F.M., "Fluid Mechanics", 5th Edition, Tata McGraw-Hill, New Delhi, 2003.							
4	Som S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", 2nd Edition, Tata McGraw-Hill, 2004.							
5	Vijay Gupta, Santhosh Kumar Gupta, "Fluid Mechanics and it applications", New Age International Publishers, 2nd Edition, 2011.							

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2010</td></tr>
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<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 311</td><td colspan="2">ENGINEERING THERMODYNAMICS</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behavior of the simple physical systems. To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances. To enlighten the basic concepts of vapour power cycles.</td></tr>
<tr><td>1</td><td colspan="4">BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS</td><td colspan="2">Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Basic concepts – concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to nozzle and diffuser, turbine and compressor.</td></tr>
<tr><td>2</td><td colspan="4">SECOND LAW OF THERMODYNAMICS AND ENTROPY</td><td colspan="2">Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Kelvin’s and Clausius statements of second law, cyclic heat engine, equivalence of Kelvin Planck and Clausius statements, Carnot cycle, Carnot’s theorem and thermodynamics temperature scale. Clausius theorem and its inequality, Entropy principle and applications – heat through finite temperature difference, mixing of two fluids.</td></tr>
<tr><td>3</td><td colspan="4">PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE</td><td colspan="2">Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, T-S, P-T, H-S diagrams, dryness fraction and its measurements, thermodynamic properties of steam. Calculations of work done and heat transfer in flow processes. Rankine cycle, Reheat cycle and Regenerative cycle.</td></tr>
<tr><td>4</td><td colspan="4">THERMO DYNAMIC RELATIONS</td><td colspan="2">Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Mathematical theorems, Maxwell’s equation, TdS equation, energy equation, Joule-Kelvin effect, Joule Thomson Coefficient, Clausius Clapeyron equation, equation of state, compressibility.</td></tr>
<tr><td>5</td><td colspan="4">PSYCHROMETRY</td><td colspan="2">Total Hrs</td><td colspan="2">12</td></tr>
<tr><td colspan="8">Psychrometry and Psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heating or cooling, cooling and dehumidification, heating and humidification adiabatic mixing.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Nag.P.K., “Engineering Thermodynamics”, 4th Edition, Tata McGraw-Hill, New Delhi, 2008.</td></tr>
<tr><td>2</td><td colspan="8">Cengel, “Thermodynamics” An Engineering Approach, 6th Edition, Tata Mc Graw Hill, New Delhi, 2006.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.</td></tr>
<tr><td>2</td><td colspan="8">Venwylen and Sontang, “Classical Thermodynamics”, Wiley Eastern, 1987.</td></tr>
<tr><td>3</td><td colspan="8">Holman.J.P., “Thermodynamics”, 3rd Edition, McGraw-Hill, 1995.</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 312</td><td colspan="2">MANUFACTURING PROCESSES</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To introduce the students to the concept of some basic manufacturing processes and fabrication techniques. Concept of metal casting, metal joining and metal forming are introduced.</td></tr>
<tr><td>1</td><td colspan="5">CASTING PROCESSES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Introduction – Patterns, Requirements of a good pattern, pattern materials, types of patterns, pattern allowances – Mould making, types of moulds, moulding processes, types of sand moulding – Core making, types of cores, core prints, core box – Moulding Sand, Properties of moulding sand, types of moulding sand – Melting equipment, cupola furnace, crucible furnace, electric furnace – Gating system – Casting processes, Sand casting, Shell-mould casting, Investment casting, Die casting, centrifugal casting – Defects, Cleaning and Inspection of casting.</td></tr>
<tr><td>2</td><td colspan="5">FABRICATION PROCESSES</td><td>Total Hrs</td><td colspan="2">11</td></tr>
<tr><td colspan="9">Introduction – Classification of welding processes – Resistance welding, spot, seam, projection, butt welding – Gas welding, oxy-acetylene welding, equipments – Arc welding, shielded arc welding, TIG, MIG, submerged arc welding, electro-slag welding, ultrasonic welding, plasma arc welding, laser beam welding, friction welding – Soldering and Brazing – Testing and Inspection of welded joints, Defects in welds.</td></tr>
<tr><td>3</td><td colspan="5">BULK DEFORMATION PROCESSES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Introduction – Cold and hot working processes – Rolling, classification of rolling, principle, rolling stand arrangement, defects in rolling – Forging, classification of forging, methods of forging, defects in forging – Extrusion, Classification of extrusion, Hot and cold extrusion processes, extrusion defects and equipments – Drawing, Drawing of rods, wire and tubes.</td></tr>
<tr><td>4</td><td colspan="5">METAL FORMING PROCESSES</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">Introduction - Metal stamping and forming, bending, deep drawing, stretch forming, metal spinning, blanking, piercing, embossing and coining, notching, punching, roll forming, rubber press forming, hydro-mechanical forming – Comparison of metal forming processes – Defects in sheet metal formed parts.</td></tr>
<tr><td>5</td><td colspan="5">PLASTIC AND COMPOSITE MATERIAL PROCESSES</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">Processing of plastics, compression moulding, transfer moulding, injection moulding, blow moulding, thermoforming and calendaring - advantages of plastic materials – Introduction to composite material – Classification of composite materials – advantages of composite materials.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book(s) :</td></tr>
<tr><td>1</td><td colspan="8">Rajput R.K., “A Text Book of Manufacturing Technology”, Laxmi publications (P) ltd, New Delhi, 2008.</td></tr>
<tr><td>2</td><td colspan="8">Sharma P.C., “A Text Book of Production Technology”, S. Chand and Company, IV Edition, 2003.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1</td><td colspan="8">Rao P.N., “Maufacturing Technology”, Vol. 1, Tata McGraw-Hill publishing company limited, New Delhi, Third edition, 2009.</td></tr>
<tr><td>2</td><td colspan="8">Hajra Choudhury, “Elements of Workshop Technology”, Vol. 1 & 2, Media promoters Pvt Ltd., Mumbai, 2001.</td></tr>
<tr><td>3</td><td colspan="8">Serope Kalpajian and Steven R.Schmid, “Manufacturing Engineering and Technology”, Pearson Education Inc., Second Indian Reprint, 2002.</td></tr>
<tr><td>4</td><td colspan="8">Jain R.K., “Production Technology”, Khanna Publications, 2001.</td></tr>
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Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
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10 ME 0P2	FLUID MECHANICS AND MACHINERY LABORATORY(MC, ME)	0	0	3	2	50	50	100
Objective(s)	To impact the knowledge in the field of fluid mechanics at various conditions, understand and learning the knowledge the pumps performance and the turbines.							
1.	Determination of the Coefficient of discharge of given Orifice meter and Venturi meter.							
2.	Calculation of the rate of flow using Rota meter.							
3.	Determination of friction factor for a given set of pipes.							
4.	Conducting experiments and drawing the characteristic curves of centrifugal pump.							
5.	Conducting experiments and drawing the characteristic curves of reciprocating pump.							
6.	Conducting experiments and drawing the characteristic curves of Gear pump.							
7.	Conducting experiments and drawing the characteristic curves of Pelton wheel.							
8.	Conducting experiments and drawing the characteristics curves of Francis turbine.							
Total hours to be taught								45
Lab Manual :								
1.	“Fluid Mechanics and Machinery Lab Manual” by Mechanical Faculty Members							

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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 3P1</td><td colspan="2">MACHINE DRAWING LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">Study of this subject provides an understanding of standard machine parts and its dimensions and enhances the design knowledge of Mechanical Engineering.</td></tr>
<tr><td>1</td><td colspan="5">INDIAN STANDARD CODE OF PRACTICE FOR ENGINEERING DRAWING</td><td colspan="2">Total Hrs</td><td>5</td></tr>
<tr><td colspan="9">General principles of presentation-Conventional representations of threaded part springs, gear and common features, Abbreviations and symbols for use in technical drawings-Conventions for sectioning and dimensioning.</td></tr>
<tr><td>2</td><td colspan="5">TOLERANCES</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Types of tolerances representation of tolerances on drawing-Fits: types of fits-selection of fits – allowance-Geometric Tolerances: Form and positional tolerances, Datum features-Maximum Material Principle: Symbols and methods of indicating it on drawing – surface finish symbols- Welding symbols and methods of indicating it on drawing.
Fastenings Nuts: bolts-screws, keys and keyways, joints,</td></tr>
<tr><td>3</td><td colspan="5">PREPARATION OF WORKING DRAWING FOR GIVEN MACHINE COMPONENTS LIKE:</td><td colspan="2">Total Hrs</td><td>30</td></tr>
<tr><td colspan="9">MANUAL DRAFTING PRACTICE:
1. Cotter joint
2. Protected flange coupling
3. Knuckle joint
4.Connecting rod
5.Universal coupling
6.Screw jack
COMPUTER AIDED DRAFTING PRACTICE:
7.Plummer block
8.Swivel bearing
9.Machine vice
10.Lathe tail stock</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">N.D. Bhatt, Machine Drawing, Charotar Publishing House Anand.New Delhi, 2010,</td></tr>
<tr><td>2</td><td colspan="8">N.Siddheswar, P.Kanniah, and V.V.S. Satry, Machine Drawing, Tata McGRAW Hill, 2010.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">K.R.Gopalakrishna, Machine Drawing, Subash Publishers, 2012</td></tr>
<tr><td>2</td><td colspan="8">Revised IS codes: 10711, 10713, 10714, 9609, 1165, 10712, 10715, 10716, 10717, 11663, 17668, 10968, 11669, 8043, 8000.</td></tr>
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<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code and Name</td><td colspan="3">ME: B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester III</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 3P2</td><td>MANUFACTURING TECHNOLOGY LABORATORY I</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To impart the knowledge on concept of some basic manufacturing processes and machining processes using Lathe.</td></tr>
<tr><td colspan="9">Measurement of the Machined Components and Machining time estimation of:</td></tr>
<tr><td>1.</td><td colspan="8">Facing and Plain Turning.</td></tr>
<tr><td>2.</td><td colspan="8">Chamfering, Step Turning and Knurling.</td></tr>
<tr><td>3.</td><td colspan="8">Grooving and Taper Turning using Compound rest.</td></tr>
<tr><td>4.</td><td colspan="8">Single and Multi start Thread cutting and Boring.</td></tr>
<tr><td>5.</td><td colspan="8">Eccentric Turning.</td></tr>
<tr><td>6.</td><td colspan="8">Drilling and Tapping.</td></tr>
<tr><td colspan="9">Preparation of Sand Mould:</td></tr>
<tr><td>7.</td><td colspan="8">Mould with Flange Pattern.</td></tr>
<tr><td>8.</td><td colspan="8">Mould with Gear Pattern.</td></tr>
<tr><td>9.</td><td colspan="8">Mould with Split Pattern.</td></tr>
<tr><td>10.</td><td colspan="8">Mould with Core.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Lab Manual :</td></tr>
<tr><td>1.</td><td colspan="8">“Manufacturing Technology – I Lab Manual” by Mechanical Faculty Members</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME: B.E. Mechanical Engineering			
Semester III								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 TP 0P1	CAREER COMPETENCY DEVELOPMENT I	0	0	2	0	100	00	100
Objective(s)	To enhance employability skills and to develop career competency							

Unit – 1	Written Communication – Part 1	Hrs
Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition - Change of Voice - Change of Speech - Synonyms & Antonyms - One Word Substitution - Using the Same Word as Different Parts of Speech - Odd Man Out - Spelling & Punctuation (Editing) **Materials:** Instructor Manual, Word Power Made Easy Book		8
Unit – 2	Written Communication – Part 2	
Analogies - Sentence Formation - Sentence Completion - Sentence Correction - idioms & Phrases - Jumbled Sentences, Letter Drafting (Formal Letters) - Reading Comprehension(Level 1) - Contextual Usage - Foreign Language Words used in English **Materials:** Instructor Manual, Word Power Made Easy Book		8
Unit – 3	Oral Communication – Part 1	
Self Introduction - Situational Dialogues / Role Play (Telephonic Skills) - Oral Presentations- Prepared -'Just A Minute' Sessions (JAM) **Materials:** Instructor Manual, News Papers		4
Unit – 4	Oral Communication – Part 2	
Describing Objects / Situations / People, Information Transfer - Picture Talk - News Paper and Book Review **Materials:** Instructor Manual, News Papers		4
Unit – 5	Speed Maths, Quantitative Aptitude	
Think Without Ink(TWI) Approach - Speed Maths: Squaring of Numbers - Multiplication of Numbers - Finding Square Roots - Finding Cube Roots - Solving Simultaneous Equations Faster - Number System: HCF, LCM - Decimals - Percentages - Averages - Powers and Roots - Sudoku (level 1) - Series Completion (Numbers, Alphabets, Pictures) - Odd Man Out - Puzzles **Materials:** Instructor Manual, Aptitude Book		6
	Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	50 Questions – 30Questions from Unit 1 & 2, 20 Questions from Unit 5, (External Evaluation)	50
2	Evaluation 2 Oral Communication 1	Self Introduction, Role Play & Picture Talk from Unit-3 (External Evaluation by English and MBA Dept)	30
3	Evaluation 3 Oral Communication 2	Book Review & Prepared Speech from Unit-4 (External Evaluation by English and MBA Dept)	20
		Total	100

Reference Books

1. Aggarwal, R.S. "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, "Quantitative Aptitude", TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note :

- Instructor can cover the syllabus by Class room activities and Assignments(5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20 questions from Unit 1, 2 and Unit 5 and 5 questions from Unit 3 and 4
- Evaluation has to be conducted as like Lab Examination.

Modules	10 MA 003 - Engineering Mathematics III Course Outcomes (COs)
	At the end of the course, the student will be able to
1	Ability to form partial differential equations by eliminating arbitrary constants and functions and understand the solutions of some standard types of first order partial differential equations.
2	Effectively apply the methods to solve Lagrange's Linear Equations and enhance the ability of solving homogeneous linear partial differential equations with constant coefficients.
3	Explain the knowledge of basic concepts of Fourier series
4	Gain the knowledge about the concept of Harmonic analysis to express the given numerical value as Harmonics
5	Understand the procedure to find the solutions of one dimensional wave equations
6	Use effective application of the procedure to find the solutions of one dimensional heat equations in steady state conditions
7	Write the concepts of Fourier transform pair, sine transform and cosine transform
8	Ability to apply convolution theorem for finding transform function and understand the usage of Parseval's identity for finding transform function.
9	Solve the concept of z- transforms and inverse z – transforms.
10	Ability to know the procedure to solve difference equations by using Z-transform

Modules	10 ME 001 - Engineering Materials and Metallurgy Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Identify the structures of materials at different solid solutions with phase diagram.
2.	Assess the effect of phase changes during the heating and cooling of steel and cast irons using Iron carbon equilibrium diagram.
3.	Illustrate the T-T-T and C-C-T diagrams and show how non equilibrium phases can be formed in steel structure.
4.	Relate the steel heating process with various case hardening process such as carburizing, nitriding, carbonitriding, flame and induction hardening.
5.	Impart the knowledge on metallurgical properties of ferrous metals (steels and cast irons) and non ferrous (Cu, brass, bronze, cupronickel, Al and its alloys) metals.
6.	Extract the strengthening treatments and heat treating steps of precipitation hardening and of over ageing.
7.	Estimate the physical and mechanical properties of ceramic materials such as Al_2O_3 and SiC in order to suit in automotive industry, military and defense system.
8.	Propose the powder metallurgy process for the production of different metal powders.
9.	Outline the metallographic procedure for using Optical microscopy and Scanning electron microscopy.
10.	Manipulate the various testing methods for evaluating the mechanical properties of materials (Tensile, compression, shear, hardness, creep, impact test etc).

Modules	10 ME 002 - Engineering Mechanics Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Apply the laws of Engineering Mechanics and do the vector operations.
2.	Determine the resultant force for a system of forces acting on the particle and apply the concept of equilibrium in 2D and 3D.
3.	Illustrate the concept of free-body diagram and supports reaction and the concept of couples and moments.
4.	Determine the resultant force for a system of forces acting on the rigid body and apply the concept of equilibrium in 2D and 3D.
5.	Compute the centroid and centre of gravity in 2D plane figures and 3D solids.
6.	Calculate the moment of inertia for different 2D plane figures and mass moment of inertia of 3D solids and locate the principal axis and calculate the principal moment of inertia.
7.	Apply the relations of displacement, velocity and acceleration of particles with rectilinear and curvilinear motion and present the relative motion of two particles.
8.	Solve the kinetic problems with Newton's law, Work –Energy and Impulse –Momentum principle and calculate the velocities of elastic bodies during various types of impact.
9.	Realize the concept of friction force and analyze the simple contact friction and apply to different applications.
10.	Compute the velocity and acceleration in translation, rotation and general plane motion of rigid bodies.

Modules	10 ME 004 - Fluid Mechanics and Machinery Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Compare and analyze the properties of fluids.
2.	State and apply the laws of fluid statics in various incompressible fluids
3.	Predict the types of fluid flow and fluid lines
4.	Calculate the discharge of fluids using continuity and Bernoulli's equation
5.	Analyze the incompressible fluid flow through parallel plates and circular tubes.
6.	Analyze the flow through pipes in series and in parallel and calculate the friction power loss
7.	Evaluate the minor losses in flow through pipes
8.	Carryout the performance analysis of hydraulic turbines.
9.	Carryout the performance analyses of Reciprocating pumps and draw the indicator diagram.
10.	Analyze the performance of centrifugal pumps.

Modules	10 ME 311 - Engineering Thermodynamics Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the basic concepts of thermodynamics and Zeroth law, and first law of thermodynamics and its applications to closed system.
2.	Apply the concept of first law of thermodynamics to open system.
3.	Relate the concept of second laws of thermodynamics to engine and R&A/C and principle of Carnot engine.
4.	Define the concepts of increase in entropy and its applications on mixing of two fluids.
5.	Recognize the concept applied to pure substances and the evaluation of steam properties.
6.	Manipulate the various properties of steam and demonstrate different types of steam power cycles.
7.	Analyze the exact differential equations, energy equations, Maxwell's equations and specific heat relations applied in thermodynamic systems.
8.	Describe the concept of Joule–Kelvin effect and Joule Thomson effect.
9.	State the importance of presence of moisture in atmosphere and its properties.
10.	Rewrite the different types of psychrometric processes and its calculations with chart.

Modules	10 ME 312 - Manufacturing Processes Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Select the types of patterns and pattern materials to make a mould cavity to produce the casting.
2.	Describe the melting procedure of raw materials to produce castings and identify the casting defects.
3.	List the types of welding processes and explain the procedure of welding of similar and dissimilar metals.
4.	Distinguish between soldering and brazing process and list out the procedure for testing of weld joints.
5.	Explain the various metal forming processes and their principles to get a final shape of a product.
6.	Describe the various press tool operations to form the product.
7.	Classify the various sheet metal processes and identify the defects in sheet metal parts.
8.	List out the types of plastics and its manufacturing processes.
9.	Classify the types of composite materials and its applications.

Modules	10 ME 0P2 - Fluid Mechanics and Machinery Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Calculate the coefficient of discharge of Orifice and Venturimeter.
2.	Estimate the rate of flow of fluid by Rotameter.
3.	Evaluate the major and minor losses of fluid flow through pipes.
4.	Analyze the performance of centrifugal pump, reciprocating pump and gear pump
5.	Carryout the performance analysis and draw the characteristics curve of Pelton wheel and Francis turbine.

Modules	10 ME 3P1 - Machine Drawing Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the conventions, abbreviations and symbols as per the BIS standards.
2.	Point out the conventions of riveted and welded joints.
3.	Draw and interpret the components of cotter, knuckle joint, protected flange coupling, universal coupling, connecting rod and screw jack
4.	Assemble and draw the components of plumber block, swivel bearing, machine vice and lathe tail stock using modeling software.

Modules	10 ME 3P2 - Manufacturing Technology Laboratory I Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Perform facing, plain turning, step turning, knurling, grooving and taper turning.
2.	Perform single and multi-start threading, eccentric turning, drilling and tapping.
3.	Prepare mould cavity for flange pattern, gear pattern and split pattern
4.	Prepare mould cavity with core.

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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 MA 004</td><td colspan="2">PROBABILITY AND STATISTICS (BT, IT, ME, TT)</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">At the end of the course, the students would Acquire skills in handling situations involving more than one random variable and functions of random variables. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems. Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.</td></tr>
<tr><td>1</td><td colspan="5">PROBABILITY AND RANDOM VARIABLE</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions - Properties- Moments - Moment generating functions and their properties.</td></tr>
<tr><td>2</td><td colspan="5">STANDARD DISTRIBUTIONS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties.</td></tr>
<tr><td>3</td><td colspan="5">TWO DIMENSIONAL RANDOM VARIABLES</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.</td></tr>
<tr><td>4</td><td colspan="5">TESTING OF HYPOTHESIS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.</td></tr>
<tr><td>5</td><td colspan="5">DESIGN OF EXPERIMENTS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Analysis of variance – One way classification – Completely Randomized block Design - Two – way classification – Randomized Block Design - Latin square.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>60</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">Gupta, S.C, and Kapur, J.N., “Fundamentals of Mathematical Statistics”, Sultan Chand, Ninth edition, New Delhi, 1996.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Ross. S., “A first Course in Probability”, Fifth Edition, Pearson Education, Delhi 2002.</td></tr>
<tr><td>2</td><td colspan="7">Johnson. R. A., “Miller & Freund’s Probability and Statistics for Engineers”, Sixth Edition, Pearson Education, Delhi, 2000.</td></tr>
<tr><td>3</td><td colspan="7">Lipschutz. S and Schiller. J, “Schaum’s outlines - Introduction to Probability and Statistics”, McGraw-Hill, New Delhi, 1998.</td></tr>
<tr><td>4</td><td colspan="7">Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, “Probability and Statistics for Engineers and Scientists”, Seventh Edition, Pearsons Education, Delhi, 2002.</td></tr>
<tr><td>5</td><td colspan="7">Johnson. R. A., “Miller & Freund’s Probability and Statistics for Engineers”, Sixth Edition, Pearson Education, Delhi, 2000. (Chapters 7, 8, 9, 12).</td></tr>
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<tr><td colspan="2">10 EE 005</td><td colspan="2">ELECTRIC DRIVES AND CONTROLS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To expose the students to Electrical drives like DC and AC machines which include induction and synchronous motors To help them know about the various techniques and applications of these drives.</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Basic elements – Types of electrical drives- factors influencing the choice of electrical drives- heating and cooling curves –Classes of duty – selection of power rating for drive motors. (Qualitative treatment only).</td></tr>
<tr><td>2</td><td colspan="5">DC MACHINES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Constructional details of machines – principle of generator – EMF equation-simple problems – Principle of operation of DC motor – Back EMF and torque equations-simple problems – Types of DC Motors – Characteristics of DC motors –Types of starters- two point starter, three point starter and four point starters. (Qualitative treatment only).</td></tr>
<tr><td>3</td><td colspan="5">AC MACHINES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Constructional details of induction motors– Types of rotors – Principle of operation – Slip– Torque equations –simple problems- Slip-torque characteristics – Types of starters – Stator resistance, rotor resistance, autotransformer and star-delta starters. (Qualitative treatment only).
Single phase induction motor – construction and operation – types. Synchronous motor – types - construction and operating principle. (Qualitative treatment only).</td></tr>
<tr><td>4</td><td colspan="5">CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC DRIVES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Speed control of DC series and shunt motors- Ward Leornard control, armature and field control- Solid state control using controlled rectifiers and DC choppers (Block diagram representation only) - Applications.</td></tr>
<tr><td>5</td><td colspan="5">CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Speed control by stator voltage control, rotor resistance control. Slip power recovery scheme- Kramer and Scherbius methods- Solid state speed control of three phase induction motor using V/F method, inverters and ac voltage regulators - Static Kramer and Static Scherbius Drive – Speed control of synchronous drive using self control method (Block diagram representation only) - applications</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">Theraja, B.L and Theraja, A.K., “A text book of Electrical Technology – Volume II (AC & DC Machines)”, S.Chand & Company Ltd., New Delhi, 2005.</td></tr>
<tr><td>2</td><td colspan="7">Gopal K.Dubey “ Fundamentals of Electrical Drives” Narosa publishing house, 2001</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Kothari, D.P. and Nagrath, I.J., “Electric Machines”, Tata McGraw Hill Publishing Company Ltd, 2002.</td></tr>
<tr><td>2</td><td colspan="7">Bimbhra.P.S..,’’Power electronics” 4th Edition, Khanna publishers, New Delhi, 2006.</td></tr>
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<tr><td colspan="2">10 ME 005</td><td colspan="2">STRENGTH OF MATERIALS (MC, ME)</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To gain knowledge of simple stresses, strains and deformation in components due to external loads. To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both. Effect of component dimensions and shape on stresses and deformations are to be understood. The study would provide knowledge for use in the design courses</td></tr>
<tr><td>1</td><td colspan="5">STRESS, STRAIN AND DEFORMATION OF SOLIDS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Stresses and Strains due to axial force – Tensile, Compressive and Shear – Factor of Safety – Deformation of simple and compound bars under axial load – Stepped Bars - Thermal stress in simple bar –Lateral strain – Poisson’s ratio, volumetric strain, changes in dimensions and volume, relationship between elastic constants - Strain energy and unit strain energy – Strain energy in uniaxial load</td></tr>
<tr><td>2</td><td colspan="5">BEAMS - LOADS AND STRESSES</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Types of beams: Supports and Loads – Shear force and bending moment diagram of statically determinate beams under concentrated loads and uniformly distributed loads, Maximum bending moment and point of Contra flexure. Theory of simple bending and assumptions – derivation of equation, section modulus, normal stresses due to flexure – semielliptical leaf spring</td></tr>
<tr><td>3</td><td colspan="5">TORSION</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Analysis of torsion of circular bars – Shear stress distribution – Bars of solid and hollow circular section – Polar modulus, Power transmitted by a shaft – Application to close coiled helical springs – Maximum shear stress in spring section – Deflection of helical coil springs under axial loads</td></tr>
<tr><td>4</td><td colspan="5">BEAM AND COLOUMN DEFLECTION</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Evaluation of cantilever and simply supported beam deflection and slope: Double integration method, Macaulay’s Method and Moment – area Method – application to simple problems – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns</td></tr>
<tr><td>5</td><td colspan="5">ANALYSIS OF STRESSES IN TWO DIMENSIONS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">State of Stress at a Point – normal and tangential Stresses on a given plane, principal stresses and their planes, planes of maximum shear stress, analytical method and Mohr’s circle method – application to simple problems. Hoop and Longitudinal stresses in thin cylindrical and spherical shells under internal pressure – changes in dimensions and volume - Introduction to failure theories</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Bansal R.K, “A Text Book of Strength of Materials”, Laxmi Publications (P) Ltd, New Delhi, Fourth Edition, 2010.</td></tr>
<tr><td>2</td><td colspan="8">Rajput .R.K, “Strength of Materials” , S.Chand &Company Ltd, New Delhi, 2005.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Beer F. P. and Johnston R, “Mechanics of Materials”, McGraw-Hill Book Co, Third Edition, 2002.</td></tr>
<tr><td>2</td><td colspan="8">Nash W.A, “Theory and problems in Strength of Materials”, Schaum Outline Series, McGraw-Hill Book Co, New York, 1998.</td></tr>
<tr><td>3</td><td colspan="8">Popov E.P, “Engineering Mechanics of Solids”, Prentice-Hall of India, New Delhi, 2009.</td></tr>
<tr><td>4</td><td colspan="8">Ramamrutham S and Narayan R., “Strength of Materials", Dhanpat Rai and Sons, New Delhi, 2003.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
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10 ME 411	THERMAL ENGINEERING	3	0	0	3	50	50	100
Objective(s)	To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process. To apply the thermodynamic concepts into various thermal application like I.C engines Steam turbines and Refrigeration and Air conditioning systems.							
1	GAS POWER CYCLES				Total Hrs	9		
Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Actual and theoretical P-V diagram of Four stroke engines, Actual and theoretical P-V diagram of two stroke engines.								
2	INTERNAL COMBUSTION ENGINES				Total Hrs	9		
Classification of I-C engines, I-C engine components and functions. Valve timing diagram and port timing diagram. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol and diesel engine. Fuels, Air-fuel ratio calculation, Knocking and Detonation. Lubrication system and cooling system. Exhaust gas analysis, pollution control norms.								
3	STEAM BOILERS, MOUNTINGS AND ACCESSORIES				Total Hrs	6		
Classification of steam boilers, simple vertical boiler, Loffler boiler, La-mount, Benson boilers. Difference between fire tube and water tube, low pressure and high pressure boiler. Boiler mountings and accessories.								
4	STEAM NOZZLES AND TURBINES				Total Hrs	9		
Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations-governors and nozzle governors.								
5	REFRIGERATION AND AIR CONDITIONING				Total Hrs	12		
Introduction to Vapour Compression Refrigeration Systems - Working of a simple Vapour Compression Refrigeration System. Introduction to Vapour Absorption refrigeration System, working of Vapour Absorption Refrigeration System. Advantages of Vapour Compression System. Properties of a Refrigerant. Refrigerant Commonly used in Practice. Simple problems in VCRS. Introduction to Air Conditioning System-factors affecting comfort Air Conditioning. Classification of Air Conditioning summer Air Conditioning- winter Air Conditioning- year-round Air Conditioning, Unitary Air conditioning.								
Total hours to be taught						45		
Text book (s) :								
1	Rajput R.K., "Thermal Engineering", Laxmi Publishers, 8th Edition, 2010.							
2	Kothandaraman.C.P., Domkundwar.S. and Domkundwar, A.V., "A Course in Thermal Engineering", Dhanpat Rai & Sons, Fifth edition, 2002.							
Reference(s) :								
1	Khurmi R.S. and Guptha J.K., "A Text Book of Thermal Engineering (Mechanical Technology)", S. Chand publishers, 2006.							
2	Eastop and McConkey, "Applied Thermodynamics", Addison Wesley, New Delhi. 1999.							
3	Rogers and Mayhew, "Engineering Thermodynamics – Work and Heat Transfer", Addision Wesley, New Delhi, 1999.							
4	Rudramoorthy R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003.							

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="2">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="8">Semester IV</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 412</td><td>KINEMATICS OF MACHINERY</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="6">To understand the layout of linkages in the assembly of a system/machine, the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism and to analyze the motion resulting from a specified set of linkages in a mechanism</td></tr>
<tr><td>1</td><td colspan="4">BASICS OF MECHANISMS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Terminology and definitions- Classification of mechanisms-Kinematic inversions: 4-bar chain, slider crank mechanism- Grashoff's law- Mechanical advantage- Transmission angle- Straight line generators</td></tr>
<tr><td>2</td><td colspan="4">KINEMATICS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Displacement, velocity, and acceleration analysis of Slider crank mechanism and four bar mechanism – Velocities and Acceleration of points on a rigid body - Analytical Method – Instantaneous Centre Method – Kennedy's theorem - Coriolis acceleration</td></tr>
<tr><td>3</td><td colspan="4">KINEMATICS OF CAM AND FOLLOWERS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Classification of cam and follower-follower motions- Displacement diagrams- Graphical layouts of cam profiles-Plate cams with knife edged-flat faced-roller followers. Derivatives of follower motion-circular arc and tangent cams- High speed cams-pressure angle and under cutting</td></tr>
<tr><td>4</td><td colspan="4">GEARING AND GEAR TRAINS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Terminology and definitions- Law of gearing-Profile for gears- Involute gearing-Interchangeability- Interference and undercutting- Contact ratio- Standard and sub gear teeth-Gear trains- Types- Parallel axis gear trains- Epicyclic gear trains</td></tr>
<tr><td>5</td><td colspan="4">FRICTION DRIVES</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Surface contact-sliding and rolling friction-Friction drives-Friction in screw threads-Friction in clutches, belt and rope drives-Friction aspects in brakes-Friction in vehicle propulsion and braking</td></tr>
<tr><td colspan="6">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">Khurumi R.S., "Theory of machines", First multicolor illustrative edition., S.Chand &company Ltd., 2005.</td></tr>
<tr><td>2</td><td colspan="7">Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Rao J.S., and Dukkipati R.Y., "Mechanism and Machine Theory", 2nd ed., Wiley Eastern Ltd., 1995.</td></tr>
<tr><td>2</td><td colspan="7">Shigley J.E., Vicker Jr., J.J., "Theory of Machines and Mechanisms", McGraw-Hill, 1995.</td></tr>
<tr><td>3</td><td colspan="7">Amitabh Ghosh and Malik, A.K., "Theory of Mechanisms and Machines", Allied East West Press Pvt. Ltd., 3rd Edition, 1998</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME 413	METROLOGY AND INSTRUMENTATION	3	0	0	3	50	50	100
Objective(s)	To understand the principles of measurements, methods of measurement and its application in manufacturing industries.							

1	MEASUREMENTS	Total Hrs	8
General Concepts - Generalized measurement system, Units and Standards - Measuring instruments - Sensitivity, readability, range of accuracy, precision - Static and dynamic response – Repeatability, hysteresis - Systematic and random errors – Correction, calibration, interchangeability.			
2	INSTRUMENTS	Total Hrs	10
Mechanical and Electrical transducers – Preamplifiers - Charge amplifiers – Filters – Attenuators - D'arsonval –CRO - Oscillographs – Recorders - Microprocessor based data logging, processing and output.			
3	MEASUREMENTS ON PARAMETERS	Total Hrs	10
Force, torque, power: mechanical, hydraulic and electrical type - Pressure measurement– Flow: Venturi, orifice, rotameter, pitot tube – Temperature: Bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor.			
4	LINEAR, ANGULAR AND ADVANCES IN METROLOGY	Total Hrs	9
Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, optical flats, limit gauges, applications, Angular measurements: sine bar, optical bevel protractor, angle decker – Taper measurements - Co-ordinate measuring machines.			
5	FORM MEASUREMENT	Total Hrs	8
Measurement of screw threads: thread gauges, floating carriage micrometer, measurement of gear tooth thickness: Base tangent method – gear testing machine – radius measurement - surface finish measurement: equipments and parameters, straightness, flatness and roundness measurements.			
Total hours to be taught			45

Text Book(s):

1	Kumar D.S, "Mechanical Measurements and Control" Metro politan book company Pvt. Ltd, New Delhi, 1996.
2	Jain R.K., "Engineering Metrology", Khanna publishers, 2009.

Reference (s) :

1	Sawhney A.K., "A Course in Mechanical Measurements and Instrumentation" Dhanpat Rai publications, 2004.
2	Donald P. Eckman, "Industrial Instrumentation ", Wiley Eastern, 1985.
3	Beckwith T.G. and Lewis Buck N., "Mechanical Measurements ", Addison Wesley, 1991.
4	Gupta S.C., "Engineering Metrology", Dhanpat rai publications, 2005.

K.S.Rangasamy College of Technology – Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code and Name			ME: Mechanical Engineering			
Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
10 EE 0P2	ELECTRIC DRIVES AND CONTROLS LABORATORY	0	0	3	2	50	50	100
Objective(s)	To expose the students to the operation of DC and AC machines and give them experimental skill							
1.	Load characteristics of D.C. shunt motor							
2.	Load characteristics of D.C series motor							
3.	Load characteristics of D.C. Compound motor							
4.	Load test on three-phase squirrel cage induction motor.							
5.	Load test on three-phase slip ring induction motor.							
6.	Load test on single phase induction motor							
7.	V and inverted V curve for synchronous motors.							
8.	Speed control of D.C shunt motor							
9.	Speed control of D.C shunt motor using controlled rectifier							
10.	Speed control of D.C shunt motor using chopper							
11.	Speed control of three phase induction motor by V/F method							
12.	Study of DC starters							
13.	Study of AC starters							
Total hours to be taught								45
Lab Manual :								
1.	“Electrical Machines Lab Manual” by EEE staff members							

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<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="4">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester IV</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 4P1</td><td colspan="2">STRENGTH OF MATERIALS, METROLOGY AND INSTRUMENTATION LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To gain knowledge of simple stresses, strains and deformation in components due to external loads. To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both. Effect of component dimensions and shape on stresses and deformations are to be understood. The study would provide knowledge for use in the design Courses & to understand the instrumentation system and measurements of various parameters.</td></tr>
<tr><td colspan="9">LIST OF EXPERIMENTS</td></tr>
<tr><td>1</td><td colspan="8">a) Determine the tensile strength of mild steel.
b) Determine the rigidity modulus of Helical spring under compression.</td></tr>
<tr><td>2</td><td colspan="8">a) Determine the hardness on given metal by Rockwell test
b) Determine the hardness on given metal by Brinell test.</td></tr>
<tr><td>3</td><td colspan="8">a) Determine the impact strength of given square rod by Charpy test.
b) Determine the impact strength of given square rod by Izod test.</td></tr>
<tr><td>4</td><td colspan="8">a) Determine the ultimate stress on given brick by compression test (UTM).
b) Determine the ultimate stress on given cube by compression test (UTM).</td></tr>
<tr><td>5</td><td colspan="8">a) Determine the deflection and Young’s modulus of the given beam.
b) Determine the shear stress and rigidity modulus of the given shaft by torsion test.</td></tr>
<tr><td>6</td><td colspan="8">a)Torque Measurement
b) Force Measurement.</td></tr>
<tr><td>7</td><td colspan="8">a) Pressure Measurement.
b) Temperature Measurement.</td></tr>
<tr><td>8</td><td colspan="8">a) Measurement of major and effective diameter using Floating Gauge Micrometer.
b) Surface profile Measurement using Auto Collimator.</td></tr>
<tr><td>9</td><td colspan="8">a) Measurement of angle and pitch value using Tool Maker’s Microscope.
b) Measuring gear angle and gear thickness using Profile projector.</td></tr>
<tr><td>10</td><td colspan="8">Measurement of taper angle using Sine Bar.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Lab Manual :</td></tr>
<tr><td>1</td><td colspan="8">“Strength of Materials Manual” by Mechanical Faculty Members</td></tr>
<tr><td>2</td><td colspan="8">“Metrology and Instrumentation Manual” by Mechanical Faculty Members</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME 4P2	THERMAL ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective(s)	To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process. To apply the thermodynamic concepts into various thermal application like I.C engines, Steam turbines, Compressors and Refrigeration and Air conditioning Systems							

1.	Valve Timing and Port Timing Diagrams
2.	Performance Test on 4-Stroke Diesel Engine
3.	Heat Balance Test on 4-Stroke Diesel Engine
4.	Morse Test on Multi-Cylinder Petrol Engine
5.	Retardation Test to find Frictional Power of a Diesel Engine
6.	Determination of Viscosity by Red Wood Viscometer
7.	Determination of Flash Point and Fire Point
8.	Performance test on Vapour Compression Refrigeration System
9.	Performance and Energy Balance Test on a Steam Generator
10.	Performance and Energy Balance Test on Steam Turbine
11.	Performance test on Two Stage Air Compressor
12.	Performance test on Air Conditioning System
Total hours to be taught	45

Lab Manual :

1	“Thermal Engineering Lab Manual” by Mechanical Faculty Members

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering			Programme Code & Name		ME : B.E. Mechanical Engineering		
Semester IV								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 TP 0P2	CAREER COMPETENCY DEVELOPMENT II	0	0	2	0	100	00	100
Objective(s)	To enhance employability skills and to develop career competency							

Unit – 1	Written Communication – Part 3	Hrs
Reading Comprehension Level 2 (Paraphrasing Poems) - Letter Drafting - Email Writing - Paragraph Writing - News paper and Book Review Writing - Skimming and Scanning - Interpretation of Pictorial Representations. **Practices:** Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Editing **Materials:** Instructor Manual, Word power Made Easy Book, News Papers		6
Unit – 2	Oral Communication – Part 3	4
Self Introduction - Miming (Body Language) - Introduction to the Sounds of English - Vowels, Diphthongs & Consonants, Introduction to Stress and Intonation - Extempore - News Paper and Book Review - Technical Paper Presentation. **Material:** Instructor Manual, News Papers		
Unit – 3	Verbal Reasoning – Part 1	8
Analogies - Alphabet Test - Theme Detection - Family Tree - Blood Relations (Identifying relationships among group of people) - Coding & Decoding - Situation Reaction Test - Statement & Conclusions **Material:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit – 4	Quantitative Aptitude – Part 1	6
Problem on Ages - Percentages - Profit and Loss - Simple & Compound Interest - Averages - Ratio, Proportion **Material:** Instructor Manual, Aptitude Book		
Unit – 5	Quantitative Aptitude – Part 2	6
Speed, Time & Work and Distance - Pipes and Cisterns - Mixtures and Allegations - Races - Problem on Trains - Boats and Streams **Practices** : Puzzles, Sudoku, Series Completion, Problem on Numbers **Material:** Instructor Manual, Aptitude Book		
	Total	30

Evaluation Criteria

S. No	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions Each from Unit 1, 3, 4 & 5 (External Evaluation)	60
2	Evaluation 2 Oral Communication	Extempore & Miming – Unit 2 (External Evaluation by English, MBA Dept.)	20
3	Evaluation 3 Technical Paper Presentation	Internal Evaluation by the Dept.	20
		Total	100

Reference Books

1. Aggarwal, R.S. “A Modern Approach to Verbal and Non-verbal Reasoning”, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, “Quantitative Aptitude”, TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note :

- Instructor can cover the syllabus by Class room activities and Assignments (5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20 questions from Unit 1, 3, 4 and Unit 5 and 5 questions from Unit 2.
- Evaluation has to be conducted as like Lab Examination.

Modules	10 MA 004 - Probability and Statistics Course Outcomes (COs)
	At the end of the course, the student will be able to
1.	Remember the basic concepts, fundamentals and the axioms of Probability
2.	Determine the probability density function, probability mass function, cumulative distribution function, expected value, variance, standard deviation
3.	Remember the basics of discrete and continuous distributions
4.	Apply the concepts of discrete and continuous distributions in solving the problems.
5.	Calculate the Covariance, Correlation and the Regression
6.	Define the Characteristic function of a distribution and to apply the Central Limit Theorem
7.	Define the principles of Testing of hypothesis, conduct the hypothesis testing to different samples means, sample proportions and the sample variances.
8.	Perform and analyze hypothesis tests of means, proportions and variances, apply the appropriate Chi-Squared test for independence and goodness of fit.
9.	Design, conduct experiments, analyze and interpret data.
10.	Apply Analysis of Variance to One-way classification, Completely randomized design, Two-way classification, Randomized block design and the Latin square

Modules	10 EE 005 - Electric Drives and Controls Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Define the steps required for the design and implementation of an electric drive system.
2.	Choose the suitable (environmental friendly) machine for the particular application based on different load.
3.	Analyze the thermal performance of electrical machine.
4.	Know the safest way to start the AC & DC machines.
5.	Classify the motor which are not self starting and they know how to make it self start.
6.	Perform the experiments on speed control of AC & DC machines.
7.	Recognize the application of the different power electronic converters in speed control of induction motor and know what the advantages in certain applications.
8.	Know how to control the speed of induction motor drives in an energy efficient manner using power electronics.
9.	Exemplify some of the trade-offs that are available to the developer or to a drive system purchaser.
10.	Operate the machine in synchronous and sub synchronous speed by conventional and solid state methods.

Modules	10 ME 005 - Strength of Materials Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Classify stress and strain and compute stress intensity in simple and compound section.
2.	Discuss the elastic property of materials and derive the relation between elastic constants.
3.	Analyse the behaviour of beams under transverse loads.
4.	Apply the bending equation in engineering problems.
5.	Calculate the torque developed in solid and hollow shaft.
6.	Analyse the closed coil helical spring subjected to axial loading and calculate stress, deformation, and strain energy.
7.	Apply various methods to calculate slope and deflection for statically determinate beams.
8.	Compute and compare the crippling load for column by Euler and Rankine.
9.	Compare the state of stress at a point using analytical and graphical method.
10.	Analyze thin cylindrical and spherical shells.

Modules	10 ME 411 - Thermal Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the concept of various types of gas power cycles, efficiency and mean effective pressure.
2.	Describe the working principle of constant pressure cycle and the actual and theoretical p-v diagram of and IC engines.
3.	Identify the various parts of IC engines and explain its functions for running the engines.
4.	Define the principles of ignition system for IC engines and explain the friction and pollution of IC engines.
5.	Describe the principles, classifications, advantages and applications of boilers. Identify an idea for improvement of boiler efficiency and explain the concept of flow of liquid in a nozzle.
6.	List out the advantages and applications of nozzles.
7.	Define the concept of impulse and reaction turbines and explain the different parameters and study of turbine governors.
8.	Define the concept of different types of refrigeration system and list out the various advantages and applications of refrigeration system.
9.	Evaluate the performance analysis of refrigeration system.
10.	List out the various types of air-conditioning systems and describe the comfort air-conditioning system.

Modules	10 ME 412 - Kinematics of Machinery Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the concepts of mechanisms, kinematic inversions of 4 bar chain and slider crank chain.
2.	Analyze the concepts related to Grashoff's law, mechanical advantage, transmission angle and straight line generators.
3.	Analyze the graphical and analytical methods to solve the velocity of slider crank and four bar mechanism.
4.	Analyze the graphical method to solve the acceleration of slider crank and four bar mechanism.
5.	Explain the basic concepts of cam and follower mechanism and solve the problems related to derivatives of follower motion for knife edged and flat faced followers.
6.	Solve the problems related to derivatives of follower motion for roller followers and analyze the concepts related to circular arc and tangent arc cam.
7.	Outline the fundamental concepts of gearing and solve the problems related to gearing.
8.	Explain the basic concepts of gear trains and evaluate the number of teeth for different types of gear trains.
9.	Describe the basic concept and solve the problems related to screw threads, clutches.
10.	Describe the basic concept and solve the problems related to belt, rope drives and brakes.

Modules	10 ME 413 - Metrology and Instrumentation Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the concept of measurements, measuring instruments and errors.
2.	Categorize the characterises of static & dynamic response of instruments.
3.	Demonstrate the working principle of mechanical and electrical transducers.
4.	Demonstrate the concept of CRO, Oscillographs, recorders & microprocessor based data logging.
5.	Calculate the parametric measurements such as force, torque and power.
6.	Identify the various methods to find out the pressure & temperature.
7.	Demonstrate the measuring concept of various linear measuring instruments.
8.	Discuss the different methodology in angular measurement techniques.
9.	Categorize the surface finish measuring instruments.
10.	Outline the concept of gear parameter measuring methods.

Modules	10 EE 0P2 - Electric Drives and Controls Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Know the safest way to start and operate the AC & DC machines.
2.	Classify the AC & DC measuring instrument and select the appropriate rating for suitable machine.
3.	Know the maximum load apply to the machine based on the rating without damaging the system.
4.	Obtain the performance and mechanical characteristics of self excited DC machines by conducting suitable test.
5.	Perform the experiments on speed control of DC machines.
6.	Acquire the performance and mechanical characteristics of single and three phase AC machines by conducting suitable test.
7.	Operate the synchronous motor in various power factors and find its performance characteristics.
8.	Describe the operation of dc motor drives to satisfy four-quadrant operation to meet mechanical load requirements.
9.	Recognize the application of the different power electronic converters in speed control of DC motors.
10.	Know how to control the speed of induction motor drives by maintain the constant ratio of voltage and frequency.

Modules	10 ME 4P1 - Strength of Materials, Metrology and Instrumentation Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the basic concepts of the tensile test on mild steel using Universal testing M/C and plot the stress strain diagram.
2.	Demonstrate the compression and tensile test on helical spring and plot the graph.
3.	Determine the hardness of the different metals using hardness testing machines.
4.	Determine the impact strength by Charpy and Izod test.
5.	Access the ultimate compressive strength for different materials.
6.	Determine the Young's modulus of beam material by deflection test.
7.	Perform the torsion test and determine modulus of rigidity of the material.
8.	Measure force, torque, pressure and temperature and compare with theoretical one.
9.	Perform the form measurement.
10.	Measure the taper angle using sine bar.

Modules	10 ME 4P2 - Thermal Engineering Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Assess the angles of opening and closing of inlet and exhaust valve timing and port timing and adjust it for correct angles.
2.	Evaluate the efficiencies for various loads keeping speed constant and identify the optimum load which gives maximum efficiency on 4-stroke diesel engine.
3.	Evaluate the various heat losses and identify the load which gives maximum work output on 4-stroke diesel engine.
4.	Demonstrate the calculation of Indicated Power by conducting Morse test on multi-cylinder petrol engine.
5.	Conduct retardation test to find frictional power of a diesel engine
6.	Determine the viscosity of various oils using red wood viscometer
7.	Determine the flash point and fire point of various oils using open cup apparatus.
8.	Evaluate the COP of vapour compression refrigeration system
9.	Demonstrate the working principles of steam generator
10.	Demonstrate the working principles of steam turbine
11.	Evaluate the efficiencies by conducting performance test on two stage air compressor
12.	Evaluate the COP of air conditioning system

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<tr><td>Department</td><td colspan="3">Mechanical Engineering</td><td colspan="2">Program code & Name</td><td colspan="2">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester V</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="3">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 HS 001</td><td colspan="3">PROFESSIONAL ETHICS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To create an awareness on Ethics and Human Values and instill Moral and Social Values in Students.</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Ethics defined – Engineering as a profession – Core qualities of professional practitioners – Theories of right action – Major ethical issues – Three types of inquiry – Kohlberg’s stages of moral development – Carol Gilligan theory – Moral dilemmas – Moral autonomy – Value based ethics.</td></tr>
<tr><td>2</td><td colspan="5">ENGINEERING AS SOCIAL EXPERIMENTATION</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Comparison with standard experiments – Relevant information – Learning from the past – Engineers as managers, consultants and leaders – Accountability – Role of codes – Code of ethics for engineers; introduction, rules of practice and professional obligations – The space shuttle challenger case study.</td></tr>
<tr><td>3</td><td colspan="5">ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK</td><td colspan="2">Total hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Safety and Risk – Types of risks – Safety and the engineer – Designing for safety – Risk Benefit analysis – Accidents - The three mile Island disaster case study – The Chernobyl disaster case study.</td></tr>
<tr><td>4</td><td colspan="5">RESPONSIBILITIES AND RIGHTS</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Collegiality – Two senses of loyalty – Professional rights and responsibilities – Conflict of Interest – Collective Bargaining – Confidentiality – Acceptance of bribes / gifts – Occupational crimes – Whistle Blowing.</td></tr>
<tr><td>5</td><td colspan="5">GLOBAL ISSUES</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Globalization – Cross Cultural Issues – The Bhopal gas tragedy case study – Computer ethics – Weapons development – Intellectual property rights (IPR)</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book(s) :</td></tr>
<tr><td>1</td><td colspan="8">Govindarajan M, Natarajan S, Senthil Kumar V.S, “Engineering Ethics”, Prentice Hall of India (P) Ltd, New Delhi, 10th Reprint 2009.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1</td><td colspan="8">Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.</td></tr>
<tr><td>2</td><td colspan="8">Govindan K.R., and Sendhil Kumar S., “Professional Ethics and Human Values”, Anuradha Publications, Chennai, 2007.</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 511</td><td>HEAT AND MASS TRANSFER</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">The course is intended to build up necessary background for the understanding of the physical behavior of the various modes of heat transfer, like, conduction, convection and radiation. To understand the application of various experimental heat transfer correlations in engineering calculations. To learn the thermal analysis and sizing of heat exchangers. To understand the basic concepts of mass transfer.</td></tr>
<tr><td>1</td><td colspan="5">CONDUCTION</td><td colspan="2">Total Hrs</td><td>14</td></tr>
<tr><td colspan="9">Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction- General Differential equation of Heat Conduction –– Cartesian Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Critical Thickness of Insulation – Fins, Types, Effectiveness and efficiency Problems – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.</td></tr>
<tr><td>2</td><td colspan="5">CONVECTION</td><td colspan="2">Total Hrs</td><td>14</td></tr>
<tr><td colspan="9">Basic Concepts – Convective Heat Transfer Coefficients – Types of Convection – Forced Convection – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.</td></tr>
<tr><td>3</td><td colspan="5">RADIATION</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff’s Law, Planck’s law – Black Body Radiation –Grey body radiation, Shape Factor Algebra – Electrical Analogy – Radiation Shields.</td></tr>
<tr><td>4</td><td colspan="5">PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Nusselt theory of condensation - pool boiling, flow boiling, correlations in boiling and condensation, Types of Heat Exchangers, Overall Heat Transfer Coefficient – Fouling Factors – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis.</td></tr>
<tr><td>5</td><td colspan="5">MASS TRANSFER</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Basic Concepts – Diffusion Mass Transfer – Fick’s Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Convective Mass Transfer Correlations and problems.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>60</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Sachdeva, R.C., “Fundamentals of Engineering Heat and Mass Transfer”, New Age International Publishers, 1995.</td></tr>
<tr><td>2</td><td colspan="8">Holman J.P “Heat and Mass Transfer” Tata McGraw-Hill, 2000.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Rajput R.K “Heat and mass Transfer (SI Units)”, S.Chand Publishers, 2007.</td></tr>
<tr><td>2</td><td colspan="8">Frank P. Incropera and David P.DeWitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and sons, 1998.</td></tr>
<tr><td>3</td><td colspan="8">Bejan, A. “Heat Transfer”, John Wiley and Sons, 1995.</td></tr>
<tr><td>4</td><td colspan="8">Kothandaraman, C.P. “Fundamental of Heat and Mass Transfer”, New age International Publishers, New
Delhi, 1998</td></tr>
<tr><td>5</td><td colspan="8">Ozisik, M.N. “Heat Transfer”, Mc Graw Hill Book Co., 1994.</td></tr>
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<tr><td>10 ME 512</td><td colspan="2">DYNAMICS OF MACHINERY</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To understand the force-motion relationship in components subjected to External Forces, force-motion characteristics of standard mechanisms, undesirable effects of unbalances resulting from prescribed motions in mechanism, effects on Dynamics of Undesirable Vibrations and different principles in mechanisms used for governing of machines.</td></tr>
<tr><td>1</td><td colspan="4">FORCE ANALYSIS</td><td colspan="2">Total Hrs</td><td>14</td></tr>
<tr><td colspan="8">Static force analysis-static equilibrium, member with two force and a torque, Equilibrium of four force members; Force convention- free body diagrams, superposition, problems; principle of virtual work; friction in mechanisms – D’Alembert’s principle, Dynamic force analysis in reciprocating engines-Engine force analysis; Equivalent masses; bearing loads; Turning moment diagrams and flywheel.</td></tr>
<tr><td>2</td><td colspan="4">BALANCING</td><td colspan="2">Total Hrs</td><td>14</td></tr>
<tr><td colspan="8">Static and dynamic balancing; balancing of rotating masses; balancing of reciprocating masses – primary and secondary unbalanced forces- partial balancing of locomotives; balancing of multi cylinder inline engines, balancing of radial engines, Balancing of V engines; balancing machines.</td></tr>
<tr><td>3</td><td colspan="4">FREE VIBRATIONS</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">Basic features of vibratory systems; Types of vibrations; Degrees of freedom; free vibrations of single degree of freedom systems: Longitudinal vibration with damping, transverse vibration – critical speed of shaft, torsional vibrations – natural frequency of two and three rotor systems.</td></tr>
<tr><td>4</td><td colspan="4">FORCED VIBRATIONS</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">Step-input forcing; Harmonic forcing; periodic forcing; forced – damped vibration; Magnification factor; vibration isolation and transmissibility.</td></tr>
<tr><td>5</td><td colspan="4">MECHANISM FOR CONTROL</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Concept and principles of Governors: Watt, Porter, Proell and Hortnel, characteristics of governors. Concept and principles of Gyroscopes.</td></tr>
<tr><td colspan="6">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">Rattan.S.S, “Theory of Machines”, Tata Mcgraw Hill Education Pvt., 3rd Edition, New Delhi, 2010.</td></tr>
<tr><td>2</td><td colspan="7">Khurmi R.S., “Theory of machines”, S.Chand &company Ltd., 14th Revised Edition, Reprint 2010.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Rao J.S., and Dukkipati R.Y., “Mechanism and Machine Theory”, New age international Publishers, 2nd Edition, Reprint 2009.</td></tr>
<tr><td>2</td><td colspan="7">Brar J.S., Babsal R.K., “A Textbook of Theory of Machines (In S.I Units)” 5th Edition, Laxmi Publications., 2011.</td></tr>
<tr><td>3</td><td colspan="7">Amitabh Ghosh and Malik, A.K., “Theory of Mechanisms and Machines”, Allied East West Press Pvt. Ltd., 3rd Edition, 2006.</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 513</td><td colspan="2">DESIGN OF MACHINE ELEMENTS</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To familiarize with various steps involved in the Design Process, principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements, standard practices and standard data and use catalogues and standard machine components.</td></tr>
<tr><td>1</td><td colspan="5">STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and ‘C’ frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.</td></tr>
<tr><td>2</td><td colspan="5">DESIGN OF SHAFTS AND COUPLINGS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings.</td></tr>
<tr><td>3</td><td colspan="5">DESIGN OF TEMPORARY AND PERMANENT JOINTS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Threaded fastners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints</td></tr>
<tr><td>4</td><td colspan="5">DESIGN OF ENERGY STORING ELEMENTS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Design of various types of springs, optimization of helical springs - rubber springs - Design of flywheels considering stresses in rims and arms, for engines and punching machines.</td></tr>
<tr><td>5</td><td colspan="5">DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Sliding contact and rolling contact bearings - Design of hydrodynamic journal bearings, McKee’s Equation, Sommerfield Number, Raimondi & Boyd graphs, - Selection of Rolling Contact bearings - Design of Seals and Gaskets - Design of Connecting Rod.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>60</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, Sixth Edition, Tata McGraw-Hill, 2003.</td></tr>
<tr><td>2</td><td colspan="8">Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill, 2003.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Norton R.L, “Design of Machinery”, Tata McGraw-Hill, 2004</td></tr>
<tr><td>2</td><td colspan="8">Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.</td></tr>
<tr><td>3</td><td colspan="8">Ugural A.C, “Mechanical Design – An Integral Approach, McGraw-Hill, 2004.</td></tr>
<tr><td>4</td><td colspan="8">Spotts M.F., Shoup T.E “Design and Machine Elements” Pearson Education, 2004.</td></tr>
<tr><td>5</td><td colspan="8">Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, 2002.</td></tr>
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<tr><td colspan="2">10 ME 514</td><td colspan="2">MACHINING PROCESSES</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.</td></tr>
<tr><td>1</td><td colspan="5">THEORY OF METAL CUTTING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Introduction: material removal processes, chip formation, forces in orthogonal metal cutting, cutting tool materials, tool nomenclature, tool wear, tool life, cutting fluids.</td></tr>
<tr><td>2</td><td colspan="5">CENTRE LATHE AND SPECIAL PURPOSE LATHES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automatic lathes: automats – single spindle: cutting off and Swiss type.</td></tr>
<tr><td>3</td><td colspan="5">RECIPROCATING MACHINE AND HOLE MAKING MACHINES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Reciprocating machine tools: shaper, planer, slotter, hole making: drilling and boring machines</td></tr>
<tr><td>4</td><td colspan="5">MILLING MACHINE AND GEAR CUTTING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Milling: types, milling cutters, operations- machining time and power estimation for the above processes, gear cutting: forming, generation, shaping, hobbing</td></tr>
<tr><td>5</td><td colspan="5">BROACHING AND ABRASIVE PROCESSES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet grinding, broaching machines: broach construction – push, pull, surface and continuous broaching machines.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Choudhury, S.K.H., Choudhury, A.K.H., Nirjhar Roy, "Elements of Workshop Technology, Vol. 2, 11th Edition, Media Promotors, Mumbai, 2003.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">H.M.T, "Production Technology", Tata McGraw-Hill Education, 2004.</td></tr>
<tr><td>2</td><td colspan="8">Khanna, O.P., and Lal, M., “A Text Book of Production Technology" , Vol. II , Dhanpat Rai & Sons.</td></tr>
<tr><td>3</td><td colspan="8">Rao, P.N. “Manufacturing Technology: Metal Cutting and Machine Tools”, Volume II, Tata McGraw–Hill Education, 2009.</td></tr>
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<tr><td colspan="2">10 ME 515</td><td colspan="2">APPLIED HYDRAULICS AND PNEUMATICS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="6">To know the advantages and applications of Fluid Power Engineering and Power Transmission System, to learn the Applications of Fluid Power System in automation of Machine Tools and others Equipments.</td></tr>
<tr><td>1</td><td colspan="5">FLUID POWER FUNDAMENTALS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics-Applications of Pascal’s Law, Losses in valves and fittings.</td></tr>
<tr><td>2</td><td colspan="5">HYDRAULIC SYSTEM AND COMPONENTS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like Tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.</td></tr>
<tr><td>3</td><td colspan="5">DESIGN OF HYDRAULIC CIRCUITS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Construction of Control Components : Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.</td></tr>
<tr><td>4</td><td colspan="5">PNEUMATIC SYSTEMS AND COMPONENTS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo-hydraulic circuit, Sequential circuit design for simple applications using cascade method.</td></tr>
<tr><td>5</td><td colspan="5">DESIGN OF PNEUMATIC CIRCUITS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">Anthony Esposito, “Fluid Power with Applications”, Pearson Education India, 2003.</td></tr>
<tr><td>2</td><td colspan="7">Majumdar S.R., “Oil Hydraulics”, Tata McGraw-Hill, 2000.</td></tr>
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<tr><td>1</td><td colspan="7">Majumdar S.R., “Pneumatic systems – Principles and Maintenance”, Tata McGraw Hill, 1995.</td></tr>
<tr><td>2</td><td colspan="7">Anthony Lal, “Oil Hydraulics in the Service of Industry”, Allied Publishers, 1982.</td></tr>
<tr><td>3</td><td colspan="7">Harry L. Stevart D.B, “Practical Guide to Fluid Power”, Taraoeala sons and Port Ltd. Broadey, 1976</td></tr>
<tr><td>4</td><td colspan="7">Michael J, Prinches and Ashby J. G, “Power Hydraulics”, Prentice Hall, 1989.</td></tr>
<tr><td>5</td><td colspan="7">Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.</td></tr>
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<tr><td>10 ME 5P1</td><td>HEAT TRANSFER LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">This laboratory provides good practical knowledge of various heat transfer principles</td></tr>
<tr><td colspan="8">1. Determination of efficiency of steam condenser using Shell and tube heat exchanger
2. Determination of temperature distribution and fin efficiency using pin-fin apparatus
3. Thermal conductivity of pipe insulation using lagged pipe apparatus
4. Determination of emissivity of a grey surface
5. Heat transfer through composite wall
6. Natural convection heat transfer from a vertical cylinder
7. Determination of Stefan-Boltzmann constant
8. Effectiveness of Parallel flow heat exchanger(water –water)
9. Effectiveness of Counter flow heat exchanger (water –water)
10.Effectiveness of Double pipe heat exchanger(Water-Water)
11.Heat transfer analysis of fins using data acquisition system</td></tr>
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<tr><td>10 ME 5P2</td><td>DYNAMICS LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To understand principles of governors, cam profile, gyroscopic effect, balancing of masses, moment of inertia, vibration and suspension systems.</td></tr>
<tr><td colspan="9">1. Determination of sensitivity and effort of Watt, Porter, Proell, Hartnel, Universal governors.
2. Plot the profile of cam and study of jump phenomenon.
3. Determination of gyroscopic couple using Motorised Gyroscope
4. Determination of critical speed of shaft with concentrated loads- Whirling of shaft.
5. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
6. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
7. Determination of influence co-efficient for multi degree freedom suspension system.
8. Determination of transmissibility ratio using vibrating table.
9. Determination of torsional frequency of a single rotor system.
10. Determination of natural frequency and deflection of free beam.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
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<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="8">Semester V</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 5P3</td><td>HYDRAULICS AND PNEUMATICS LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To know the advantages and applications of Fluid Power Engineering and Power Transmission System. To learn the Applications of Fluid Power System in automation of Machine Tools and others Equipments.</td></tr>
<tr><td colspan="8">1. Study and execution of the Basic Hydraulic circuit .
2. Study and execution of Meter in and Meter out circuit- Hydraulic.
3. Study and execution of Hydraulic circuit using PLC.
4. Study and execution of Basic pneumatic circuit.
5. Study and execution of Meter in and Meter out circuit-Pneumatic.
6. Study and execution of Electro pneumatic circuit.
7. Study and execution of synchronizing circuit.
8. Study and execution of Automatic Reciprocation circuit.
9. Study and execution of Pneumatic circuit using PLC.
10. Study and execution of Fluid power circuit using Automation studio software.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering		Programme Code & Name			ME : B.E. Mechanical Engineering		
Semester V								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 TP 0P3	CAREER COMPETENCY DEVELOPMENT III	0	0	2	0	100	00	100
Objective(s)	To enhance employability skills and to develop career competency							

Unit – 1	Written and Oral Communication – Part 1	Hrs
Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate-Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions **Practices:** Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations - Editing - GD - Debate. **Materials:** Instructor Manual, Word power Made Easy Book, News Papers		6
Unit – 2	Verbal & Logical Reasoning – Part 1	8
Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions - Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements **Practices:** Analogies - Blood Relations - Statement & Conclusions **Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit – 3	Quantitative Aptitude – Part 3	6
Probability - Calendar- Clocks - Logarithms - Permutations and Combinations **Materials:** Instructor Manual, Aptitude Book		
Unit – 4	Quantitative Aptitude – Part 4	6
Algebra - Linear Equations - Quadratic Equations - Polynomials **Practices:** Problem on Numbers - Ages - Train - Time and Work - Sudoku - Puzzles **Materials:** Instructor Manual, Aptitude Book		
Unit – 5	Technical & Programming Skills – Part 1	4
Core Subject – 1,2 3 **Practices :** Questions from Gate Material **Materials:** Text Book, Gate Material		
	Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions each from Unit 1, 2, 3, 4 & 5 (External Evaluation)	60
2	Evaluation 2 - Oral Communication	GD and Debate (External Evaluation by English, MBA Dept & External Trainers)	20
3	Evaluation 3 – Technical Paper Presentation	Internal Evaluation by the Dept.	20
		Total	**100**

Reference Books

1. Aggarwal, R.S. “A Modern Approach to Verbal and Non-verbal Reasoning”, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, “Quantitative Aptitude”, TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note :

- Instructor can cover the syllabus by Class room activities and Assignments (5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20 Questions from Unit 1,2,3,4 and 5 and 5 Questions from Unit 1
- Evaluation has to be conducted as like Lab Examination.

Modules	10 HS 001 - Professional Ethics Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Demonstrate the concept of ethics and engineering as a profession.
2.	Categorize the core qualities of professional practicing engineers.
3.	Find out theories of right action and major ethical issues.
4.	Analyse the concept of moral dilemmas and moral autonomy.
5.	Realize the concept of relevant information and learning from the past.
6.	Practice the code of ethics for engineers and risk benefit analysis.
7.	Proficient to know about three mile Island and Chernobyl disasters.
8.	Analyse the concept of acceptance of bribes / gifts.
9.	Discuss about globalization and cross cultural issues.
10.	Recognize the concept of computer ethics, Intellectual property rights (IPR) and weapons development.

Modules	10 ME 511 - Heat and Mass Transfer Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the concepts of one dimensional steady state heat conduction through various coordinate systems.
2.	Apply the concepts of one dimensional transient heat conduction through various coordinate systems.
3.	Relate the concept of forced convection with external flow and internal flow of fluids flows in various elements.
4.	Manipulate the concept of free convection for laminar and turbulent flows on tubes.
5.	Define and explain the laws of radiation and its applications.
6.	Carryout the electrical network analogy for heat transfer problems.
7.	Identify the theory and its correlations on boiling and condensation.
8.	Explain the concept of heat exchanger and its applications.
9.	State the basic concept of mass transfer with practical applications and diffusion mass transfer.
10.	Rewrite the concept and correlations of convective mass transfer and their applications

Modules	10 ME 512 - Dynamics of Machinery Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the basic concepts of static, dynamic forces and solve the problems related to dynamic force analysis in reciprocating engines and engine force analysis.
2.	Analyse the problems related with Equivalent masses; bearing loads; Turning moment diagrams and flywheel.
3.	Define the concept of balancing of revolving masses and solve the problems.
4.	Define the concept of balancing of reciprocating masses and solve the problems.
5.	Outline the types of vibratory system, degree of freedom and solve the problems related to undamped and damped longitudinal vibrations.
6.	Resolve the problems related with transverse and torsional vibrations.
7.	Identify the concepts and problems related with forced damped vibration, harmonic forcing, and periodic forcing.
8.	Assess the problems related with magnification factor, vibration isolation and transmissibility.
9.	Discover the principles and concepts of governors and evaluate the problems related with Porter, Proell, and Hartnell governors.
10.	Define the concepts of gyroscopic couple and evaluate the problems related with aeroplane, ship and automobile.

Modules	10 ME 513 - Design of Machine Elements Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the basic concept of design process and Calculate tensile, compressive, bearing and shear stresses in machine elements.
2.	Distinguish between straight and curved beams and apply theories of failures in design of various machine elements.
3.	Design of a shafts, keys and keyways based on strength, rigidity and critical speed.
4.	Differentiate the function of various couplings in machinery and to design rigid and flexible couplings.
5.	Design and analyze bolted joints, knuckle joints, cotter joints.
6.	Design welded joints, riveted joints for structures and apply theory of bonded joints.
7.	Design and optmize the helical and rubber springs.
8.	Design the flywheel suitable for engine and punching machine.
9.	Demonstrate different types of bearings and their applications and design sliding and roller bearings.
10.	Design the connecting rod suitable for IC engine.

Modules	10 ME 514 - Machining Processes Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the concept of various material removal processes.
2.	Explain the concept of cutting forces, temperature and sliding action due to relative motion between tool and the work piece.
3.	Outline the applications of various attachments and its usage with centre lathe.
4.	List out the various operational techniques used on capstan and turret lathe.
5.	Present the details of specifications of various machine tools used for production.
6.	Explain the hole making process and its enlargement through vertical reciprocating motion.
7.	List the types of grinding process and describe their working methods.
8.	List and explain the various finishing processes on machine tools.
9.	Explain the working principle of broaching machines.
10.	Calculate the total machining time and power required in various machining operations.

Modules	10 ME 515 - Applied Hydraulics and Pneumatics Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the fundamentals of fluid power, properties, types, symbols of fluid power and basics of hydraulics. List the advantages and disadvantages of hydraulic and pneumatic fluids
2.	Explain Pascal's law and calculate the losses in valves and fittings
3.	Describe various types of pumps and performance parameters
4.	Outline the various types of actuators, motors and components
5.	List the different types of valves
6.	Apply the concept of accumulator and intensifier in various circuits
7.	Realize the component of pneumatic system
8.	Outline the various simple pneumatic circuits
9.	Apply the concept of servo system and fluidics in pneumatics
10.	List the applications of PLC and analyze failure and trouble shooting

Modules	10 ME 5P1 - Heat Transfer Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Analyze the performance of steam condenser using Shell and tube heat exchanger.
2.	Determine the thermal conductivity of pipe insulation using lagged pipe apparatus.
3.	Determine the emissivity of a grey surface.
4.	Evaluate the heat transfer through composite wall.
5.	Demonstrate the heat transfer through natural convection from a vertical cylinder.
6.	Determine the Stefan-Boltzmann constant using Stefan-Boltzmann apparatus.
7.	Evaluate the heat transfer through Parallel flow, Counter flow and Double pipe heat exchangers.
8.	Calculate the temperature distribution and fin efficiency using pin-fin apparatus.

Modules	10 ME 5P2 - Dynamics Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Determine the performance characteristics of governors.
2.	Plot the profile of the cam and find the jumping speed.
3.	Determine the critical speed of shaft for concentrated loads.
4.	Determine of moment of inertia by oscillation method for connecting rod.
5.	Describe the basic concepts of vibratory system.
6.	Determine the influence co-efficient for multi degree freedom suspension system.
7.	Determine and compare the transmissibility ratio using vibrating table with analytical model.
8.	Determine and compare the torsional frequency of a single rotor system with analytical model.
9.	Determine and compare the natural frequency and deflection of free beam with analytical model.

Modules	10 ME 5P3 - Hydraulics and Pneumatics Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the performance of hydraulics and pneumatics in fluid power system.
2.	Design the simple hydraulic and pneumatic circuits.
3.	Outline the concept of PLC and ladder diagram using hydraulic and pneumatic circuits
4.	Demonstrate special pneumatics circuits.
5.	Reproduce and justify the circuits using automation studio software.

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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 EC 010</td><td>MICROPROCESSORS AND MICROCONTROLLERS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To study the Architecture of 8085, 8086 & 8051. To study the addressing modes & instruction sets of 8085, 8086 & 8051. To introduce the need & use of Interrupt structure. To develop the skill in simple program writing. To introduce the commonly used peripheral / interfacing ICs and study simple applications.</td></tr>
<tr><td>1</td><td colspan="5">8085 PROCESSOR</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">8085 Architecture – Functional block diagram - Instruction set – Addressing modes – Timing diagrams – Assembly language programming – Interrupts, memory interfacing.</td></tr>
<tr><td>2</td><td colspan="5">8086 PROCESSOR</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">8086 Architecture – Functional block diagram - Instruction set – Addressing modes – Assembly language programming – Interrupts, memory interfacing.</td></tr>
<tr><td>3</td><td colspan="5">PERIPHERAL INTERFACING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – water level monitoring system, turbine monitoring system interfacing using 8085 and peripheral ICs.</td></tr>
<tr><td>4</td><td colspan="5">8051 MICRO CONTROLLER</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Functional block diagram - Instruction set - addressing modes – Interrupt structure – Timer –I/O ports – Serial communication.</td></tr>
<tr><td>5</td><td colspan="5">8051 MICRO CONTROLLER APPLICATIONS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Interfacing of ADC, DAC and stepper motor, speed control of DC motor interfacing, traffic light control, washing machine control interfacing.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book(s) :</td></tr>
<tr><td>1</td><td colspan="8">Krishna Kant, “Microprocessors and Microcontrollers Architecture, Programming and system Design 8085, 8086, 8051, 8096”, Prentice Hall of India, New Delhi, 1999</td></tr>
<tr><td>2</td><td colspan="8">Ajay V. Deshmukh, “Microcontrollers Theory and Applications, “Tata McGraw Hill Publishing company Ltd, New Delhi 2001.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1</td><td colspan="8">R.S. Goankar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Prentice Hall, 2002.</td></tr>
<tr><td>2</td><td colspan="8">John E Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Prentice Hall of India, 2001.</td></tr>
<tr><td>3</td><td colspan="8">A.K. Ray and K.M. Bhurchandi, “Advanced Microprocessors and peripherals”, 2nd Edition, Tata McGraw-Hill Publishing company Ltd, 2006.</td></tr>
<tr><td>4</td><td colspan="8">Muhammad Ali Mazidi, Janice Gillispie Mazidi & Rolin McKinlay, ‘The 8051 Micro Controller and Embedded Systems’, Prentice Hall of India, 2005.</td></tr>
<tr><td>5</td><td colspan="8">Kenneth J Ayala, “The 8051 Micro controller”, Thomson Delmer Learning, 2004</td></tr>
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<tr><td colspan="2">10 ME 611</td><td colspan="2">GAS DYNAMICS AND JET PROPULSION</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To understand the basic difference between incompressible and compressible flow, phenomenon of shock waves and its effect on flow and basic knowledge about jet propulsion and Rocket Propulsion</td></tr>
<tr><td>1</td><td colspan="5">COMPRESSIBLE FLOW – FUNDAMENTALS</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Energy and momentum equations for compressible fluid flows, various regions of flows, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, reference velocities, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.</td></tr>
<tr><td>2</td><td colspan="5">FLOW THROUGH VARIABLE AREA DUCTS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.</td></tr>
<tr><td>3</td><td colspan="5">FLOW THROUGH CONSTANT AREA DUCTS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. Isothermal flow with friction in constant area ducts Flow in constant area ducts with heat transfer (Rayleigh flow)- Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.</td></tr>
<tr><td>4</td><td colspan="5">NORMAL SHOCK</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock (elementary treatment only).</td></tr>
<tr><td>5</td><td colspan="5">PROPULSION</td><td colspan="2">Total Hrs</td><td>14</td></tr>
<tr><td colspan="9">Aircraft propulsion – types of jet engines, energy flow through jet engines, study of turbojet engine components , diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines, thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines. Rocket propulsion – rocket engines, thrust equation, effective jet velocity, specific impulse, rocket engine performance, solid and liquid propellants, comparison of different propulsion systems.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Yahya. S.M., “Fundamental of Compressible Flow”, New Age International (P) Ltd., Third Edition, 2003.</td></tr>
<tr><td>2</td><td colspan="8">Oosthuizen, P.H., William E. Carscallen, Patrick H. Oosthuizen, “Compressible fluid flow”, McGraw-Hill College, 1997.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Cohen. H., Rogers G. F. C., and Saravanamuttoo, “Gas Turbine Theory”, 4th Edition, Addison Wesley Longman Ltd., 1996.</td></tr>
<tr><td>2</td><td colspan="8">Ganesan. V., “Gas Turbines”, Tata McGraw-Hill Publishing Co., New Delhi, 1999.</td></tr>
<tr><td>3</td><td colspan="8">Rathakrishnan.E, “Gas Dynamics”, Prentice Hall of India, New Delhi, 2008.</td></tr>
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10 ME 612	CAD/CAM	3	0	0	3	50	50	100
Objective(s)	To gain knowledge on how computers are integrated at various levels of design and drafting. To understand the computer aided manufacturing and to handle the product data and various software used for manufacturing and design.							

1	DESIGN PROCESS	Total Hrs	8
Introduction-Design Process, Design process and Steps, Morphology of Design, Product Cycle Sequential Engineering, Role of Computers In Design, Computer Aided Engineering, Computer Aided Design, Benefits of CAD.			
2	INTERACTIVE COMPUTER GRAPHICS AND SOLID MODELING	Total Hrs	10
Creation of Graphics Primitives, Graphical input Techniques, Display Transformation in 2D, and Display Transformation in 3D. Model Storage and Data Structure, Data Structure Organization, Accessing Data Files, Integrated Data Processing Information System EDMS, Hierarchical Data Structure, Relational Data Structure, Data Storage, and Search Methods. Geometric Modeling- Wire frame, Surface and Solid model. Parametric modeling.			
3	FUNDAMENTAL OF CNC	Total Hrs	9
Introduction to, NC systems and CNC, Machine axis and Co-ordinate system, CNC machine tools, Principle of operation CNC, Construction features including structure, drives and CNC controllers, 2D and 3D machining on CNC.			
4	PART PROGRAMING	Total Hrs	9
Introduction of Part Programming, types - Detailed Manual part programming (FANUC) on Lathe & Milling machines using G , M codes, Cutting Cycles, Loops, Sub program and Macros. Introduction of CAM package.			
5	GROUP TECHNOLOGY AND CAPP	Total Hrs	9
Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations. Computer Aided Processes Planning, Retrieval type and Generative type.			
Total hours to be taught			45

Text book (s) :

1	Sadhu Singh, “Computer Aided Design and Manufacturing“, Kanna Publishers, New Delhi, 1998.
2	Steve Krar and Srthur Gill, “CNC Technology and Programming” Mc Graw Hill Inc., New york,1990

Reference(s) :

1	Radhakrishnan P. and Kothandaraman C.P.” Computer Graphics and Design” Dhanpat Rao and Sons New Delhi, 1991.
2	George E.D., “Engineering Design” McGraw Hill International Edition, 1991
3	Ibrahim Zeid ”CAD-CAM Theory and Practice” Tata McGraw Hill Publishing Co Ltd.,1991
4	Groover and Zimmers “CAD/CAM Computer Aided Design and Manufacturing” Prentice Hall of India, New Delhi, 1994
5	Groover MP. V,” Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2009.

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<tr><td colspan="2">10 ME 613</td><td>DESIGN OF MECHANICAL TRANSMISSION SYSTEMS</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To gain knowledge on the principles and procedure for the design of power Transmission components. To understand the standard procedure available for Design of Transmission sip terms. To learn to use standard data and catalogues.</td></tr>
<tr><td>1</td><td colspan="5">PULLEY, BELT AND CHAIN</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Selection of V belt and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.</td></tr>
<tr><td>2</td><td colspan="5">SPUR GEARS AND PARALLEL AXIS HELICAL GEARS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations - Parallel axis Helical Gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.</td></tr>
<tr><td>3</td><td colspan="5">BEVEL, WORM AND CROSS HELICAL GEARS</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.
Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.
Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.</td></tr>
<tr><td>4</td><td colspan="5">CLUTCHES AND BRAKES</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.</td></tr>
<tr><td>5</td><td colspan="5">GEAR BOX</td><td>Total Hrs</td><td colspan="3">12</td></tr>
<tr><td colspan="9">Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box – Design of multi speed gear box.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">60</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Juvinall R. C., Marshek K.M., “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, 2002.</td></tr>
<tr><td>2</td><td colspan="8">Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill, 1994.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 1985.</td></tr>
<tr><td>2</td><td colspan="8">Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, McGraw-Hill International Editions, 1989.</td></tr>
<tr><td>3</td><td colspan="8">Norton R.L, “Design of Machinery”, McGraw-Hill Book co, 2004.</td></tr>
<tr><td>4</td><td colspan="8">Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Book Co., 1999.</td></tr>
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Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 CS 004	OBJECT ORIENTED PROGRAMMING (EE, EI, MC, ME)	3	0	0	3	50	50	100
Objective(s)	To study the object oriented programming principles, tokens, expressions, control structures and functions. To introduce the classes, objects, constructors and Destructors. To introduce the operator overloading, inheritance and polymorphism concepts in C++.							

1	OBJECT ORIENTED PROGRAMMING AND BASICS OF C++	Total Hrs	9
Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Object-oriented languages – Applications of OOP - C++, simple programs, statements, structure of a program. Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables			
2	OPERATORS AND FUNCTIONS	Total Hrs	9
Operators in C++ – Scope resolution operator – Manipulators – Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading.			
3	CLASSES AND OBJECTS	Total Hrs	9
Specifying a class – Defining member functions – Private member functions –Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments –Friendly functions – Returning objects.			
4	CONSTRUCTORS, DESTRUCTORS AND OPERATOR OVERLOADING	Total Hrs	9
Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors – Destructors. Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions			
5	INHERITANCE AND POLYMORPHISM	Total Hrs	9
Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions.			
Total hours to be taught			45

Text book(s) :

1.	E.Balagurusamy, ‘Object Oriented Programming with C++’, Second edition, Tata McGraw Hill, 2003.
2.	K.R.Venugopal, Rajkumar, T.Ravishankar, “Mastering C++”, Tata McGraw Hill, 2010.

Reference(s):

1.	Herbert Schildt, ‘C++ - The Complete Reference’, Tata McGraw Hill, 1997.
2.	Bjarne Stroustrup, ‘The C++ Programming Language’, Addison Wesley, 2000.
3.	John .R .Hubbard, ‘Schaums Outline Programming with C++’, Tata McGraw Hill, 2003.
4.	Deitel and Deitel, " C++ How to Program", Prentice Hall, 1998
5.	Trivedi, “Programming with ANSI C++”, Oxford University Press, 2007.

<table>
<tr><td colspan="8">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester VI</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 EC 0P5</td><td colspan="2">MICROPROCESSORS AND MICROCONTROLLERS LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To learn practically the programming and interfacing techniques of 8085, 8086 microprocessors and 8051 microcontroller.</td></tr>
<tr><td>1.</td><td colspan="8">Study of 8085 microprocessor, 8086 microprocessor, 8051 microcontroller kit</td></tr>
<tr><td>2.</td><td colspan="8">Programming for 8/16 bit Arithmetic operations Using 8085: Addition / subtraction / multiplication / division.</td></tr>
<tr><td>3.</td><td colspan="8">Programming with control instructions Using 8085
• Increment / Decrement.
• Ascending / Descending order.
• Maximum / Minimum of numbers.
• Rotate instructions.
• Hex. / ASCII / BCD code conversions.</td></tr>
<tr><td>4.</td><td colspan="8">Programming for Arithmetic operations Using 8086 : Addition / subtraction / multiplication / division.</td></tr>
<tr><td>5.</td><td colspan="8">Programming with control instructions Using 8086
• Increment / Decrement.
• Ascending / Descending order.
• Maximum / Minimum of numbers.
• Rotate instructions.
• Hex. / ASCII / BCD code conversions.</td></tr>
<tr><td>6.</td><td colspan="8">Interface Experiments:
• A/D Interfacing.
• D/A Interfacing.
• Traffic light controller.</td></tr>
<tr><td>7.</td><td colspan="8">Interface Experiments: Simple experiments using 8251, 8279, 8254.</td></tr>
<tr><td>8.</td><td colspan="8">Programming for 8/16 bit Arithmetic operations Using 8051: Addition / subtraction / multiplication / division.</td></tr>
<tr><td>9.</td><td colspan="8">Interfacing and Programming of DC Motor Speed control using 8051.</td></tr>
<tr><td>10.</td><td colspan="8">Interfacing and Programming of Stepper Motor control using 8051.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Lab Manual :</td></tr>
<tr><td>1.</td><td colspan="8">“Microprocessors and Microcontrollers Laboratory”, Faculty of EEE, KSRCT, Tiruchengode.</td></tr>
</table>

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<tr><td>Department</td><td>Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="4">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="8">Semester VI</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 6P1</td><td>MANUFACTURING TECHNOLOGY LABORATORY II</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.</td></tr>
<tr><td colspan="8">1. Measurement of cutting force using Lathe tool dynamometer
2. Machining of external splines in Slotter
3. Exercises in Capstan and Turret lathes
4. Exercises in Drilling
5. Machining of Dovetail and keyway in shaper
6. Machining of Hexagonal surface in Milling machine
7. Machining of Spur gear in Milling machine
8. Surface grinding of a plate in Surface grinding machine
9. Cylindrical Grinding in Cylindrical Grinding machine
10. Generating Spur Gear in Gear Hobbing Machine</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
</table>

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<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 6P2</td><td colspan="2">CAM LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To develop the students to perform the computer aided manufacturing process using different programming techniques.</td></tr>
<tr><td colspan="9">1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe.
2. Part programming simulation for Linear and Circular Interpolation, Chamfering and Grooving.
3. Part programming simulation using standard canned cycles for Turning, Facing, Taper turning and Thread cutting.
4. MANUAL PART PROGRAMMING (using G and M codes) in CNC milling.
5. Part programming simulation for Linear and Circular interpolation and Contour motions.
6. Part programming simulation involving canned cycles for Drilling, Peck drilling, and Boring.
7. To generate the NC code in the lathe environment for the given specimen using CAM software.
8. To generate the NC code in the milling environment for the given specimen using CAM software.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Semester VI								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 TP 0P4	CAREER COMPETENCY DEVELOPMENT IV	0	0	2	0	100	00	100
Objective(s)	To enhance employability skills and to develop career competency							

Unit – 1	Written and Oral Communication – Part 2	Hrs
Self Introduction – GD - Personal Interview Skills **Practices** on Reading Comprehension Level 2 – Paragraph Writing - News paper and Book Review Writing - Skimming and Scanning – Interpretation of Pictorial Representations - Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Editing **Materials:** Instructor Manual, Word power Made Easy Book, News Papers		4
Unit – 2	Verbal & Logical Reasoning – Part 2	8
Analogies – Blood Relations – Seating Arrangements – Syllogism - Statements and Conclusions, Cause and Effect – Deriving Conclusions from Passages – Series Completion (Numbers, Alphabets & Figures) – Analytical Reasoning – Classification – Critical Reasoning **Practices**: Analogies – Blood Relations - Statement & Conclusions **Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal		
Unit – 3	Quantitative Aptitude - Part – 5	6
Geometry - Straight Line – Triangles – Quadrilaterals – Circles – Co-ordinate Geometry – Cube – Cone – Sphere. **Materials:** Instructor Manual, Aptitude book		
Unit – 4	Data Interpretation and Analysis	6
Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs can be Column Graphs, Bar Graphs, Line Charts, Pie Chart, Graphs representing Area, Venn Diagram & Flow Charts. **Materials:** Instructor Manual, Aptitude Book		
Unit – 5	Technical & Programming Skills – Part 2	6
Core Subject – 4,5,6 **Practices :** Questions from Gate Material **Materials:** Text Book, Gate Material		
	Total	30

Evaluation Criteria

S.No.	Particular	Test Portion	Marks
1	Evaluation 1 Written Test	15 Questions each from Unit 1, 2, 3, 4 & 5 (External Evaluation)	60
2	Evaluation 2 - Oral Communication	GD and HR Interview (External Evaluation by English, MBA Dept.)	20
3	Evaluation 3 – Technical Interview	Internal Evaluation by the Dept. – 3 Core Subjects	20
		Total	100

Reference Books

1. Aggarwal, R.S. “A Modern Approach to Verbal and Non-verbal Reasoning”, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, “Quantitative Aptitude”, TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

Note:

- Instructor can cover the syllabus by Class room activities and Assignments (5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough Work pages
- Each Assignment has 20 questions from Unit 1,2,3,4,5 and 5 questions from Unit 1(Oral Communication) & Unit 5(Programs)
- Evaluation has to be conducted as like Lab Examination.

Modules	10 EC 010 - Microprocessors and Microcontrollers Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Identify the basic elements and functions of 8085-Microprocessor.
2.	Apply the programming techniques in developing the ALP using 8085 instruction sets for various applications.
3.	Understand the concepts of 8086 microprocessor and memory interfacing with 8086.
4.	Develop the program using instruction set of 8086 Microprocessor for various applications.
5.	Connect peripheral chips and I/O devices with 8085Microprocessor to develop a system.
6.	Construct the machine code that will provide solutions real world control problems such as temperature control and fluid level control etc.
7.	Understand the basic blocks of 8051 and programming it for various special function tasks.
8.	Learn the operating principles of and gain hands-on experience with timers/counters, I/O ports and UART available in 8051 Microcontroller.
9.	Interfacing peripherals with 8051 Microcontroller for external world communication.
10.	Design 8051 Microcontroller based system for various control application.

Modules	ME 611 - Gas Dynamics and Jet Propulsion Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Analyse the compressible flow, based on fundamental physical principles (continuity, momentum, energy equations) and derive mach number and velocity of sound.
2.	Distinguish between intensive and extensive properties.
3.	Develop equation and concept to analyze many real situations where gradual variations in the flow cross section.
4.	Perform calculations of flow properties of various practical flow situations where wall friction and heat transfer is involved.
5.	Develop the assumptions and governing equations to study the Normal shock and to perform calculations of flow properties of various practical flow situations where Normal shock is involved.
6.	Explain the concept of jet and rocket propulsion based on Newton's third law and its types, working principle of various jet and rocket engines practically used.
7.	Distinguish between jet and rocket propulsion.
8.	Carryout performance analysis on practically used jet and rocket engines.

Modules	10 ME 612 - CAD /CAM Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	List the steps involved in design processes of product.
2.	Write the role of computer in design.
3.	Construct and modify the graphics primitives.
4.	Compare the different geometry modeling techniques.
5.	Differentiate the NC and CNC system.
6.	Describe the components of CNC system.
7.	List the G and M codes.
8.	Construct the part program of milling and turning centre.
9.	Characterize the part family and coding system.
10.	Explain the computer aided process planning.

Modules	10 ME 613 - Design of Mechanical Transmission Systems Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Select, design and analyze the belt drives.
2.	Design and analyze chain drive systems.
3.	Select gear materials, name different types of gears and recognize terminologies.
4.	Compute the fundamental quantities related with gear geometry and to explain fundamental law of gearing.
5.	Analyze different gear forces and to explain the types of tooth failures.
6.	Design and analyze spur gear and parallel axis helical gear.
7.	Design and analyze bevel, worm and cross helical gears.
8.	Design and analyze different types of clutches and brakes.
9.	Describe about geometric progression, ray diagram, kinematic layout in gear box.
10.	Design the sliding mesh and constant mesh gear box.

Modules	10 CS 004 - Object Oriented Programming Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Elicit information about basics of procedure oriented programming and to find out different types of function calls.
2.	Interpret how to overload functions and to use function arguments.
3.	Extract the use of binding of data and its associated functions together.
4.	Comprehend about the object interaction with each other within the class.
5.	Access the private member of the class.
6.	Realize about different types of constructors and identify the object that has destroyed.
7.	Observe the use of different rules of the operator overloading.
8.	Reuse of the existing codes.
9.	Create the variables, functions or an object that has more than one forms.
10.	Summarize the rules for virtual functions.

Modules	10 EC 0P5 - Microprocessors and Microcontrollers Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Identify the basic element and functions of various microprocessor and microcontrollers.
2.	Develop the ALP programs for arithmetic operations, sorting, searching and code conversions using 8085.
3.	Apply the programming techniques in developing the ALP using 8085 for various applications.
4.	Develop the ALP programs for arithmetic operations, sorting, searching and code conversions using 8085.
5.	Apply the programming techniques in developing the ALP using 8086 for various applications.
6.	Interface peripheral chips and I/O devices with 8085Microprocessor to develop a system.
7.	Programming 8051 Microcontroller for basic arithmetic operations.
8.	Learn the operating principles of, and gain hands-on experience with timers/counters, I/O ports and UART available in 8051 Microcontroller.
9.	Interfacing ADC and DAC with 8051 Microcontroller and verify its functionality.

Modules	10 ME 6P1 - Manufacturing Technology Laboratory II Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Measure of cutting force using Lathe tool dynamometer.
2.	Machine of external splines in Slotter.
3.	Demonstrate the working principle of Capstan and Turret lathes.
4.	Make a hole in drilling machine.
5.	Machine a dovetail and keyway using shaper.
6.	Machine the hexagonal surface using milling machine.
7.	Produce spur gear using horizontal milling machine.
8.	Grind a plate using surface grinding machine.
9.	Practice cylindrical grinding operation using cylindrical grinding machine.
10.	Generate spur gear in gear hobbing machine.

Modules	10 ME 6P2 - CAM Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Write and simulate the CNC lathe part program for facing operation.
2.	Write and simulate the CNC lathe part program for step turning operation.
3.	Write and simulate the CNC lathe part program using turning cycle code.
4.	Write and simulate the CNC lathe part program using canned cycle code.
5.	Write and simulate the CNC lathe part program for chamfer, grooving and thread cutting operation.
6.	Write and simulate the CNC milling part program for circular interpolation operation.
7.	Write and simulate the CNC milling part program for end milling operation.
8.	Write and simulate the CNC milling part program for peck drilling operation.
9.	Write and simulate the CNC milling part program for irregular milling operation.
10.	Write and simulate the CNC milling part program using mirroring code.

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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 HS 003</td><td colspan="2">PRINCIPLES OF MANAGEMENT</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge in international aspect of management.</td></tr>
<tr><td>1.</td><td colspan="5">HISTORICAL DEVELOPMENT</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.</td></tr>
<tr><td>2.</td><td colspan="5">PLANNING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Nature & Purpose – Types of Plans – Steps involved in Planning – Objectives – Setting Objectives – process of Management by Objectives – Strategies, Policies & Planning Premises – Forecasting – Decision making.</td></tr>
<tr><td>3.</td><td colspan="5">ORGANISING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Nature and purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and limitations – De-Centralization and Delegation of Authority – Staffing – Selection process – Techniques – HRD – Managerial Effectiveness.</td></tr>
<tr><td>4.</td><td colspan="5">DIRECTING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Scope – Human Factors – Leadership – Types of Leadership – Motivation – Hierarchy of needs – Motivation Theories – Motivational Techniques – Job Enrichment – Communication – process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.</td></tr>
<tr><td>5.</td><td colspan="5">CONTROLLING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">System and process of Controlling – Requirements for effective control – the Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s):</td></tr>
<tr><td>1.</td><td colspan="8">Harold Kooritz & Heinz Weihrich, “Essentials of Management”, Tata McGraw-Hill, 1998.</td></tr>
<tr><td>2.</td><td colspan="8">Joseph L Massie, “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.</td></tr>
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<tr><td>1.</td><td colspan="8">Tripathy PC And Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.</td></tr>
<tr><td>2.</td><td colspan="8">Decenzo David, Robbin Stephen A, “Personnel and Human Reasons Management”, Prentice Hall of India, 1996.</td></tr>
<tr><td>3.</td><td colspan="8">JAF Stomer, Freeman R. E and Daniel R “Gilbert Management”, Pearson Education, Sixth Edition, 2004.</td></tr>
<tr><td>4.</td><td colspan="8">Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.</td></tr>
<tr><td>5.</td><td colspan="8">Prasad L.M, “Principles of Management”, Sultan Chand & Sons Ltd, 2003.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering		Programme Code & Name		ME: B.E. Mechanical Engineering			
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME 711	AUTOMOBILE ENGINEERING	3	0	0	3	50	50	100
Objective(s)	To impact knowledge to students in various systems of Automobile Engineering and to have the practice for Assembling and Dismantling of Engine Parts.							

1	VEHICLE STRUCTURE AND ENGINES	Total Hrs	9
Types of Automobiles - Vehicle Construction – Chassis –Classification of chassis- Frame and Body – Vehicle dimension-aerodynamics-Introduction to body building technology. Engine Emission –emission Control by 3–Way Catalytic Controller – Emission norms- Maintenance and trouble shooting of engine -Automobile air conditioning, Basics of off road vehicles.			
2	FUEL SUPPLY SYSTEMS	Total Hrs	9
Fuel supply system of S.I engine-Carburetor-Function-Types-Construction of S.U & Solex Carburetor– Super Charger -Turbo Chargers - Fuel supply system of C.I engine- Fuel injection system, Fuel pumps and Fuel Injector - Types and Construction - Electronic fuel injection system, MPFI,CRDI, Introduction to alternative fuels.			
3	AUTOMOTIVE ELECTRICAL SYSTEM	Total Hrs	9
Starting system-Construction, Operation and Maintenance of Lead Acid Battery – Starter motor and drives- Charging system- Generator and Alternator-Regulators- cutout-Ignition system– Battery, Magneto Coil and Electronic Type–Lighting & accessory system - Electric and Hybrid Vehicles-Fuel cell.			
4	POWER TRANSMISSION SYSTEMS	Total Hrs	9
Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Simple Floor Mounted Shift Mechanism – Over Drives – Transfer Box- Fluid flywheel-Torque convertors– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive.			
5	STEERING, BRAKES AND SUSPENSION	Total Hrs	9
Steering Geometry and Types of steering gear box– Power Steering, Wheels and Tyres – Wheel Alignment Parameters – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction – Diagonal Braking System – Antilock Braking System,.			
Total hours to be taught		45	

Text book (s) :	
1	Sethi H.M, “Automobile Technology”, Tata McGraw-Hill-2003.
2	Kirpal Singh “Automobile Engineering Vol. 1& 2”, Standard Publishers, New Delhi.
Reference(s) :	
1	Crouse and Anglin “Automotive Mechanism”, 9th Edition. Tata McGraw-Hill, 2003.
2	Newton, Steeds and Garet, “Motor vehicles”, Butterworth Publishers, 2000.
3	Srinivasan.S , “ Automotive Mechanics” 2nd edition, 2003, Tata McGraw-Hill, 2002.
4	Joseph Heitner, “Automotive Mechanics”, 2nd edition, East-West Press, 2002.

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<tr><td colspan="2">10 ME 712</td><td colspan="2">MECHATRONICS AND ROBOTICS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">The course aims to provide a detailed appreciation of the concepts of mechatronics and robotics in the context of automation industry. It is undertaken with particular on mechatronics drives and controllers with several applications and robot sensors and end effectors.</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION</td><td colspan="2">Total Hrs.</td><td>9</td></tr>
<tr><td colspan="8">Mechatronics systems-Stages in Designing mechatronic systems - Traditional and Mechatronic design-program control, adaptive control and distributed systems - Man machine interface, industrial design and ergonomics, information transfer from machine to man and man to machine, safety.</td></tr>
<tr><td>2</td><td colspan="5">DRIVES AND CONTROLLERS</td><td colspan="2">Total Hrs.</td><td>9</td></tr>
<tr><td colspan="8">Introduction of Mechanical Actuation Systems - Electrical Actuation Systems - Solenoids -Stepper and servo Motors.
Controllers - PID Controllers- Programmable Logic Controller (PLC) -Introduction-Basic structure-Input /Output Processing - PLC Programming- Timers, Internal relays and counters - Data handling - Analog Input /Output-Selection of a PLC.</td></tr>
<tr><td>3</td><td colspan="5">CASE STUDIES OF MECHATRONIC SYSTEMS</td><td colspan="2">Total Hrs.</td><td>9</td></tr>
<tr><td colspan="8">Pick and place robot - automatic car park system -engine management system-Testing of transportation bridge surface materials - Transducer calibration system for Automotive applications - Skip control of a CD Player.</td></tr>
<tr><td>4</td><td colspan="5">FUNDAMENTALS OF ROBOT</td><td colspan="2">Total Hrs.</td><td>9</td></tr>
<tr><td colspan="8">Basic structure of robot - classification of robot and robotic systems - laws of robotics - robot motions work space - precision of movement- Introduction of homogeneous transformation matrices.</td></tr>
<tr><td>5</td><td colspan="5">END EFFECTORS AND SENSORS</td><td colspan="2">Total Hrs.</td><td>9</td></tr>
<tr><td colspan="8">Mechanical grippers - Types of gripper mechanisms - Other types of grippers - Vacuum cups - Magnetic grippers - Adhesive grippers.
Force, Pressure and Torque sensors - Touch and tactile sensors - Proximity, Range and Sniff Sensors - Introduction to Machine vision</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="8">Text book(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Bolton. “Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering”, 2nd edition, Addison Wesley Longman Ltd., 1999.</td></tr>
<tr><td>2.</td><td colspan="7">Saeed B. Niku, “Introduction to Robotics: Analysis, Systems, Applications”, 2nd edition, Pearson Education India, 2003.</td></tr>
<tr><td colspan="8">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="7">M.P.Groover, “Industrial Robotics-Technology, Programming and Applications”, Tata McGraw Hill, 2008.</td></tr>
<tr><td>2.</td><td colspan="7">Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003</td></tr>
<tr><td>3.</td><td colspan="7">Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill, 2000.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering		Programme Code & Name		ME : B.E. Mechanical Engineering			
Semester VII								
Course Code	Course Name	Hours / Week				Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME 713	FINITE ELEMENT ANALYSIS	3	1	0	4	50	50	100
Objective(s)	To understand the principles involved in discretization and finite element approach and learn to form stiffness matrices and force vectors for simple elements.							
1	FUNDAMENTAL CONCEPTS					Total Hrs		12
Introduction to numerical method–Applications and advantages of FEM- The role of FEM in numerical simulation-Principle of minimum potential energy-Principle of virtual work– The variational method –Weighted Residual method – Solution of algebraic equations – Gaussian elimination method.								
2	ONE – DIMENSIONAL PROBLEMS					Total Hrs		12
Procedure of FEM- Finite element modeling –Element design- Discretisation – Coordinate system and shape functions – Strain - displacement relations and Stress - strain relations – Element stiffness matrices and force vectors – Assembly to global element equation – Boundary conditions – solution of primary and secondary variables- Applications to axial loadings of rods – Extension to plane trusses. Higher order elements- Shapes functions.								
3	ONE DIMENSIONAL BEAM AND SCALAR VARIABLE PROBLEMS					Total Hrs		12
One Dimensional beam element –Hermite shape function - Element stiffness matrices and force vectors -Problems. Applications to scalar variable problems - Element stiffness matrices and force vectors - Assembly to Global equations –boundary conditions – Solutions - heat transfer problems.								
4	TWO DIMENSIONAL PROBLEMS – VECTOR VARIABLE PROBLEMS					Total Hrs		12
CST and LST elements -Shapes functions – Strain Displacement matrix - Element stiffness matrices and force vectors for CST element - Plane Stress, Plane Strain and Axisymmetric problems.								
5	ISOPARAMETRIC ELEMENT FORMULATIONS					Total Hrs		12
ISO parametric elements – four noded quadrilateral element – Serendipity element -Element shapes Functions – Jacobian matrix - Strain -Displacement matrix – Numerical Integration -Gaussian quadrature method.								
Total hours to be taught								60
Text book (s) :								
1	Chandrupatla T.R. & Belegundu A.D., “Introduction to Finite Elements in Engineering”, Pearson Education 2002, 3rd Edition.							
2	Chennakesava R.Alavala , “Finite element methods Basic concepts and applications”, PHI learning, 2012							
Reference(s) :								
1	Reddy J.N., “An Introduction to Finite Element Method”, Tata McGraw-Hill Publishing company Ltd., 2005							
2	Daryl L.Logan ., “A First course in the Finite Element Method”, Fourth Edition, Cengage Learning, 2007							
3	David V.Hutton, “Fundamentals of finite element analysis”, Tata McGraw-Hill Publishing company Ltd, 2012							
4	Robert D.Cook., David.S, Malkucs Michael E Plesha, “Concepts and Applications of Finite Element Analysis” 4th Edition. Wiley, 2003.							
5	Asghar Bhatti, “Fundamental Finite Element Analysis and Applications”, John Wiley & Sons Inc, 2005							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME: B.E. Mechanical Engineering			
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	CS	Total
10 ME 714	OPTIMIZATION TECHNIQUES	3	1	0	4	50	50	100
Objective(s)	To create awareness about optimization techniques in utilization of resources and it's applications in industrial and business applications.							

1	LINEAR MODEL	Total Hrs	12
The phases of OR study – formation of an L.P model- Graphical solution – Simplex algorithm – Big M method – Solution by Dual.			
2	TRANSPORTATION PROBLEM	Total Hrs	12
Balanced and unbalanced transportation models – LP formulation - Initial solution by North West Corner method- Least cost method – Vogel's approximation method – Optimality Test – MODI method. Assignment problem – LP formulation – Hungarian method - Unbalanced assignment Problem.			
3	NETWORK MODELS	Total Hrs	12
Shortest route – Minimal spanning tree - Maximum flow models – Project Network- CPM and PERT network – Critical path scheduling – Crashing of project networks – Resource Leveling and smoothing technique			
4	INVENTORY MODELS	Total Hrs	12
Deterministic Inventory models - Economic Order Quantity - Quantity discount models - Multi product EOQ models – Introduction to Probabilistic Inventory models with simple discreet and continuous cases			
5	QUEUING THEORY & SIMULATION	Total Hrs	12
Queuing models – Queuing systems and structures – notation – Poisson and Exponential distribution for arrival and service - Single server models - multi server models (Infinite population). Simulation Modeling - Random number generation - simple inventory and queuing problems.			
Total hours to be taught			60

Note : Practice in OR software package (TORA or LINDO or LINGO)

Text Book:

1.	Hamdy A. Taha, "Operation Research - An Introduction", Prentice – Hall of India Private Limited, New Delhi. 7th Edition, 2004.

Reference (s) :

1	Perm Kumar Gupta, D.S. Hira, "Operations Research", S.Chand and Company Ltd., 2007.
2	R. Panneerselvam, 'Operations Research" Prentice Hall of India Private Ltd, New Delhi, 2003.
3	Wayne L. Winston, "Operations Research – Applications and Algorithms", Cengage Learning, 4th Edition, 2011.
4	Frederick S. Hillier And Gerald J. Lieberman, "Introduction To Operations Research", McGraw Hill Publishing Co., New Delhi, 8th Edition, 2007.

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="2">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="8">Semester VII</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 7P1</td><td>ANALYSIS AND SIMULATION LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To develop the students to perform finite element analysis of various kind of static structural, thermal and dynamic problems and to simulate the results using the FEA software.</td></tr>
<tr><td colspan="8">Introduction of FEA software – GUI and Macros

Structural analysis:
1. Analysis of stepped bar under axial load and thermal load
2. Analysis of plane truss members
3. Analysis of beams with point load, UDL, and UVL
4. Analysis of plate with plane stress and plane strain conditions
5. Analysis of Cylinders under internal pressure

Thermal analysis:
6. Steady state heat transfer analysis on plate and composite wall
7. Transient heat transfer analysis on plate

Fluid analysis:
8. Computational fluid dynamics(CFD) on Fluid flow through pipes</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Program code & Name			ME : B.E. Mechanical Engineering			
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME 7P2	MECHATRONICS LABORATORY	0	0	3	2	50	50	100
Objective(s)	To equip students with different robot knowledge and also several transformations in articulated robot with continuous programming exercises and machine vision techniques.							

1.	Programming exercises for loops and charts
2.	Programming exercises for clusters and graphs
3.	Programming exercises on case and sequence structures
4.	Programming exercises on basic string operation
5.	Temperature conversion using Lab VIEW
6.	Real time data acquisition for temperature monitoring using Lab VIEW
7.	Control of LED using Lab VIEW
8.	Pattern matching analysis of the captured image
9.	Thresholding the component image for pattern matching
10.	Edge detection of the component image for pattern matching
11.	Study of different types of robots based on configuration, end effectors and application with simple robot programming exercises
Total hours to be taught	45
Text book :	
1.	Jovitha Jerome, “Virtual Instrumentation using Lab VIEW”, PHI learning private Limited, 2010.
Reference(s) :	
1.	M.P.Groover, “Industrial Robotics-Technology, Programming and Applications”, Tata McGraw Hill, 2008.

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2010</td></tr>
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<tr><td colspan="8">Semester VII</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 7P3</td><td>PROJECT WORK - PHASE I</td><td>0</td><td>0</td><td>4</td><td>2</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">The objective of the Project Work - Phase I is to enable the students in convenient groups of not more than 4 members and to search for related area in which the members are going to do their project. Project Work - Phase I involves in identifying right project work, acquiring knowledge on that area, making preliminary works towards phase II of the project work.</td></tr>
<tr><td>Methodology</td><td colspan="7">• Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide
• Problem should be selected
• Students have to collect about 20 papers related to their work
• Report has to be prepared by the students as per the format
• Preliminary implementation can be done if possible
• Internal evaluation has to be done for 100 marks</td></tr>
<tr><td colspan="7">Total Hrs</td><td>60</td></tr>
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<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
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<tr><td colspan="8">Semester VII</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours/Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 TP 0P5</td><td>CAREER COMPETENCY DEVELOPMENT V</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To enhance employability skills and to develop career competency</td></tr>
<tr><td>Unit – 1</td><td colspan="6">Written and Oral Communication</td><td>Hrs</td></tr>
<tr><td colspan="7">Self Introduction – GD – HR Interview Skills – Corporate Profile Review
Practices on Company Based Questions and Competitive Exams
Materials: Instructor Manual</td><td>6</td></tr>
<tr><td>Unit – 2</td><td colspan="6">Verbal & Logical Reasoning</td><td rowspan="2">6</td></tr>
<tr><td colspan="7">Practices on Company Based Questions and Competitive Exams
Materials: Instructor Manual</td></tr>
<tr><td>Unit – 3</td><td colspan="6">Quantitative Aptitude</td><td rowspan="2">6</td></tr>
<tr><td colspan="7">Practices on Company Based Questions and Competitive Exams
Materials: Instructor Manual</td></tr>
<tr><td>Unit – 4</td><td colspan="6">Data Interpretation and Analysis</td><td rowspan="2">6</td></tr>
<tr><td colspan="7">Practices on Company Based Questions and Competitive Exams
Materials: Instructor Manual</td></tr>
<tr><td>Unit – 5</td><td colspan="6">Programming & Technical Skills – Part 3</td><td rowspan="2">6</td></tr>
<tr><td colspan="7">C Language - Control Structures – Data Types – Arrays – Operators -Functions-Structures – Pointers-Files
Practices : Programs and Find Output and Errors
Materials: Instructor Manual , Exploring C by Yashwant Kanetkar</td></tr>
<tr><td colspan="7">Total</td><td>30</td></tr>
<tr><td colspan="8">Evaluation Criteria</td></tr>
<tr><td>S.No.</td><td colspan="2">Particular</td><td colspan="4">Test Portion</td><td>Marks</td></tr>
<tr><td>1</td><td colspan="2">Evaluation 1
Written Test</td><td colspan="4">15 Questions each from Unit 1, 2,3, 4 & 5
(External Evaluation)</td><td>60</td></tr>
<tr><td>2</td><td colspan="2">Evaluation 2 -
Oral Communication</td><td colspan="4">GD and HR Interview
(External Evaluation by English, MBA Dept.)</td><td>20</td></tr>
<tr><td>3</td><td colspan="2">Evaluation 3 –
Technical Interview</td><td colspan="4">Internal Evaluation by the Dept. – 3 Core Subjects</td><td>20</td></tr>
<tr><td colspan="7">Total</td><td>100</td></tr>
<tr><td colspan="8">Reference Books
1. Aggarwal, R.S. “A Modern Approach to Verbal and Non-verbal Reasoning”, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, “Quantitative Aptitude”, TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL PUBlications
Note:
• Instructor can cover the syllabus by Class room activities and Assignments(5 Assignments/week)
• Instructor Manual has Class work questions, Assignment questions and Rough work pages
• Each Assignment has 20 questions for Unit 1,2,3,4 & 5 and Unit 5 and 5 questions from Unit 5(Algorithms) & Unit 1(Oral Communication)
• Evaluation has to be conducted as like Lab Examination.</td></tr>
</table>

Modules	10 HS 003 - Principles of Management Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the basic concepts of management.
2.	Explain the contributions and functions, types of business organization.
3.	Point out the various types of planning, setting objectives.
4.	Select forecasting models for future demands and to make decision in the management processes.
5.	Explore the difference between formal and informal organization, knowing the various types of organization structure and its process.
6.	Analyze the selection process.
7.	List the various types of leadership and evaluate the motivation theories and techniques.
8.	Explore the importance of barriers, breakdown and electronic media in communication.
9.	Discuss the different process of controlling and apply the managerial principles to improve the productivity.
10.	Outline the global environment, international management and global theory of management.

Modules	10 ME 711 - Automobile Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	List out the types and describe construction of vehicle and chassis.
2.	Describe the emission control techniques, emission norms and automobile air conditioning system.
3.	Compare the fuel supply system of SI with CI engine.
4.	Apply the electronic components in fuel supply system and differentiate the turbo with super chargers.
5.	Write the working of starting, charging and ignition system.
6.	Explain the working of lead acid battery, lighting system, hybridand electric car.
7.	Write the type and working of clutches and gear boxes
8.	Choose the rear axle drive of different types of vehicle.
9.	Characterize the steering geometry.
10.	Explain the types and working of suspension and braking system.

Modules	10 ME 712 - Mechatronics and Robotics Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the concepts of mechatronic systems, adoptive control, man-machine interface and mechatronic design.
2.	Summaries the concepts of mechanical and electronic actuation systems.
3.	Explain the working of stepper and servo motors.
4.	Write the programme for programmable logic controllers and discuss case studies of mechatronic systems.
5.	List out the classification of robots and explain the structure of robot.
6.	Use the homogeneous transformation matrices in robotics
7.	Compare the different types of grippers used in robotics.
8.	Use the vacuum cups and magnetic grippers in mechatronic systems.
9.	Explain the working principle of touch, tactile proximity, range and sniff sensors.
10.	Explain the various techniques of machine vision system.

Modules	10 ME 713 - Finite Element Analysis Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the concept of finite element method and its applications.
2.	Outline the various classical approaches to solve engineering problems.
3.	Convert the continuous system into discredited FE model with elements and nodes.
4.	Construct and solve the element equation for one dimensional structural and thermal problems.
5.	Describe the concept of two dimensional meshing with the 2D triangular elements.
6.	Derive the shape functions, global stiffness matrix for triangular element.
7.	Solve the 2D problems with plane stress, plane strain and axisymmetric conditions.
8.	Explain the concept of isoparametric element formulation and its applications.
9.	Solve 2D problems using isoparametric quadrilateral element.
10.	Implement the Gaussion quadrature expression for numerical integration.

Modules	10 ME 714 - Optimization Techniques Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the importance and phases of Operation Research.
2.	Form the Linear programming model and solve it by graphical method and simplex algorithms.
3.	Recognize the balanced and unbalanced transportation models and predict optimum solution by MODI method.
4.	Solve balanced and unbalanced assignment problems by Hungarian method.
5.	Outline and solve the shortest route, minimal spanning tree and maximal flow network problems.
6.	Construct the CPM and PERT networks.
7.	Identify various deterministic Inventory models and solve EOQ problems.
8.	Evaluate the probabilistic Inventory models with simple discreet and continuous cases.
9.	Select queuing models to solve queuing problems.
10.	Describe Simulation and solve simple simulation problems in inventory and queuing.

Modules	10 ME 7P1 - Analysis and Simulation Laboratory Course Outcomes
	At the end of the course, the student will be able to
1.	Describe the basics of FEA software.
2.	Define the engineering problem to the FEA software.
3.	Perform the structural analysis of rod for various loads and boundary conditions.
4.	Compute the deflection and stress on each member of plane truss structure.
5.	Conduct the bending analysis on beams with various load conditions.
6.	Solve the 2D structural problems for stress analysis.
7.	Demonstrate the 2D axisymmetric structural problems.
8.	Compute and plot the temperature distribution on the composite wall.
9.	Demonstrate the transient heat transfer analysis on plate.
10.	Simulate the flow of fluid through the pipe.

Modules	10 ME 7P2 - Mechatronics Laboratory Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Write a program using loops, charts, clusters, and graphs to solve problems.
2.	Code a program using case and sequence structure.
3.	Solving string operations using graphical programming.
4.	Convert the temperature for different units using graphical programming.
5.	Aquire and analyses the real time data using data acquisition.
6.	Distinguish between analog and digital I/O signals.
7.	Explain the concept of pattern matching, thresholding and edge detection using machine Vision.
8.	Explain the different types of robots and end-effectors.

Modules	10 ME 7P3 - Project wok – Phase I Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Select the title and collect relevant information related with selected title.
2.	Collect the literature and partially design the system.
3.	Carryout partial design and prepare and present the project report

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME: B.E. Mechanical Engineering			
Semester VIII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 HS 002	TOTAL QUALITY MANAGEMENT	3	0	0	3	50	50	100
Objective(s)	To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management, statistical approach for quality control, ISO and QS Certification process and its need for the industries.							
1	INTRODUCTION					Total Hrs		9
Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Quality Council, Quality Statements, Deming Philosophy, Barriers to TQM Implementation.								
2	TQM PRINCIPLES					Total Hrs		9
Customer satisfaction, Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement, Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership, Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures-Basic Concepts, Strategy.								
3	STATISTICAL PROCESS CONTROL (SPC)					Total Hrs		9
The tools of quality, Statistical Fundamentals, Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New Management tools.								
4	TQM TOOLS					Total Hrs		9
Benchmarking, Reasons to Benchmark, Benchmarking Process, Quality Circle, Quality Function Deployment (QFD). House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), Concept, Improvement Needs, FMEA–Stages, Types.								
5	QUALITY SYSTEMS					Total Hrs		9
Need for ISO 9000 Quality Systems, ISO 9001:2008 ISO 14000 Quality Systems, Elements Concepts, Implementation, Documentation, Quality Auditing, Requirements and Benefits, Non Conformance report, Case Studies on Educational System.								
Total hours to be taught						45		
Text book (s) :								
1	Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, 1999. (Indian reprint 2002).							
Reference(s) :								
1	James R.Evans & William M.Lidsay, “The Management and Control of Quality”, (5th Edition), South-Western (Thomson Learning), 2002.							
2	Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.							
3	Jayakumar.V, “Total Quality Management” Lakshmi Publications, 2006.							
4	Suburaj, Ramasamy “Total Quality Management”, Tata McGraw Hill, 2005.							

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<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">M.E : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester VIII</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME 811</td><td colspan="2">POWER PLANT ENGINEERING AND ENERGY AUDIT</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To understand the importance of energy utilization in power plants and to understand various components, operations and applications of various power plants.</td></tr>
<tr><td>1</td><td colspan="5">THERMAL POWER PLANT</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Layout of thermal power plant, Fuel and ash handling, Combustion equipment for burning coal, Mechanical stokers, Pulveriser, Electrostatic precipitator (ESP), Draught – Natural and forced draught types, Surface condenser types, Cooling towers, Chimney, Feed water treatment and Ejection system.</td></tr>
<tr><td>2</td><td colspan="5">NUCLEAR AND HYDEL POWER PLANTS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Nuclear Energy: Fission, Fusion reaction, Layout of nuclear power plant, Types of reactors, Pressurized water reactor, Boiling water reactor, Waste disposal and safety. Hydro-electric power plant- Layout, Advantages of water power, Essential elements, Classification, Classification of turbines, Governing of turbines, Mini and micro hydel plants.</td></tr>
<tr><td>3</td><td colspan="5">DIESEL AND GAS TURBINE POWER PLANT</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Layout of Diesel power plant, Types of diesel plants, Components, Applications and advantages. Layout of gas turbine power plant, Fuels, Gas turbine material, Open and closed cycles, Reheating, Regeneration, Inter-cooling, Combined cycle.</td></tr>
<tr><td>4</td><td colspan="5">NON CONVENTIONAL POWER PLANTS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Layout and components: Magneto Hydro Dynamic (MHD) power plant, Geothermal power generation, Ocean thermal energy conversion (OTEC), Tidal power generation, Solar power generation and Wind energy power generation.</td></tr>
<tr><td>5</td><td colspan="5">ENERGY AUDIT</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Energy - Production, Transport and control, Load duration curves, Load factor. Cost of electric energy, Types of tariffs, Electric power generation in India, Basic problems on power generation. Power plant economics, Cost, Depreciation, Indian energy scenario.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">R. K. Rajput, “A Textbook of Power Plant Engineering”, Laxmi Publications Pvt. Ltd. Fourth Edition, 2008</td></tr>
<tr><td>2</td><td colspan="8">P.K. Nag, “Power plant Engineering” - Second Edition, Tata McGraw-Hill, New Delhi, 2001.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">K. K. Ramalingam, “Power Plant Engineering”, Scitech Publications (India) Pvt Ltd., 2002.</td></tr>
<tr><td>2</td><td colspan="8">G.R. Nagpal, “Power Plant Engineering”, Hanna Publishers, 1998.</td></tr>
<tr><td>3</td><td colspan="8">G.D.Rai, “Introduction to Power Plant Technology”, Khanna Publishers, 1995.</td></tr>
<tr><td>4</td><td colspan="8">Frank D.Graham “Power Plant Engineers Guide”, D.B. Taraporevala Sons & Co, New Delhi, 1993.</td></tr>
<tr><td>5</td><td colspan="8">T.Morse Frederick, “Power Plant Engineering”, Prentice Hall of India, 1998.</td></tr>
<tr><td>6</td><td colspan="8">M.M. EI- Wakil, “Power Plant Technology”, McGraw-Hill 1985</td></tr>
<tr><td>7</td><td colspan="8">S.C. Arora, and S. Domkundwar, “A course in Power Plant Engineering”, Dhanpatrai, 2001.</td></tr>
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<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2010</td></tr>
<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME: B.E. Mechanical Engineering</td></tr>
<tr><td colspan="9">Semester VIII</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME 8P1</td><td>PROJECT WORK - PHASE II</td><td>0</td><td>0</td><td>16</td><td>8</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.</td></tr>
<tr><td>Methodology</td><td colspan="8">Three reviews have to be conducted by the committee of minimum of three members one of which should be their project guide.
Progress of project has to be monitored by the project guide and committee regularly.
Each review has to be evaluated for 100 marks.
Attendance is compulsory for all reviews. If a student fails to attend review for some valid reasons, one more chance may be given.
Final review will be carried out by the committee that consists of minimum of three members one of which should be their project guide (if possible include one external expert examiner within the college).
The project report should be submitted by the students around at the first week of April.</td></tr>
<tr><td colspan="8">Total Hrs</td><td>240</td></tr>
</table>

Modules	10 HS 002 - Total Quality Management Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Recognize the basic concepts of total quality management.
2.	List the role of senior management.
3.	Identify the customer satisfaction, retention and employee involvement.
4.	Locate the continuous process improvement techniques.
5.	List the seven tools of quality and new seven management tools.
6.	Demonstrate concept of six sigma.
7.	Implement the concept of quality function deployment.
8.	Assess the total productive maintenance, failure mode and effective analyses
9.	Demonstrate the need for ISO 9000 and other quality system.
10.	Categorize the quality auditing.

Modules	10 ME 811 - Power Plant Engineering and Energy Audit Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Categorize the types of power plant layouts.
2.	Recognize the fuel and ash handling system in thermal power plant.
3.	List the various components involved in thermal power plant.
4.	Describe the function of nuclear power plant.
5.	Explain the function hydel power plant.
6.	Outline the concept of governing of turbines
7.	Describe the function of diesel power plant.
8.	List the functions of gas power plant.
9.	Assess the cost of electric energy.
10.	Evaluate the power generation and cost of depreciation.

Modules	**10 ME 8P1 - Project Work – Phase II** **Course Outcomes(COs)**
	At the end of the course, the student will be able to
1.	Design the project work.
2.	Model and fabricate the project work.
3.	Analyze, prepare and present the project work along with report.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering		Programme Code & Name		ME : B.E. Mechanical Engineering			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E11	VIBRATION AND NOISE CONTROL	3	0	0	3	50	50	100
Objective(s)	The students will be able to understand the sources of vibration, noise and harshness in automobiles and make design modifications to reduce them and improve the life of the components and the comfort of the passengers.							
1	BASICS OF VIBRATION				Total Hrs	9		
Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.								
2	VIBRATION CONTROL TECHNIQUES				Total Hrs	10		
Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.								
3	BASICS OF NOISE AND SOURCES				Total Hrs	9		
Introduction, noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.								
4	NOISE CONTROL				Total Hrs	9		
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.								
5	HARSHNESS AND ITS CONTROL				Total Hrs	8		
Harshness, sources and its effects, measurement and control								
Total hours to be taught						45		
Text book (s) :								
1	Singiresu, S.Rao., “Mechanical Vibrations”, Pearson Education, 2010							
2	Kewal Pujara, “Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992							
Reference(s) :								
1	Bernard Challen and Rodica Baranescu, “Diesel Engine Reference Book” Second edition, SAE International,1999							
2	Julian Happian-Smith, “An Introduction to Modern Vehicle Design” Butterworth-Heinemann, 2004							
3	John Fenton, “Handbook of Automotive body Construction and Design Analysis” Professional Engineering Publishing, 1998							

K.S.Rangasamy College of Technology Autonomous Regulation			R 2010
Department	Mechanical Engineering	Program code & Name	ME : B.E. Mechanical Engineering

Elective I

Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E12	RENEWABLE SOURCES OF ENERGY	3	0	0	3	50	50	100

Objective(s)	To know detailed information about the renewable energy sources and their applications and impart knowledge on the environmental aspects of renewable energy sources.

1	INTRODUCTION	Total Hrs	8

World energy use – Reserves of energy resources – Environmental aspects of energy utilization – Renewable energy scenario in India – Potentials – Achievements – Applications

2	SOLAR ENERGY	Total Hrs	10

Solar thermal – Flat plate and concentrating collectors – Solar heating and cooling techniques – Solar desalination – Solar Pond – Solar cooker – Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

3	WIND ENERGY	Total Hrs	8

Wind data and energy estimation – Types of wind energy systems – Performance – Details of wind turbine generator – Safety and Environmental Aspects.

4	BIOMASS ENERGY	Total Hrs	8

Biomass direct combustion – Biomass gasifier – Biogas plant – Ethanol production – Bio diesel – Cogeneration – Biomass applications.

5	OTHER RENEWABLE ENERGY SOURCES	Total Hrs	11

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Fuel cell systems.

Total hours to be taught	45

Text Book (s):

1	G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2010.
2	S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008

Reference(s) :

1	Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 2004.
2	Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 2nd Edition, 2005.
3	G.N. Tiwari, “Solar Energy – Fundamentals Design, Modeling and applications”, Narosa Publishing House, New Delhi, 2003.
4	L.L. Freris, “Wind Energy Conversion systems”, Prentice Hall, UK, 1990.
5	Johnson Gary, L., “Wind Energy Systems”, Prentice Hall, New York, 2001

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E13	CRYOGENIC ENGINEERING	3	0	0	3	50	50	100
Objective(s)	To enhance students' knowledge of theoretical and modern technological aspects in Cryogenic Engineering, enable the students to correlate the theoretical principles with application oriented studies.							
1	INTRODUCTION TO CRYOGENIC SYSTEMS				Total Hrs	9		
Mechanical Properties at low temperatures – Properties of cryogenic fluids. Gas Liquefaction: Minimum work for liquefaction – Methods to produce low temperature – Liquefaction systems for gases other than Neon, Hydrogen and Helium								
2	LIQUEFACTION SYSTEMS				Total Hrs	9		
Liquefaction systems for Neon, Hydrogen and Helium Components of Liquefaction systems – Heat Exchangers – Compressors and Expanders – expansion valve – Losses for real machines								
3	GAS SEPARATION AND PURIFICATION SYSTEMS				Total Hrs	9		
Gas separation and purification systems – Properties of mixtures – Principles of mixtures – Principles of gas separation – Air separation systems								
4	CRYOGENIC REFRIGERATION SYSTEMS				Total Hrs	9		
Cryogenic Refrigeration Systems – Working media – Solids, Liquids and gases. Cryogenic fluid storage & transfer – Cryogenic storage systems – Insulation – Fluid transfer mechanisms – Cryostat – Cryo Coolers								
5	APPLICATIONS OF CRYOGENIC REFRIGERATION SYSTEMS				Total Hrs	9		
Applications – Space technology – In-flight air separation and collection of LOX – Gas Industry – Biology – Medicine - Electronics								
Total hours to be taught						45		
Text Book (s):								
1.	Cryogenic Systems – R.F. Barron, Oxford University Press							
Reference (s) :								
1	Cryogenic Research and Applications – Marshall Sitting, Von Nostrand Inc, New Jersey							
2	Cryogenics Engineering Edit by B.A.Hands, Academic Press, 1986							
3	Cryogenics Engineering – R. B. Scott, Von Nostrand Inc, New Jersey, 1959							
4	Experimental Techniques in Low Temperature Physics – G.K. White, Oxford Press, 1968							
5	Cryogenics process Engineering – K.D.Timmerhaus & TM Flynn, Plenum press, 1998							
6	Cryogenic Heat Transfer - R.F. Baron.							
7	Cryogenic Two Phase flow – N.N . Falina and J.G. Weisend –II							
8	Cryogenic Regenerative Heat Exchangers – Robort Ackermann, Plenum Press, 1997							
9	Cryogenic Engineering – Thomas M. Flynn							
10	Safety in Handling of Cryogenic Fluids – Fredrick J. Edeskutty and Watter F. Stewart, Plenum Press, 1996							
11	Hand Book of Cryogenic Engineering – J.G.Weisend –II, Taylor and Francis, 1998							

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2010</td></tr>
<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="10">Elective I</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME E14</td><td colspan="2">DESIGN OF HEAT EXCHANGERS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="9">To build up necessary background for the design of various types of heat exchangers. To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.</td></tr>
<tr><td>1</td><td colspan="6">DESIGN METHODS OF HEAT EXCHANGES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Introduction, Arrangement of flow path in heat exchangers, Basic equations in design, Overall heat transfer coefficient, Log mean temperature difference method for heat exchanger analysis, The effectiveness-NTU method for heat exchanger analysis, Heat exchanger design calculation, Variable overall heat transfer coefficient , Heat exchanger design methodology.</td></tr>
<tr><td>2</td><td colspan="6">CLASSIFICATION OF HEAT EXCHANGERS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Introduction; Recuperation and regeneration, Transfer processors, Geometry of construction – tubular heat exchangers, plate heat exchangers, extended surface heat exchanges, Heat transfer mechanisms, Flow arrangements, Selection of heat exchangers.</td></tr>
<tr><td>3</td><td colspan="6">SHELL AND TUBE HEAT EXCHANGERS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Introduction, Basic components – shell types, tube bundle types, tubes and tube passes, tube layout, baffle type and geometry, allocation of streams, Basic design procedure of a heat exchanger – preliminary estimation of unit size, rating of preliminary design, Shell-slide heat transfer and pressure drop – shell-side heat transfer coefficient, shell-side pressure drop, tube-side pressure drop.</td></tr>
<tr><td>4</td><td colspan="6">COMPACT HEAT EXCHANGERS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Introduction, Plate-fin heat exchangers, tube-fin heat exchangers, Heat transfer and pressure drop – heat transfer, pressure drop for finned-tube exchangers, pressure drop for plate-fin exchangers.</td></tr>
<tr><td>5</td><td colspan="6">CONDENSERS, EVAPORATORS AND COOLING TOWERS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Introduction, Shell and Tube condensers, Steam turbine exhaust condensers, Plate condensers, Air cooled condenser, Direct contact condenser, Design and operational considerations, Condensers for refrigeration and air conditioning, Evaporators for refrigeration and air conditioning. Cooling Towers – Introduction, Spray design, Selection of pumps, Fans and Pipes, Testing and Maintenance.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="10">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="9">Arthur P. Fraas, “Heat Exchanger Design” 2nd Edition, Wiley India Pvt. Ltd, 2011.</td></tr>
<tr><td>2</td><td colspan="9">Sadik Kakac and Hongtan Liu, "Heat Exchangers", CRC Press, 1997.</td></tr>
<tr><td colspan="10">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="9">J.P. Gupta, Fundamentals of heat exchangers and pressure vessel technology, Hemisphere publishing corporation, Springer-Verlag (outside NA), 1986</td></tr>
<tr><td>2</td><td colspan="9">T.Taborek, G.F.Hewitt and N.Afgan, Heat Exchangers, Theory and Practice, McGraw-Hill Book Co.1980.</td></tr>
<tr><td>3</td><td colspan="9">Ramesh K. Shah, Dusan P. Sekulic, “Fundamentals of Heat Exchanger Design”, John Wiley & Sons, 2003.</td></tr>
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<tr><td colspan="9">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2010</td></tr>
<tr><td colspan="2">Department</td><td colspan="3">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME : B.E. Mechanical Engineering</td></tr>
<tr><td colspan="10">Elective I</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td colspan="3" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME E15</td><td colspan="3">MAINTENANCE ENGINEERING</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="8">To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities, to explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements
and to illustrate some of the simple instruments used for condition monitoring in industry.</td></tr>
<tr><td>1</td><td colspan="5">PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING</td><td colspan="2">Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="10">Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity- Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT Factors of availability – Maintenance organization – Maintenance economics.</td></tr>
<tr><td>2</td><td colspan="5">MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.</td></tr>
<tr><td>3</td><td colspan="5">CONDITION MONITORING</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.</td></tr>
<tr><td>4</td><td colspan="5">REPAIR METHODS FOR BASIC MACHINE ELEMENTS</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.</td></tr>
<tr><td>5</td><td colspan="5">REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT</td><td colspan="2">Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="10">Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="10">Text Book(s):</td></tr>
<tr><td>1</td><td colspan="9">Srivastava S.K., “Industrial Maintenance Management”, - S. Chand and Co., 2005.</td></tr>
<tr><td>2</td><td colspan="9">Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995.</td></tr>
<tr><td colspan="10">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="9">Armstrong, “Condition Monitoring”, BSIRSA, 1988.</td></tr>
<tr><td>2</td><td colspan="9">Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.</td></tr>
<tr><td>3</td><td colspan="9">Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.</td></tr>
<tr><td>4</td><td colspan="9">Higgins L.R., Mobley.K, Kaith Mobley.R “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 2001.</td></tr>
<tr><td>5</td><td colspan="9">White E.N., “Maintenance Planning”, Control and Documentation, Gower Press, London, 1979.</td></tr>
<tr><td>6</td><td colspan="9">“Advances in Plant Engineering and Management”, Seminar Proceedings - IIPE, 1996.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E16	THERMAL TURBO MACHINES	3	0	0	3	50	50	100
Objective(s)	To instill the working principles, performance and applications of Turbo machines, energy transfer process in Turbo machines and governing equations of various forms, structural and functional aspects of major components and applications.							

1	INTRODUCTION	Total Hrs	9

Basics of isentropic flow - diffuser and nozzle configurations - static and stagnation properties - area ratio - mass flow rate - critical properties - operating characteristics of diffuser and Nozzle. Various types of subsonic and supersonic inlets. Basics of Fanno and Rayleigh flow. Basics of normal and oblique shock waves. Use of gas tables. Energy transfer between fluid and rotor velocity triangles for a generalized turbo machine - methods of representing velocity diagrams - Euler turbine equation and its different forms - degree of reaction in turbo-machines - various efficiencies - isentropic, mechanical, thermal, polytropic etc.

2	CENTRIFUGAL AND AXIAL FLOW COMPRESSORS	Total Hrs	9

Centrifugal compressor - configuration and working - slip factor - work input factor - ideal and actual work - pressure coefficient - pressure ratio. Axial flow compressor - geometry and working - velocity diagrams - ideal and actual work - stage pressure ratio - free vortex theory - performance curves.

3	COMBUSTION CHAMBER	Total Hrs	9

Basics of combustion and chamber - chamber arrangements - flame stability - fuel injection nozzles. Swirl for stability - cooling of combustion chamber.

4	AXIAL AND RADIAL FLOW TURBINES	Total Hrs	9

Elementary theory of axial flow turbines - stage parameters- multi-staging - stage loading and flow coefficients - degree of reaction - stage temperature and pressure ratios - single and twin spool arrangements - performance. Matching of components. Blade Cooling. Radial flow turbines.

5	GAS TURBINE AND JET ENGINE CYCLES	Total Hrs	9

Gas turbine cycle analysis - simple and actual - Reheater, Regenerator and Intercooled cycles. Working principles of Turbojet, Turbofan, Turboprop, Ramjet, Scarmjet and Pulsejet Engines and cycle analysis - thrust, specific impulse, sfc, thermal and propulsive efficiencies.

Total hours to be taught	45

Text book (s) :

1. Khajuria P.R and Dubey S.P., Gas Turbines and Propulsive Systems, Dhanpat Rai Publications, 2003.
2. Ganesan, V., “Gas Turbines”, Tata Mc GrawHill, 1999.

Reference(s) :

1. Cohen, H., Rogers, G F C and Saravanmotto, H I H, Gas Turbine Theory, John Wiely, 5th Edition 2001.
2. Hill P G and Peterson C R, Mechanics and Thermodynamics of Propulsion, Addition-Wesley, 1970.
3. Mattingly J D, Elements of Gas Turbine Propulsion, McGraw Hill, 1st Edition. 1997.

K.S.Rangasamy College of Technology - Autonomous Regulation									R 2010
Department	Mechanical Engineering		Programme Code & Name		ME : B.E. Mechanical Engineering				
Elective I									
Course Code	Course Name	Hours / Week			Credit	Maximum Marks			
		L	T	P	C	CA	ES	Total	
10 ME E17	FUNDAMENTALS OF IT	3	0	1	3	50	50	100	
Objective(s)	To introduce the fundamentals of computer hardware and system software and to introduce basic TDBMS concepts.								
1	COMPUTER ARCHITECTURE AND SYSTEM SOFTWARE				Total Hrs	9			
Fundamentals of Computer Architecture – Organization of Small Computer – Execution of the Instructions – Input/output Devices – Measure of CPU Performance – Addressing modes – System Software – Assemblers – Loaders and linkers – Compilers and interpreters.									
2	OPERATING SYSTEMS AND COMPUTER NETWORKS				Total Hrs	9			
Operating system – memory management – Process management – File System Management – File Permissions – New Technology File System – Device Management – Computer Networks – Motivation and need for Computer Networks – Network topology – The OSI model – Important Routing devices – Types of Networks.									
3	RDBMS AND DATABASE DESIGN				Total Hrs	9			
Introduction to DBMS – data processing – the database technology – data models – RDBMS – ER modeling concept – Notations – Normalization – Need for Normalization – Process of Normalization – Types of Normal forms.									
4	SQL				Total Hrs	9			
SQL – The purpose of SQL – History of SQL – Data types – Statement Types – DDL statements – DML statements – Views – DCL statements – Embedded SQL – Best Practices.									
5	OLTP CONCEPTS				Total Hrs	9			
OLTP – Purpose – Transaction – Transaction Systems – Transaction Properties – Requirements for an OLTP System – Locks – Granularity of Locking – Intent Looking – Dead Lock – Time stamping – Security & Recovery Transaction log.									
Total hours to be taught						45			
Text book (s) :									
1	Foundation Program Books Vol-1 and Vol-2, Infosys.								
Reference(s) :									
1	Andrew S. Tanenbaum, “Structured Computer Organization”, PHI, 3rd ed., 1991.								
2	Silberschatz and Galvin, Operating System Concepts, 4th ed., Addision-Wesley, 1995.								
3	Henry F Korth, Abraham Silberschatz, Database System Concept, 2nd edition, McGraw-Hill International editions, 1991.								

Modules	10 ME E11 - Vibration and Noise Control Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Defend the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
2.	Analyze the mathematical model of a linear vibratory systems its response.
3.	Outline the various vibration controlling techniques.
4.	Apply the fundamental concepts in noise and vibration control engineering
5.	Analyze the sound fields and to determine the effects of different noise sources in machinery and engineered products with respect to human behavior and safety.
6.	Choose the concepts in order to design machines or products that are quiet and functional.
7.	Describe the basics of noise control techniques.
8.	Identify and correct potentially hazardous sound levels in the workplace or in any other noisy environment.
9.	Define the physiological and subjective responses of humans exposed to noise and vibration, quantify the exposure and assess the response.
10.	Apply the engineering and other methods for controlling exposure to noise and vibration.

Modules	10 ME E12 - Renewable Sources of Energy Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Discuss the importance of energy and availability and applications of energy in India.
2.	Choose the importance of renewable energy and availability and applications of renewable energy in India.
3.	Recognize the concepts of solar energy collectors and the applications of solar energy.
4.	Describe the working principle of solar power plant, photo voltaic conversion and solar cells.
5.	Categorize the availability and the conversion method of wind energy.
6.	Explain the performance of wind energy conversion system's turbine and generators with environmental impacts.
7.	Categorize the availability and the conversion method of biomass energy..
8.	Choose the method of producing biogas, ethanol and bio diesel.
9.	List the contributions of tidal energy, wave energy, ocean thermal energy and geothermal energy in energy utilization.
10.	Outline the working principle of open and closed ocean thermal energy conversion system and geothermal energy conversion system.

Modules	10 ME E13 - Cryogenic Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Define the mechanical properties materials at low temperatures
2.	Draw the schematic diagram and explain the gas liquefaction system.
3.	Identify the steps in the liquefaction systems for Neon, Hydrogen and Helium.
4.	Compare the liquefaction systems
5.	Compare the gas separation and purification systems
6.	Distinguish between the air and gas separation
7.	Explain the cryogenic refrigeration systems, working media, solids, liquids and gases.
8.	Outline the Cryogenic fluid storage and its transfer.
9.	List the applications of cryogenic fluids to gas and biological industries.
10.	List the applications of LOX in space, medicine and electronic industries.

Modules	10 ME E14 - Design of Heat Exchangers Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Formulate the basic equations in the design of heat exchangers.
2.	Perform the calculation on design of heat exchangers.
3.	Classify and draw the schematic diagram and explain the operation of heat exchangers.
4.	Explain the concept of selection of heat exchangers.
5.	Outline the various types of heat exchangers and its geometry.
6.	Perform the various calculations on shell-side heat transfer.
7.	Perform the calculations on plate-fin heat exchangers and tube-fin heat exchangers,
8.	Evaluate the pressure drop for finned tube and plate fin exchangers.
9.	Carryout the design calculations on various types of condensers.
10.	Carryout the design calculations on various types of evaporators.

Modules	10 ME E15 - Maintenance Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Analyze the basics of maintenance engineering, its scope, objectives, principle, benefits and limitations.
2.	Categorize the various reliability measures such as MTTF, MTBF, MWT factors of availability, failure rate, Bathtub curve, etc.
3.	Interpret the maintenance categories and compare them in various industry sectors.
4.	Analyze the basics of lubrication theory and its various types.
5.	Compare and evaluate the various cost with and without the application of condition monitoring.
6.	Manipulate the various methods and instruments used for condition monitoring.
7.	Demonstrate the various repair methods used for various mechanical components.
8.	Compare the various types of failure and identify the different types of elements which are used for analyzing the failures.
9.	Describe the various types of repair methods which are used for repairing material handling equipments.
10.	Make the judgment about the job order systems, records and incorporation of computers in maintenance.

Modules	10 ME E16 - Thermal Turbo Machines Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the importance of isentropic process and its usage in diffuser and nozzle.
2.	Explain the concepts of energy transfer in velocity diagram, efficiencies of turbo machine with isentropic, mechanical, thermal and polytrophic.
3.	Describe the configuration, working principle and performance of centrifugal compressors.
4.	Outline the configuration, working principle and performance of axial flow compressors.
5.	Recall the basics of combustion and flame stability.
6.	Explain the construction of combustion chamber and chamber arrangements.
7.	Describe the basics of axial flow turbines and the performance of multi stage turbine.
8.	Predict the usage and performance of spool arrangement, matching components and redial flow turbines.
9.	Derive the gas turbine cycles.
10.	Apply the working principles of turbojet, turbofan, turboprop, ramjet, scramjet and pulsejet engines in real time applications.

Modules	10 ME E17 - Fundamentals of IT Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Point out the specification of instructions and how the hardware unit implements those instructions.
2.	List the various system software and their application.
3.	Explore the various operating system and its functions.
4.	Categorize the OSI layer and types of networks.
5.	Analyze the various data models such as E-R model, relational model, etc..
6.	Design a data base using various normal forms.
7.	List the purpose of SQL.
8.	Define the concepts of data manipulation language, data definition language, data control language and data transaction language and applying queries for retrieving data from the database.
9.	Explain the data transaction concepts with transaction properties.
10.	Point out the various locking methods.

<table>
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<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="2">ME : B.E. Mechanical Engineering</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME E21</td><td>REFRIGERATION AND AIR-CONDITIONING</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To integrate the thermodynamic concepts into the analysis of refrigeration cycles, give awareness to students on parameter to be considered for designing Refrigeration and Air Conditioning and enable the student to design air conditioning system for building.</td></tr>
<tr><td>1</td><td colspan="4">REFRIGERATION CYCLE</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Review of thermodynamic principles of refrigeration. Concept of Aircraft refrigeration system. Vapour compression refrigeration cycle - use of p-h charts - multistage and multiple evaporator systems - cascade system - COP comparison. Vapor absorption refrigeration system, Ammonia water and Lithium Bromide water systems. Steam jet refrigeration system.</td></tr>
<tr><td>2</td><td colspan="4">REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Compressors - reciprocating and rotary (elementary treatment.) - Condensers - evaporators - cooling towers. Refrigerants - properties - selection of refrigerants, Alternate Refrigerants, Refrigeration plant controls - testing and charging of refrigeration units. Balancing of system components. Applications to refrigeration systems - ice plant - food storage plants - milk -chilling plants – refrigerated cargo ships.</td></tr>
<tr><td>3</td><td colspan="4">PSYCHROMETRY</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Psychrometric processes- use of psychrometric charts - Grand and Room Sensible Heat Factors - bypass factor - requirements of comfort air conditioning - comfort charts - factors governing optimum effective temperature, recommended design conditions and ventilation standards.</td></tr>
<tr><td>4</td><td colspan="4">COOLING LOAD CALCULATIONS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Types of load - design of space cooling load - heat transmission through building - Solar radiation, infiltration, internal heat sources (sensible and latent), outside air and fresh air load, estimation of total load. Domestic, commercial and industrial systems - central air conditioning systems.</td></tr>
<tr><td>5</td><td colspan="4">AIR-CONDITIONING AND COMPONENTS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Air conditioning equipments – air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser – cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems. Applications: car, industry, stores, and public buildings.</td></tr>
<tr><td colspan="6">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1995.</td></tr>
<tr><td>2</td><td colspan="7">Arora C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 2006.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Roy.J Dossat, “Principles of Refrigeration”, Pearson Education 2001.</td></tr>
<tr><td>2</td><td colspan="7">Jordon and Prister, “Refrigeration and Air Conditioning”, Prentice Hall of India PVT Ltd., New Delhi, 1985.</td></tr>
<tr><td>3</td><td colspan="7">Stoecker N.F and Jones, "Refrigeration and Air Conditioning", TMH, New Delhi, 1983.</td></tr>
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		L	T	P	C	CA	ES	Total
10 ME E22	QUALITY CONTROL AND RELIABILITY ENGINEERING	3	0	0	3	50	50	100
Objective(s)	To understand the Quality concepts and principles and the various tools available to achieve Quality, the statistical approach for quality control. Create awareness about reliability and its need for the industries.							
1	FUNDAMENTALS OF QUALITY CONTROL				Total Hrs	9		
Definition of Quality- Method of control, chance, causes, assignable causes, SQC benefits and limitations. Quality assurance, Quality management, quality control, quality circles, fundamental concepts, normal curve, measure of dispersion, Distributions: Binomial, Poisson, Geometric, Hyper geometric, Gamma distribution. Poisson as an approximation to the binomial, normal, approximation to the Binomial. Review of Probability theorems.								
2	THEORY OF CONTROL CHARTS				Total Hrs	9		
Sample as an estimate of universal process control, control charts for variables – X bar and R charts, standard deviation charts, run up and run down ,process capability studies ,control charts for attributes ,fraction defective and number of defective charts, chart sensitivity, control charts for non conformities-C and U charts.								
3	ACCEPTANCE SAMPLIING				Total Hrs	9		
Fundamental concepts and terms, OC curves, AQL, LTPD, AOQL sampling plans, Simple, double, multiple and sequential sampling plans, stratified sampling for variables, Dodge –Roming sampling plans, bulk sampling- problem using Dodge – Roming and BIS code books – A case study in an industry.								
4	FUNDAMENTALS OF RELIABILITY				Total Hrs	9		
Definition, mean fracture rate, mean time to failure, meantime between failure, hard rate, hazard models. Constant hazard, linearly increasing hazard, weibull model, system reliability, series, parallel, and mixed configuration, simple problems.								
5	RELIABILITY IMPROVEMENT				Total Hrs	9		
Reliability improvement, redundancy, element, unit and stand by redundancy, reliability allocation for a series system, maintainability and availability, system down time, reliability and maintainability trade - off, simple problems.								
Total hours to be taught						45		
Text book (s) :								
1	Grantt, “Statistical Quality Control”, Mc Graw Hill, ISE.,1998							
2	Srinath L.S., “Concepts in Reliability Engineering”, Eastwest Press Ltd., New Delhi, 1991							
Reference(s) :								
1	Jerry Banks, “Principles of Quality Control”, John Wiley, 1990							
2	Montgomery D.C., “Introduction to Statistical Quality Control”, John Wiley, 2008							
3	Gupta R.C., “Statistical Quality Control”, Khanna Publishers, 8th Edition,2008							

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10 ME E23	UNCONVENTIONAL MACHINING PROCESSES	3	0	0	3	50	50	100
Objective(s)	This course will give a good perspective with adequate depth to understand the unconventional machining processes; its relative advantages were conventional techniques.							

1	INTRODUCTION	Total Hrs	7
Unconventional machining Process-Need-clarification- Brief Overview.			
2	MECHANICAL ENERGY BASED PROCESSES	Total Hrs	10
Abrasive Jet Machining-Water Jet Machining-Ultrasonic Machining.(AJM,WJM and USM). Working Principles-equipment used-Process parameters-MRR-Variation in techniques used-Applications.			
3	ELECTRICAL ENERGY BASED PROCESSES	Total Hrs	8
Electric Discharge Machining (EDM)-working Principles-equipments-Process Parameters-MRR-electrode/Tool-Power Circuits-Tool Wear-Dielectric-Flushing-Wire cut EDM-Applications.			
4	CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES	Total Hrs	10
Chemical machining (CM) - Etchants Maskant- techniques of applying maskants -process parameters-MRR-Applications. Electro-Chemical machining and finishing (ECM, ECG and ECH) - Principles -equipments- Process Parameters – MRR - Electrical circuit and applications.			
5	THERMAL ENERGY BASED PROCESSES	Total Hrs	10
Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types - Applications.			
Total hours to be taught			45

Text book (s) :

1	Vijay. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2009.

Reference(s) :

1	Benedict.G.F.”Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York, 1987.
2	Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2008.
3	Me Geough,”Advanced Methods of Machining” Chapman and Hall, London, 1988.
4	Paul De Garmo, J.T.Black, and Ronald A.Kosher, “Material and Processes in Manufacturing” Wiley, 2003

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<tr><td colspan="2">10 ME E24</td><td colspan="2">PRODUCTION PLANNING AND CONTROL</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control. To know the recent trends like manufacturing requirement planning (MRP II) and Enterprise Resource Planning (ERP).</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Objectives and benefits of planning and control-Functions of production control-Types of production-job-batch and continuous-Product development and design-Marketing aspect-Functional aspects-Operational aspect- Durability and dependability aspect-aesthetic aspect. Profit consideration-Standardization, Simplification and specialization-Break even analysis-Economics of a new design.</td></tr>
<tr><td>2</td><td colspan="5">WORK STUDY</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Method study, basic procedure – Selection-Recording of process-Critical analysis, Development-Implementation-Micro motion and memo motion study-work measurement-Techniques off work measurement-Time study –Production study –Work sampling from standard data-Predetermined motion time standards.</td></tr>
<tr><td>3</td><td colspan="5">PRODUCTION PLANNING AND PROCESS PLANNING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Production planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process Planning and rounting-pre requisite information needed for process planning-steps in process planning-quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.</td></tr>
<tr><td>4</td><td colspan="5">PRODUCTION SCHEDULING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Production control systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems-Line of balance-Flow production scheduling-Batch production scheduling-Product sequencing-Production control system-Periodic batch control-Material requirement planning. Kanban - Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.</td></tr>
<tr><td>5</td><td colspan="5">INVENTORY CONTROL AND RECENT TRENDS IN PPC</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system-Ordering cycle system-P and Q system -ABC analysis - Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS- Fundamentals of MRP-II and ERP.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Martand Telsang, “Industrial Engineering and Production Management, S.Chand and Company, First edition,2000</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1</td><td colspan="8">Samson Eilon, “ Elements of production planning and control”, Universal book corpn.1984</td></tr>
<tr><td>2</td><td colspan="8">Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production/Operations Management”, 8th Ed. John Wiley and Sons,2000.</td></tr>
<tr><td>3</td><td colspan="8">K.C.Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers, 1990</td></tr>
<tr><td>4</td><td colspan="8">N.G.Nair, “Production and Operations Management”, Tata McGraw-Hill, 1996.</td></tr>
<tr><td>5</td><td colspan="8">S.N.Chary, “Theory and Problems in Production & Operations Management”, Tata McGraw hill, 1995.</td></tr>
<tr><td>6</td><td colspan="8">S.K.Hajra Choudhury, Nirjhar Roy and A.K. Hajra Choudhury, “Production Management”, Media Promoters and Publishers Pvt.Ltd., 1998.</td></tr>
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<tr><td colspan="2">10 ME E25</td><td colspan="2">AIRCRAFT SYSTEMS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">• To understand the basics of aircraft, mechanical, electrical systems in aircrafts.
• To understand the basic principle of aircraft and flight mechanics.</td></tr>
<tr><td>1</td><td colspan="5">AIRCRAFT INDUSTRY OVERVIEW AND INTRODUCTION TO AIRCRAFTS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Evolution and History of Flight, Global and Indian Aircraft Scenario, Key Players in Aerospace Industry, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Aerospace Manufacturing. Types of Aerospace Industry, Basic components of an Aircraft, Aircraft Axis System, Aircraft Motions. Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts, Tail Unit Arrangements and Landing Gear Arrangements.</td></tr>
<tr><td>2</td><td colspan="5">INTRODUCTION TO AIRCRAFT SYSTEMS: MECHANICAL</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Types of Aircraft Systems. Mechanical Systems. Electrical and Electronic Systems. Auxiliary systems. Mechanical Systems: Pneumatic systems, Hydraulic systems, Fuel systems, Engine Control Systems, Environmental control systems (ECS), Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems.</td></tr>
<tr><td>3</td><td colspan="5">INTRODUCTION TO AIRCRAFT SYSTEMS: ELECTRICAL</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Electrical systems: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System</td></tr>
<tr><td>4</td><td colspan="5">BASIC PRINCIPLES OF FLIGHT</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects.
Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag,</td></tr>
<tr><td>5</td><td colspan="5">BASICS OF FLIGHT MECHANICS</td><td colspan="2">Total Hrs</td><td>8</td></tr>
<tr><td colspan="8">Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects Stability and Control: Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves Aircraft Performance and Maneuvers: Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on a Aeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">A.C Kermode, "Flight without Formulae", Pearson Education India, 1989.</td></tr>
<tr><td>2</td><td colspan="7">A.C Kermode, "Mechanics of Flight", Pearson Education India, 10th Edition, 1989.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">R. S. Shevell, "Fundamentals of Flight", Prentice Hall, 2nd Edition, 1988.</td></tr>
<tr><td>2</td><td colspan="7">John David Anderson. "Introduction to Flight", McGraw-Hill Higher Education, 2005.</td></tr>
<tr><td>3</td><td colspan="7">Ian Moir, Allan Seabridge, "Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration", John Wiley & Sons Ltd., Third Edition, 2008.</td></tr>
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10 ME E26	IT ESSENTIALS	3	0	0	3	50	50	100
Objective(s)	To introduce and various essential concepts of IT							

1	ANALYSIS OF ALGORITHMS	Total Hrs	9
Introduction of ADA – Code Tuning Techniques – Analysis of Algorithms – Analysis of Some Known Algorithms – Algorithmic Techniques – Linear search – Binary search – Bubble sort – Quick sort – Merge sort – Selection sort – Insertion sort – Intractable Problems.			
2	OBJECT ORIENTED CONCEPTS	Total Hrs	9
Introduction to Object oriented concepts – Advanced concepts in Object oriented technology – relationship – Inheritance – Abstract classes – Polymorphism – Object oriented design methodology – Recent trends in OO Technology.			
3	SYSTEM DEVELOPMENT METHODOLOGY	Total Hrs	9
System Development Methodology – Evolution of Software – Software Development Models – Requirement Analysis and Design – Software Construction – Software Testing – Software Quality.			
4	CLIENT SERVER CONCEPTS	Total Hrs	9
Client server computing – Back Ground – Client Server Technologies – Middle ware technologies – Introduction to Web Technology.			
5	WEB TECHNOLOGIES & USER INTERFACE DESIGN	Total Hrs	9
The world wide web – Web Application – Security in Applications – issues in web based application – Introduction to User interface Design (UID) – The elements of UID –UID Tips and techniques – Good Vs Bad User Interface – Reports.			
Total hours to be taught			45

Text book (s) :

1	Foundation Program Books Vol-2 and Vol-3, Infosys.

Reference(s) :

1	Brad J.Cox, Andrew J.Novobilski, Object Oriented Programming – An evolutionary approach, Addison Wesley, 1991
2	Alfred V.Aho, John E.Hopcroft, Jeffrey D.Ullman, Design and Analysis of Computer Algorithms, Addison Wesley Publishing Co., 1998
3	Rojer Pressman, Software Engineering-A Practitioners approach, McGraw Hill, 5th Edition, 2001
4	Wilbert O.Galitz, Essential Guide to User Interface Design, John Wiley, 1997
5	Alex Berson, Client server Architecture, Mc Grew Hill International, 1994
6	Dromey R.G., How to solve it by Computers, PHI, 1994

Modules	ME E21 - Refrigeration and Air-conditioning Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Evaluate the performance of the vapour compression refrigeration system.
2.	Draw the schematic diagram and explain the operation of aqua ammonia and water - lithium bromide.
3.	Describe the types of compressors, condensers, evaporators, expansion valve and cooling towers.
4.	Distinguish the desirable properties of refrigerants and select the alternate refrigerants.
5.	Perform the calculations for various psychrometric process using psychrometric chart and equations.
6.	Perform the calculations to find effective and grand sensible heat factor.
7.	Estimate the total load for domestic, industrial and central air-conditioning systems.
8.	Name the elements of a typical heating ventilation and air-conditioning systems.
9.	Explain the working of a typical air conditioning system with the help of schematic diagram.
10.	Explain the important requirements of an air-conditioning duct and the general rules to be followed.

Modules	10 ME E22 - Quality Control and Reliability Engineering Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the concepts of quality, quality assurance, quality management and quality circles.
2.	Apply the binomial, poisson, geometric, hyper geometric and gamma distributions and probability theorems for quality control.
3.	Construct the control charts for variables – X bar and R charts and standard deviation charts.
4.	Plot control charts for attributes, fraction defective and number of defective charts, control charts for non-conformities, C and U charts.
5.	Apply the various sampling plans and stratified sampling for variables.
6.	Solve bulk sampling problem using Dodge – roming and BIS code books and can do a case study in an industry.
7.	Describe reliability concepts and Weibull model.
8.	Solve problems in system reliability, series, parallel, and mixed configuration.
9.	Improve reliability and perform reliability allocation for a series system.
10.	Solve simple problems in reliability, maintainability and availability.

Modules	10 ME E23 - Unconventional Machining Processes Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Differentiate the conventional and unconventional machining processes.
2.	Classify the unconventional machining processes based on energy consumption.
3.	Describe the concept of mechanical energy based processes.
4.	Analyze the process parameters of mechanical energy based processes.
5.	Explain the concept of electrical energy based processes.
6.	Identify the process parameters of electrical energy based processes.
7.	Define the chemical and electro-chemical machining processes.
8.	Identify the process parameters of chemical and electro-chemical machining processes.
9.	Describe the concept of thermal energy based processes.
10.	Analyze the process parameters of thermal energy based processes.

Modules	10 ME E24 - Production Planning and Control Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Discuss the various aspects to be considered while performing the product analysis.
2.	Apply the concept of standardization, simplification and specialization in product design.
3.	Describe the various steps involved in conducting the method study.
4.	Describe the various steps involved in conducting the time study.
5.	Apply the concept of principles and applications of value analysis.
6.	Describe the meaning of machine loading and machine balancing and its effects.
7.	List the functions of an effective production scheduling system.
8.	Solve the sequencing and assignment problems using Jonson algorithm.
9.	Evaluate the inventory problems and the effect of demand on inventories.
10.	Define the principle, objectives and basic elements of JIT system and functions of ERP.

Modules	10 ME E25 - Aircraft Systems Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Outline the overview of aircraft industry.
2.	Describe the basic components, types, axis system, motions, tail unit and landing gear arrangements in the aircraft system.
3.	Discuss the environmental control, pneumatic and hydraulic systems in the aircraft.
4.	Explain the Fuel, engine control, air-conditioning and protection systems in the aircraft.
5.	Outline the flight control and flight management systems.
6.	Describe the navigation and communication systems in the aircraft.
7.	Describe the basic principle of flight.
8.	Demonstrate the aerofoil in the aircraft systems.
9.	Explain the stability and control of aircraft systems.
10.	Discuss the performance and maneuvers of aircraft.

Modules	10 ME E26 - IT Essentials Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the fundamental concepts of procedural programming and object-oriented programming.
2.	Discover the fundamental properties of algorithmic techniques and its types.
3.	Explain the concept of intractability in a given problem.
4.	Recognize the basics concepts of inheritance, polymorphism, abstract classes, classes, their member variables, methods and interfaces.
5.	Realize the problems in software development and the evolution of software.
6.	Identify the fundamental functions of software development life cycle models recognize the different approaches to testing, test plan design and execution.
7.	List the quality concepts, International Quality Standard and Capability Maturity Model.
8.	Discover the fundamental concepts of client server model with host centric and isolated computing model.
9.	Point out the fundamental concepts of web technology, networking, internet and world wide web.
10.	Discover the user interface issues in software development and identify the user interface design techniques

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Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E31	INDUSTRIAL TRIBOLOGY	3	0	0	3	50	50	100
Objective(s)	The course is aimed at developing the basic knowledge on tribological aspects of engineering fields. The topics introduced will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics.							
1	SURFACES AND FRICTION				Total Hrs	9		
Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction – Adhesion – Ploughing - Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction – Stick slip motion - Measurement of Friction.								
2	WEAR				Total Hrs	8		
Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals – Abrasive wear – Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture - wear - Wear of Ceramics and Polymers - Wear Measurements								
3	LUBRICANTS AND LUBRICATION TYPES				Total Hrs	10		
Types and properties of Lubricants - Testing methods – Concepts of Hydrodynamic, Hydrostatic, Elasto-hydrodynamic, and Boundary Lubrication. Thin film and thick film lubrication – Methods of lubrication – Semi solid and Solid Lubrication.								
4	FILM LUBRICATION THEORY				Total Hrs	10		
Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings – Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction – The Sommerfeld diagram.								
5	SURFACE ENGINEERING AND MATERIALS FOR BEARINGS				Total Hrs	8		
Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.								
Total hours to be taught						45		
Text book(s):								
1	A.Harnoy " Bearing Design in Machinery "Marcel Dekker Inc, New York, 2003							
2	Basu S.K. et. Al., "Fundamentals of Tribology" PHI Learning Private Limited, 2009.							
Reference(s) :								
1	M.M.Khonsari & E.R.Booser, " Applied Tribology", John Willey & Sons, New York,2001							
2	E.P.Bowden and Tabor.D, "Friction and Lubrication ", Heinemann Educational Books Ltd., 1974.							
3	A.Cameron, "Basic Lubrication theory ", Longman, U.K.., 1981.							
4	M.J.Neale (Editor), "Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1995.							

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<tr><td colspan="2">Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="3">ME: BE. Mechanical Engineering</td></tr>
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<tr><td colspan="2" rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td colspan="2">10 ME E32</td><td colspan="2">PROCESS PLANNING AND COST ESTIMATION</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">At the end of this course the student should be able to understand the traditional process planning and need methods of computer aided process planning, importance and procedure of costing, elements of costing, budgeting and decision making and the cost estimation of various manufacturing methods.</td></tr>
<tr><td>1</td><td colspan="5">PROCESS PLANNING</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Types of production, importance of process planning – steps involved in manual experienced Process Planning –need for CAPP – Variant and Generative approaches of CAPP- Future trend of CAPP.</td></tr>
<tr><td>2</td><td colspan="5">ESTIMATION AND COSTING</td><td colspan="2">Total Hrs</td><td>8</td></tr>
<tr><td colspan="9">Estimating – Importance, aims, function of estimating – Constituents of estimation – Estimating procedure – sources of errors – costing – Aims of costing – costing procedure – methods of costing – Advantages of efficient costing – Difference between estimating and costing.</td></tr>
<tr><td>3</td><td colspan="5">ELEMENTS OF COSTS</td><td colspan="2">Total Hrs</td><td>8</td></tr>
<tr><td colspan="9">Price determination – Elements of costs – Ladder of cost – Material cost Determination of direct material cost – Labour cost – Determination of direct labour cost- over heads – classification of overhead expenses – Depreciation- Methods of depreciation – Allocation of overhead expenses.</td></tr>
<tr><td>4</td><td colspan="5">COST ESTIMATION</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Estimation of Material cost – Estimation of process cost: Lathe operations, Milling operations, Grinding operations, Planning & shaping operations. Estimation in welding shop: Arc welding, Gas Welding, Flame cutting- Estimation of forging operations: Forging losses- Estimation in Foundry shop : pattern making , Moulding,</td></tr>
<tr><td>5</td><td colspan="5">COST ECONOMICS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Budget – Essentials of budgeting – Types of Budgets – Budgetary control – Objectives – Benefits – Measures of cost economics – Make or buy decision and Analysis.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text Book(s) :</td></tr>
<tr><td>1</td><td colspan="8">G.B.S.Narang and V.Kumar, “Production and Costing”, Khanna Publishers, New Delhi 1995.</td></tr>
<tr><td>2</td><td colspan="8">T.R.Banga and S.C.Sharma, “Estimating and Costing”, Khanna Publishers, New Delhi 1986</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">M.Adithan and B.S.Pabla, “Estimating and Costing”, Konark Publishers Pvt. Ltd., 1989.</td></tr>
<tr><td>2</td><td colspan="8">A.K.Chitale and R.C.Gupta, “Product Design and Manufacturing”, Prentice Hall Pvt. Ltd., 2005.</td></tr>
<tr><td>3</td><td colspan="8">Nanua Singh, “System approach to Computer Integrated Design and Manufacturing”, John Wiley & Sons, Inc., 1996.</td></tr>
<tr><td>4</td><td colspan="8">Joseph G.Monks, “Operations Management, Theory & Problems”, McGraw Hill Book Company, 1982.</td></tr>
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<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="4">ME : B.E. Mechanical Engineering</td></tr>
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<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td><td></td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME E33</td><td colspan="2">COMPOSITE MATERIALS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To impart knowledge on composite materials and their physical properties and behaviour. The modern material revolution in the world to produce low density, high strength, high stiffness to weight ratio used in application of spacecraft, aircraft and automobile. Mainly this study focuses on the mechanics, performance, manufacturing and design of composite materials.</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="9">Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic, Aramid and Natural fibers. Matrix –Selection of matrix- Epoxy, Polyester, Vinyl ester, Nylon, Ceramic and Metal Matrices –Fiber surface treatments, Glass Fiber and carbon fiber- Fillers and additives-Fiber content- density - void content.</td></tr>
<tr><td>2</td><td colspan="5">MECHANICS</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="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, coordinate 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.</td></tr>
<tr><td>3</td><td colspan="5">DESIGN</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="9">Failure Predictions, Unidirectional Lamina, Unnotched Laminates, Notched Laminates-Laminate Design Consideration, Design criteria, Design allowables, Design guidelines- Joint design-Bolted and Bonded Joints. Metal Matrix Composites-Mechanical Properties-Manufacturing process.</td></tr>
<tr><td>4</td><td colspan="5">PERFORMANCE</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="9">Static Mechanical Properties – Fatigue and Impact Properties –-damping properties-Environmental effects (thermal, degradation, creep) – fundamentals of Fracture Behavior of composites.</td></tr>
<tr><td>5</td><td colspan="5">MANUFACTURING</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="9">Preperg - Sheet Molding Compounds-Bag Molding – Compression Molding – Pultrusion – Filament Winding – Resin Transfer Molding - SRIM process - ERM process -Tube Rolling – Quality Inspection methods.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Mallick, P.K., “Fiber Reinforced Composites: Materials, Manufacturing and Design”, Marcel Dekker Inc, New York, 1993</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Kaw and Autar K, “Mechanics of Composite Materials”, CRC Press, London, 2006</td></tr>
<tr><td>2</td><td colspan="8">Agarwal, B.D. and Broutman, L.J., “Analysis and Performance of Fiber Composites”, John Wiley & Sons, New York, 1990</td></tr>
<tr><td>3</td><td colspan="8">Gibson and Ronald, “Principles of Composite Material Mechanics", Tata McGraw-Hill, New Delhi, 1994</td></tr>
<tr><td>4</td><td colspan="8">Chawla K.K, “Composite Materials and Engineering”, Springer Verlag, New York, 2nd Edition, 2008</td></tr>
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Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E34	ENERGY CONSERVATION IN THERMAL SYSTEMS	3	0	0	3	50	50	100
Objective(s)	To learn the present energy scenario and the need for energy conservation, learn the instruments suitable for energy auditing and study the various measures for energy conservation and financial implications for various thermal utilities.							

1	INTRODUCTION	Total Hrs	10

Energy Scenario – world and India. Energy Resources Availability in India. Energy consumption pattern. Energy conservation potential in various Industries and commercial establishments. Energy intensive industries – an overview. Energy conservation and energy efficiency – needs and advantages. Energy auditing – types, methodologies, barriers. Role of energy manager – Energy audit questionnaire – energy Conservation Act 2003.

2	INSTRUMENTS FOR ENERGY AUDITING	Total Hrs	8

Instrument characteristics – sensitivity, readability, accuracy, precision, hystersis. Error and calibration. Measurement of flow, velocity, pressure, temperature, speed, Lux, power and humidity. Analysis of stack, water quality, power and fuel quality.

3	THERMAL UTILITIES: OPERATION AND ENERGY CONSERVARTION	Total Hrs	9

Boilers-Thermic Fluid Heaters-Furnaces-Waste Heat Recovery Systems-Thermal Storage.

4	THERMAL ENERGY TRANSMISSION / PROTECTION SYSTEMS	Total Hrs	8

Steam traps – Refractories – Optimum insulation thickness – Insulation – Piping design.

5	POWER PLANT ECONOMICS	Total Hrs	10

Energy - production, transport and control, Load duration curves, load factor. Cost of electric energy, types of tariffs, electric power generation in India, basic problems on power generation. Power plant economics, cost, depreciation, Indian energy scenario, problems.

Total hours to be taught	45

Text book (s) :

1	Smith, CB Energy Management Principles, Pergamon Press, NewYork, 1981
2	Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980

Reference(s) :

1	Trivedi, PR, Jolka KR, Energy Management, Commonwealth Publication, New Delhi, 1997.
2	Write, Larry C, Industrial Energy Management and Utilization, Hemisphere Publishers, Washington, 1988.
3	Diamant, RME, Total Energy, Pergamon, Oxford, 1970.
4	Handbook on Energy Efficiency, TERI, New Delhi, 2001.

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<tr><td colspan="2">10 ME E35</td><td>INTERNAL COMBUSTION ENGINES</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To impart the knowledge in working process of spark ignition and compression ignition engines, Automobile pollution and its control, Pollution norms, Alternative fuels for I.C engines, Recent trends in I.C engines like learn burn engines, stratified charge engines, homogeneous charge ignition, plasma ignition and engine combustion.</td></tr>
<tr><td>1</td><td colspan="6">SPARK IGNITION ENGINES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Air-fuel mixture requirements - equivalence ratio - Feedback Control Carburetors - Injection systems –Mono-point and Multi-point injection - stages of combustion in SI engine- Normal combustion and Abnormal combustion-Factors affecting knock - Combustion equation-Combustion Chambers - Introduction to Thermodynamic analysis S.I. Engine combustion process.</td></tr>
<tr><td>2</td><td colspan="6">COMPRESSION IGNITION ENGINES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">States of combustion in C.I. Engine - Normal combustion and Abnormal combustion-Factors affecting Abnormal combustion - Combustion equation-Direct and indirect injection systems - Combustion chambers - Air motion-Fuel spray behavior - spray structure, spray penetration and evaporation - Turbo charging - Introduction to Thermodynamic Analysis of C.I. Engine combustion process</td></tr>
<tr><td>3</td><td colspan="6">POLLUTANT FORMATION AND CONTROL</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Pollutant - Sources and types - formation of NOx - Hydro-carbon Emission Mechanism - Carbon Monoxide Formation - Particulate emissions - Methods of controlling Emissions- Catalytic converters and Particulate Traps-Methods of measurements –Indian Driving cycles- Various norms of pollution.</td></tr>
<tr><td>4</td><td colspan="6">FUELS AND ALTERNATIVE FUELS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Fuels and types-Qualities of S.I and C.I engine fuels – Rating of S.I and C.I engine fuels- Need of alternative fuels-types- Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio-Diesel - Properties, Suitability, Engine Modifications, Merits and De-merits as fuels.</td></tr>
<tr><td>5</td><td colspan="6">RECENT TRENDS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Learn Burn Engies - Stratified charge Engines - Homogeneous charge compression Ignition - Plasma Ignition- Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine , Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">John B. Heywood, “Internal Combustion Engine Fundamentals", McGraw Hill, 2002.</td></tr>
<tr><td>2</td><td colspan="8">V.Ganesan, “Internal Combustion Engines”, Second Edition, Tata McGraw Hill, 2004</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Rowland S.Benson and N.D.Whitehouse,"Internal combustion Engines", Vol.I & II, Pergamon Press, 2004.</td></tr>
<tr><td>2</td><td colspan="8">Duffy Smith, “Auto fuel Systems", The Good Heart Willox Company, Inc., 2000.</td></tr>
<tr><td>3</td><td colspan="8">Dr.K.K.Ramalingam “Internal Combustion Engines Theory and Practice”, Scitech Publications (India) Pvt. Ltd., Chennai, 2002.</td></tr>
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Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E36	AIRCRAFT STRUCTURE DESIGN	3	0	0	3	50	50	100
Objective(s)	To understand the basics of aircraft structure and its design process, manufacturing processes. Also to analysis the aircraft structure.							

1	OVERVIEW AND FUNDAMENTALS OF AIRCRAFT STRUCTURE DESIGN PROCESS	Total Hrs	9

Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies. Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant's Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations.

2	INTRODUCTION TO AIRCRAFT STRUCTURES AND LOADS	Total Hrs	9

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints. Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads

3	AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES	Total Hrs	9

Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials, Use of Advanced materials Smart materials, Manufacturing of A/C structural members, Overview of Types of manufacturing processes for Composites, Sheet metal Fabrication ,Machining, Welding, Superplastic Forming And Diffusion Bonding.

4	STRUCTURAL ANALYSIS OF AIRCRAFT STRUCTURES	Total Hrs	9

Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear. Sample Exercises. Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, sample exercises Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. Sample Exercises. Theory of Torsion- Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, Sample Exercises.

5	AIRWORTHINESS AND AIRCRAFT CERTIFICATION AND AIRCRAFT STRUCTURAL REPAIR	Total Hrs	9

Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements. Types of Structural damage, Nonconformance, Rework,
Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices.

Total hours to be taught	45

Reference(s) :

1	Daniel P.Raymer, "Aircraft Design-A Conceptual Approach", AIAA education series,6th Edition.
2	Michael Niu , "Airframe Structural Design", Conmilit Press, 1988,2nd Edition
3	Michael Niu, "Airframe Stress Analysis and Sizing", Conmilit Press, 1999,3rd Edition
4	Roger D. Schaufele, "The Elements of Aircraft Preliminary Design" Aries Publications, 2000
5	Dale Hurst, "Aircraft Structural Maintenance" Avotek publishers, 2nd Edition, 2006
6	Frank Delp, Michael J. Kroes & William A. Watkins, Glencoe, "Aircraft Maintenance & Repair" Mc Graw-Hill, 6th Edition,1993
7	Filippo De Florio, Butterworth-Heinemann, "An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA "

Modules	10 ME E31 - Industrial Tribology Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Define the basic principles of tribology-friction, wear and lubrication.
2.	Explain the friction characteristic of metals and non-metals.
3.	Describe the importance and general concept of topography of engineering surfaces.
4.	Differentiate the different types of wear in sliding contacts.
5.	Assess the types of lubricants for Industrial applications.
6.	Explain the concepts of hydrodynamic, hydrostatic, elasto-hydrodynamic and boundary lubrication.
7.	Characterize the film lubrication theory in journal bearing.
8.	Implement the basic knowledge of surface modification process to reduce wear.
9.	Choose the materials for roller element bearing, fluid film bearings and dry bearings.
10.	Rate the potential economic savings that could be achieved through the development and adoption of better engineering practices for minimizing the unnecessary wear, friction and breakdowns associated with tribological failures

Modules	10 ME E32 - Process Planning and Cost Estimation Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Develop a process plan for manufacturing a product.
2.	Distinguish between the manual and computer aided process plan.
3.	Differentiate the estimation and costing.
4.	Outline the type and method of costing.
5.	Define the importance and objectives of cost estimation.
6.	Practice the various components of cost involved in cost estimation and allocate the overhead cost to the job.
7.	List the allowances and losses in forging, welding and foundry operations.
8.	Determine the machining time for lathe, milling, shaping grinding and drilling operations.
9.	Describe the concept of budgetary control.
10.	Identify the make or buy decision.

Modules	10 ME E33 - Composite Materials Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the need, characteristics and applications of composite materials.
2.	Summarize the importance of surface treatments of fibers and adding fillers and additives to the composite materials.
3.	Manipulate the interaction between fiber and matrix in a unidirectional lamina under tensile and compressive loading.
4.	Explain the experimental techniques used for evaluating the fatigue and impact properties.
5.	Discuss the mechanical behavior of composites due to variation in temperature and moisture.
6.	Choose the most appropriate manufacturing process for fabricating composite components.
7.	Describe the non-destructive inspection and structural health monitoring of composites.
8.	Identify and design composite materials and structures in various engineering applications.
9.	Select the appropriate joint for composite laminates and distinguish the advantages and disadvantages of different joints.
10.	Carryout the analysis on laminated composites using FEM software.

Modules	10 ME E34 - Energy Conservation In Thermal Systems Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Identify the importance of energy and the consumption pattern and conservation potential in Industries and commercial establishments.
2.	Examine the energy auditing, barriers, role of energy manager and energy conservation act 2003.
3.	Formulate the characteristics, error and calibration of instruments.
4.	List the characteristics, flow measuring instruments.
5.	Explain the concepts of thermal utilities such as boiler, heater and furnace.
6.	Carryout the calculations on waste heat recovery systems and thermal storage.
7.	Compare the methods of thermal energy transmission system.
8.	Indicate the methods of thermal energy protection system.
9.	Explain the methods of energy production, transport and control.
10.	Rewrite the available tariffs and problems on power generation.

Modules	10 ME E35 - Internal Combustion Engines Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Choose optimum fuel air mixture for complete combustion in S.I engine at different condition.
2.	List the stages of combustion in S.I and C.I engine.
3.	Identify the condition to avoid the S.I and C.I engine knocking.
4.	Differentiate between the direct and indirect injection of C.I engine.
5.	Categorize the emission of C.I and S.I engine.
6.	Explain the different methods of emission control mechanism.
7.	Characterise the S.I and C.I engine fuel.
8.	Rate the alternate fuels for S.I and C.I engine.
9.	Describe the working of electronic injection system.
10.	Explain the working of data acquisition system of engine.

Modules	10 ME E36 - Aircraft Structure Design Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Define the various phases of design, design methodologies of aircraft.
2.	Review the Hooke's law, principal stresses, equilibrium and compatibility equations, St Venant's principle, conservation of energy, stress transformation, stress strain relations to design aircraft structure.
3.	Recognise the types and sectional properties of structural members and their loads of component in aircraft structures.
4.	Describe the types of joints and their loads and also recognise the load in aircraft elements.
5.	Explain the material selection process for aircraft structural design.
6.	Explain the machining, joining, fabrication in manufacturing of structural and sheet metal in aircraft.
7.	Describe the basic theory of plates, behaviour of plate subjected to bending and buckling
8.	Interpret the overview of beams and torsion in various cross section of beams
9.	List the airworthiness regulations, types and requirements related to aircraft design
10.	Recognise the structural damage, repair and their types.

<table>
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<tr><td>Department</td><td colspan="2">Mechanical Engineering</td><td colspan="2">Programme Code & Name</td><td colspan="4">ME : B.E. Mechanical Engineering</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>10 ME E41</td><td colspan="2">ADVANCED CASTING PROCESSES</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To Know freedom of design advanced subjects related to the cast metal industry, To describe the state of the art materials such as castable super alloys and metal matrix composites, To Know heat treatment rules, mathematical analysis of solidification, use of microscope, and metallographic techniques.</td></tr>
<tr><td>1</td><td colspan="5">PRODUCTION OF MOULDS AND CORES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Mould production - equipment for moulding, moulding technique - pattern utilisation, hand and machine compaction, machine moulding, mould drying and hardening. Cores and core making - core boxes, compaction, core hardening, closing of moulds.</td></tr>
<tr><td>2</td><td colspan="5">MELTING AND POURING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Melting Practice: Classification of melting furnaces, brief description of construction and operation of various furnaces - cupola and its design, electric arc furnaces, electric induction furnaces. Melting charge, melting conditions, melting losses, special melt treatment, melt quality control and recent development in metal melting. Pouring- Metal temperature, pouring equipment and techniques.</td></tr>
<tr><td>3</td><td colspan="5">STUDY OF CASTING TECHNIQUES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Shell moulding - Basic operation, production systems, characteristics of shell moulded casting and D-process. Investment Casting - expandable pattern process. Pattern production, investment, pattern removal and firing, casting. Factor influencing casting quality characteristics of precision investment casting. Investment casting from permanent casting. Die-casting - Gravity die-casting, pressure-die casting, die-casting machines, casting techniques, characteristics of die - castings. Centrifugal casting - Fundamental principles, methods production techniques, characteristics of centrifugal casting.</td></tr>
<tr><td>4</td><td colspan="5">SOLIDIFICATION OF CASTINGS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Crystallization and development of cast structure - Nucleation, Growth and dendrite growth, independent nucleation, eutectic freezing, paratactic relations, structure of castings - significance and practical control cast structure, grain shape and orientation, grain size, refinement and modification of cast structure. Concept of progressive and directional solidification, solidification time and derivation of Chvorinov's equation influence of mould characteristics and cast metal. Properties on solidification, process numerical methods for heat flow analysis.</td></tr>
<tr><td>5</td><td colspan="5">FEEDING OF CASTINGS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Feeding characteristics of alloys, geometric influences on solidification. Methods of the feeding of castings - cost and concept of yield, orientations, gating technique, casting temperature and pouring speed, design and location of feeder heads. Aids to feeder head efficiency, junction of feeder head and casting, use of padding, chills and insulators.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">"Foundry Technology" O.P. Khanna, Dhanapat Raj Publications, Edition 2003.</td></tr>
<tr><td>2</td><td colspan="8">"Principles of Metal Casting" Richard W Heine, Carl R Loper, Philip C Rosenthal, Tata MGraw Hill, 1993</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">"Metal Casting" ASME Handbook</td></tr>
<tr><td>2</td><td colspan="8">"Metal Casting Technology" P.C.Mukherji, Oxford & IBM, 1979-1988</td></tr>
<tr><td>3</td><td colspan="8">"Foundry Technology" Sinha K.P., Goel D.B, Standard Publishers, 6th Edition, 1999.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2010
Department	Mechanical Engineering	Programme Code & Name			ME : B.E. Mechanical Engineering			
Elective IV								
Course Code	Course Name	Hours /week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
10 ME E42	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3	50	50	100
Objective(s)	Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.							
1	INTRODUCTION				Total Hrs			9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.								
2	ENTREPRENEURSHIP MOTIVATION				Total Hrs			9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.								
3	BUSINESS OPPORTUNITIES				Total Hrs			9
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.								
4	FINANCING AND ACCOUNTING				Total Hrs			9
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.								
5	SUPPORT TO ENTREPRENEURS				Total Hrs			9
Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.								
Total hours to be taught								45
Text book (s) :								
1	S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 2010.							
2	Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill, 2011.							
Reference(s) :								
1	Rabindra N. Kanungo “Entrepreneurship and innovation”, Sage Publications, New Delhi, 2010.							
2	EDII Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development” Institute of India, Ahmadabad, 2010.							

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<tr><td colspan="2">10 ME E43</td><td>NON DESTRUCTIVE MATERIALS EVALUATION</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">Study the most important Non Destructive Evaluation and Testing methods, theory and their industrial application.</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION TO NON DESTRUCTIVE TESTING</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Comparison of advantages and limitations of different NDT methods. Visual inspection.</td></tr>
<tr><td>2</td><td colspan="5">SURFACE NDT, LIQUID PENETRANT (PT), MAGNETIC PARTICLE TESTING (MT)</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">PT: Physical Principles, Penetrant Systems, Applications. MT: Magnetisation methods, evaluation of results</td></tr>
<tr><td>3</td><td colspan="5">THERMOGRAPHY AND EDDY CURRENT TESTING (ET)</td><td>Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="9">Active and Passive Thermography, Application in flaw detection. ET: Principles, permeability and conductivity, Testing for defects, material characterisation and sorting.</td></tr>
<tr><td>4</td><td colspan="5">ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)</td><td>Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="9">Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Principle of AET, instrumentation, Applications-testing of metal pressure vessels, Fatigue crack detection in aerospace structures.</td></tr>
<tr><td>5</td><td colspan="5">RADIOGRAPHY (RT)</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Principle, interaction of X-Ray with matter, imaging, film and film less techniques, Computed Radiography, Computed Tomography.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text Book(s):</td></tr>
<tr><td>1</td><td colspan="8">Prakash Ravi," Nondestructive Testing Techniques", New Age International Publishers, 1st edition, 2007.</td></tr>
<tr><td>2</td><td colspan="8">Paul E Mix," Introduction to nondestructive testing: a training guide", Wiley, 2nd edition New Jersey, 2005.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Baldev raj, Jayakumar.t, Thavasimuthu.m, Practical Non Destructive Testing, Narosa publishing house, newdelhi, edition, 3, Year: 2009.</td></tr>
<tr><td>2</td><td colspan="8">Baldev Raj, B. Venkataraman, O. J. Varde, Nerulikar, "Practical Magnetic Particle Testingv", Narosa Publishing House, 2007</td></tr>
<tr><td>3</td><td colspan="8">Charles, J. Hellier," Handbook of nondestructive evaluation", McGraw Hill, New York 2001.</td></tr>
<tr><td>4</td><td colspan="8">ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NOT Handbook, Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.</td></tr>
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<tr><td colspan="2">10 ME E44</td><td>TOOL DESIGN</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Objective(s)</td><td colspan="7">To Impart knowledge on Tool design, Tooling materials, design of sheet metal blanking, piercing, design of sheet metal bending, forming and drawings die and plastics as tooling materials.</td></tr>
<tr><td>1</td><td colspan="5">METAL CUTTING TOOLS: ANALYSIS AND DESIGN</td><td>Total Hrs</td><td colspan="2">8</td></tr>
<tr><td colspan="9">Historical Development - Geometry of Cutting Tools – Cutting Tool Nomenclature Systems – Reference Planes – Single-point Cutting Tool: Signature and design .</td></tr>
<tr><td>2</td><td colspan="5">DESIGN OF CUTTING TOOLS</td><td>Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="9">Multi-point Cutting Tools - Drill Geometry - Design of Drills - Rake & Relief Angles of Twist Drill - Speed, Feed and Depth of Cut - Machining Time – Forces - Milling Cutters - Cutting Speeds and Feed-Machining Times – Design of Form Milling Cutters.</td></tr>
<tr><td>3</td><td colspan="5">DESIGN OF SHEET METAL BLANKING AND PIERCING DIES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Die-cutting Operations: Fundamentals of Die-cutting Operations - Power-press Types - General Press Information – Material-handling Equipment - Cutting Action in Punch and Die Operations - Die Clearance - Types of Die Construction. Die design fundamentals: Blanking and Piercing Die Construction – Pilots - Strippers and Pressure Pads - Presswork Materials - Strip Layout – Short-run Tooling for piercing.</td></tr>
<tr><td>4</td><td colspan="5">DESIGN OF SHEET-METAL BENDING, FORMING AND DRAWINGS DIES</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Introduction - Bending Dies - Drawing Dies - Forming dies - Drawing Operations - Variables That Effect Metal Flow during Drawing. Determining Blank Size - Drawing Force - Single and Double-action Draw Dies.</td></tr>
<tr><td>5</td><td colspan="5">PLASTICS AS TOOLING MATERIALS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="9">Introduction - Plastics Commonly Used as Tooling Materials - Application of Epoxy Plastic Tools - Construction Methods of Plastic Tooling- Metal-forming Operations with Urethane Dies - Calculating Forces for Urethane Pressure Pads.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Donaldson, Leain and Goold, “Tool Design”, 44th Edition, Tata Mc Graw Hill, New Delhi, 2010.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Surendra Kenav and Umesh Chandra, “Production Engineering Design (Tool Design)” Satyaprakashan, New Delhi 1994.</td></tr>
<tr><td>2</td><td colspan="8">Amitabha Battacharya and Inyong Ham, “Design of cutting Tools. Use of Metal Cutting Theory”, ASTME publication Michigan, USA, 1969.</td></tr>
<tr><td>3</td><td colspan="8">Rodin, “Design of cutting tools”, Mir Publications, Moscow.</td></tr>
<tr><td>4</td><td colspan="8">K.C. Jain and L.N. Agarwal, “Metal cutting science and Production Technology”’, Khanna Publishers, Delhi, 1986.</td></tr>
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<tr><td>10 ME E45</td><td colspan="2">SUPPLY CHAIN MANAGEMENT</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">At the end of this course the student should be able to understand the basics of supply chain concepts, associated networks, tools and techniques required for evaluating various supply chain processes.</td></tr>
<tr><td>1</td><td colspan="4">STRATEGIC FRAMEWORK</td><td colspan="2">Total Hrs</td><td>7</td></tr>
<tr><td colspan="8">Objective, decision phases, process views, examples, strategic fit, supply chain drivers and metrics.</td></tr>
<tr><td>2</td><td colspan="4">SUPPLY CHAIN NETWORKS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Distribution networks, Facility networks and design options, Factors influencing, Models for facility location and capacity allocation, Transportation networks and design options, Evaluating network design decisions.</td></tr>
<tr><td>3</td><td colspan="4">MANAGING DEMAND AND SUPPLY IN A SUPPLY CHAIN</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">Predictable variability in a supply chain, Economies of scale and uncertainty in a supply chain – Cycle and safety Inventory, Optimum level of product availability, Forward Buying, Multi-echelon cycle inventory.</td></tr>
<tr><td>4</td><td colspan="4">SOURCING AND PRICING IN A SUPPLY CHAIN</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Cross-Functional drivers, Role of sourcing in a supply chain, Logistics providers, Procurement process, Supplier selection, Design collaboration, Role of Pricing and Revenue Management in a supply chain.</td></tr>
<tr><td>5</td><td colspan="4">INFORMATION TECHNOLOGY AND COORDINATION IN SUPPLY CHAIN</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">The role of IT in supply chain, The supply chain IT frame work, Customer Relationship Management, Supplier relationship management, Future of IT in supply chain, E-Business in supply chain, Bullwhip effect – Effect of lack of co-ordination in supply chain, Building strategic partnerships, CPFR</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="8">Text Book:</td></tr>
<tr><td>1</td><td colspan="7">Sunil Chopra and Peter Meindl, “Supply Chain Management, Strategy, Planning, and operation”, PHI, 3rd Edition, 2007.
.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Jeremy F.Shapiro, “Modeling the supply chain”, Thomson Duxbury, 2002.</td></tr>
<tr><td>2</td><td colspan="7">James B.Ayers, “Handbook of Supply chain management”, St.Lucle press, 2000.</td></tr>
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10 ME E46	SOLAR ENERGY	3	0	0	3	50	50	100
Objective(s)	To understand the fundamentals of solar energy and its conversion techniques for both thermal and electrical energy applications, radiation principles with respective solar energy estimation, PV technology principles and techniques of various solar cells / materials for energy conversion and economical and environmental merits of solar energy for variety applications.							
1	SOLAR RADIATION AND COLLECTORS				Total Hrs	9		
Solar angles - day length, angle of incidence on tilted surface - Sunpath diagrams -shadow determination - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - heat capacity effect - testing methods- evacuated tubular collectors - concentrator collectors - classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats - performance of the collectors.								
2	SOLAR PV FUNDAMENTALS				Total Hrs	9		
Semiconductor - properties - energy levels - basic equations of semiconductor devices physics. Solar cells - P-N junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells - preparation of metallurgical, electronic and solar grade Silicon - production of single crystal Silicon: Czokralski (CZ) and Float Zone (FZ) method - Design of a complete silicon - GaAs- InP solar cell - high efficiency III-V, II-VI multi junction solar cell; a-Si-H based solar cells-quantum well solar cell - thermophotovoltaics.								
3	DESIGN AND ANALYSIS OF SOLAR PHOTOVOLTAIC SYSTEM				Total Hrs	9		
Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - use of computers in array design - quick sizing method - array protection and troubleshooting - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.								
4	SOLAR PASSIVE ARCHITECTURE				Total Hrs	9		
Thermal comfort - heat transmission in buildings- bioclimatic classification - passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. - energy efficient landscape design - thermal comfort - concept of solar temperature and its significance - calculation of instantaneous heat gain through building envelope.								
5	APPLICATIONS OF SOLAR THERMAL TECHNOLOGY				Total Hrs	9		
Principle of working, types - design and operation of - solar heating and cooling systems - solar water heaters - thermal storage systems - solar still - solar cooker - domestic, community - solar pond - solar drying.								
Total hours to be taught						45		
Text book (s) :								
1	Sukhatme S P, Solar Energy, Tata McGraw Hill, 1984.							
2	Kreider, J.F. and Frank Kreith, Solar Energy Handbook, McGraw Hill, 1981.							
3	Goswami, D.Y., Kreider, J. F. and & Francis, Principles of Solar Engineering, 2000.							
Reference(s) :								
1	Duffie, J. A. and Beckman, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.							
2	Garg H P., Prakash J., Solar Energy: Fundamentals & Applications, Tata McGraw Hill, 2000.							
3	Alan L Fahrenbruch and Richard H Bube, Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, 1983.							
4	Larry D Partain, Solar Cells and their Applications, John Wiley and Sons, Inc, 1995.							

Modules	10 ME E41 - Advanced Casting Processes Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the mould production, equipment and their techniques.
2.	Describe the concept of core and core making.
3.	Explain the working principles of furnace and metal melting temperature.
4.	List out the recent developments in metal melting techniques.
5.	Explain the various shell moulding processes.
6.	Recognise the fundamental principles of die casting, characteristics of die casting and methods of production techniques.
7.	Analyze the solidification controls and casting defects occur during solidification.
8.	Define the concept of the solidification, solidification time and properties of solidification.
9.	Present the basic principles of how to design a feeder system.
10.	Provide the techniques that are used to compensate for the solidification shrinkage of castings.

Modules	10 ME E42 - Entrepreneurship Development Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Identify the concept of entrepreneurship in economic growth.
2.	Characterize the concept of motivation training.
3.	Describe the concept of stress management in entrepreneurship development
4.	Identify and select a good business opportunity.
5.	Explain the preparation of preliminary project reports.
6.	Determine the sources of finance.
7.	Describe the break even and network analysis of PERT/CPM.
8.	Outline the concepts of growth strategies in small industries.
9.	List out the causes and consequences, corrective measures related to entrepreneurship development.
10.	Explain about the expansion, diversification, joint venture, merger and sub contracting.

Modules	10 ME E43 - Non Destructive Materials Evaluation Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Describe the science and engineering of various NDT techniques to meet the diverse requirements of modern engineering industries.
2.	Distinguish the salient features and limitation of different NDT methods.
3.	Generalize the steps and procedure involved in any non destructive testing to detect any in homogeneity present in the material.
4.	Find the application of NDT techniques used for high technology products such as nuclear reactors, supersonic aircrafts, spacecrafts, rockets and missiles etc, and also in the field of inspection of more consumer oriented products.
5.	Apply the specific NDT method depends on many factors includes availability, accessibility and suitability based on analysis and past experience.
6.	Illustrate the components, construction and working principles of various NDT like surface NDT, PT, MT, Thermography, ET,VT and RT.
7.	Summarize the characteristic of various types of discontinuities present in the material.
8.	Choose the various codes and standards (ASTM) for macro etching, specimen preparations and evaluation of field metallographic replicas.
9.	Perform the various case studies for assessment of simple components, elements etc.
10.	Find the skill requirements needed for process control, various electronic components used in NDT process.

Modules	10 ME E44 - Tool Design Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Characterise the cutting tool and geometry of cutting tools.
2.	Describe the nomenclature of single point cutting tool.
3.	Explain the nomenclature of multi point cutting tools and drill geometry.
4.	Evaluate the rake and relief angles of twist drill, and depth of cut for the milling cutters.
5.	Recognize the fundamentals of die-cutting operation, power press types, and material handling equipments.
6.	List the types of die construction and die design fundamentals.
7.	Demonstrate the drawing operations and explain the variable that effect metal flow during drawing.
8.	Determine the blank size and drawing force while drawing operation.
9.	Identify the various tooling materials used in tool design and list the applications of epoxy plastic tools.
10.	Explain the metal forming operations with urethane dies and rank the urethane pressure pads.

Modules	10 ME E45 - Supply Chain Management Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Recognize the decision phases.
2.	Characterize the supply chain drivers and metrics.
3.	Demonstrate the facility networks and design options.
4.	Demonstrate the models for facility location and capacity allocation.
5.	List the economies of scale and uncertainty in a supply chain.
6.	Implement the optimum level of product availability.
7.	Categorize the role of sourcing in a supply chain.
8.	Categorize the role of pricing and revenue management in a supply chain.
9.	Assess the supply chain IT frame work.
10.	Identify the effect of lack of co-ordination in supply chain.

Modules	10 ME E46 - Solar Energy Course Outcomes(COs)
	At the end of the course, the student will be able to
1.	Explain the solar intensity of solar radiation measurement and estimation of on horizontal and titled surfaces.
2.	Differentiate the various types of solar collectors and explain its performance.
3.	List out the different types of solar devices and explain its characteristics.
4.	Describe the solar grade silicon production with single crystal silicon.
5.	Design the solar cell array design concept and PV system design.
6.	Explain the solar system installation, operation and maintenances.
7.	Describe the passive heating concepts, direct heat gain, in direct heat gain and isolated gain.
8.	Design the energy efficient landscape design and explain the concept of solar temperature and its significance.
9.	List the application of small solar equipments like solar water heater and solar cooling system.
10.	Explain the large solar system like solar pond & solar dryings.