K.S. Rangasamy College of Technology

(Autonomous Institution)

Curriculum & Syllabus

of

B.E. Mechanical Engineering

(For the batch admitted in 2017 – 18)

R 2014

Courses Accredited by NBA, Accredited by NAAC with 'B^{++}' Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.

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

Vision

The Vision of Mechanical Engineering is to train the students to have in depth knowledge in the field of Mechanical Engineering thereby making them as a globally competent Engineers, Entrepreneurs, Managers and Researchers

Mission

To offer quality education that gives them knowledge for professional practice and a career of lifelong learning; prepare the students for their role as engineers in society with an awareness of environmental and ethical values.

Program Educational Objectives (PEOs)

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

Programme Outcomes (Pos)

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 for 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 2014**
Department	**Department of Mechanical Engineering**
Programme Code & Name	ME : B.E. Mechanical Engineering

Semester I

Course Code	Course Name	Hours/Week			Credit
		L	T	P	C
THEORY					
40 EN 001	English	3	0	0	3
40 MA 001	Ordinary and Partial Differential Equations	3	1	0	4
40 CH 002	Applied Chemistry	3	0	0	3
40 CS 001	Fundamentals of Programming	3	0	0	3
41 EE 002	Elements of Electrical Engineering	3	0	0	3
40 ME 003	Engineering Drawing	2	0	3	4
PRACTICAL					
40 CH 0P1	Chemistry Laboratory	0	0	3	2
40 CS 0P1	Fundamentals of Programming Laboratory	0	0	3	2
Total		17	1	9	24

Semester II

Course Code	Course Name	Hours / Week			Credit
		L	T	P	C
THEORY					
40 EN 002	Communication Skills	3	0	0	3
40 MA 002	Laplace Transform and Complex Variables	3	1	0	4
40 PH 003	Condensed Matter Physics	3	0	0	3
41 CH 007	Environmental Science and Engineering	3	0	0	3
40 EC 001	Basics of Electronics Engineering	3	0	0	3
40 ME 004	Engineering Mechanics	3	1	0	4
PRACTICAL					
40 PH 0P1	Physics Laboratory	0	0	3	2
40 ME 0P2	Engineering Practices Laboratory	0	0	3	2
40 ME 0P3	Computer Aided Drafting Laboratory	0	0	3	2
Total		18	2	9	26

Semester III

	THEORY				
40 MA 004	Boundary Value Problems and Transform Methods	3	1	0	4
40 ME 301	Engineering Materials and Metallurgy	3	0	0	3
40 ME 302	Engineering Thermodynamics	3	1	0	4
40 ME 303	Manufacturing Process	3	0	0	3
40 ME 007	Fluid Mechanics and Machinery	3	1	0	4
40 PH 008	Applied Physics	3	0	0	3
	PRACTICAL				
40 ME 3P1	Fluid Mechanics and Machinery Laboratory	0	0	3	2
40 ME 3P2	Manufacturing Technology Laboratory I	0	0	3	2
40 ME 3P3	Machine Drawing Laboratory	0	0	3	2
40 TP 0P1	Career Competency Development- I	0	0	2	0
Total		18	3	11	27

Semester IV

	THEORY				
40 MA 008	Statistics and Numerical Methods	3	1	0	4
40 EE 005	Electric Drives and Controls	3	0	0	3
40 ME 006	Strength of Materials	3	1	0	4
40 ME 401	Kinematics of Machinery	3	1	0	4
40 ME 402	Thermal Engineering	3	0	0	3
40 ME 403	Applied Hydraulics and Pneumatics	3	0	0	3
	PRACTICAL				
40 EE 0P1	Electric Drives and Control laboratory	0	0	3	2
40 ME 0P4	Strength of Materials Laboratory	0	0	3	2
40 ME 4P1	Thermal Engineering Laboratory	0	0	3	2
40 TP 0P2	Career Competency Development- II	0	0	2	0
Total		18	3	11	27

K.S.Rangasamy College of Technology, Tiruchengode – 637 215	
Curriculum for the Programmes under Autonomous Scheme	
Regulation	**R 2014**
Department	**Department of Mechanical Engineering**
Programme Code & Name	ME : B.E. Mechanical Engineering

Semester V

Course Code	Course Name	Hours/Week			Credit
		L	T	P	C
THEORY					
40ME011	Machining Process	3	0	0	3
40ME501	Dynamics of Machinery	3	1	0	4
40ME502	Design of Machine Elements	3	1	0	4
40ME013	Heat and Mass Transfer	3	1	0	4
40ME503	Automobile Engineering	3	0	0	3
40HS003	Total Quality Management	2	0	0	2
PRACTICAL					
40ME0P7	Manufacturing Technology Laboratory II	0	0	3	2
40ME5P1	Dynamics Laboratory	0	0	3	2
40ME0P9	Heat Transfer Laboratory	0	0	3	2
40TP0P3	Career Competency Development III	0	0	2	0
Total		17	3	11	26

Semester VI

Course Code	Course Name	Hours / Week			Credit
		L	T	P	C
THEORY					
40EC006	Microprocessors and Microcontrollers	3	0	0	3
40ME012	CAD/CAM	3	0	0	3
40ME601	Design of Mechanical Transmission Systems	3	1	0	4
40ME014	Gas Dynamics and Jet Propulsion	3	1	0	4
40ME015	Finite Element Method	3	1	0	4
40MEE1*	Elective I	3	0	0	3
PRACTICAL					
40EC0P3	Microprocessors and Microcontrollers Laboratory	0	0	3	2
40ME0P8	CAD/CAM Laboratory	0	0	3	2
40ME0P10	Analysis and Simulation Laboratory	0	0	3	2
40TP0P4	Career Competency Development IV	0	0	2	0
Total		18	3	11	27

Semester VII

	THEORY				
40MC001	Mechatronics	3	0	0	3
40ME016	Power Plant Engineering and Energy Economics	3	0	0	3
40ME701	Operations Research	3	1	0	4
40ME702	Metrology and Measurements	3	0	0	3
40MEE2*	Elective II	3	0	0	3
40MEE3*	Elective III	3	0	0	3
	PRACTICAL				
40MC0P1	Mechatronics Laboratory	0	0	3	2
40ME7P1	Metrology and Measurements laboratory	0	0	3	2
40ME7P2	Project Work - Phase I	0	0	3	2
40TP0P5	Career Competency Development V	0	0	2	0
Total		18	1	11	25

Semester VIII

	THEORY				
40HS002	Engineering Economics and Financial Accounting	2	0	0	2
40MEE4*	Elective IV	3	0	0	3
40MEE5*	Elective V	3	0	0	3
	PRACTICAL				
40ME8P1	Project Work - Phase II	0	0	16	8
Total		8	0	16	16

K.S.Rangasamy College of Technology, Tiruchengode – 637 215									
Curriculum for the Programmes under Autonomous Scheme									
Regulation		R 2014							
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									
40 CS 004	Object Oriented Programming	3	0	0	3	50	50	100	
40 ME E11	Renewable Sources of Energy	3	0	0	3	50	50	100	
40 ME E12	Design of Jigs, Fixtures and Press Tools	3	0	0	3	50	50	100	
40 ME E13	Maintenance Engineering	3	0	0	3	50	50	100	
40 ME E14	Fundamentals of Information Technology	3	0	0	3	50	50	100	
40 ME E15 / **40 ME L01**	**Logistics Management**	3	0	0	3	50	50	100	
Elective II									
40 ME E21	Flexible Manufacturing System	3	0	0	3	50	50	100	
40 ME E22	Energy Storing Devices and Fuel Cells	3	0	0	3	50	50	100	
40 ME E23	Thermal Turbo Machines	3	0	0	3	50	50	100	
40 ME E24	Design of Heat Exchangers	3	0	0	3	50	50	100	
40 ME E25	Advanced IC Engines	3	0	0	3	50	50	100	
40 ME E26	Industrial safety and hazards management	3	0	0	3	50	50	100	
Elective III									
40HS001	Professional Ethics	3	0	0	3	50	50	100	
40 ME E31	Industrial Robotics	3	0	0	3	50	50	100	
40 ME E32	Computational Fluid Dynamics	3	0	0	3	50	50	100	
40 ME E33	Computer Integrated Manufacturing	3	0	0	3	50	50	100	
40 ME E34	Cryogenic Engineering	3	0	0	3	50	50	100	
40 ME E35	Refrigeration and Air conditioning	3	0	0	3	50	50	100	
Elective IV									
40 ME E41	Advanced Manufacturing Process	3	0	0	3	50	50	100	
40 ME E42/ **40 ME L02**	**Composite Materials**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	
40 ME E43	Entrepreneurship Development	3	0	0	3	50	50	100	
40 ME E44	MEMS Devices – Design and Fabrication	3	0	0	3	50	50	100	
40 ME E45	Process Planning and Cost Estimation	3	0	0	3	50	50	100	
Elective V									
40 ME E51	Non Destructive Materials Evaluation	3	0	0	3	50	50	100	
40 ME E52	Fundamentals of Nanoscience	3	0	0	3	50	50	100	
40 ME E53	Supply Chain Management	3	0	0	3	50	50	100	
40 ME E54	Lean Manufacturing	3	0	0	3	50	50	100	
40 ME E55	Welding Technology	3	0	0	3	50	50	100	
40 ME E56/ **40 ME L03**	**Additive Manufacturing**	3	0	0	3	50	50	100	

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 EN 001 English								
Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	50	50	100

Objective(s)	• To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts. • To help learners develop strategies that could be adopted while reading texts. • To help learners acquire the ability to speak effectively in English in real life and career related situations. • To train learners in organized academic and professional writing.

Grammar and Vocabulary

Word formation with Prefixes and Suffixes Level -1 (50 words), Level -2 (100 words) – Synonyms and Antonyms (100 each)– Verbal Analogy- Finding the Odd man out- Alphabet Test- One word substitute- Sentence Patterns- Subject-Verb Agreement – Tenses – Active and Passive voice – Use of conditionals – Comparative Adjectives– Expanding Nominal Compounds (100) – Articles – Use of Prepositions (basic level – 25) Identifying Phrasal Verbs - Error Detection – Abbreviations and Acronyms (100 each).

Suggested Activities

Prefixes and suffixes– identifying the lexical and contextual meanings of words – correction of errors in the given sentences -providing a context for the use of tenses, sentence structures – using comparative forms of adjectives - Identifying phrasal verbs - 'if' clauses – the three main types, probable condition, improbable condition and impossible conditions.

Note: All examples should preferably be related to science and technology.

Listening skill

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

Suggested Activities

Taking a quick glance at the text to predict the content – reading to identify main content and giving feedback in response to the teacher's questions – making a thesis statement about the text – scanning for specific information – sequencing of jumbled sentences using linguistic clues (e.g. reference words and repetition) and semantic clues following propositional development –fast reading drills – comprehending a passage and answering questions of varied kinds relating to information, inference and prediction.

Speaking skill

Verbal and Non-Verbal communication – Speech Sounds – Syllables – Word Stress (structural and content words) – Sentence 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 – (Road Maps)

Suggested Activities

Role play activities based on real life situations – discussing travel plan / industrial visits- giving oral instructions for performing tasks at home and at work (use of imperatives) -using appropriate expressions- defining / describing an object /device / instrument / machine – participating in a short discussion on a controversial topic – oral presentation

Reading skill

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.

Suggested Activities

Gap filling activity while listening to a text – listening intently to identify the missing words in a given text –

listening to a brief conversation and answering questions – listening to a discourse and filling up gaps in a worksheet – taking notes during lecture – inferential comprehension and literal comprehension tasks based on listening to quizzes.

Note: The listening activities can be done using a worksheet in the Language Laboratory or in the class room using a tape recorder.

Writing skill

Introduction 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)

Suggested Activities

writing a paragraph based on information provided in a tree diagram / flow chart / bar chart / pie chart / tables – formal letters – writing to officials (leave letter, seeking permission for practical training , asking for certificates, testimonials) – letter to the editor – informal letters (persuading / dissuading, thanking and congratulating friends / relatives) – sending e- mail – editing a passage (correcting the mistakes in punctuation, spelling and grammar)

Total hours to be taught : 45

Text book :

1. Ashraf M Rizvi, 'Effective Technical Communication', 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.

Reference(s) :

1. M.Balasubramanian and G.Anbalagan, 'Performance in English', Anuradha Publications, Kumbakonam, 2007.
2. Sharon J. Gerson, Steven M. Gerson, 'Technical Writing – Process & Product',3rd Edition, Pearson Education (Singapore) (p) Ltd., New Delhi, 2004.
3. Mitra K. Barun, 'Effective Technical Communication – A Guide for Scientists and Engineers', Oxford University Press, New Delhi, 2006.
4. R.S. Aggarwal, 'A Modern Approach to Verbal & Non – Verbal Reasoning', S.Chand & Company Ltd., New Delhi, Revised Edition, 2012.
5. NPTEL Video Courses on Spoken English.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 MA 001 Ordinary and Partial Differential Equations								
Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	50	50	100

Objective(s)	• This course creates the ability to model, solve and interpret any physical or engineering problems. • Development of mathematical skills to solve the ordinary and partial differential equations. • To understand the concepts of vectors in two-dimension and three dimension spaces.
Course Outcomes	**At the end of the course, the students will be able to** **1.** (i) Understand the types of matrix and find eigen values, eigen vectors and inverse of the matrix. (ii) Solve the system of linear equations. **2.** Apply transformation techniques to reduce quadratic form into canonical form. **3.** Solve linear differential equations with constant and variable coefficients. **4.** (i) Find the solution of differential equations by the method of variation of parameters. (ii) Solve simultaneous differential equations. **5.** Understand the concepts of curvature and evolutes. **6.** (i) Analyze the maxima and minima of a function (ii) Expand the function of two variables as Taylor's series and find the Jacobians. **7.** Construct partial differential equations and find the solutions of non-linear partial differential equations of first order. **8.** Apply the appropriate method to solve Lagrange's linear equations and solve linear partial differential equations with constant coefficients. **9.** Know about gradient, directional derivative, solenoidal and irrotational of a vector function. **10.** Apply the notions of vector calculus to verify Green's, Gauss divergence and Stoke's theorems.

MATRICES

Basic concepts – Addition and multiplication of matrices – Orthogonal matrices – Conjugate of a matrix – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (without proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation – System of linear equations.

ORDINARY DIFFERENTIAL EQUATIONS

Introduction – Differential equations of first-order and first degree – Exact differential equations – Linear differential equations of second and higher order with constant co-efficient when the R.H.S is $e^{\alpha x}$, sin α x or cos α x ,x^n n>0, $e^{\alpha x}x^n$, $e^{\alpha x}$ sinβx, and $e^{\alpha x}$ cosβx – Differential equations with variable co-efficients reducible to differential equations with constant co-efficients (Cauchy's form and Legendre's linear equation) – Method of variation of parameters – Simultaneous first-order linear equations with constant co-efficients.

DIFFERENTIAL CALCULUS AND FUNCTIONS OF SEVERAL VARIABLES

Curvature – Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Taylor's series for a function of two variables – Maxima and minima of function of two variables – Constrained maxima and minima (Lagrange's method of undetermined multipliers) – Jacobians(Problems only).

PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Non-linear partial differential equations of first order (Type I – IV) – Solution of partial differential equations of first order – Lagrange's linear equations – Linear partial differential equations with constant coefficients.

VECTOR CALCULUS

Introduction – Gradient of a scalar point function – Directional derivative – Angle of intersection of two surfaces – Divergence and curl(excluding identities) – Solenoidal and irrotational vectors – Green's theorem in the plane – Gauss divergence theorem – Stoke's theorem(without proof) – Verification of the above theorems and evaluation of integrals using them.

Text book:

1	Kreyszig E, "Advanced Engineering Mathematics", 9th Edition, John Wiley and Sons (Asia) Limited, New Delhi, Reprint 2012.

Reference(s):

1	Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2013.
2	Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Lakshmi Publications Pvt Ltd, New Delhi, 2014.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40CH002 - Applied Chemistry								
Common to MECH & MCT								
Semester	Hours / Week			Total hrs	Credit	Maximum marks		
	L	T	P	45	C	CA	ES	Total
I/II	3	0	0		3	50	50	100
Objective(s)	1. To help the learners to analyze the hardness of water and its removal. 2. To familiarize the learners with the basics of electrochemistry, its applications, corrosion and its control. 3. To infer the relevance in engineering materials. 4. To highlight the significance of fuels and combustion. 5. To enlighten the learners on polymers							
Course Outcomes	1. Recognize sources of water, quality parameter and hardness of water. 2. Analyze and appraise methods to overcome hardness. 3. Relate the basic tenets of electrochemistry to arrive at mathematical expression and outline its various applications. 4. Identify the types, mechanism, and factors influencing corrosion and describe its control measures. 5. Recognize the characteristics, classification and uses of abrasives and refractories. 6. Analyze the characteristics, manufacturing and uses of cement and glass. 7. Illustrate the classification and manufacturing of fuels. 8. Appraise the combustion and calorific value. 9. Explain the basic concepts, characteristics of polymer and mechanisms of polymerization. 10. Discuss the preparation, properties and uses of select polymers							

WATER TREATMENT

Sources of water and its properties - Water quality parameter (EPA) - Hard and soft water - Hardness of water - Types - Units of hardness - ppm and mg/L - Estimation of hardness - EDTA method - Boiler feed water - Boiler problems - Internal treatment - Carbonate, Phosphate and Calgon conditioning. External treatment - Zeolite and deionization process - Desalination - Reverse osmosis and Electro dialysis.

ELECTROCHEMISTRY AND CORROSION

Basics of electrochemistry - Reversible and irreversible cells - Nernst equation (problems) - EMF - measurement - EMF series - Applications - Types of electrodes - Reference electrodes - Conductometric titration. Corrosion - Types - Galvanic and differential aeration corrosion - Mechanism (Dry and wet) - Factors influencing corrosion - Corrosion control - Cathodic protection - Corrosion inhibitors. Electroplating of nickel and chromium..

ENGINEERING MATERIALS

Abrasives - Definition- Classification - Properties - Manufacture of abrasive paper and cloth. Refractories - Definition - Classification - Properties - Refractoriness and RUL, dimensional stability, thermal spalling and porosity - Manufacture of alumina, magnesia and graphite bricks. Portland cement - Manufacture and properties - Setting and hardening of cement. Special cement - Water proof and white cement - Properties and uses. Glass - manufacture, types, properties and uses.

FUELS AND COMBUSTION

Fuels - Classification - Coal - Types of coal - Proximate and Ultimate analysis of coal - Manufacture of metallurgical coke - Otto Hoffman's byproduct oven method - Liquid fuel - Manufacture of synthetic petrol - Fischer-Trospch's and Bergius methods - Knocking - Octane number - Cetane number- Gaseous fuel - CNG - LPG - Water gas - Producer gas - Biogas. Combustion - Calorific value - GCV- NCV- Flue gas analysis.

POLYMERS

Introduction - Types of polymerization - Mechanism of polymerization - Free radical polymerization - Co-ordination polymerization - Properties of polymers - Tg, tacticity and degradation of polymers - Plastics - Thermo and thermosetting - Preparation, properties and uses of PE, PVC, PTFE, PMMA, epoxy resin, nylon 6,6 and bakelite. Basic materials and properties of LCD and LED

Text Book:

1.	Vairam S "Engineering Chemistry", Wiley India, Delhi, 2 nd Edition, 2013

References books:

1.	Dara. S.S, "A text book of Engineering Chemistry", S Chand & Co. Ltd., 2003.
2.	Bill Mayer. F.W, "Text book of Polymer Science", Wiley - New York, 3rd Edition, 1991.
3.	Jain. P.C. and Monica Jain, "Engineering Chemistry", Dhanpatrai Publishing Co. New Delhi, 14th Edition, 2002.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 CS 001 & Fundamentals of Programming								
Common to BIOTECH,CIVIL,ECE,EEE,,E&I,TEX,MECH,MCT,NST								
Semester	Hours / Week			Total hrs	Credit	Maximum marks		
	L	T	P		C	CA	ES	Total
I/ II	3	0	0	60	3	50	50	100

Objective(s)	• This Course provides comprehensive knowledge about the fundamental principles, concepts and constructs of modern computer programming and competencies for the design, coding and debugging of computer programs. • This course provides ample way to identify, formulate, and solve engineering problems.
Course Outcomes	1. Recognize the generation and application of computers 2. Analyze various problem solving techniques with categories of software 3. Recognize the concepts of tokens branching and looping statements 4. Affirm the concepts of arrays and strings 5. Identity the purpose of pointers with its associated features 6. Recognize the concepts of functions, recursion with its features 7. Comprehend basic concepts of structures and unions 8. Relate the concept of user defined data types and preprocessor 9. Annotate the concepts of console input and output features 10. Interpret the concept of file input and output features

Computer Fundamentals

Evolution of computers - Generations of computers - Applications of computers - Computer Memory and Storage – Algorithm – Flowchart - Pseudo code – Program control structures -Programming languages - Computer Software – Definition - Categories of Software.

Introduction TO C

An Overview of C – Data types – Identifiers - Variables- – Type Qualifiers - Constants – Operators - Expressions – Selection statements – iteration statements – jump statements, Arrays: Introduction - Types – Initialization, Strings: Strings: Introduction - Arrays of Strings – String and Character functions.

Pointers and Functions

Pointers: Introduction - Pointer Variables - The Pointer Operators - Pointer Expressions - Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes – Function Categorization - Function Arguments - Arguments to main function - The return Statement - Recursion - Passing Arrays to Functions – Dynamic memory allocation – Storage class Specifiers.

Structures, Unions, Enumerations, Typedef and Preprocessors

Structures - Arrays of Structures - Passing Structures to Functions - Structure Pointers - Arrays and Structures within Structures - Unions – BitFields - Enumerations - typedef – The preprocessor and comments.

Console I/O and File I/O

Console I/O: Reading and Writing Characters - Reading and Writing Strings - Formatted Console I/O, File I/O: Streams and Files - File System Basics - fread( ) and fwrite( ) - Random Access I/O - fprintf( ) and fscanf( ) - The standard streams

Text book(s) :

1	Herbert Schildt, “The Complete Reference C”, Fourth Edition, TMH.

Reference(s) :

1	Brian W. Kernighan and Dennis M. Ritchie, “C Programming Language”, Prentice-Hall.
2	E.Balagurusamy, “Programming in ANSI C”, TMH, New Delhi, 2002.

K.S.Rangasamy College of Technology – Autonomous								R 2014
41 EE 002 Elements of Electrical Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objective(s)	1. To determine the voltage, current, power in resistive elements of simple DC circuits by understanding the concept of series-parallel circuit reduction technique. 2. To determine the Impedance, Power and Power factor in series RL, RC and RLC circuits by understanding the concept of instantaneous, RMS and average value of Voltage/Current in an AC source. 3. To describe the application of Faraday's, Lenz's laws and Fleming's rules, and determine the performance of transformers. 4. To measure the parameters of voltage, current, power, energy and insulation resistance using suitable measuring instruments by knowing their construction and principle of operation. 5. To impart the basic knowledge on power system and its components, simple house wiring layout, types and need for earthing, and energy conservation.
Course Outcomes	**At the end of the course, the students will be able to** 1. Identify the basic elements of electrical circuits and define important terms with their units. 2. Solve DC circuits using Ohm's & Kirchhoff's laws. 3. Characterize the single and three phase AC supply. 4. Calculate Impedance, Power and Power factor of single phase AC circuits. 5. Express the principle of electromagnetic induction and identify its usefulness in electrical engineering. 6. Explain the principle of operation of transformers and calculate its regulation and efficiency. 7. Describe the construction and principle of operation of instruments used for voltage and current measurements. 8. Explain the construction and principle of operation of instruments used for power, energy and insulation resistance measurements. 9. Outline the components of various sub-systems in a power system. 10. Sketch the layout of simple house wiring by identifying the wiring materials and express the need for energy conservation.

DC Circuits

Basic elements – resistance, inductance and capacitance – Definitions and Units: Current, Voltage, Power and Energy – Ohm's law – Kirchhoff's laws – Simple Series and Parallel circuits.

AC Circuits

Introduction to AC circuits –Single and Three phase AC supply – Advantages of Three phase AC system – Instantaneous, RMS and average value for sine wave form– Series RL,RC and RLC Circuits – Impedance, Admittance, Power and Power factor – Practical importance of power factor.

Electromagnetic Induction

Faraday's law of Electromagnetic Induction, Fleming's rules and Lenz's law - Statically and dynamically Induced emf.

Transformers

Construction, Principle of operation, types, regulation and efficiency, all day efficiency- Current and Potential transformers.

Measuring Instruments

Classification of instruments – Types of torques in an instruments – construction and working principle of moving coil and moving iron instruments – Dynamo meter type watt meter – Induction type energy meter – Multimeter – Megger – Electronic Energy Meter.

Power Systems

Structure of power system – Generation system – Transmission System – Distribution system – Power system protection.

House Wiring

Wiring material and Accessories – Simple wiring layout – Earthing – Lightning Arrestor – UPS – Energy Conservation.

Text book(s):

1.	M.Maria Louis, "Elements of Electrical Engineering", PHI, New Delhi, 2014.
2.	S. Sukhija, T.K. Nagsarkar, "Basic Electrical and Electronics Engineering", OxfordUniversity Press, 2012.

Reference(s):

1.	V.K.Mehta, Rohit Mehta, "Principles of Electrical Engineering", S.Chand Publications, New Delhi, 2014.
2.	Edward Hughes, "Electrical and Electronic Technology", Pearson Education, 9th Edition, New Delhi, 2009.
3.	Del Tora "Electrical Engineering Fundamentals" Pearson Education, New Delhi, 2007
4.	S.P.Bihari and BhuPendraSehgal, "Basic Electrical Engineering – Made Easy", Cengage Learning
5.	Alan S Moris, Principles of Measurements and Instruments, Prentice – Hall of India Pvt. Ltd, New Delhi, 1999.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 003 Engineering Drawing								
Common to Civil, Mech, MCT, & Textile								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	2	0	3	60	4	50	50	100
Objective(s)	• To enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient • To impart the graphic skills for communicating concepts, ideas and designs of engineering products							
Course outcomes	At the end of the course, the student will be able to: 1. Use the drafting instruments and construct the conics 2. Draw the projection of points, straight lines and plane surfaces 3. Draw the projection of simple solids 4. Draw the true shape of section 5. Develop the lateral surfaces of prism, pyramid, cylinder and cone 6. Convert the pictorial views in to orthographic views 7. Sketch the three dimensional view of solids given orthographic views.							

Introduction to Engineering Drawing and Plane Curves

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 - Construction of ellipse, parabola, and hyperbola by eccentricity method - Construction of cycloids –Construction of involutes of square and circle.

Projection of Points and Lines

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 Plane Surfaces

Projection of Planes in the first quadrant (Inclined to one plane and parallel to other – Inclined to both Planes).

Projection of Solids

Projections of simple solids: prism, pyramid, cylinder and cone (Axis parallel to one plane and perpendicular to other, axis inclined to one plane and parallel to other).

Projection of Sectioned Solids

Section of simple solids : 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.

Development of Surfaces

Development of lateral surfaces of simple and sectioned solids: Prism, pyramid cylinder and cone.

Orthographic Projection

Introduction to orthographic projections –Conversions of pictorial views to orthographic views.

Isometric Projection

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids : Prism, pyramid, cylinder, cone - Combination of two solid objects in simple vertical positions.

Perspective Projection

Perspective projection of prisms by visual ray method and vanishing point method.

Text book(s):

1	Bhatt N.D., “Engineering Drawing”, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2014.
2	Venugopal K., “Engineering Graphics”, New Age International (P) Limited, 2014.

Reference(s):

1	Shah M.B. and Rana B.C., “Engineering Drawing”, Pearson Education, 2005.
2	Natarajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2014

K.S.Rangasamy College of Technology – Autonomous								R 2014
40CH0P1 Chemistry Laboratory								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum marks		
	L	T	P	30	C	CA	ES	Total
I	0	0	3		2	50	50	100
Objective(s)	1. Test the knowledge of theoretical concepts. 2. To develop the experimental skills of the learners. 3. To facilitate data interpretation 4. To expose the learners to various industrial and environmental applications.							
Course Outcomes	1. Estimate the hardness of water sample. 2. Estimate the alkalinity of water sample. 3. Estimate the chloride content in water sample. 4. Determine the dissolved oxygen in water. 5. Determine the molecular weight of polymer. 6. Estimate the mixture of acids by conductometry 7. Estimate the ferrous ion by potentiometry. 8. Estimate the strength of acid by pH metry and apply the knowledge of pH determination for health drinks, beverages, soil, effluent and other biological samples. 9. Estimateferrous ion by spectrophotometry. 10. Determine the corrosion by weight loss method.							

List of Experiments

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of chloride content in water sample (Argentometric method)
4. Determination of dissolved oxygen in boiler feed water (Winkler's method)
5. Determination of molecular weight of a polymer by viscometry method.
6. Estimation of mixture of acids by conductometric titration.
7. Estimation of ferrous ion by potentiometric titration.
8. Estimation of HCl beverages and other biological samples by pH meter.
9. Estimation of iron content by spectrophotometry method.
10. Determination of corrosion by weight loss method.

Lab Manual:

1	Vairam S "Engineering Chemistry", Wiley India, Delhi, 2 nd Edition, 2013

Reference:

1.	Mendham. J, Denney. R.C, Barnes. J.D and Thomas. N.J.K, "Vogel's text book of quantitative chemical analysis", 6th Edition, Pearson Education, 2004.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 CS 0P1 Fundamentals of Programming Laboratory								
Common to BIOTECH,CIVIL,ECE,EEE,,E&I,TEX,MECH,MCT,NST								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	0	0	3	45	2	50	50	100

Objective(s)	• To enable the students to apply the concepts of C to solve basic problems • To apply the knowledge of library functions in C programming • To implement the concepts of functions, structures and enumerator in C • To implement the file handling operations through C
Course Outcomes	1. Perform basic calculations using MS-EXCEL. 2. Write a simple C program to read and display basic information. 3. Develop a C program using selection and iterative statements. 4. Demonstrate a C program to manage collection related data. 5. Interpret a C program to perform string manipulation functions. 6. Perform dynamic memory allocation using C. 7. Design and Implement different ways of passing arguments to functions. 8. Implement a C program to manage collection of different data using Structure or Enum. 9. Apply a C program to manage data using preprocessor directives. 10. Demonstrate a C program to store and retrieve data using file concepts.

LIST OF EXPERIMENTS

1. Implement basic calculations using MS EXCEL.
2. Implement a simple C program to read and display basic information.
3. Implement a C program using selection and iterative statements.
4. Implement a C program to manage collection related data.
5. Implement a C program to perform string manipulation functions.
6. Implement a C program to perform dynamic memory allocation.
7. Implement different ways of passing arguments to functions.
8. Implement a C program to manage collection of different data using Structure or Enum.
9. Implement a C program to manage data using preprocessor directives.
10. Implement a C program to store and retrieve data using file concepts.

Note: Programs specific to branches are to be taught and examined.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 EN 002 Communication Skills								
Common to All Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objective(s)	• To equip students with effective speaking and listening skills in English. • To help them to develop soft skills and people skills which will make them excel in their jobs. • To enhance students' performance in placement interviews.

The Listening Process

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

Suggested activities

Listening to casual conversations, talks, interviews, lectures, specific information relating to technical content, statistical information, retrieving information, gapped texts-listening comprehension through video clippings and lectures.

Nature of Communication

Stages of communicationChannels of communication- Barriers to effective communication - Differences between spoken and written communication - Giving directions - Art of small talk-presentation skills - Taking part in casual conversation - Making a short formal speech-Describing people, place, and events.

Suggested activities

Motivating and conducting prepared speech – debate on topics of interest **-** conversation (dialogue based on particular situation by using pleasantries) – extempore - picture description (people, place, things and events)

Telephonic Conversational Skill

Using the telephone - Greeting and introduction - Making requests - Asking for permission, Giving / Denying permission - Giving information on the phone – Leaving messages on Answer Machines - Making / changing appointments - Making complaints – Reminding - Listening and Taking messages - Giving instructions & Responding to instructions

Suggested activities

Familiarizing the telephone etiquette and telephone jargon – use of role play cards – conversational practices – games for spelling out proper nouns, long words, numbers, etc., -- useful phrases for complaints or making appointments – providing the needed vocabulary and expressions for agreeing and disagreeing – video clippings of speeches to drill note taking – providing context for framing yes or no questions for making requests.

Remedial Grammar

Tenses - 'Do' forms – Impersonal Passive voice - Imperatives – using should form – Direct, Indirect speech – Discourse markers – SI Units - Numerical adjectives – Prepositions (intermediate level) - Phrasal verbs (usage)- Correct use of words - Use of formal words in informal situations - Commonly confused words – Editing.

Suggested activities

Providing various contexts to fill tense gaps (stories , demos, future plans etc.,) Technical context for impersonal passive structures – transformation drills for imperatives – elucidating suggestion and recommendation formats – contextual frames for preposition and phrasal verbs – editing exercises – standard paradigm for negative structures – use of SI units (25 common units to be taught) numerical adjectives in various contexts – providing examples and drill units for commonly confused words-exemplifying the structures for direct and indirect speech – monitoring the drill units for conversion of direct to indirect, imperatives to recommendations and vice versa – reinforcing skills for discourse markers.

Written Communication & Career Skills

Writing e-mails - Writing Reports – Lab Reports - Preparing Curriculum Vitae and cover letters - Facing an Interview - Flow Charts, Interpreting the data from Tables– Recommendations – Check List – Slide Preparation –Theme Detection – Deriving Conclusions from the passages – Situation Reaction Test – Statements - Conclusions-Statement and Courses of Action

Suggested activities

Deliberating the content, format and diction for drafting e-mails -- elucidating the structure and content for writing reports especially Accident and Lab Reports -- mentoring strategy to construe the difference between Résumé and CV , and preparing the wards for the recruitment -- building self confidence in facing an interview with flawless presentation and persuasion skills -- reinforcing the interpretative skills of transcoding flow charts and Tables by employing appropriate discourse markers -- inculcating the language and format of writing Recommendations and Checklists -- enforcing innovatively the Reasoning and Logical Detection in Verbal Ability for the effective equipment of grooming for the primary leg of the recruitment process.

Total hours to be taught : 45

Text book :

1. Ashraf M Rizvi, 'Effective Technical Communication', 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.

Reference(s) :

1. P.Kiranmai Dutt, Geetha Rajeevan and CLN.Prakash, 'A Course in Communication Skills', by Ebek – Cambridge University Press India Pvt. Ltd., 2008.
2. B. Jean Naterop, 'Telephoning in English' – Cambridge University Press India Pvt.Ltd., 2007.
3. Jack. C. Richards, 'New Interchange Services (Student's Book)' – Introduction, Level – 1, Level – 2, Level – 3, Cambridge University Press India Pvt.Ltd., 2007.
4. R.S. Aggarwal, 'A Modern Approach to Verbal & Non – Verbal Reasoning',S.Chand& Company Ltd., New Delhi, Revised Edition, 2012.
5. NPTEL Video Courses on Communication Skills.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 MA 002 Laplace Transform and Complex Variables								
Common to MECH, CIVIL, MCT, EEE, EIE, CSE, IT, TT, BT & NST								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	50	50	100

Objective(s)	• To use multiple integration to solve problems involving volume and surface area. • To introduce the concepts of Laplace transform, complex variables and complex integration which are imperative for effective understanding of engineering subjects. • To identify the properties of planar and solid geometric shapes and use these properties to solve common applications.
Course Outcomes	**At the end of the course, the students will be able to** 1. (i) Apply double integral to find area between two curves. (ii) Evaluate double integral by changing the order of integration and triple integral. 2. Study the concepts of Beta and Gamma functions. 3. Understand the concepts of Laplace transforms for some elementary functions, some special functions, periodic functions, derivatives and integrals. 4. Apply the techniques of inverse Laplace transform to solve linear ordinary differential equation and simultaneous differential equations. 5. Know about the construction of analytic and conjugate harmonic functions and their properties. 6. Employ conformal maps to determine images of curves and find the bilinear transformation. 7. Expand the functions as Taylor's and Laurent's series and evaluate the complex integrals. 8. Evaluate real definite integrals with suitable contours using Cauchy's residue theorem. 9. Understand the notions of plane, straight line and skew lines. 10. Relate the concepts between tangent planes and spheres.

MULTIPLE INTEGRALS

Double integration – Cartesian and polar coordinates – Change of order of integration – Area between two curves – Area as double integral – Triple integration in Cartesian coordinates.

Beta and Gamma functions**:** Relationship between Beta and Gamma functions – Properties – Problems.

LAPLACE TRANSFORM

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms – Initial and final value theorem – Transform of unit step function – Dirac's delta function – Transform of periodic functions. Inverse Laplace transform – Convolution theorem – Solution of linear ordinary differential equation with constant co-efficients – First order simultaneous equations with constant co-efficients.

COMPLEX VARIABLES

Functions of a complex variable – Analytic functions – Necessary conditions (Cauchy–Riemann equations) – Sufficient conditions (excluding proof) – Properties of analytic functions – Harmonic function – Conjugate harmonic functions– Construction of analytic functions– Conformal mapping: w = z + a, az, 1/z and bilinear transformation.

COMPLEX INTEGRATION

Cauchy's Integral theorem (without proof) – Cauchy's integral formula – Taylor and Laurent series (without proof) – Classification of singularities – Cauchy's residue theorem – Contour integration – Circular and semi-circular contours (excluding poles on real axis).

SOLID GEOMETRY

Direction cosines – Plane – Straight lines – Coplanar – Point of intersection – Skew lines – Sphere – Tangent plane – Great circle – Orthogonal sphere.

Text book:

1	Kreyszig E, "Advanced Engineering Mathematics", 9th Edition, John Wiley and Sons (Asia) Limited, New Delhi, Reprint 2012.

Reference(s):

1	Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2013.
2	Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Lakshmi Publications Pvt Ltd, New Delhi, 2014.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 PH 003 Condensed Matter Physics								
Common to MECH, MCT								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objectives	1. To impart fundamental knowledge about crystal physics, conducting, magnetic, dielectric and advanced materials. 2. To correlate the theoretical principles with application oriented studies.
Course outcomes	1. Comprehend crystal symmetry and understand the characteristics of HCP. 2. Apply crystal growth techniques to prepare crystal and analyze crystal imperfect grown crystal. 3. Recognize electrical and thermal conductivity to understand the properties of a free electron in conducting materials. 4. State Fermi,distribution function to deduce density of energy state and apply conductivity theory in thermistor. 5. Classify magnetic material based on the properties. 6. Employ magnetic material to act us memory storage device. 7. Comprehend different types of polarization in dielectric and analyze dielectric material based on frequency, temperature and breakdown voltage. 8. Apply ferro and piezo electric material for research and industrial application. 9. Understand and apply the properties of metallic glasses, SMA, MEMS for research and industrial applications. 10. Understand the properties and prepration of nanomaterials and its impact in research and industrial applications.

Crystal Physics

Crystal symmetry elements of a simple cubic system – HCP structure: coordination number, atomic radius, c/a ratio, packing factor – Crystal imperfections –Crystal growth techniques-solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

Conducting Materials and Applications

Conductors-Classical Free electron theory of metals- -Electrical Conductivity- Expression for electrical Conductivity-Thermal Conductivity-Expression for thermal Conductivity- Widemann Franz Law (Derivation)-Lorentz number - Drawbacks of Classical free electron theory-Quantum theory-Fermi distribution function – Effect of temperature and Fermi function-density of energy states-Application: Thermistor

Magnetic Materials and Devices

Classification –properties-Domain theory of ferromagnetism-Hystersis-Hard and Soft magnetic materials-Ferrites: structure, preparation and applications-Applications: Charge coupled devices (CCD)-optical and magnetic data storage

Dielectric Materials and Devices

Introduction-Polarization: Electronic, ionic, orientation and space charge-Frequency and Temperature dependence of polarization- Ferroelectric materials – Classification–Piezoelectric materials- Applications of ferroelectric and piezoelectric materials-Breakdown mechanisms- Classification of insulating materials

Advanced Materials

Metallic glasses: preparation, properties and applications – Shape memory alloys (SMA):Characteristics, properties of NiTi alloy-application-MEMS – Nanomaterials: Properties- Top-down process: Ball Milling method – Bottom-up process: Vapour Phase Deposition method- Carbon Nano Tube(CNT): Properties, preparation by Electric arc method- Applications

Text Books

1. Rajendran V, “Engineering Physics”, TataMcGraw Hill, New Delhi, 2011
2. William D. Callister, “Material Science and Engineering” ,Wiley India, 2006

References

1. Charles Kittel, Introduction to solid state physics, Wiley Publications, 2006
2. Neil W.Ashcroft, N.David Mermin, Solid State Physics, Cengage Publications, 2011
3. S.O.Pillai, “Solid State Physics,” New Age International, New Delhi, 2005

K.S.Rangasamy College of Technology – Autonomous								R 2014
41CH007 Environmental Science and Engineering								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum marks		
	L	T	P	45	C	CA	ES	Total
II	3	0	0		3	50	50	100
Objective(s)	1. To help the learners to analyze the importance of ecosystem and biodiversity. 2. To familiarize the learners with the impacts of pollution, control and legislation. 3. To enlighten the learners about waste and disaster management. 4. To endow with an overview of food resources and human health. 5. To enlighten awareness and recognize the social responsibility in environmental issues.							
Course Outcomes	1. Recognize the concepts and issues related to environment and ecosystem. 2. Assess the importance of biodiversity 3. Analyze the source, effects, and control measures of pollution. 4. Imbibe the applications of Laws of environmental protection. 5. Appraise the methods of solid waste management. 6. Increase the awareness of disaster management and preparedness. 7. Instill the awareness on the impacts of food resources and its related problems. 8. Evaluate the problems related to population explosion and its related health issues. 9. Analyze the value of sustainable development. 10. Identify the issues related to environmental issues and civic responsibilities.							

Environmental Studies, Ecosystem and Biodiversity

Environment- Segment - Environmental studies - Scope and multidisciplinary nature - Need for public awareness - Environmental ethics- Ecosystem - Structure and function - Ecological succession. Biodiversity - Values of biodiversity - Endangered and endemic species - Hot spots - India a mega biodiversity nation - Threats - Impact of biodiversity loss - Conservation - In-situ and ex-situ - Case studies.

environmental pollution and legislation

Pollution - Sources, effects and control measures - Air, water, soil, noise, thermal, nuclear and marine - Major polluting industries of India - Land degradation - Impacts of mining. Environmental legislation in India- Environment protection act - Air pollution, water pollution, wildlife protection and forest conservation - Case studies.

Waste and Disaster Management

Waste - Solid waste - Sources, effects and control measures - Management techniques - e-waste - Effluent water treatment - Radioactive waste and disposal methods. Disaster management - Earth quakes - Landslides - Floods - Cyclones - Tsunami - Disaster preparedness - Response and recovery from a disaster - Disaster management in India - Case studies.

Food Resources, Human Population and Health

World food problems - Over grazing and desertification - Effects of modern agriculture - Fertilizer – Pesticide - Problems, water logging and salinity. Population - Population growth and explosion - Population variation among nations. Human rights - Value education - Women and child welfare - HIV/AIDS - Role of IT in environment and human health - Case studies.

Social Issues and The Environment

Unsustainable to sustainable development - Use of alternate energy sources - Energy Conversion processes - Biogas - Anaerobic digestion - Production and uses - Water conservation - Rain water harvesting - Water shed management - Resettlement and rehabilitation of people - Deforestation - Greenhouse effect - Global warming - Climate change - Acid rain - Ozone layer depletion - Waste land reclamation. Consumerism and waste products - Role of an individual in conservation of natural resources - Case studies.

Text book(s):

1	Tyler miller. G, “Environmental Science”, 13th Edition Cengage Publications, Delhi, 2013.

Reference(s):

1.	Gilbert M.Masters and Wendell P. Ela,”Environmental Engineering and Science”, Phi learning private limited, New Delhi, 3rd Edition, 2013. Learning private limited, New Delhi, 3rd Edition, 2013.
2.	Rajagopalan. R, “Environmental Studies” Oxford University Press, New Delhi, 2nd Edition, 2012.
3.	Deeksha Dave and Katewa. S.S, “Environmental Studies” 2nd Edition, Cengage Publications, Delhi, 2013.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 EC 001 Basics of Electronics Engineering								
Common to Mech, BioTech, Nano								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objective(s)	To introduce the fundamentals of Electron Devices and integrated Circuits.
Course Outcomes	1. Discuss the operational basics of semiconductor devices. 2. Explain the construction, characteristics and applications of PN junction diodes. 3. Describe the construction, working and characteristics of bipolar junction transistor. 4. Discuss the applications of bipolar junction transistor. 5. Explain the construction, working and characteristics of FET. 6. Describe the construction, operating principle and characteristics of MOSFET and know the applications of FET. 7. Discuss different number systems used to represent digital data and apply Boolean laws to reduce complex logic expressions. 8. Explain the basics of logic gates, combinational and sequential logic circuits. 9. Describe the operational fundamentals and characteristics of an Opamp. 10. Discuss various Opamp Application Circuits.

Semiconductor Diodes

Review of semiconductor physics: Insulators, Conductors and Semiconductors-Semiconductor types- Law of Mass Action- Drift and Diffusion carriers; PN Junction Diode- Ideal and Practical diode- VI characteristics-Temperature dependence-Diode specifications-Equivalent circuits-Zener Diode- Photo Diodes- Light Emitting Diodes-Applications of Diode- Rectifier, Clipper, Clamper.

Bipolar Junction Transistors

Transistor- construction, types, operation, configurations, specification and rating- Transistor as a switch-Applications- Regulator, RPS/SMPS- Power Amplifier- Block diagram.

Field Effect Transistors

JFET-Construction, operation, characteristics, effect of temperature- FET parameters and specifications-MOSFET- Types, construction and operation- Applications.

Digital Electronics

Number Systems- Boolean algebra – Logic gates- OR, AND, NOT, NAND, NOR-Adder, Subtractor, Multiplexer, Demultiplexer, Encoder, Decoder-Flip-Flops.

Operational Amplifier

Introduction, Ideal Vs. Practical- Performance Parameters- Applications- Inverting and Non-inverting Amplifiers, Voltage Follower-Summing and difference amplifier, Comparator, Integrator, Differentiator, Instrumentation amplifier.

Text book (s) :

1	Anil K. Maini, Varsha Agrawal ‘Electronic Devices and Circuits’, Wiley India Pvt.Ltd, 2013.
2	Anil K. Maini, ‘Digital Electronics Principles and Integrated Circuits’, Wiley India Pvt.Ltd, 2009.

Reference(s) :

1	Robert L. Boylestad, Louis Nashelsky, ‘Electronic Devices and Circuit Theory’, Pearson New Delhi, 11th Edition, 2012.
2	Mehta V K, ‘Principles of Electronics’, S.Chand & Company Ltd., 11th Edition, 2008.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 004 Engineering Mechanics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	50	50	100

Objective(s)	• To acquire knowledge about basic laws of mechanics and equilibrium of rigid bodies. • To identify the properties of surfaces and solids by using different theorem. • To impart basic concept of dynamics of particles, friction and elements of rigid body dynamics.
Course Outcomes	At the end of the course, the student will be able to: 1. Apply the laws of engineering mechanics, vector operations. 2. Calculate the resultant force on a particle, 2D and 3D bodies. 3. Determine the moments, couples and support reactions. 4. Analyze the equilibrium conditions in 2D and 3D. 5. Calculate the centroid of areas and centre of gravity of volumes. 6. Apply the parallel and perpendicular axis theorem for calculating the mass moment of inertia. 7. Apply the kinematics to particle and rigid bodies. 8. Apply the kinetics to connected rigid bodies. 9. Explain the causes of friction applied to various mechanical components. 10. Apply the concept of general plane motion to rigid bodies.

Basics and Statics of Particles

Introduction - Units and Dimensions - Laws of Mechanics – Principle of transmissibility- 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 —- Single equivalent force.

Equilibrium of Rigid Bodies

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.

Properties of Surfaces and Solids

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 - Mass moment of inertia of thin rectangular section - Relation to area moment of inertia.

Dynamics of Particles

Displacement, Velocity, acceleration and their relationship – Relative motion – Projectile motion in horizontal plane – Newton's law – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

Friction

Frictional force – Laws of Coloumb friction – Simple contact friction – Ladder friction - Rolling resistance – Ratio of tension in belt.

Elements of Rigid Body Dynamics

Translation and Rotation of Rigid Bodies: Velocity and acceleration – General Plane motion: Crank and Connecting rod mechanism.

Text Book(s):

1	Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 2000.
2	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 8th Edition, 5th Reprint 2009.

Reference(s):

1	Jayakumar, V. and Kumar, M, Engineering Mechanics, PHI Learning Private Ltd, New Delhi, 2012.
2	Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
3	Bansal R.K," Engineering Mechanics" Laxmi Publications (P) Ltd, 2011.
4	Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt. Ltd., 2003.

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2014</td></tr>
<tr><td>Department</td><td></td><td colspan="3">Programme Code & Name</td><td colspan="4">Common for ME,IT,EE,EC,EI</td></tr>
<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>40PH0P1</td><td>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">1. To give exposure for understanding the various physical phenomena in mechanics, optics, materials science and properties of matter
2. To correlate the theoretical principles with application oriented studies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">01.Ability to know the concept of parameters, such as stress, strain and elastic limit needed to achieve a given amount of deformation in the given material (1)
02.Ability to understand the concept of a wave encountering an obstacle (particle) that is comparable in size to its wavelength, undergoing scattering (diffraction) by particles and to apply it find the wavelength of light and the particle size (2)
03.Ability to understand the light gathering efficiency of optical fiber communication by finding the light launching parameters, acceptance angle and numerical aperture (3)
04.Ability to understand the role of valence band, conduction band and difference in their band gap energy in determining the conductivity of a semiconductor for semiconducting and opto-electronic device applications.(4)
05.Ability to understand the lagging of magnetisation behind the applied magnetic field (hysteresis behaviour) of a ferromagnetic material, the application being the ON/OFF switch in memory devices (5)
06.Ability to understand the phenomenon of interference of light between the two reflected lights from a flat (glass plate) and spherical surfaces (Plano-convex lens) that produces puddles of Newton’s rings, the application of which is an accurate measure of the size of any hollows and heights on a surface by counting the rings and knowing the wavelength of the illumination (6)
07.Ability to understand the concept of refractive index that varies with the wavelength of the light and to know the dispersion of light due to refraction by a glass prism in optical device applications. (7)
08.Ability to know the concept of interference of light between two reflected lights from a thin air wedge. (8)
09.Ability to comprehend the diffraction property of light through a spectrometer grating element which yields the wavelength of mercury spectral lines (9)
010.Ability to apply the knowledge of semiconductor thin films in conversion of optical energy into electrical energy, the application being the photovoltaic solar cells employed as one of the potential and perennial renewable energy source (10)</td></tr>
<tr><td>Sl.No.</td><td colspan="8">List of Experiments</td></tr>
<tr><td>1.</td><td colspan="8">Determination of Young’s modulus of a cantilever (Pin & Microscope method).</td></tr>
<tr><td>2.</td><td colspan="8">Determination of wavelength of laser and particle size</td></tr>
<tr><td>3.</td><td colspan="8">Determination of acceptance angle and numerical aperture of an optical fiber.</td></tr>
<tr><td>4.</td><td colspan="8">Determination of band gap energy of semiconductor.</td></tr>
<tr><td>5.</td><td colspan="8">Study of characteristics of hysteresis curve (B-H curve) of a ferromagnetic material.</td></tr>
<tr><td>6.</td><td colspan="8">Determination of radius of curvature of a plano convex lens using Newton’s rings.</td></tr>
<tr><td>7.</td><td colspan="8">Determination of dispersive power of a prism using spectrometer.</td></tr>
<tr><td>8.</td><td colspan="8">Determination of thickness of a thin wire by air wedge.</td></tr>
<tr><td>9.</td><td colspan="8">Determination of wavelength of mercury spectral lines using spectrometer grating element.</td></tr>
<tr><td>10.</td><td colspan="8">V-I characteristics of Solar cell.</td></tr>
<tr><td colspan="9">Lab Manual :</td></tr>
<tr><td colspan="9">“Physics Lab Manual”, Department of Physics, KSRCT.</td></tr>
</table>

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 0P2 Engineering Practices Laboratory								
Common to ME,EEE,CSE,IT,EIE,NST								
Semester I	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	3	45	2	50	50	100
Objective(s)	To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical Engineering							
Course Outcomes	At the end of the course, the student will be able to: 1. Make a model of fitting like Square and V fitting using fitting tools 2. Make a model of carpentry like Dovetail joint, and cross lap joint using carpentry tools 3. Fabricate the models of sheet metal in sheet metal shop. 4. Prepare joints by arc welding 5. Construct electrical wiring circuit and demonstrate in electrical wiring section 6. Construct the water pipe line in plumbing shop							

Fitting
Safety aspects in Fitting, Study of tools and equipments, Preparation of models- Filing, Square, Vee.

Carpentry
Safety aspects in Carpentry, Study of tools and equipments, Preparation of models- Planning, Dove tail, Cross Lap.

Sheet Metal
Safety aspects in Sheet metal, Study of tools and equipments, Preparation of models- Scoope, Cone, Tray.

Welding
Safety aspects of welding, Study of arc welding equipments, Preparation of models -Lap, butt, T-joints. Study of Gas Welding and Equipments.

Electrical Wiring And Plumbing
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, wiring circuit for 3 phase motor. Study of plumbing tools, assembly of G.I. pipes/ PVC and pipe fittings, Cutting of threads in G.I.Pipes/PVC by thread cutting dies.

Lab Manual :

1. “Engineering Practices Lab Manual”, Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology – Autonomous					R 2014		
40 ME 0P3 Computer Aided Drafting Laboratory							
Common to MECH , CIVIL, MCT, TT							
Semester	Hours / Week			Total hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
II	0	0	3	45	2	50	50	100
Objective(s)	To impart the knowledge on use of drafting software to draw the conics, solids, isometric and orthographic views.							
Course outcomes	At the end of the course, the student will be able to: 1. Cons truct special curves and conic sections using drafting software. 2. Draw the projection of solids using drafting software. 3. Draw the true shape of section of solids 4. Covert the pictorial views into orthographic views using drafting software. 5. Construct the isometric projections of objects using drafting software.							

1. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-line figures.
2. Computer aided drafting of ellipse, parabola, involute and cycloid using B-Spline or Cubic Spline.
3. Computer aided drafting of front and top view of prism, pyramid, cylinder and cone.
4. Computer aided drafting of sectional views of prism, pyramid, cylinder and cone.
5. Computer aided drafting of front, top and side views of objects from the given pictorial views.
6. Computer aided drafting of isometric projection of an object.

Reference Book(s):

1	Bhatt N.D., “Engineering Drawing”, Charotar Publishing House Pvt. Ltd., 49th Edition, Anand, Gujarat, 2006.
2	D.M.Kulkarni,A.P.RAstogi, A.K.Sarkar, ”Engineering Graphics with Auto CAD”, PHI Private Limited, New Delhi, 2009.
3	Cencil Jenson, Jay D.Helsel, Desnnis R.Short, “Engineering Drawing & Design”, 7th Edition, Tata Mcgraw Hill Pvt. Ltd., New Delhi. 2012.

K.S.Rangasamy College of Technology – Autonomous								R2014
40 MA 004 Boundary Value Problems and Transform Methods								
Common to CIVIL, CSE, IT, MCT, MECH and NST								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	50	50	100

Objective(s)	• To apply Fourier series and Fourier transform for engineering discipline. • To acquire analytical skills in the areas of one dimensional and two dimensional boundary value problems. • To introduce the concepts of Z- transform and its application to various problems related to engineering and technology.
Course Outcomes	**At the end of the course, the students will be able to** 1. Obtain the Fourier series expansion for the periodic function. 2. Understand the notions of half – range Fourier series and harmonic analysis. 3. Know about the procedure to find the solution of one-dimensional wave equation with zero or non-zero velocity. 4. Understand the procedure to find the solution of one-dimensional heat equation with steady state or unsteady state condition. 5. Solve the solution of two dimensional heat flow equation for finite plates. 6. Solve the solution of two dimensional heat flow equation for infinite plates. 7. Apply Fourier transform technique and Parseval's identity for the continuous function. 8. Discuss the Fourier sine and cosine transforms and properties of Fourier transforms. 9. Understand the concepts of Z- transform for some elementary functions and its properties. 10. Apply the inverse Z-transform techniques to the function and solve the difference equation using Z-transform.

Fourier Series

Dirichlet's conditions – Fourier series – Odd and even functions – Half range Fourier series – Root mean square value of a function – Parseval's identity – Harmonic analysis.

Boundary Value Problems – I

Classification of second order quasi - linear partial differential equations – Solution of one-dimensional wave equation – Solution of one-dimensional heat equation – Problems.

Boundary Value Problems – II

Two dimensional heat flow equation (Insulated edges excluded): Finite plates – Square plates temperature given in horizontal edge – Square plate temperature given in horizontal and vertical edges – Rectangular plates temperature given in horizontal edge – Rectangular plates temperature given in horizontal and vertical edges – Infinite plates – Vertically infinite plates – Horizontally infinite plates.

Fourier Transform

Fourier transform pair – Fourier transform of simple functions – Fourier sine and cosine transform – Properties – Convolution theorem – Parseval's identity – Problems.

Z –Transform

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.

Text book(s):

1	Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
2	Kreyszig E, "Advanced Engineering Mathematics", 9thEdition, John Wiley & Sons (Asia) Limited, New Delhi, Reprint 2012.

Reference(s):

1	Veerarajan T, "Engineering Mathematics-III", Tata McGraw-Hill Publishing Company Limited, New Delhi.
2	Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Lakshmi Publications Pvt Ltd, New Delhi, 2014.
3	Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2011.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME301 Engineering Materials and Metallurgy								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100

Objective(s)	• To impart concept on reactions, treatment, microstructure and mechanical behaviour of engineering materials at different temperature. • To learn basic principles in metallurgy and materials engineering. • To identity and select suitable engineering materials based on their applications.
Course Outcomes	At the end of the course the students will be able to 1. Explain with the structures of materials at different solid solutions and phase diagram. 2. Assess the effect of phase changes during the heating and cooling of steel and cast iron using Iron carbon equilibrium diagram. 3. Interpret the metallurgical properties of ferrous metals. 4. Predict the metallurgical properties of Non-ferrous metals, aluminium alloy and bearing materials 5. Construct the T-T-T and C-C-T diagrams and analyse the effect of cooling rate on steels. 6. Choose the heat treatment process for steels. 7. Apply the physical and mechanical properties of ceramic materials for engineering fields. 8. Explain with the powder metallurgy process for the production of different metal powders. 9. Select the testing methods to determine the mechanical properties of materials. 10. Aanalyse microstructure of material using Optical microscopy and Scanning electron microscopy.

Constitution of Alloys and Phase Diagrams

Constitution of alloys - solid solutions, substitutional and interstitial - phase diagrams - cooling curve, phase rule, lever rule, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron-Iron carbide equilibrium diagram.

Ferrous and Non-ferrous Metals

Classification of steel and cast iron – microstructure - properties and applications - Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti &W) - stainless and tool steels - HSLA - maraging steels - Cast iron: gray, white, malleable, spheroidal graphite - alloy cast irons - Copper and Copper alloys; Brass, Bronze and Nickel-copper alloys - Aluminium and its alloys - Bearing materials

Heat Treatment

Process: Annealing, Normalizing, Hardening, Tempering, austempering, and martempering of steel - T.T.T diagrams - CCR – Hardenability - Jominy end quench test - Precipitation strengthening treatment - Case hardening processes - Flame and Induction hardening.

Non Metallic Materials

Engineering Ceramics - Properties and applications of Al_2O_3, SiC - Fiber and Particulate reinforced composites - fabrication of fiber reinforced composites.

Powder Metallurgy

Powder metallurgy process - characteristics of metal powders - production of metal powders - powder metallurgy process- applications - advantages and limitations.

Testing of Engineering Materials

Mechanism of plastic deformation - slip and twinning - Types of fracture - Destructive Testing: 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.

Text Book(s):

1	Sidney H.Avner “Introduction to Physical Metallurgy” Tata McGraw-Hill Companies Inc., New Delhi, 2009.

Reference(s):

1	Khanna O.P, “A Text Book of Martial Science and Metallurgy”, Dhanpat Rai Publishers, New Delhi, 2010.
2	William D. Callister, “Material Science and Engineering: An Introduction”, Wiley India Pvt Ltd, New Delhi, 2010.
3	Raghavan.V., “Materials Science and Engineering: A First Course”,5th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME302 Engineering Thermodynamics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	50	50	100

Objective(s)	• Evaluate the change of properties of various closed and open systems using first law of thermodynamics. • Demonstrate the application • of second law of thermodynamics to heat engine and refrigeration system and argue the concept of increase in entropy. • Examine the dryness fraction for various regions and conclude the performance of Rankine, Reheat and Regenerative cycles. • Derive the mathematical relations, Maxwell relations and Tds equations and evaluate the Joule-Kelvin effect, Joule Thomson coefficient and Clausius Clapeyron equation. • Recognize and label the psychrometric property in psychrometric chart and evaluate the psychrometric processes.
Course Outcomes	At the end of the course the students will be able to 1. Describe the basic concepts of thermodynamics, zeroth law and first law of thermodynamics and apply the concepts of first law of thermodynamics to closed system. 2. Diagnose the concept of first law of thermodynamics to open system. 3. Relate the concept of second laws of thermodynamics to engines and refrigeration and air-conditioning cycle and to outline the principle of Carnot engine. 4. Define the concept of increase in entropy and predict its applications on mixing of two fluids. 5. Recognize the behaviour of pure substances and evaluate the properties of steam. 6. Evaluate the performance of Rankine cycle, Reheat cycle and Regenerative cycle. 7. Apply the differential equations to energy equations, Maxwell's equations and specific heat relations. 8. Describe the concept of Joule Thomson effect, Clausius Clapeyron equation, equation of state and compressibility. 9. Explain the importance of presence of moisture in atmosphere and its properties. 10. Assess the application of psychrometric processes.

Basic Concepts and First Law of Thermodynamics
Basic concepts - Zeroth law of thermodynamics - First law of thermodynamics – application to closed and open systems.

Second Law of Thermodynamics, Entropy and Availability
Kelvin Planck and Clausius statements of second law - Cyclic heat engine - Carnot cycle - Carnot's theorem and thermodynamics temperature scale - Clausius theorem and its inequality - Entropy principle and applications - Introduction to availability.

Properties of Pure Substance and Steam Power Cycle
Properties of pure substances - phase rule, P-V, T-V, P-T, h-s diagrams - dryness fraction and its measurements - thermodynamic properties of steam and analysis of Rankine cycle, Reheat cycle and Regenerative cycle.

Thermodynamic Relations
Mathematical theorems - Maxwell's equation - TdS equation - Energy equation - Joule Thomson Coefficient - Clausius Clapeyron equation – Equation of state and compressibility.

Psychrometry
Psychrometry and psychrometric charts - property calculations of air and water vapour mixtures - Psychrometric process – Sensible heating / cooling - cooling and dehumidification - heating and humidification - adiabatic mixing.

Text Book(s):

1	Nag. P.K., "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill Publications, New Delhi, 2013.
2	Cengel, Y. A., "Thermodynamics - An Engineering Approach", 7th Edition, Tata Mc Graw Hill Publications, New Delhi, 2011.

Reference(s):

1	Arora, C.P., "Thermodynamics", Tata McGraw-Hill Publications, New Delhi, 2007.
2	Venwylen and Sontang, "Classical Thermodynamics", Wiley Eastern Publications, 1987.
3	Holman,J.P., "Thermodynamics", 3rd Edition, McGraw-Hill Publications, 1995.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME303 Manufacturing Process								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100

Objective(s)	• To describe the manufacturing methods of foundry processes. • To explain the positive and negative impacts that welding processes has on society. • To demonstrate the methodologies of hot and cold forming for engineering materials. • To interpret the manufacturing concepts of plastics materials
Course Outcomes	At the end of the course the students will be able to 1. Explain the various molding materials used in the making of moulds and cores. 2. Manipulate different types of furnaces used in modern castings and casting defects. 3. Select different arc welding processes for large volume manufacture. 4. Relate the different types of welding processes used for special fabrication. 5. Demonstrate hot rolling, forging and extrusion processes and applications. 6. Illustrate about extrusion and drawing processes and applications. 7. Use techniques, skills and modern engineering tools necessary for press and die performance assessment. 8. Describe the characteristics of metal forming process required for a component manufacturing. 9. Select appropriate type of plastics and plastics processing method used in making of plastic parts. 10. Discuss the molding operations for producing discrete parts.

Foundry Processes
Introduction - Moulding tools and equipment - Patterns - Moulding sands - Properties of molding sand - Types of mould - Design of mould - Machine mould - Casting methods - Cores - Design of riser and gating system - Furnaces: Cupola furnace - Pouring temperature: Solidification and cooling - Cleaning - Inspection and testing of castings - Casting defects and remedy.

Welding Processes
Introduction - Physics of welding - Classification of welding processes - Design considerations in welding - Welding position and joints - Arc welding - Resistance welding - Thermo-chemical welding - Radiant energy welding - Solid-state welding - Gas welding - Brazing and soldering - Welding defects - Inspection and testing of weldments.

Hot Forming Processes
Introduction – Classification - Fundamentals of hot forming processes - Plastic deformation and yield criteria - Major hot working processes - Hot rolling: Rolling parameters and their effects - Types of rolling mills - Defects in rolled plates and sheets - Hot forging: Forces in hot forging - Hot extrusion: Types and characteristics of hot extrusion - Extrusion defects – Forces - Extrusion of tubing - Hot drawing and hot spinning.

Cold Forming Processes
Introduction - Classification - Fundamentals of cold forming processes: Cold rolling - Swaging - Coining - Cold drawing of rods - Wires and tubes - Sheet metal forming (press working): Press - Die assembly - Types of press - Safety in press working - Sheet metal shearing processes - Sheet metal forming processes: Bending - Stretching - Drawing - Metal spinning - Stamping - Bulging and hydro forming – Load estimation.

Plastic Processes
Introduction - Classification of plastics - Manufacturing of plastic products: Compression - Transfer - Injection - Extrusion - Calendaring - Blow molding - Machining and joining of plastics - Industrial applications of plastics.

Text Book(s):

1	Kaushish, J.P., “Manufacturing Processes,” PHI Learning Ltd, New Delhi, 2013.

Reference(s):

1	Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Pearson publication, London, 2009.
2	John A. Schey, “Introduction to Manufacturing Processes”, McGraw Hill Education Ltd, New Delhi, 2014.
3	Rajput, R.K., “A Textbook of Manufacturing Technology”, Laxmi publications Ltd, New Delhi, 2014.
4	Rao, P.N., “Manufacturing Technology Vol-1”, 3rd Edition, McGraw-Hill publishing Ltd, New Delhi, 2009.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME007 Fluid Mechanics and Machinery								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	50	50	100
Objective(s)	• To impart knowledge on properties of fluid, fluid statics & dynamics reactions, incompressible fluid flow. • To acquire knowledge on hydraulics machines.							
Course Outcomes	At the end of the course the students will be able to 1. Explain and evaluate the various properties of fluids. 2. Perform the measurement of fluid pressure using manometer. 3. Determine the weight of body by using buoyancy method 4. Estimate the rate of flow of fluids using continuity equation. 5. Apply the concept of Bernoulli's equation to Venturimeter and orifice meter 6. Evaluate the pressure drop using Hagen poiseulle's equation 7. Predict the major and minor losses in flow through pipes 8. Analyze the similarity of motion between model and prototype 9. Evaluate the performance of the various turbines. 10. Evaluate the performance of the various pumps.							

Fluid Properties and Fluid Statics

Units and Dimensions – Fluid Properties – Density, Specific gravity, Viscosity, Surface tension, capillarity, compressibility and bulk modulus - Fluid Statics -Pascal's law – Pressure measurements – Atmospheric, vacuum pressure and gauge pressure – simple and differential manometers - Buoyancy – Centre of buoyancy – meta center and meta center height.

Fluid Kinematics and Fluid Dynamics

Types of fluid Flow – types of flow line – control volume - velocity field and acceleration - Continuity equation-stream and potential function – energy equation - Euler's and Bernoulli's Equation – Applications **–** Venturimeter, orifice meter and pitot tube.

Flow through circular conduits

Laminar flow through circular pipes - Hagen Poiseuille equation – Turbulent flow - Boundary layer concepts – Darcy Weisbach formula -Loss of energy in pipes – major and minor losses of flow in pipes – Pipes in series and in parallel - Equivalent pipes.

Dimensional Analysis

Need for dimensional analysis **–** methods of dimensional analysis - Similitude – types of similitude – Dimensionless parameters – application of dimensionless parameters – Model analysis.

Hydraulic Pump and Turbine

Classification – construction, working principles and design of Pelton wheel and Francis turbines – head, losses, work done and efficiency – specific speed – operation characteristics – Governing of turbines – Classification of pumps – centrifugal pump and reciprocating pump - working principle – discharge, work done and efficiencies.

Text Book(s):

1	R.K Rajput A Textbook of Fluid Mechanics and Hydraulic Machines S.Chand & company Ltd. 4th Edition 2011.

Reference(s):

1	Ramamrutham.S. "Hydraulics Fluid Mechanics and Fluid Machines", 8th Edition, Dhanpat Rai Publishing company (P) Ltd, New Delhi, 2014.
2	Cengel Yunus A. and Cimbala, John M., "Fluid Mechanics", Tata McGraw - Hill, New Delhi, 2nd Edition, 2010.
3	Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi, 2010.
4	Modi P. N and Seth S.M "Hydraulics and mechanics, including Hydraulic machines" standard book house, Delhi 2002.

K.S. Rangasamy College of Technology - Autonomous								
Common to all Branches								
40 PH 008 Applied Physics								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100
Objective(s)	1. To enhance students' knowledge of theoretical and modern technological aspects in physics 2. To enable the students to correlate the theoretical principles with application oriented studies							
Course Outcomes	At the end of the course the students will be able to 1. Explain the principle of laser emission and classification of lasers 2. Identify the applications of lasers. 3.Explain the propagation of lights in fibre optic cables, classification of fibre, splicing and their fabrication. 4. Describe the fibre optic communication link, its applications and light propagation losses. 5. Explain the production and detection of ultrasonic waves. 6. Identify the industrial and medical applications of ultrasonic waves. 7. Explain the development of quantum theory and its applications. 8. Describe the concepts of nuclear physics and identify the elementary particles. 9. Classify the sound and analyze its characteristics 10. Give suggestions for buildings with good acoustics							

Laser Technology

Introduction – Principle of spontaneous emission, stimulated absorption and emission – Einstein's co-efficient (derivation)-population inversion-pumping mechanisms – Types of lasers: Nd:YAG, Semiconductor laser (homo junction and hetero junction), CO_2 laser – Industrial applications: Lasers in welding, cutting, drilling and soldering-Medical applications: laser endoscopy,– Holography: Construction and reconstruction of hologram –Applications.

Fiber Optics and Sensors

Principles – cone of acceptance, numerical aperture (derivation)- Modes of propagation –Fabrication: Crucible-crucible technique - Classification: based on materials, modes and refractive index profile– Splicing – types of splicing- Losses in optical fiber – Light sources for fiber optics – Detectors – Fiber optical communication links(Block diagram) – Advantage of fiber optical cable over copper cables- Fiber optic sensors-principle-liquid level sensors-Temperature, Displacementmeasurement.

Ultrasonics and Applications

Introduction-Properties-Production: Magnetostriction effect, magnetostriction generator- piezoelectric effect, piezoelectric generator – Ultrasonic detection- acoustical grating-Applications: Cavitation, cleaning, SONAR,– Non-destructive testing: Pulse echo system, through transmission, resonance system- Medical applications: cardiology, neurology, ultrasonic imaging (A, B and TM- Scan).

Quantum and Nuclear Physics

Quantum physics: Introduction – de-Broglie hypothesis –Matter waves– Uncertainty principle, application: single slit experiment – wave function-physical significance-Schrodinger's wave equation: Time dependent and time independent – Particle in a box (one dimensional and three dimensional)–Microscopy: Scanning Electron Microscope.

Nuclear Physics: Introduction, atomic nucleus, nuclear force, nuclear density, atomic mass unit - mass defect - Binding energy-Nuclear fission-Energy released in fission- Stellar energy-elementary particles:Leptons, Hadrons: Mesons and Baryons

Acoustics

Introduction-Classification of sound – Characteristics of musical sound – sound intensity level – Weber-Fechner law – loudness level and intensity: Bel, Decibel–Reverberation – Reverberation time – Sabine's formula (derivation) – sound absorption coefficient measuring method -Absorption co-efficient (derivation)– Factors affecting the acoustics of buildings and their remedies - basic requirements for acoustically good halls - acoustical materials.

Text book:

1	V.Rajendran, Engineering Physics, Tata McGraw Hill Publishers, New Delhi, 2011

Reference(s) :

1.	Jeremy Bernstein, Paul M.Fishbane, Stephen Gasiorowicz, Modern Physics, Pearson Education, 2009.
2.	S.Kalainathan, A.Ruban kumar, Physics for Engineers, , RBA publications, Chennai, 2010.
3.	A.Arumugham, Engineering Physics, Anuradha Agencies, Chennai, 2005.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40ME3P1 Fluid Mechanics and Machinery Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	3	45	2	50	50	100
Objective(s)	• To emphasize the concepts of Bernoulli's principle using ventrimeter and orificemeter. • To evaluate the rate of flow in pipes. • To evaluate the frictional loss in pipes. • To analyse the performance characteristics of turbines and pumps.							
Course Outcomes	At the end of the course students will be able to • Apply the Bernoulli's principle to find the rate of flow using ventrimeter and orificemeter. • Determine the rate of flow in pipes. • Determine the friction factor for various pipes (major and minor losses). • Analyze the performance characteristics of turbines. • Analyze the performance characteristics of pumps							

1. Determination of the Coefficient of discharge of orificemeter.
2. Determination of the Coefficient of discharge of venturimeter.
3. Calculation of rate of flow using rotameter.
4. Determination of friction factor for a set of pipes.
5. Performance analysis of Pelton wheel.
6. Performance analysis of Francis Turbine.
7. Performance analysis of Kaplan Turbine.
8. Performance analysis of centrifugal pump
9. Performance analysis of reciprocating pump.
10. Performance analysis of gear pump.

Lab Manual :

1. "Fluid Mechanics and Machinery Laboratory Manual", Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME3P2 Manufacturing Technology Laboratory I								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	3	45	2	50	50	100

Objective(s)	• To combine and use machine tools to operate and control manufacturing processes to solve production problems. • To work safely in teams and solve foundry related problems • To select the use of basic hand tools • To plan, design, analyze, implement and improve cost-effective manufacturing methods • To analyze machine setup and operation techniques • To recognize the dimensional characteristics of interchangeable parts • To explain the various manufacturing processes and their influencing process parameters.
Course Outcomes	At the end of the course the students 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. Perform mold cavity for flange pattern, gear pattern and split pattern 4. Prepare mold cavity with core

MeasurementoftheMachinedComponentsandMachiningtimeestimationof:

1. FacingandPlainTurning.
2. Chamfering,StepTurningandKnurling.
3. GroovingandTaperTurningusingCompoundrest.
4. SingleandMultistartThreadcuttingandBoring.
5. EccentricTurning.
6. DrillingandTapping.

PreparationofSandMould:

7. MouldwithFlangePattern.
8. MouldwithGearPattern.
9. MouldwithSplitPattern.
10. MouldwithCore.

Lab Manual:

1. “Manufacturing Technology I Laboratory Manual” by Mechanical Faculty Members

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME3P3 Machine Drawing Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	3	45	2	50	50	100

Objective(s)	1. To provide the students with the opportunity of visualizing and comprehending information presented verbally or graphically 2. To develop conceptual knowledge of a purely theoretical form and providing a study in spatial perception where drawings are used in analyzing and solving two and three-dimensional problems by rigorous application of geometrical principles. 3. To demonstrate how to utilize Indian Standard code of practice, represent the fits, tolerances, allowances and symbols on drawings 4. To provide information of assembly drawing for manufacturing showing all parts, its dimensions, explanatory notes, relationship of each part and part list manually as well as using computer software.
Course Outcomes	At the end of the course students will be able to 1. Select conventional representation of threaded parts, springs and gears on drawing using Indian standard code of practice 2. Select fit, allowance, tolerance, and symbols for mechanical components based on requirement. 3. Prepare the assembly drawing to assist the manufacturing from the given part drawing with and without the application of CAD software.

Indian Standard Code of Practice for Engineering Drawing

General principles of presentation-Conventional representation of threaded parts, springs, gear and common features-Abbreviations and symbols for use in technical drawings-Conventions for sectioning and dimensioning.

Fits and Tolerances

Types of fits-selection of fits-allowances-types of tolerances-representation of tolerances on drawing-geometric tolerances-form and positional tolerances-datum features –maximum material principle-symbols-methods of indicating symbols on drawing-surface finish symbols-welding symbols-methods of indicating welding symbols on drawing. Fastening nuts-bolts-screws-keys and keyways-joints.

Preparation of Working Drawings

Manual Drafting Practice:(Part drawing should be given)

1. Cotter joint
2. Knuckle joint
3. Protected flange coupling
4. Plummer block
5. Connecting rod (I/C engine)
6. Screw jack (Bottle type)

Computer Aided Drafting Practice:

7. Universal coupling
8. Swivel bearing
9. Machine vice

Text Book(s):

1	N.D Butt, Machine Drawing, Charotar puplishing house Anand.New Delhi, 2010
2	K.R.Gopolakrishna, “Machine Drawing”, Subash Publishers, 2012

Reference(s):

1	N.Siddeswar,P.Kanniah, and V.V.S.Satry, Machine drawing”, Tata McGraw Hill, 2010
2	Revised IS codes:10711, 10712, 10713, 10714, 10715, 10716, 10717, 10968, 11663, 11669, 17668, 8000, 8043, 9609, 1165,

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2014
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**
40TP0P1	**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 **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 - **Materials:** Instructor Manual, Word Power Made Easy Book		6
Unit – 3	**Written Communication – Part 3**	
Jumbled Sentences, Letter Drafting (Formal Letters) - Foreign Language Words used in English - - Spelling & Punctuation (Editing) **Materials:** Instructor Manual, News Papers		4
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		6
Unit – 5	**Oral Communication – Part 2**	
Describing Objects / Situations / People, Information Transfer - Picture Talk - News Paper and Book Review **Materials:** Instructor Manual, News Papers		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. 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.

K.S.Rangasamy College of Technology – Autonomous								R2014
40 MA 008 Statistics and Numerical Methods								
Common to MECH, MCT, CIVIL & NST								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	50	50	100

Objective(s)	• To provide an understanding of the statistical methods and distribution concept by which real life problems are analyzed. • To apply numerical techniques for solving system of linear equations. • To understand and apply the concepts of interpolation and numerical integration. • To solve initial value problems of ordinary differential equations numerically.
Course Outcomes	At the end of the course, the students will be able to 1. Analyze and apply the concepts of some standard distributions. 2. Test the statistical hypothesis using t, F and χ^2distributions. 3. Analyze the variance of factors using CRD and RBD. 4. Analyze the design of experiment using Latin square. 5. i) Employ different techniques to approximate roots of algebraic and transcendental equations of higher degrees. ii) Solve the system of linear equations using direct methods 6. i) Solve the system of linear equations using indirect methods. ii) Find the largest Eigen value of a matrix of order 2x2 and 3x3. 7. Find the intermediate values from a set of tabular values of equal and unequal intervals of a function by using interpolation techniques. 8. Apply different integration techniques to evaluate single and double definite integrals. 9. Compute point wise solutions for initial value problem of first order ordinary differential equations using single step methods. 10. Compute point wise solutions for initial value problem of first order ordinary differential equations using multi step methods.

Standard distributions and testing of hypothesis

Binomial, Poisson, Exponential and Geometric Distributions – Problems – Small sample tests based on t, F and χ^2distributions – Contingency table (Test for Independency) – Goodness of fit.

Design of experiments

One way classification – Completely randomized design – Two-way classification – Randomized block design – Latin square design.

Solution of equations and eigen value problems

Newton Raphson method – Horner's method – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

Interpolation and numerical integration

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolations – Romberg's method – Two and three point Gaussian quadratures – Single and double integrations using Trapezoidal and Simpson's 1/3 and 3/8 rules.

Numerical solution of ordinary differential equations

Single step methods: Taylor's series method – Euler's and modified Euler's methods – Fourth order Runge – Kutta method for solving first order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

Text book(s):

1	Johnson R.A and Gupta C.B., "Miller and Freund's Probability and statistics for Engineers'', 11th Edition, Pearson Education, Asia, 2011.
2	Grewal B.S and Grewal J.S., "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.

Reference(s):

1	Kandasamy P., Thilakavathy K. and Gunavathy K., "Numerical Methods", 3rd Edition, S.Chand and Co., New Delhi, 2003.
2	Subramaniam N., "Numerical Methods", SCM Publishers, 2010.
3	Veerarajan T., "Probability, Statistics and Random process", 3rd Edition, Tata Mc-Graw Hill Publications, New Delhi, 2008.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40EE005Electric Drives and Controls								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	50	50	100

Objective(s)	1. To select appropriate electrical drive system based on their thermal factors. 2. To interpret the characteristics of DC motors and perform appropriate conventional control techniques for desired applications. 3. To interpret the characteristics of AC motors and perform appropriate conventional control techniques for desired applications. 4. To employ solid state speed control techniques for DC drives. 5. To employ solid state speed control techniques for AC drives.
Course Outcomes	At the end of this course the students are able to 1. Explain the basic requirements for developing an electrical drive system. 2. Select a suitable motor drive for particular application based on different load conditions. 3. Describe the constructional details of DC motors with their characteristics. 4. Interpret the conventional speed control methods of DC motors with starting and braking methods. 5. Describe the constructional details of AC motors with their characteristics. 6. Interpret the conventional speed control methods of AC motors with starting and braking methods. 7. Apply converters for speed control of DC drives. 8. Apply choppers for speed control of DC drives. 9. Employ static open loop speed control using inverters for AC drives. 10. Employ static closed loop speed control using converters for AC drives.

Introduction of Electrical Drives

Basic Elements of a drive system – 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.

DC Drives

Constructional details of DC Motors – Principle of operation DC Motor – Back EMF and torque equations – Types of DC Motors – Characteristics of DC Motors – Starting of DC Motors – Types of Braking – Conventional Speed Control of DC Motors: Armature Voltage Control, Field Flux Control, Ward Leornard Control. Stepper motor: Permanent magnet stepper motor – Principle of operation – Applications.

AC Drives

Constructional details of Three Phase Induction Motors – Types of rotors – Principle of operation – Slip – Torque Equations – Speed-Torque Characteristics – Types of Starters – Types of Braking – Conventional Speed Control of Induction Motors: Stator Voltage Control, Stator Frequency Control, Rotor Resistance Control – Servomotor.

Single phase Induction Motor – Construction and operation – Types – Capacitor start and run, Shaded pole – Applications.

Solid State Speed Control of DC Drives

Single Phase and Three Phase Fully controlled Converter: Principle of operation and waveforms of single phase and three phase fully controlled converter fed DC drive – Choppers Fed DC Motor Drive – Applications.

Solid State Speed Control of AC Drives

Voltage/Frequency Control of induction motor, Voltage Source Inverter and Current Source Inverter – VSI fed Three Phase Induction Motors – CSI Fed Three Phase Induction Motors- Static Rotor Resistance Control – Static Scherbius and static Kramer Drives block diagram and explanation – Applications.

Text Book(s):

1	Gopal.K.Dubey,"Fundamentals of Electrical Drives" Narosa Publishing House, 2001
2	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.

Reference(s):

1	Vedam Subrahmanyam, "Electric Drives Concepts and Applications" Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 1998.
2	M.D.Singh and K.B. Khanchandani, "Power Electronics", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2008.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME006 Strength of Materials								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	50	50	100

Objective(s)	• Evaluate the engineering materials subjected to various loads. • Examine the stresses and strains developed in a material. • Analyse the bending moment and shear stress distributions in beams. • Derive and apply the bending and torsional equations in beams, shafts and springs. • Compute the stresses developed in cylindrical and spherical shells.
Course Outcomes	At the end of the course the students will be able to 1. Estimate the stress intensity and deformation in solid bodies subjected to various types of loading. 2. Evaluate the elastic properties of materials and their significant effects in engineering applications. 3. Compute the principal stresses and strains by analytical and graphical methods. 4. Apply the concepts of shear force and bending moment diagrams in design of machine elements. 5. Estimate the stresses developed due to bending and shear in the design of machine members and structures. 6. Analyze the twist and strength of torsion members. 7. Compute the deflection and stress developed in helical spring. 8. Estimate the slope and deflection in determinate beams 9. Calculate the stresses, strains and deformation of the thin cylindrical and spherical vessels. 10. Apply the Euler's theory and Rankine formula for buckling load analysis in columns.

Stress, strain and deformation of solids

Rigid bodies and deformable bodies – Tension, compression and shear stresses – Deformation of simple and compound bars –Composite bars - Thermal stresses – Elastic constants – Volumetric strains – Strain energy due to axial force. Normal and shear stresses on any oblique planes – Principal stresses and their planes by analytical and Mohr's circle method.

Transverse bending on beams

Types of beams: Supports and loads – Shear force and bending moment in beams – Cantilever, simply supported and overhanging beams.

Stresses in beams

Theory of simple bending – Bending stress distribution – Symmetrical and unsymmetrical sections. Shear stress distribution.

Torsion

Torsion of solid and hollow circular shafts – Stepped shafts – Power transmission, strength and stiffness of shafts. Leaf spring – Stresses and deflection in close coiled helical spring.

Deflection of Beams

Slope and deflection in beams - Double integration method - Moment area and Macaulay's method for statically determinate beams.

Thin cylinders, Spheres and Columns

Thin cylindrical shells subjected to internal pressure – Circumferential and longitudinal stresses and deformation. Thin spherical shells subjected to internal pressure – Stresses and deformation. Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula.

Text Book(s):

1	R.K.Bansal, "Strength of Materials", 5th edition, Laxmi Publications (P) Limited, New Delhi, 2013.

Reference(s):

1	Beer and Johnston, "Strength of Materials", CSB Publisher 2010.
2	E.P. Popov, "Introduction to Mechanics of solids", Prentice Hall Publication 2009.
3	Timoshenko and Young, "Strength of Materials", CSB Publisher 1998.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME401 Kinematics of Machinery								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	50	50	100

Objective(s)	• To differentiate between mechanism and machine and describe inversions of simple mechanisms. • To calculate the velocity and acceleration of simple mechanisms using graphical method. • To construct the cam profile for different followers and their motions. • To find module, contact ratio and analyse the interference phenomenon. • To calculate no. of teeth and speed of different gear trains. • To analyse the various kinds of friction and calculate the frictional force.
Course Outcomes	At the end of the course the students will be able to 1. Describe the concepts of mechanisms, kinematic inversions of 4 bar chain and slider crank chain. 2. Apply the concepts related to mechanical advantage, transmission angle and straight line generators. 3. Calculate the velocity of slider crank and four bar mechanism using graphical method. 4. Calculate the acceleration of slider crank and four bar mechanism using graphical method. 5. Construct the cam profile for knife edged and flat faced followers using various follower motions. 6. Construct the cam profile for roller follower using various follower motions. 7. Outline the concepts of gearing and solve the problems related to gearing. 8. Explain the concepts of gear trains and evaluate the number of teeth for different types of gear trains. 9. Describe the concept and solve the problems related to screw threads, clutches. 10. Describe the concept and solve the problems related to belt, rope drives.

Basics of Mechanisms

Terminology and definitions - Classification of mechanisms - Grashoff's law -Kinematic inversions: 4-bar chain, slider crank mechanism - Mechanical advantage - Transmission angle - Straight line generators.

Kinematics

Displacement, velocity, and acceleration analysis of Slider crank mechanism and four bar mechanism – Velocities and Acceleration of points on a rigid body - Instantaneous Centre Method – Kennedy's theorem - Coriolis acceleration.

Kinematics of Cam and Followers

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 - pressure angle and under cutting.

Gears

Terminology, definitions and classifications - Law of gearing-forms of teeth - Involute gearing- Interchangeability - Contact ratio - Standard and non standard gears - Interference and undercutting.

Gear Trains

Gear trains – Types - Parallel axis gear trains - Epicyclic gear trains.

Friction Drives

Surface contact - Sliding and rolling friction - Friction drives - Friction in screw threads - Friction in clutches, belt and rope drives.

Text Book(s):

1	Rattan S.S., "Theory of Machines", 4th Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2014.
2	R.K.Bansal and J.S.Brar., "A Textbook of theory of machines" 5th edition laxmi publication(P) LTD, New Delhi, 2015.

Reference(s):

1	Rao J.S., and Dukkipati R.Y.,"Mechanism and Machine Theory", 2nd Edition, Reprint, New Age International, New Delhi, 2014.
2	Khurmi R.S., and Gupta J.K., "Theory of machines", 14th Edition, S.Chand & Company Ltd., New Delhi, 2014.
3	Amitabh Ghosh and Malik, A.K., "Theory of Mechanisms and Machines", 3rd Edition, Reprint, Affiliated East West Press Pvt. Ltd., 2011.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME402 Thermal Engineering								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	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 applications like I.C engines, Compressor, Steam boilers, Steam turbines and Refrigeration and Air conditioning systems.							
Course Outcomes	At the end of the course the students will be able to 1. Apply the concept of air standard efficiency to Otto, dual and brayton cycles. 2. Demonstrate the I.C engine components, actual and theoretical P-V diagram, valve and port timing diagram of two stroke and four stroke engines. 3. Discuss the fuel systems, cooling and lubrication systems of petrol and diesel engines. 4. Explain the operation of steam boiler and it components. 5. Interpret the construction and operation of low and high pressure boiler and its mountings. 6. Analyse the shapes of the steam nozzle. 7. Explain the functions of impulse and reaction turbines. 8. Describe the working priniple of single stage and multi stage air compressor. 9. Explain the components of refrigeration systems and its operation. 10. Demonstrate the principle of operation of air-conditioning systems							

Gas Power Cycles
Introduction – Classification of Cycles - Air standard efficiency - Otto, Diesel, Dual and Brayton cycles.

Internal Combustion Engines
I.C engines - Classification, components and functions. P-V diagram - Valve and port timing diagram, Two-stroke and four -stroke engines - Petrol and diesel engine – Ignition, Fuel injection system, Cooling systems – Governing.

Steam Boilers
Classification of steam boilers - Difference between fire tube and water tube, low pressure and high pressure boiler- super-critical boiler - Boiler mountings and accessories.

Steam Nozzles
Nozzles and its shapes, Friction in a nozzle, Maximum discharge through a nozzle.

Steam Turbines
Introduction - Classification of steam turbines - compounding- velocity diagrams for turbines.

Air Compressor
Classification of air compressor- Construction of reciprocating compressor – Intercooler - applications.

Refrigeration
Refrigeration systems - Vapour compression and vapour absorption system- Compare - Properties and classification of an ideal refrigerant.

Air Conditioning
Simple air-conditioning cycle- Classification and working principle of air-conditioning system.

Text Book(s):

1	R.K.Rajput, “Thermal Engineering”, 9th Edition, Laxmi Publications (P) Ltd., New Delhi, 2013.

Reference(s):

1	R.S.Khurmi and J.K.Guptha, “Thermal Engineering”, 15th Edition, S.Chand publisher, 2013.
2	C.P.Kothandaraman, S.Domkundwar and A.V.Domkundwar, “A course in Thermal Engineering”, Dhanpat Rai & Sons, 2014.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME403 Applied Hydraulics and Pneumatics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	50	50	100

Objective(s)	• To acquire the fundamentals of hydraulics and pneumatics. • To describe the working principles, operation of hydraulic and pneumatic components. • To explain the various techniques of circuit building in hydraulics and pneumatics. • To design the ladder diagram for controlling the sequence of operations in industrial applications.
Course Outcomes	At the end of the course the students will be able to 1. Describe the fundamentals of fluid power. 2. Apply the concept of fluid power in hydraulic and pneumatic systems. 3. Explicit the types, working and performance of pumps and actuators in hydraulic system. 4. Describe the types and functions of control valves in hydraulic systems. 5. Explain the working of FRL unit and actuators in pneumatic systems. 6. Outline the types and its functions of control valves in pneumatic systems. 7. Design and develop the hydraulic circuits for simple industrial applications. 8. Design and develop the pneumatic circuits for simple industrial applications. 9. Describe the construction and working of servo valve and proportional valves. 10. Outline the concept of fluidic devices and PLC applications in fluid power systems.

Introduction

Introduction to fluid power – Pascal's law - Applications of fluid power, Types of fluids - Properties of hydraulic fluids, Comparison between hydraulics and pneumatics, Fluid power symbols.

Elements of Hydraulic System

Introduction - Hydraulic pumps, Actuators, Motors – types and construction details, Cushioning mechanism, Valves - direction, flow and pressure - types and construction details.

Elements of Pneumatic System

Introduction - Properties of air, Compressors – types - construction details, Filter - Regulator and Lubricator unit, Actuators – types and construction details, Valves - direction, flow and pressure – types and construction details.

Industrial Application of Hydraulic And Pneumatic Systems

Speed control circuits, Regenerative circuits, Feed circuits, Sequencing circuits, Synchronizing circuits, Cascade method, Fail-safe circuits, Accumulators and Intensifier circuits and its applications.

Advanced Topics In Hydraulics and Pneumatics

Servo systems – Proportional valves. Fluidics – Introduction to fluidic devices - simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Failure and troubleshooting.

Text Book(s):

1	Anthony Esposito, "Fluid Power with Applications", 7th Edition, Pearson India, New Delhi, 2014.
2	Srinivasan R, "Hydraulic and Pneumatic Controls", 2nd Edition, Tata McGraw – Hill Education India, New Delhi, 2008

Reference(s):

1	Majumdar S.R., "Oil Hydraulics", 1st Edition Tata McGraw-Hill Education India, New Delhi, 2001.
2	Majumdar S.R., "Pneumatic systems – Principles and Maintenance", Tata McGraw Hill Education, New Delhi, 2004.
3	Anthony Lal, "Oil Hydraulics in the Service of Industry", Allied Publishers, Mumbai, 1982.
4	Ilango S, Soundararajan V, "Introduction to Hydraulics and Pneumatics", Prentice hall of India, New Delhi, 2007.
5	Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall of India, New Delhi, 1989.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40EE0P1Electric Drives and Controls Laboratory								
Common to MECH, MCT								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	0	0	3	45	2	50	50	100
Objective(s)	• To determine the performance characteristics of the given DC and AC motors from the test data. • To control the speed of DC shunt motor and AC motor by applying different techniques. • To determine the regulation and efficiency of the given transformers from the test data.							
Course Outcomes	At the end of the course, the students will be able to 1. Test and analyze the performance of DC motors under different load conditions. 2. Test and analyze the performance of induction motors under different load conditions. 3. Analyze the performance of conventional speed control systems for DC shunt motors. 4. Design the power electronic based speed control systems for DC drives. 5. Design the power electronic based speed control systems for induction motor drives. 6. Test and analyze the performance of single phase transformer.							

1. Load characteristics of DC shunt motor and compound motor
2. Load characteristics of DC series motor
3. Load test on three-phase squirrel cage induction motor
4. Load test on three-phase slip ring induction motor
5. Load test on single phase induction motor
6. Speed control of DC shunt motor
7. Speed control of DC shunt motor using controlled rectifier
8. Speed control of DC shunt motor using chopper
9. Speed control of three –phase induction motor by V/F method
10. Load test on single phase transformer and calculation of efficiency and regulation

Lab Manual:

1. “Electrical Machines Lab Manual” by EEE staff members

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 0P4 Strength of Materials Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	0	0	3	45	2	50	50	100

Objective(s)	• To analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials. • To utilize appropriate materials in design considering engineering properties and sustainability.
Course Outcomes	At the end of the course students will be able to 1. Explain the basic concepts of the tensile test on mild steel using Universal Testing Machine and plot the stress strain graph. 2. Assess the ultimate compressive strength for different materials. 3. Determine shear strength of different metals using double shear attachments. 4. Demonstrate the compression and tensile test on helical spring and plot the load Vs deflection graph. 5. Determine the hardness of the different metals using hardness testing machines. 6. Determine the impact strength by Charpy and Izod test. 7. Determine the Young's modulus of beam by deflection test. 8. Perform the torsion test and determine modulus of rigidity of the material. 9. Perform test on thin cylinder to determine and analyse stress and strain. 10. Demonstrate the improvement in the mechanical properties of heat treated materials.

1. Tension test on ductile materials.
2. Compression test on brittle materials.
3. Double shear test on ductile materials.
4. Tension and compression test on helical springs.
5. Hardness test on metals - Brinell and Rockwell hardness number.
6. Impact test on metal specimen - Charpy and Izod.
7. Deflection test on simply supported beam.
8. Torsion test on mild steel rod.
9. Test on thin cylinders.
10. Effect of hardening – Improvement in hardness of steels.

Lab Manual :

1. "Strength of Materials Lab Manual", Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 4P1 Thermal Engineering Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	0	0	3	45	2	50	50	100

Objective(s)	• To demonstrate the vale and port timing diagram of two stroke and four stroke engines • To evaluate the thermodynamic concepts into I.C engines and Compressor • To demonstrate the structures of steam boilers and steam turbine • To explain the working principles of refrigeration and air-conditioning systems
Course Outcomes	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 and port timing and adjust it for correct angles. 2. Evaluate the efficiencies for various loads under constant speed 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. Calculate the indicated power by conduction Morse test on multi-cylinder petrol engine. 5. Determine the frictional power of a diesel engine using retardation test. 6. Determine the viscosity of oil by using redwood viscometer. 7. Determine the flash and fire point of various oils by 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 reciprocating air compressor. 12. Evaluate the COP of air conditioning system.

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 redwood 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 reciprocating air-compressor.
12. Performance test on air-conditioning system.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2014
Department	**Mechanical Engineering**	**Programme Code & Name**	M.E:B.E. Mechanical Engineering					
Semester IV								
Course Code	**Course Name**	**Hours/Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**ES**	**Total**
40 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 - Newspaper 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.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 011 Machining Process								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100
Objective(s)	To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping, milling, drilling, grinding, broaching and other allied machines.							
Course Outcomes	**At the end of the course the students will be able to** 1. Estimate the cutting force in metal cutting using Merchant's theory. 2. Analyze the type of wear to increase the tool life of various cutting tool materials for different cutting fluids 3. Outline the construction features and operations performed in centre lathe. 4. Illustrate the various operations carried on special purpose lathes. 5. Explain the reciprocating machine tool types and their operations. 6. Describe the hole making processes and its applications. 7. Classify the types of milling process and describe their working methods. 8. Interpret the gear nomenclature and select the gear generating methods. 9. Discuss the various broaching operations. 10. Describe the different surface finish in grinding processes.							

Theory of Metal Cutting

Mechanism of metal cutting- types, cutting force- chip formation-tool geometry-Merchant's circle diagram-calculations-Thermal aspects- machinability-tool wear-tool life-cutting tool materials-cutting fluids-types.

Turning Machines

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – tool layout automatic lathes: semi automatic – single spindle: Swiss type, automatic screw type – multi spindle.

Reciprocating and Hole making Machine Tools

Reciprocating machine tools: types, specifications, construction features, principle of working, operations and work holding devices of Shaper, Planer and Slotter. Hole making machine tools: types, specifications, construction features, principle of working, operations and work holding devices of drilling and boring machine.

Milling and Gear Generating Machine Tools

Milling- specifications- types- cutter nomenclature- types of cutters- milling processes- indexing- gear forming in milling- gear generation- gear shaping and gear hobbing- specifications-cutters- cutting spur and helical gears-bevel gear generators- gear finishing methods.

Broaching and Abrasive Processes

Broaching- specifications, types, tool nomenclature, broaching operations- grinding- types of grinding machines- grinding wheels, specifications- bonds- mounting and reconditioning of grinding wheels.

Text Book(s):

1	Kaushish, J.P., "Manufacturing Processes," PHI Learning Ltd, New Delhi, 2013.

Reference(s):

1	Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson publication, London, 2009.
2.	R.K. Jain, "Production Technology" Khanna Publishers, New Delhi, 2015
3	Rajput, R.K., "A Textbook of Manufacturing Technology", Laxmi publications Ltd, New Delhi, 2014.
4	Rao, P.N., "Manufacturing Technology Vol-1", 3rd Edition, McGraw-Hill publishing Ltd, New Delhi, 2009.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 501 Dynamics of Machinery								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	50	50	100

Objective(s)	• To impart the knowledge of static and dynamic force analysis of various parts of reciprocating engine. • To recognize the functions of flywheel and the construction of turning moment diagram. • To distinguish between static and dynamic balancing and the balancing of rotating and reciprocating parts. • To differentiate between free and forced vibrations. • To impart the concepts of governor and their types. • To recognize the concept of gyroscopic couple and their effects in airplane, ship, automobiles.
Course Outcomes	**At the end of the course, the students will be able to** 1. Solve the problems related to dynamic force analysis in reciprocating engines and engine force analysis. 2. Analyse the problems related with turning moment diagrams and flywheel. 3. Solve the problems related to balancing of revolving masses. 4. Solve the problems related to balancing of reciprocating masses. 5. Estimate the natural frequency of undamped and damped longitudinal vibrations. 6. Estimate the natural frequency of transverse and torsional vibrations. 7. Resolve the problems related with harmonic forcing, periodic forcing and magnification factor. 8. Analyze the problems related with vibration isolation and transmissibility. 9. Evaluate the characteristics of Porter, Proell and Hartnell governors. 10. Evaluate the effect of gyroscopic couple related to aeroplane, ship and automobile.

Force analysis

Static force analysis-static equilibrium, Force convention- free body diagrams, superposition, problems; D'Alembert's principle, Dynamic force analysis in reciprocating engines- Engine force analysis; Equivalent masses; bearing loads. Turning moment diagrams - fluctuation of energy, flywheels-dimensions of flywheel rims - punching press.

Balancing

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.

Free vibrations

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.

Forced vibrations

Step-input forcing; Harmonic forcing; periodic forcing; Magnification factor; vibration isolation and transmissibility.

Governors

Functions of Governors – Gravity controlled and Spring controlled governor characteristics. Stability – Hunting and Isochronisms. Effect of friction – Calculation of equilibrium speeds and ranges of speed of Watt, Porter, Proell and Hartnell governors.

Gyroscopic couple

Gyroscopic couple – Gyroscopic effects on the movement of air planes and ships – Stability of automobiles (two wheel drive & four wheel drive).

Text Book(s):

1	Rattan S.S., "Theory of Machines", 4th Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2014.
2	R.K.Bansal and J.S.Brar., "A Textbook of theory of machines" 5th edition laxmi publication(P) LTD, New Delhi, 2015.

Reference(s):

1	Rao J.S., and Dukkipati R.Y.,"Mechanism and Machine Theory", 2nd Edition, Reprint, New Age International, New Delhi, 2014.
2	Khurmi R.S., and Gupta J.K., "Theory of machines", 14th Edition, S.Chand & Company Ltd., New Delhi, 2014.
3	Amitabh Ghosh and Malik, A.K., "Theory of Mechanisms and Machines", 3rd Edition, Reprint, Affiliated East West Press Pvt. Ltd., 2011.

K.S.Rangasamy College of Technology – Autonomous					R2014			
40 ME 502Design of Machine Elements								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	50	50	100
Objective(s)	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.							
Course Outcomes	**At the end of the course, the students will be able to** 1. Describe the basic concept of design process, design the straight and curved beams. 2. Apply theories of failures (biaxial, steady load) and Soderberg, Goodman and Gerber relations (variable loading) in design of various machine elements. 3. Design of a shafts, keys and keyways based on strength, rigidity and critical speed. 4. Design and analyze the rigid and flexible couplings. 5. Design and analyze the bolted joints. 6. Design welded joints, riveted joints for structures. 7. Design and optimize the helical, leaf springs. 8. Design the flywheel for an IC engines. 9. Design of seals, gaskets and connecting rod. 10. Demonstrate different types of bearings and their applications and design sliding and roller contact bearings.							

Steady and Variable Stresses in Machine Members

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – stress concentration – Design for variable loading.

Design of Shafts, keys and Couplings

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and keyways - Rigid and flexible couplings.

Design of Temporary and Permanent Joints

Threaded fasteners: Design of bolted joints including eccentric loading, Knuckle joints and Cotter joints. Welded joints, riveted joints for structures - theory of bonded joints.

Design of Energy Storing Elements and Engine components

Types of springs – Design of helical and leaf springs.Flywheels considering stresses in rims and arms for engines - Connecting Rods and crank shafts.

Design of Bearings

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs- Selection of Rolling Contact bearings.

Note: Use of approved Design Data book is permitted for examination.

Text Book(s):

1	Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill education private limited, Third Edition 2010.
2	Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

Reference(s):

1	Norton R.L, "Design of Machinery", McGraw-Hill Book co, 2004.
2	Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3	AnselUgural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
4	Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003.
5	Juvinall R. C., Marshek K.M., "Fundamentals of Machine Component Design", John Wiley & Sons, Fifth Edition, 2011.

Data Book(s):

1	Design Data - Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam – Coimbatore, 2012.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40 ME 013 Heat and Mass Transfer								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	1	0	60	4	50	50	100

Objective(s)	• To understand the physical behavior of the various modes of heat transfer, like conduction, convection and radiation. • To understand the mechanisms of heat transfer under steady state and transient conditions. • To understand the concepts of heat transfer through extended surfaces. • To understand the applications of various experimental heat transfer correlations in engineering calculations. • To understand process of boiling, condensation and applications of heat exchangers • To understand the basic concepts of mass transfer.
Course Outcomes	**At the end of the course, the student will be able to** 1. Solve the one dimensional steady state heat conduction problems. 2. Solve the one dimensional transient heat conduction problems. 3. Apply the concept of forced convection to solve the External and Internal Flow problems. 4. Apply the concept of free convection to solve the External and Internal Flow problems.. 5. Apply the laws of radiation to solve the radiation problems. 6. Analyze the reduction in heat transfer using radiation shield and apply electrical network analogy on radiation. 7. Estimate the heat transfer during boiling and condensation. 8. Design the heat exchanger using LMTD and NTU method for industrial applications. 9. Estimate the co efficient of diffusivemass transfer. 10. Evaluate convective mass transfer co efficient.

Conduction

Basic Concepts – Mechanism of Heat Transfer – Modes of Heat Transfer- 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 – Semi infinite and Infinite Solids – Use of Heisslers Chart.

Convection

Free and Forced Convection – Hydrodynamic and thermal boundary layer- External Flow over Plates, Cylinders and Spheres and Internal Flow through tubes.

Radiation

Laws of Radiation: Stefan Boltzman Law, Kirchoff's Law, Planck's law – Black Body Radiation –Grey body radiation - Shape Factor– Electrical Analogy – Radiation Shields.

Phase Change Heat Transfer and Heat Exchangers

Nusselt theory of condensation – Regimes of boiling - Pool boiling and Flow boiling - Correlations in boiling and condensation - Types of Heat Exchangers - Overall Heat Transfer Coefficient - Fouling Factors - LMTD Method - Effectiveness – NTU Method.

Mass Transfer

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion- Equimolar Counter Diffusion - Convective Mass Transfer – Convective Mass Transfer Correlations

NOTE : (Use of Heat and Mass Transfer Data Book and Steam Table are Permitted in the Examination)

Text Book(s):

1	Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer",(SI Units – FOURTH EDITION) New Age International Publishers, 2014..
2	Holman J.P "Heat Transfer" Tata McGraw-Hill company, 10th edition, 2015.

Reference(s):

1	Rajput R.K "Heat and mass Transfer (SI Units)", S.Chand Publishers, 4th edition, 2011.
2	Frank P. Incropera and David P.DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and sons, 2001.
3	Kothandaraman, C.P. "Fundamental of Heat and Mass Transfer", New age International Publishers, New Delhi, 3rd edition, 2008
5	Nag. P.K, "Heat and Mass Transfer" Tata McGraw-Hill, 3rd edition, 2015.

Data book(s):

1	Kothandaraman, C.P. ,Subramanyam.S . "Heat and Mass Transfer Data Book" New age International Publishers, New Delhi, (Eigth Edition) 2014.
2	Kurumi. R.S "Steam Tables" S.Chand Publishers, 2012.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40 ME 503 Automobile Engineering								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	50	50	100
Objective(s)	To impart knowledge to students in various systems of Automobile Engineering and to gain knowledge in latest technology of automobile system.							
Course Outcomes	**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. Explain the working of starting, charging and ignition system. 6. Explain the working of lead acid battery, lighting system, hybrid and 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.							

Vehicle Structure and Engine Emission

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.

Fuel Supply Systems

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, GDI,MPFI,CRDI, Introduction to alternative fuels.

Automotive Electrical System

Starting system-Construction, Operation and Maintenance of Lead Acid Battery – Starter motor and drives-Charging system- Alternator-Regulators- cutout-Ignition system– Battery, Magneto Coil and Electronic Type–Lighting & accessory system - Seat belts-Air bags- Electric and Hybrid Vehicles-Fuel cell.

Power Transmission Systems

Clutch – Types and Construction –-Gear Boxes, Manual and Automatic – Fluid flywheel-Torque convertors Over Drives – Transfer Box – Propeller shaft – Slip Joint – Universal Joints – Differential - Need - Construction – Non-slip differential –Differential locks - Four wheel drive and Rear Axle – Hotchkiss Drive and Torque Tube Drive.

Steering, Brakes and Suspension

Principle of steering - Steering Geometry and wheel alignment - Steering linkages –Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers – Wheels and Tyres - Construction - Types and specifications - Tyre wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist –Retarders – Anti-lock Braking System(ABS)

Text Book(s):

1. Dr. Kirpal Singh “Automobile Engineering Vol. 1 & 2”, 13th Edition Standard Publishers, New Delhi- 2012.

Reference(s):

1. W. H. Crouse, D. L. Anglin “Automotive Mechanics”, 10th Edition. McGraw Hill Private Limited, New Delhi-2008.
2. K. Newton, W. Steeds & T. K. Garrett, “The motor vehicle”, 13th Edition, Society of Automotive Engineers, U.S. - 2001.
3. S. Srinivasan , “ Automotive Mechanics” 2nd edition, McGraw Hill Education Private Limited- New Delhi, 2006.
4. K.K. Jain and R.B. Asthana “Automobile Engineering”, 1st Edition. McGraw Hill Education Private Limited, New Delhi- 2006.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 HS 003 Total Quality Management								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	0	45	2	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.							
Course Outcomes	**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.							

Introduction

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.

TQM Principles

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.

Statistical Process Control (SPC)

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.

TQM Tools

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.

Quality Systems

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.

Text Book(s):

1	Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, 2012.

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, 2015.
4	Suburaj, Ramasamy “Total Quality Management”, Tata McGraw Hill, 2005.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 0P7 Manufacturing Technology Laboratory II								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	3	45	2	50	50	100
Objective(s)	To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry.							
Course Outcomes	**At the end of the course, students will be able to** 1. Demonstrate the working principle of Capstan and Turret lathes. 2. Measure the cutting forces using Lathe tool dynamometer. 3. Machine the external splines and estimate the power requirement and machining time in slotting machine. 4. Perform drilling, reaming and tapping operations and estimate the power requirement and machining time in drilling machine and tap set 5. Machine a dovetail, keyway and estimate the power requirement and machining time in shaper machine 6. Machine the polygon surface and estimate the power requirement and machining time in milling machine. 7. Produce spur gear and estimate the power requirement and machining time in horizontal milling machine. 8. Grind a plate and estimate the power requirement and machining time in surface grinding machine. 9. Practice cylindrical grinding operation and estimate the power requirement and machining time in cylindrical grinding machine. 10. Produce spur gear and estimate the power requirement and machining time in gear hobbing machine							

1. a) Turning and Facing operations using capstan and Turret lathe and study of bar feeding mechanism
   b) Measurement of cutting forces in turning operations using lathe tool dynamometer
2. Machining of external splines and estimation of machining time and power requirement in slotting machine.
3. a) Drilling and reaming operations and estimation of machining time and power requirement in drilling machines
   b) Internal Threading operations using tap set.
4. Machining of dovetail, keyway and estimation of machining time and power requirement in shaper
5. Machining of hexagonal surface and estimation of machining time and power requirement in milling machine
6. Machining of spur gear and estimation of machining time and power requirement in milling machine
7. Surface grinding using surface grinder and estimation of machining time and power requirement
8. External cylindrical grinding of shaft using cylindrical grinding machine and estimation of machining time and power requirement
9. Spur Gear generation using Gear Hobbing Machine and estimation of machining time and power

Lab Manual :

1. "Manufacturing Technology Lab Manual", Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 5P1 Dynamics Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	3	45	2	50	50	100

Objective(s)	• To study the principle of governors, gyroscope, and cam. • To calculate the moment of inertia. • To analyze the natural frequency of different types of vibrations. • To reveal the transmissibility ratio. • To analyze the influence co-efficient in multidegree of freedom systems.
Course Outcomes	**At the end of the course students will be able to** 1. Draw characteristics curves for watt, porter, proell, and hartnell governors. 2. Verify the laws of gyroscope. 3. Plot the profile of cam. 4. Calculate the moment of inertia of connecting rod. 5. Analyze the critical speed of the shaft. 6. Evaluate the natural frequency of spring mass system. 7. Estimate the transmissibility ratio using vibrating table. 8. Analyze the influence co-efficient using multi-degree of freedom systems. 9. Evaluate the natural frequency and deflection of free beam. 10. Analyze the natural frequency of single rotor system.

1. Determination of sensitivity and power of Watt governor.
2. Determination of sensitivity and power of Porter governor.
3. Determination of sensitivity and power of Proell governor.
4. Determination of sensitivity and power of Hartnell governor.
5. Determination of gyroscopic couple using Motorized Gyroscope.
6. Plot the profile of cam and study of jump phenomenon.
7. Calculate the moment of inertia of connecting rod by oscillation method.
8. Determination of natural frequency and critical speed of given shaft.
9. Determination of natural frequency of given spring mass system.
10. Determination of transmissibility ratio using vibrating table.
11. Determination of influence co-efficient for multi-degree freedom suspension system.
12. Determination of natural frequency and deflection of free beam.
13. Determination of torsional frequency of a single rotor system.

Lab Manual :

1. “Dynamics Laboratory Manual”, Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 0P9 Heat Transfer Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	3	45	2	50	50	100
Objective(s)	To provides good practical knowledge of various heat transfer principles.							
Course Outcomes	**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. Calculate the fin efficiency using pin-fin apparatus. 3. Determine the thermal conductivity of pipe insulation using lagged pipe apparatus. 4. Determine the emissivity of a grey surface. 5. Evaluate the heat transfer through composite wall. 6. Determine the convective heat transfer co efficient by natural convection using vertical cylinder. 7. Determine the Stefan-Boltzmann constant using Stefan-Boltzmann apparatus. 8. Evaluate the effectiveness of heat exchanger using parallel flow and counter flow heat exchanger.							

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. Determination of thermal conductivity of pipe insulation using lagged pipe apparatus.
4. Determination of emissivity of a grey surface using emissivity measurement.
5. Determination of heat transfer coefficient using composite walls.
6. Determination of convective heat transfer co efficient by using natural convection apparatus.
7. Determination of Stefan-Boltzmann constant by using Stefan-Boltzmann apparatus.
8. Determination of effectiveness of Parallel flow heat exchanger(water –water).
9. Determinationeffectiveness of Counter flow heat exchanger(water –water).
10. Heat transfer analysis of fins using data acquisition system.

Lab Manual :

1. “Heat Transfer Lab Manual”, Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2014
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
40TP0P3	**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.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 EC 006 Microprocessor and Microcontroller								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• To introduce the architecture and programming of 8085 microprocessors, interfacing of peripheral devices with 8085 microprocessors. • To introduce the architecture, programming and interfacing of 8051 micro controller. • To explore the applications using microcontroller 8051
Course Outcomes	**At the end of the course, the students will be able to** 1. Describe the concept of 8 bit microprocessor and its architecture. 2. Develop the assembly language program using instruction set of 8085 microprocessor. 3. Describe the functional units of peripheral IC's. 4. Interface and configure the peripheral IC's with 8085 Microprocessor. 5. Describe the fundamental features and operation of 8051 microcontroller. 6. Develop the assembly language program using instruction set of 8051 microcontroller. 7. Program the ports, timers, counters and UART of 8051 microcontroller for various applications. 8. Interface ADC/DAC with 8051microcontroller. 9. Interface the input and output devices with 8051Microcontroller. 10. Develop the 8051 microcontroller based system for various applications.

8085 Microprocessor

8085 Internal Architecture - Addressing modes - Instruction set - Assembly language Programming- Machine cycles with states and timing diagram – Interrupts - Interfacing memory and I/O devices.

Peripherals Interfacing

Programmable Peripheral Interface (PPI 8255) –Programmable Interval Timer (PIT 8253) – 8259 Programmable Interrupt Controller – keyboard & display controller (8279) - Interfacing serial I /O (8251) - ADC/DAC interfacing.

8051 Microcontroller

8051 Architecture- Memory origination-Addressing modes -Instruction set - Microcontroller hardware - I/O pins and ports - Assembly language programming- I/O port programming.

8051 Peripheral and its Programming

Interrupts -Counters and Timers- Timer and counter programming - Serial Communication - Interrupt programming, ADC, DAC and sensor interfacing.

8051 Applications

LCD and Keyboard Interfacing – RTC Interfacing and programming- Stepper motor and DC motor interfacing.
Case study:
Temperature monitoring system, Turbine monitoring system, traffic light control, washing machine control, Automotive applications, Closed loop process control.

Text book(s):

1	Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. 5th edition, Penram International Publishing, 2010.
2	Krishna Kant, Microprocessors and microcontrollers Architecture, Programming and System design 8085,8086,8051,8096,PHI-Third Printing-2010

Reference(s) :

1	Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011.
2	A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition. Twelfth reprint 2009.
3	Soumitra Kumar Mandal, Microprocessors and Microcontrollers Architecture, "Programming and Interfacing using 8085, 8086 and 8051" 6th reprint 2012.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 012 CAD/CAM								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	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.							
Course Outcomes	**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.							

Overview of CAD/CAM system

Product life cycle-Product design and development cycle- Design process - Shigley's model- Sequential and Concurrent engineering-Role of computer in product cycle-Introduction to CAD/CAM/CAE.

Interactive Computer Graphics and Geometric modeling

CAD hardware and software-Creation of Graphics Primitives- Bresenham's Algorithm and DDA Algorithm, Clipping, Hidden line/surface removal, Display Transformation in 2D, and 3D. Geometric Modeling – Wireframe, Surface and Solid modeling - CSG and B-Rep-Feature based modelling and Parametric modelling.

Fundamentals of CNC machines

Introduction to NC, CNC and DNC – NC Control system –point to point and continuous path - Open loop and Closed loop systems - CNC Control Hardware and Software -Machine axis and Co-ordinate system -CNC machine tools – CNC Machining operations.

CNC Programming

Introduction to Part Programming –Manual part programming using G and M codes in CNC Lathe and Milling machines - Cutting Cycles and Loops -Sub program and Macros - Introduction to Computer assisted Part Programming - CAM packages.

Group Technology and CAPP

Group Technology - Part family, Coding and classification, Production flow analysis, Cellular manufacturing systems - Computer Aided Processes Planning (CAPP) - Retrieval type and Generative type.

Text Book(s):

1	Mikell P. Groover and Enory W. Zimmers Jr "CAD/CAM: Computer-Aided Design and Manufacturing**",**Pearson Education**,**New Delhi, 2008

Reference(s):

1	Radhakrishnan P. and Kothandaraman C.P." Computer Graphics and Design" Dhanpat Rai and Sons, New Delhi, 2000.
2	Dr.Sadhu Singh, "Computer Aided Design and Manufacturing", Khanna Publishers, New Delhi, 2000.
3	Ibrahim Zeid, R.Sivasubramanian "CAD-CAM Theory and Practice" ,2nd Edition ,Tata McGraw-Hill Education, 2010.
4	Steve Krar and Srthur Gill, "CNC Technology and Programming" McGraw Hill Inc., New york,1990.
5	Groover MP. V," Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, New Delhi, 2008.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40ME601Design of Mechanical Transmission Systems								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	50	50	100

Objective(s)	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.
Course Outcomes	**At the end of the course, the students will be able to** 1. Select, design and analyze the belt drives. 2. Design and analyze chain drive systems. 3. Design of spur gears based on Lewis and Buckingham equation and gear life. 4. Design of helical gears based on Lewis and Buckingham equation and gear life. 5. Design of bevel gears based on Lewis and Buckingham equation and gear life. 6. Design of worm gears based on Lewis and Buckingham equation and gear life. 7. Design and analyze the multispeed gear box. 8. Design of cam drives. 9. Design and analyze different types of clutches. 10. Design and analyze different types of brakes.

Selection of Flat ,V belts and chains
Selection of flat belts and pulleys, selection of V belt and pulleys, wire ropes and pulleys, selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

Design of Spur and Helical Gears
Review of gear fundamentals, interference, force analysis in gears, determining dimensions of a spur gear pair. Design of helical gears-parallel axis helical gear, normal and transverse planes, helix angles, equivalent number of teeth, determining dimension of helical gear pair.

Design of Bevel and Worm Gears
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.

Design of gearboxes and Cam Design:
Preparation of ray diagram and kinematic arrangement diagram for multi-speed gearbox. Cam Design: Types - pressure angle and under cutting base circle determination - relative advantages and disadvantages - forces and surface stresses.

Design of Frictional Drives
Clutches - role of clutches, positive and gradually engaged clutches, toothed claw clutches, design of single plate and multiple plate clutches, variable speed drives, types and selection.

Design of Brakes
Role of brakes-types of brakes-self energizing and de-energizing brakes. Design of internally expanding shoe brakes - calculation of heat generation and heat dissipation in brakes.
Note: Use of Approved Design Data Book is permitted for examination.

Text book(s):

1	Richard G. Budynas, J.KeithNisbett, “Shigley’s Mechanical Engineering Design”, McGraw-Hill Education (India) P Ltd., Ninth Edition, 2011.
2	Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill, 2010.

Reference(s) :

1	Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 2010.
2	Juvinall R. C., Marshek K.M., “Fundamentals of Machine Component Design”, John Wiley & Sons, Fourth Edition, 2011.
3	Norton R.L, “Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines”, McGraw-Hill Book co, 2008.
4	Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Co.,2011.

Data book(s):

1	Design Data - Data Book of Engineers by PSG College of Technology, Kalaikathir Achchagam – Coimbatore, 2012.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME 014 Gas Dynamics and Jet Propulsion								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	50	50	100
Objective(s)	To understand the basic difference between incompressible and compressible flow,phenomenon of shock waves and its effect on flow and basic knowledge about jet propulsionand rocket propulsion.							
Course Outcomes	**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) 2. Analysis of mach number, velocity of sound and calculate the flow properties. 3. Develop equation and concept to analyze compressible flow properties across variable area. 4. Develop equation and concept to analyze compressible flow properties across constant area with friction (without heat transfer) and with heat transfer (without friction). 5. Develop the assumptions and governing equations to calculate the property variations across nozzle and diffuser with normal shock. 6. Develop the assumptions and governing equations to calculate the property variations across normal shock in constant area with friction (without heat transfer) and with heat transfer (without friction). 7. Explain the concept of jet propulsion based on Newton's third law with its types and working principle. 8. Analyze the performance of jet engines to calculate thrust, thrust power and efficiencies 9. Explain the concept of rocket propulsion based on Newton's third law with its types and working principle. 10. Analyze the performance of rocket engines to calculate thrust, thrust power and efficiencies.							

Compressible Flow – Fundamentals

Compressible Flow -Fundamentals Energy and momentum equations for compressible fluid flows- various regions of flows - reference velocities - stagnation state - Wave propagation in elastic medium – propagation of sound waves and derivation for velocity of sound - critical states, Mach number, critical Mach number - types of waves - Mach cone - Mach angle - effect of Mach number on compressibility .

Flow Through Variable Area and Constant Area Ducts

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 Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation - variation of flow properties - variation of Mach number with duct length - Flow in constant area ducts with heat transfer (Rayleigh flow) - Rayleigh line and Rayleigh flow equation - variation of flow properties - maximum heat transfer.

Compressible Flow With Normal Shock

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).

Air Craft Propulsion Systems

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 Systems

Rocket propulsion – Classification of rocket engines – Propellants: solid and liquid propellants, rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance - Flow through rocket nozzles – mass ratio and propellant mass fraction – Vertical flight of a rocket: powered flight and coasting flight – Rocket applications.

Note: Use of approved gas tables are to be permitted for examination.

Text Book(s):

1	Yahya. S.M."Fundamental of compressible flow", New Age Internationa (p)Ltd., New Delhi, 2006(revised edition).

Reference(s):

1	Rathakrishnan.E, "Gas Dynamics", Prentice Hall of India, New Delhi, 2008
2	Ganesan. V., "Gas Turbines", Tata McGraw-Hill Publishing Co., , New Delhi,3rd edition, 2012.
3	Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 2013

Data Book(s):

1	Yahya. S.M "Gas Tables for compressible flow calculations", New Age International Pvt. Ltd., New Delhi, 2006(revised edition).

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME 015 - Finite Element Method								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	1	0	60	4	50	50	100

Objective(s)	• To explore the mathematical theory underpinnings in FEM • To practice the various steps involved in the finite element analysis of a problem • To apply the finite element method by solving the problems in solid and structural mechanics, heat transfer etc.
Course Outcomes	**At the end of the course, the students will be able to** 1. Apply the Variational methods of approximation for solving continuum structural problems. 2. Solve the finite element equations using Gaussian elimination method. 3. Formulate the one dimensional bar element and apply it for solving solid mechanics problems. 4. Formulate the plane truss element and apply it for solving truss problems. 5. Formulate the beam element and apply it for various beam problems. 6. Estimate the steady state heat transfer through composite wall and thin fins. 7. Solve the structural problems with plane stress, plane strain assumptions using triangular element. 8. Solve the axisymmetric problems using triangular element. 9. Formulate the Quadrilateral element for isoparametric conditions. 10. Implement the Gauss-Legendre quadrature technique for numerical integration.

Fundamentals

Mathematical models of physical systems – Analytical solutions - Variational methods of approximation – Ritz method – Weighted residual method: Galerkin, Least squares and Collocation methods. Piecewise approximation – Finite element method (FEM) – Basic features - steps of FEM – Numerical solution of finite element equations – Gauss elimination method.

One Dimensional Problems

One dimensional elements – Interpolation and Shape functions - Principle of minimum potential energy - Derivation of element equations – Connectivity of elements – Imposition of boundary conditions – Solution of equations - Application to Bars and Plane Trusses.

One Dimensional Beam and Heat Transfer Problems

One dimensional beam element – formulation – hermite shape function - Element equations - Load vector and boundary conditions – Solution - Application to analysis of beams. One dimensional heat transfer - Conduction and Convection – Application to steady state heat transfer in composite walls and thin fins.

Two Dimensional Problems

Triangular element – Interpolation and Shape functions – Strain-Displacement relations - Stress-Strain relations – Plane stress and Plane strain assumptions - Element equations – Axisymmetric problems - Application to Structural and heat transfer problems.

Isoparametric Formulations

Natural co-ordinate systems - Legrangian and Serendipity Rectangular elements - Isoparametric formulations - Quadrilateral elements – Coordinate transformations – Jacobian transformation matrix -Shape functions - Element equations - Application to plane stress problems - Numerical integration – Gauss-Legendre quadrature.

Total hours to be taught: 45

Text Books

1	Chandrupatla T.R and Belegundu A.D., “Introduction to Finite Elements in Engineering”, 4th edition, Pearson Education, New Delhi, 2011.
2	SingiresuS.Rao, “The Finite Element Method in Engineering”, 5th edition, Butterworth-Heinemann, New Delhi, 2011.

Reference(s)

1	Reddy J.N., “An Introduction to Finite Element Method”, 3rdedition, McGraw Hill Education Ltd, New Delhi, 2006.
2	Daryl L.Logan,“A First course in the Finite Element Method”, 5th Edition, Cengage Learning, 2011.
3	Zeinkiewicz.O.C, “The Finite Element Method: Its Basis and Fundamentals”, 7th Edition, Elsevier, 2013.
4	Cook R D, Malkus D S,Plesha M E, “Concepts and Applications of Finite Element Analysis”, Fourth Edition, John Wiley and Sons, New Delhi, 2011.
5	NitinS.Gokhale , Sanjay S.Deshpande , “Practical Finite Element Analysis”, First Edition, Finite To Infinite, 2008.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 EC 0P3 Microprocessor and Microcontroller Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	2	50	50	100

Objective(s)	• To introduce the programming concepts of 8085 microprocessors • To interface peripheral devices with 8085 microprocessors • To introduce the programming concepts of 8051 micro controllers • To interface peripheral devices with 8051 microcontrollers
Course Outcomes	**At the end of the course students will be able to** 1. Perform the basic arithmetic, sorting and searching operations using 8085. 2. Demonstrate the interfacing of keyboard and display controller using 8085. 3. Demonstrate the interfacing of interrupt controller using 8085. 4. Demonstrate the interfacing of Timer using 8085. 5. Demonstrate the interfacing of ADC/DAC using 8085. 6. Perform the basic arithmetic and logical instructions in 8051. 7. Program and verify Timer, Interrupts and UART operations in 8051. 8. Demonstrate the interfacing of parallel and serial communication in 8051. 9. Demonstrate the interfacing of Traffic light controller in 8051. 10. Demonstrate the interfacing of Stepper Motor & DC Motor Speed control in 8051.

1. Programs for arithmetic, sorting and searching operations.
2. Interfacing and programming of keyboard & display controller
3. Interfacing and programming of interrupt controller
4. Interfacing and programming of Timer
5. Interfacing ADC and DAC.
6. Microcontroller 8051 - Programming using Arithmetic and Logical instructions.
7. Microcontroller 8051 - Programming and verifying Timer, Interrupts and UART operations.
8. Parallel Communication and Serial Communication
9. Interfacing and Programming of Traffic light controller.
10. Interfacing, Programming of Stepper Motor & DC Motor Speed control.

Lab Manual :

1. "Microprocessor and Microcontroller Laboratory Manual", Department of Electronics and Communication Engineering, KSRCT.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME 0P8 CAD/CAM Laboratory								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	2	50	50	100
Objective(s)	To develop the students to perform the computer aided design and manufacturing processes using CAD and CAM packages.							
Course Outcomes	**At the end of the course, the student will be able to** 1. To create the Solid modeling of engineering components 2. To assemble the various machine components. 3. Write the part program for various turning operations on work piece for CNC lathe and simulate the program. 4. Write the part program for various milling operations on work piece for CNC milling machine and simulate the program. 5. Generate the tool path and appropriate part program in turning and milling operations on work piece for CNC lathe and milling machine using CAM software.							

1. Computer Aided Design (CAD):

Interpretation of production drawings for industrial components.

Solid Modeling and of Assembly of machine elements: Flange coupling, Screw jack (Bottle type) and Plummer block.

2. Computer Aided Manufacturing (CAM):

Manual part programming (Using G and M Codes) in CNC lathe:

Part programming and simulation for Linear and Circular Interpolation, Chamfering and Grooving.

Part programming and simulation using standard canned cycles for Turning, Facing, Taper turning and Thread cutting.

Manual part programming (using G and M codes) in CNC milling:

Part programming and simulation for Linear and Circular interpolation and Contour motions.

Part programming and simulation involving canned cycles for Drilling, Peck drilling, and Boring.

CAM software:

Generate the NC code in the lathe environment for the given specimen.

Generate the NC code in the milling environment for the given specimen.

Lab Manual :

1. “CAD/CAM Lab Manual”, Department of Mechanical Engineering, KSRCT.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40 ME 0P10 Analysis and Simulation Laboratory								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	2	50	50	100
Objective(s)	• To perform finite element analysis of 1D, 2D static structural and heat transfer problems. • To simulate the results using the FEA software.							
Course outcomes	**At the end of the course, the students will be able to** 1. Analyze and simulate the static solid and structural mechanics problems using FEA software. 2. Analyze and simulate the temperature distribution on composite wall and plate using FEA software. 3. Analyze and simulate the Laminar and Turbulent fluid flow on pipes. 4. Write the MATLAB program for solving 1D bar and beam problems							

Structural analysis:

1. Analysis of stepped bar under axial loads and thermal loads.(1D)

2. Analysis of truss structure. (1D)

3. Analysis of beams with point load, UDL, and UVL. (1D)

4. Analysis of a steel bracket assuming plane stress conditions. (2D)

5. Analysis of cylinder under internal pressure assuming axisymmetric conditions.(2D)

Thermal analysis:

6. Steady state heat transfer analysis of composite wall. (2D)

7. Transient heat transfer analysis of plate. (2D)

8. Stress analysis of a solid object. (3D)

Fluid analysis:

9.Laminar fluid flow analysis on circular pipe.(2D)

10.Turbulent fluid flow analysis on circular pipe.(2D)

FE programming using MATLAB:

11.MATLAB programming for solving stepped bar problem using 1D bar element

12. MATLAB programming for solving beam problem using 1D beam element

Lab Manual

1. “Analysis and Simulation Lab Manual”, Department of Mechanical Engineering, KSRCT.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2014
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
40TP0P4	**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 - Newspaper 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.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 MC 001 Mechatronics								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)	• To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.
Course Outcomes	**At the end of the course, the students will be able to** 1. Explain the design concepts of Mechatronic systems 2. Compare the working of different sensors used in Mechatronics. 3. Discuss the working of mechanical or electrical actuators which are used in Mechatronics system design. 4. Classify various actuators according to the applications. 5. Explain various system models and controllers. 6. Select a controller for a Mechatronics system. 7. Write a program to operate a programmable logic controller for a particular application. 8. Select a PLC for a particular mechanical application. 9. Compare the Mechatronics system with traditional systems. 10. Discuss the details about the Mechatronics case studies.

Mechatronics, Sensors and Transducers

Introduction to Mechatronics systems – Measurement systems – Control systems – Microprocessor based controllers. Sensors and transducers – Performance terminology – Sensors for displacement, position and proximity: Velocity, motion, force, fluid pressure, liquid flow, liquid level, Temperature, light sensors – Selection of sensors.

Actuation Systems

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and Pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors - Servomotors.

System Models and Controllers

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

Programming Logic Controllers

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC – Application of PLCs for control and automation systems.

Design of Mechatronics System

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case Studies of Mechatronics Systems, Pick and place robot – Automatic Car Park Systems – Automatic Camera – Automatic Washing Machine - Engine Management Systems.

Text book(s):

1	Bolton, W. “Mechatronics”, Pearson Education, 4th Edition, 2008.

Reference(s) :

1	Mechatronics', HMT Ltd., Tata McGraw Hill Publication Co. Ltd., New Delhi, 5th Edition, 2009.
2	Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2005.
3	Ramachandran, K.P., Vijayaraghavan, G.K.andBalaSundaram, M.S. “Mechatronics: Integrated Mechanical Electronic System” Wiley India Pvt Ltd.
4	Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
5	Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint).
6	Lawrence J. Kamm, “Understanding Electro – Mechanical Engineering”, An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
7	NitaigourPremchandMahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME 016 - Power Plant Engineering and Energy Economics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	To understand the importance of energy utilization in power plants and to understand various components, operations and applications of various power plants.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Describe the function and recognize the fuel and ash handling system in thermal power plant. 2. Identify the draught, condenser, cooling tower and feed water treatment system in thermal power plant. 3. Describe the function of nuclear power plant and identify various types of nuclear reactors. 4. Explain the function of hydel power plant and outline the concept of governing of turbines. 5. Describe the function of diesel power plant. 6. Recognize the various processes involved in gas turbine power plants. 7. Explain the non-conventional power plants-MHD, OTEC, Geothermal 8. Propose the non-conventional power plants using Solar, Tidal and Wind energy. 9. Recognize the production, load factor and tariffs involved in power generation. 10. Evaluate the power generation and depreciation cost of various power plants.							

Thermal Power Plant

Site selection - Components and 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 - Surface condensers - Cooling towers – Chimney - Feed water treatment - Ejection system.

Nuclear and Hydel Power Plants

Nuclear Energy: Fuels and Nuclear reactions - Components and Layout of nuclear power plant - Pressurized Water Reactor - Boiling Water Reactor - Fast Breeder Reactor - Radioactive waste disposal. Hydro-electric power plant: Site selection - Components and Layout – Advantages - Classification of turbines - Governing of turbines - Mini and micro hydel plants.

Diesel and Gas Turbine Power Plant

Components and Layout of diesel power plant - Applications and Advantages. Layout of gas turbine power plant – Fuels - Gas turbine material - Open and closed cycles – Reheating – Regeneration - Inter-cooling – Combined gas and steam power generation.

Non-Conventional Power Plants

Layout and components: Magneto Hydro Dynamic (MHD) power plant - Geothermal power generation - Ocean thermal energy conversion (OTEC) - Tidal power generation - Wind energy power generation - Solar power generation -Spherical Sun Power Generator -Bio-solar cells - Floating panels - Floating solar farms - Solar energy harvesting trees - Concentrated PV cells

Power Plant Economics

Energy – Production - Transport and control - Load duration curves - Load factor - Cost of electric energy - Types of tariff - Electric power generation in India - Basic problems on power generation - Power plant economics - Indian energy scenario - Technology in Improving Power Generation Efficiency in India.

Total hours to be taught: 45

Text Book(s):

1	R. K. Rajput, “A Textbook of Power Plant Engineering”, 5th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2016
2	P.K. Nag, “Power Plant Engineering”, 4th edition, Tata McGraw-Hill, New Delhi, 2014.

Reference(s):

1	K. K. Ramalingam, “Power Plant Engineering”, 1st edition, Scitech Publications (India) Pvt Ltd, Chennai, 2010.
2	G.D.Rai, “Introduction to Power Plant Technology”, 11th reprint, Khanna Publishers, 2013.
3	R K Hegde, “Power Plant Engineering”, 1st edition, Pearson education India, New Delhi, 2015.
4	M.M. EI- Wakil, “Power Plant Technology”, 1st edition, Tata McGraw-Hill, New Delhi, 2017.
5	S.C. Arora, and S. Domkundwar, “A course in Power Plant Engineering”, 6th edition, Dhanpatrai Publications Ltd, New Delhi, 2011.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40ME701 - Operations Research								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	1	0	60	4	50	50	100
Objective(s)	• To impart knowledge about optimization techniques and enable students to take effective managerial decisions. • To train students to use optimization techniques for the effective utilization of available resources in engineering and business.							
Course Outcomes	**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. Apply 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 networks and solve CPM & PERT problems. 7. Identify various deterministic Inventory models and solve EOQ problems. 8. Evaluate the probabilistic Inventory models with simple discrete and continuous cases. 9. Select queuing models to solve queuing problems. 10. Describe Simulation and solve simple inventory and queuing problems in simulation.							

Linear Model

Introduction - The phases of OR study - Linear programming problems (LPP) – graphical method– Simplex algorithm - Big M method– primal-dual relationship – Integer programming – Gomory algorithm - Dynamic programming – Simple problem.

Transportation Problems

Balanced and unbalanced transportation models – optimality test by Modified Distribution (MODI) method - Balanced and unbalanced assignment problems–optimality by Hungarian method

Network Models

Shortest route - Minimal spanning tree - Maximum flow models – Project networks - CPM and PERT networks – Crashing of project networks

Inventory Models

Deterministic Inventory models - Economic order quantity - Quantity discount models - Multi product EOQ models - Introduction to probabilistic inventory models–discrete cases and continuous cases

Queuing Theory & Simulation

Queuing models - Single server models – Poisson input – Exponential service - Infinite population–Simulation - random number generation –Simple problems in inventory and queuing using simulation

Total hours to be taught: 45

Text Book(s):

1	Hamdy A. Taha, “Operation Research - An Introduction”, 9th Edition, Pearson India Education Services Pvt. Ltd., New Delhi, 2014.

Reference(s):

1	Wayne L. Winston, “Operations Research – Applications and Algorithms”, 4th Edition, Cengage Learning India Private Limited, New Delhi, 2011.
2	Frederick S. Hillier And Gerald J. Lieberman, “Introduction To Operations Research”, 9th Edition, McGraw Hill Publishing Co., New Delhi, 2011.
3	Perm Kumar Gupta, D.S. Hira, “Operations Research”, S.Chand and Company Ltd., 2008.
4	R. Panneerselvam, ‘Operations Research” 2nd edition, Prentice Hall of India Private Ltd, New Delhi, 2006.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40ME702 - Metrology and Measurements								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To understand the principles of measurements, methods of measurement and its application in manufacturing industries.							
Course Outcomes	**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 characteristics of static and dynamic response of instruments. 3. Demonstrate the measuring concept of various linear measuring instruments. 4. Discuss the different methodology in angular measurement techniques. 5. Outline the concept of gear parameter measuring methods. 6. Categorize the surface finish measuring instruments. 7. Demonstrate the working principle of AC and DC interferometer. 8. Describe the concept of CMM and machine vision system. 9. Calculate the parametric measurements such as force, torque and power. 10. Identify the various methods to find out the pressure and temperature.							

Measurements

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.

Linear and Angular Measurements

Linear Measuring Instruments – Evolution – Classification – Limit gauges – Gauge design – Taylor's principles –Application of Limit gauges – Comparators: Types, Principles and applications.Transducers: Types, Principle and applications. Angular measuring instruments –Bevel protractor,Sine bar – Angle dekkor– Autocollimator – Applications.

Form Measurement

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 - Roundness measurements.

Advances in Metrology

Basic concept of lasers - Advantages of lasers – Laser Interferometers – Types – DC and AC Lasers - Interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications. Basic concepts of Machine Vision System – Element – Applications.

Measurements of Parameters

Force, torque, power: Mechanical, Hydraulic and Electrical type - Pressure measurement. Temperature: Bimetallic strip, Thermocouples, Pyrometer, Electrical resistance thermistor.

Total hours to be taught: 45

Text Book(s):

1	Kumar D.S, "Mechanical Measurements and Control" 4th Edition, Metro politan book company Pvt. Ltd, New Delhi, 2016.
2	Jain R.K., "Engineering Metrology", 21st Revised Edition, Khanna publishers, New Delhi, 2015.

Reference(s):

1	Gupta S.C., "Engineering Metrology", 20th Edition, DhanpatRai Publications, New Delhi, 2007.
2	Sawhney A.K., "A Course in Mechanical Measurements and Instrumentation" DhanpatRai Publications, 2004.
3	Donald P. Eckman, "Industrial Instrumentation ", Wiley Eastern, 2004.
4	Thomas G. Beckwith and Roy D. Marangoni, "Mechanical Measurements ", 6th Edition, Pearson Education India, Noida, 2007.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40MC0P1 - Mechatronics Laboratory								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	3	45	2	50	50	100
Objective(s)	• To equip students with mechatronics knowledge and also gather knowledge of virtual instrumentation systems for mechanical engineering applications.							
Course outcomes	**At the end of the course, the students will be able to** 1. Design and test a hydraulic circuits for particular operation. 2. Design and test a pneumatic circuits for particular operation. 3. Create a virtual instrument program using different palettes of virtual instrumentation software. 4. Write a virtual instrument program using local and global variables. 5. Write a virtual instrument program for converting temperatures into other units. 6. Design a software program for acquire, analyze and control of temperature of a system. 7. Write a program to control the LED interface 8. Write a software program to control the motors. 9. Design and simulate a mass – spring damper system. 10. Design a PID control system for particular application. 11. Identify different sensors used in automotive engines.							

1. Design and testing of basic hydraulic circuit, meter in and meter out circuits using hydraulic components.
2. Design and testing of meter in, meter out and automatic reciprocating circuits using pneumatic components.
3. Programming virtual instrument using structure, arrays, clusters, File I/O, and Graphs palletes.
4. Programming virtual instrument using local and global variables.
5. Temperature conversion using virtal instrumentation software.
6. Monitoring of furnace temperature using data acquisition system.
7. Control of LED display output using data acquisition.
8. Control of speed of DC motor using virtual instrumentation.
9. Design and simulation of mass-spring damper system using virtual instrumentation software.
10. Design of PID control using virtual instrumentation software.
11. Study on identification of sensors in automotive engines.

Text book :

1. Jovitha Jerome, “Virtual Instrumentation using Lab VIEW”, PHI learning private Limited, 2010

Reference(s) :

1. Garry M. Johnson, “LabVIEW Graphical Programming”, Tata McGraw Hill Edition, 1996.
2. “LabVIEW Basics I and II Manual”, National Instruments, 2003.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40 ME 7P1 - Metrology and Measurements laboratory								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	0	0	3	45	2	50	50	100

Objective(s)	• To familiar with different measurement equipment's and use of this industry for quality inspection. • Identify and use reference materials to ensure good quality, accurate, traceable measurement results
Course outcome(s)	**At the end of the course, the students will be able to** 1. Describe the basic concepts of Metrology and classify different measuring tools related to experiments. 2. Select the precision measuring instrument for measurement of various components. 3. Discriminate between various screws by measuring their taper angle and pitch. 4. Separate the different gears through measurement of various dimensions of gears 5. Measure the taper angle for measurement of various components. 6. Measure the diameter of the screw thread. 7. Discriminate the capabilities of machining process by measuring surface flatness of the component produced. 8. Describe the methods of measurement for various quantities like pressure, force, torque and temperature. 9. Measure the displacement and vibration parameters.

Introduction to metrology and measurement.

1. Calibration of micrometer using slip gauges.
2. Calibration of dial gauge using slip gauges.
3. a) Study of Tool Makers Microscope.
   b) Measurement of taper angle and pitch by using tool maker's microscope.
4. a) Study of Gear Terminology.
   b) Measurement of various dimensions of the given component using profile projector.
5. Measurement of taper angle using sine bar.
6. a) Study of Screw thread terminology.
   b) Measurement of major and effective diameter of screw thread using 2 wire methods.
7. a) Study of various surface finish measurement techniques.
   b) Measurement of surface flatness by using autocollimeter.
8. Measurement of pressure using strain gauge.
9. Measurement of Force using strain gauge.
10. Measurement of Torque using digital torque transducer.
11. Measurement of Temperature using transducers. (Thermo couple, RTD, Thermistor, Semiconductor).
12. Study of Coordinate Measuring Machines (CMM).
13. Displacement measurement set up for LVDT.
14. Measurement of vibration parameters using vibration set up.

Lab Manual

1." Metrology and Measurements laboratory Manual", Department of Mechanical Engineering, KSRCT.

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R 2014</td></tr>
<tr><td colspan="9">40 ME 7P2 - Project Work - Phase I</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total Hrs</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>VII</td><td>0</td><td>0</td><td>3</td><td>60</td><td>2</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">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>Course outcome(s)</td><td colspan="8">At the end of the course, the students 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</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 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>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2014
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
40TP0P5	**CAREER COMPETENCY DEVELOPMENT V**	0	0	2	0	100	00	100
Objective(s)	To enhance employability skills and to develop career competency							

Unit – 1	**Written and Oral Communication**	Hrs
Self-Introduction – GD – HR Interview Skills – Corporate Profile Review - Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		6
Unit – 2	**Verbal & Logical Reasoning**	6
Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		
Unit – 3	**Quantitative Aptitude**	6
Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		
Unit – 4	**Data Interpretation and Analysis**	6
Practices on Company Based Questions and Competitive Exams **Materials:** Instructor Manual		
Unit – 5	**Programming & Technical Skills – Part 3**	6
Data Structure - Arrays – Linked List – Stack – Queues – Tree – Graph. Practices on Algorithms and Objective Type Questions. **Materials:** Instructor Manual		
	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 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.

K.S.Rangasamy College of Technology – Autonomous R2014								
40 HS 002 - Engineering Economics and Financial Accounting								
Common to all Branches								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	2	0	0	45	2	50	50	100
Course Objective(s)	• The main objective of this course is to make the Engineering student to know about the basic of economics, how to organize a business, financial aspects related to business, different methods of appraisal of projects and pricing techniques.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Apply suitable demand forecasting techniques. 2. Appraise the prevailing market structure. 3. Describe forms of business in an organization. 4. Distinguish between proprietorship and partnership. 5. Explain the various kinds of banking. 6. Illustrate the balance sheet with a suitable example. 7. Differentiate between fixed cost and variable cost. 8. Interpret technical feasibility and economic feasibility. 9. Apply break even analysis in engineering projects. 10. Summarize the managerial uses of break-even analysis.							

Basic Economics

Definition of economics – nature and scope of economics – basic concepts of economics – factors of production – demand analysis – definition of demand – Law of demand – Exception to law of demand – Factors affecting demand – elasticity of demand – demand forecasting – definition of supply – factors affecting supply – elasticity of supply – market structure – perfect competition – imperfect competition - monopoly – duopoly – oligopoly and bilateral monopoly .

Organization and Business Financing

Forms of business – proprietorship – partnership - joint stock company - cooperative organization – state Enterprise - mixed economy - Money and banking – kinds of banking - commercial banks - central banking functions - control of credit - monetary policy - credit instrument – Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations.

Financial Accounting and Capital Budgeting

The balance Sheet and related concepts – The profit and loss statement and related concepts – Financial ratio analysis – Cash flow analysis – fund flow analysis – Capital budgeting– Average rate of return – Payback period – Net present value and internal rate of return.

Cost Analysis

Types of costing – traditional costing approach - activity based costing - Fixed Cost – variable cost – marginal cost – cost output relationship in the short run and in long run – pricing practice – full cost pricing – marginal cost pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project profitability - cost benefit analysis – feasibility reports – appraisal process – technical feasibility - economic feasibility – financial feasibility.

Break Even Analysis

Basic assumptions –break even chart – managerial uses of break-even analysis - applications of break-even analysis in engineering projects.

Textbook(s):

1. Khan MY and Jain PK., “Financial Management” McGraw - Hill Publishing Co., Ltd., New York, 2000.
2. Varshney RL and Maheshwary KL. “Managerial Economics” S Chand and Co., New Delhi, 2001.

Reference(s):

1. Barthwal R.R., “Industrial Economics - An Introductory” Text Book, New Age Publications, New Delhi, 2001.
2. Samuelson P.A., “Economics - An Introductory Analysis”, McGraw - Hill & Co., New York, 2000.
3. S.K.Bhattacharyya, John Deardon and Y.M.Koppikar, “Accounting for Management Text and Cases”,
4. V.L.Mote, Samuel and G.S.Gupta, “Managerial Economics – Concepts and Cases”, Tata Mcgraw Hill

<table>
<tr><th colspan="8">K. S. Rangasamy College of Technology – Autonomous R 2014</th></tr>
<tr><th colspan="8">40 ME 8P1 - Project Work - Phase II</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total Hrs</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>VIII</td><td>0</td><td>0</td><td>16</td><td>240</td><td>8</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">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>Course outcome(s)</td><td colspan="7">At the end of the course, the students 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.</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 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>
</table>

K.S. Rangasamy College of Technology – Autonomous								R2014
Common to CS,IT,EC,EE,EI,MC,Mech								
40 CS 004 - Object Oriented Programming								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• To enable the students to learn how C++ supports object Oriented properties • To create and use classes and objects for specific applications • To understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code
Course Outcomes	**At the end of the course, the students will be able to** 1. Recognize the principles of object-oriented problem solving and programming. 2. Review the essential features and elements of the C++ programming language 3. Implement the concept of class and objects 4. Comprehend the concept of constructors and destructors 5. Analyze the reusability through various types of Inheritance 6. Interpret the concept of operator overloading 7. Recognize the concept of dynamic memory allocation 8. Implement the concept of runtime polymorphism by using virtual functions 9. Identify the uses of generic programming and exception handling 10. Interpret the file operation concepts to manipulate the data

Introduction to C++ and Functions:

Evolution of C++ - The Object Oriented Technology - Disadvantages of Conventional Programming-Concepts of OOP - Advantages of OOP,Basics of C++:Structure of a C++Program- Streams in C++ and Stream Classes - Formatted Console I/O Operations-Bit Fields - Manipulators - User-defined Manipulators, C++ Declarations, Functions: L Values and RValues - Return by Reference - Returning more Values by Reference - Default Arguments -Constarguments - Inline Functions - Function Overloading.

Classes and Objects, Constructors and Destructors:

Classes in C++ - Declaring Objects- Access Specifiers and their Scope - Defining Member Functions - Static Members - Array of Objects - Constant object and Constant Member Functions - Object as Function Arguments - Friend Function and FriendClasses, Constructors and Destructors: Characteristics - Parameterized Constructors - Overloading Constructors - Copy Constructors - Dynamic Initialization Constructors – Destructors.

Inheritance, Operator Overloading and Type Conversion:

Inheritance: Reusability - Types of Inheritance - Object as Class Member, Operator Overloading: The Keyword Operator - Unary, Binary and Stream Operators Overloading- Constraint on Increment and Decrement Operators - Rules for Operator Overloading -Overloading using Friend Function -Type Conversion.

Pointers, Memory models, Binding and polymorphism:

Pointers: Pointer to Class - Pointer to Object –void, wild and this Pointers, Memory Models: Dynamic Memory Allocation - Heap Consumption - Object Address - Dynamic Objects, Binding: Binding in C++ - Pointer to Base and Derived class objects -Working with Virtual Functions - Pure Virtual Functions -Abstract Classes - Object Slicing - Virtual Destructor, Working with Strings.

Generic Programming with Templates, Exception Handling and Applications of Files:

Class and Function Templates -Overloading of Template Functions, Exception Handling: Principles of Exception Handling -try, catch and throw- Re-throwing Exception - Specifying Exception, Class Templates with Exception, File Stream Classes - Steps of File Operations - File Opening Modes - File Pointers and Manipulators - File Access - Command Line Arguments - Error Handling Functions.

Text book:

1	Ashok N. Kamthane, “Programming in C++”, Pearson, Second Edition, 2013.

Reference(s) :

1.	Herbert Schildt, “ The Complete Reference C++”, Fourth Edition, McGraw-Hill Education, 2013.
2.	BjarneStroustrup, “The C++ programming language”, Addison Wesley, 2013.
3.	Venugopal K.R., Rajkumar Buyya, "Mastering C++", Second Edition,McGraw-Hill Education, 2013.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E11 - Renewable Sources of Energy								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	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.							
Course Outcomes	**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.							

Introduction

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

Solar Energy

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.

Wind Energy

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

Biomass Energy

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

Other Renewable Energy Sources

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

Text Book(s):

1	G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
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, 2012.
2	Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 3rd Edition, 2015.
3	G.N. Tiwari, "Solar Energy – Fundamentals Design, Modeling and applications", Narosa Publishing House, New Delhi, 2013.
4	L.L. Freris, "Wind Energy Conversion systems", Prentice Hall, UK, 1990.
5	Gary L.Johnson, "Wind Energy Systems", Prentice Hall, New York, 2008

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E12 - Design of Jigs, Fixtures and Press Tools								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100
Objective(s)	• To understand the principles of locating elements and clamping elements. • To understand the principles, functions and design practices of Jigs, fixtures and dies for press working.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Select the locating methods and clamping devices. 2. Design jigs for automatic drill and rack and pinion 3. Design and develop the jigs for given component for grinding, planning and welding operations. 4. Design and develop the jigs for given component for lathe and milling operations. 5. Compute the capacities and tonnage of press for various processes. 6. Select the standard die sets for strip layout. 7. Design the dies for blanking, piercing and bending operations. 8. Develop the dies for drawing, forging, extrusion. 9. Describe the sheet metal forming techniques. 10. Analyze the sheet metal forming process using computer aids.							

Locating and Clamping Principles of Jigs and Fixtures

Tool Design Objectives - Production Devices - Inspection Devices - Materials used in Jigs and Fixtures - Basic Principle of Six Point Location - Locating Methods and Devices - Principle of Clamping and Its Types - Analysis of Clamping Force.

Design of Jigs

Drill Bushes - Classification of Jigs - Automatic Drill Jigs - Rack and Pinion Operated - Air Operated Jigs. Design and Development of Jigs for given Component.

Design of Fixtures

General Principles of Boring, Lathe, Milling and Broaching Fixtures - Grinding, Planning and Shaping Fixtures, Assembly, Inspection and Welding Fixtures - Modular Fixtures. Design and Development of Fixtures for given Component**.**

Press Working Terminologies andElements of Dies and Strip Layout

Press Working Terminology - Presses and Press Accessories - Computation of Capacities and Tonnage Requirements. Elements of Progressive Combination and Compound Dies: Die Block - Die Shoe. Bolster Plate - Punch Plate – Punch Holder - Guide Pins and Bushes - Strippers - Knockouts - Stops - Pilots - Selection of Standard Die Sets Strip Layout - Strip Layout Calculations.

Design and Development of Dies

Design and Development of Progressive and Compound Dies for Blanking and Piercing Operations. Bending Dies - Development of Bending Dies - Forming and Drawing Dies - Development of Drawing Dies. Design Considerations in Forging, Extrusion, Casting and Plastic Dies.

Other Forming Techniques

Bulging, Swaging, Embossing, Coining, Curling, Hole Flanging, Shaving and Sizing, Fine Blanking Dies - Recent Trends in Tool Design - Computer Aids for Sheet Metal Forming Analysis - Basic Introduction - Tooling for Numerically Controlled Machines - Setup Reduction for Work Holding - Single Minute Exchange of Dies - Poka Yoke.

Text Book(s):

1	Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, Singapore, 2010.
2	Donaldson. C, “Tool Design”, Tata McGraw-Hill, 2012.

Reference(s):

1	Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2	Joshi, P.H., “Jigs & Fixtures”, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2010.
3	Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
4	“Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
5	PSG Design Data –Faculty of mechanical engineering, PSG College of Technology, Coimbatore.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E13 - Maintenance Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• 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. • To illustrate some of the simple instruments used for condition monitoring in industry.
Course Outcomes	**At the end of the course, the students 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. Apply the various methods and instruments for condition monitoring. 7. Select the various repair methods used for 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. Apply the computers in the maintenance of job order systems and records.

Principles and Practices of Maintenance Planning

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.

Maintenance Policies – Preventive Maintenance

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

Condition Monitoring

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.

Repair Methods for Basic Machine Elements

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.

Repair Methods for Material Handling Equipment

Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

Text Book(s):

1	Srivastava S.K., “Maintenance Engineering and Management” (Industrial Maintenance Management), - S. Chand and Co., 2008.
2	Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 2008.

Reference(s):

1	Higgins L.R., Mobley.K, Kaith Mobley.R “Maintenance Engineering Hand book”, McGraw Hill, 7th Edition, 2013.
2	White, Edwin Neville, “Maintenance Planning Control and Documentation”, Gower Press, London, 1979.
3	Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1998.
4	Garg H.P., “Industrial Maintenance”, S. Chand & Co., 1986.
5	Armstrong, “Condition Monitoring”, BSIRSA, 1988.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E14 - Fundamentals of Information Technology								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• To enable students to learn basic concepts of Information Technology and its applications. • To explain technological outlook in social, economic, and political context. • To introduce cutting-edge technologies and trends in the areas of wireless multimedia, digital videos and computer networking.
Course Outcomes	**At the end of the course, the students will be able to** 1. Outline the basics of Information Technology and digital domain. 2. Explain mathematical techniques to manipulate number systems. 3. Explore the fundamental components of computer and its storage technologies. 4. Describe the stages of software development process and programming paradigms. 5. Categorize the practical processes of creating and manipulating digital images. 6. Identify the technical processes of producing digital videos. 7. Classify the types of networks. 8. Examine the Internet Architecture and articulate unique economic and social issues that accompanied the Internet evolutions. 9. Realize the traditional telephone systems architecture, VoIP and Wireless multimedia systems. 10. Infer the multimedia access devices and identify the transform of information access.

Introduction to Information Technology

Information Technology Introduction - The Information Era - Defining Information Technology –Information Technology in Society-The State of IT Careers- Emergence of the Digital Age-The Difference between Analog and Digital Representations of Information-Manipulating Bits-Advantages of Digital Technology – The Binary Numbering System –Alternative Numbering Systems – Representing Text and other Characters in Binary.

Fundamentals of Computers

Introduction - A brief History of Computer - Digital Logic-Fundamental Components of a Computer- Factors That Affect Computer Performance-Inside a Typical Computer-Types of Computers and Their Applications-Storage Technologies - Software – Programming Languages – Types of Software – The Software Development Process – Open Source Software

Digital Images and Video

Introduction - Imaging Technologies – Digitizing Images and Video – Digital Image and Video Formats – Display Technologies.

Computer Networking

Introduction- Defining LANs – LAN Design Characteristics – The Evolution of LAN Types - WAN Background - WAN Alternatives – WAN Access Alternatives – Network Management Systems – Internet History – Internet Architectural Components – Internet Applications – Internet Administration - Internet Open Issues – Case Project.

Internet and Wireless Multimedia

Introduction—Historical Background – Public Switched Telephone Network – Telecommunications Principles – Future of the Telephone System– VoIP Protocols – Implementation Options – Internet Telephony Benefits – Internet Telephony Challenges – Public Policy Issues - Wireless Multimedia Devices-The Bluetooth Standard-Cellular Technology-Wi-Fi, WiMAX, and Cellular Integration

Text Book(s):

1	Pelin Aksoy , Laura Denardis,"Information Technology in Theory", Cengage Learning India Private Limited, Reprint 2012.

Reference(s):

1	Turban,Rainer,Potter, "Introduction to Information Technology", WSE Wiley, Reprint 2014.

K.S. Rangasamy College of Technology – Autonomous								R 2014
40 ME E15 **/ 40 ME L01 - Logistics Management**								
Semester	Hours / Week			Total Hrs.	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VI	3	0	0	45	3	50	50	100

Objective(s)	• To learn the need and importance of logistics in product flow. • To gain the working knowledge on theories of logistics and competitive strategy. • To enhance the knowledge in logistics function including performance measurement, costs, transportation and packaging. • To learn the current challenges faced by logistics professionals.
Course Outcomes	**At the end of the course the students will be able to** 1. Describe the logistics scope and its application. 2. Outline the logistics in competitive strategy. 3. Apply the concept of warehousing in logistics management. 4. Describe all the material handling equipment systems. 5. Outline the Internal and External Performance Measurement in logistics management. 6. Describe the Total Logistics Cost Concept. 7. Select all the efficient method of moving products with optimization. 8. Outline the time and cost in freight management. 9. Describe Logistics Resource Management and, Automatic Identification Technologies. 10. Explain the E-Logistics Structure and Operation for future scope.

Introduction to Logistics and Competitive Strategy

Definition and Scope of Logistics - Functions & Objectives, Customer Value Chain - Service Phases and attributes, Value added logistics services - Role of logistics in Competitive strategy.

Warehousing and Materials Handling, Material Handling Equipment and Systems

Warehousing Functions - Types and Site Selection, Layout Design and Costing - Virtual Warehouse, Role of Material Handling in Logistics - Material Storage Systems - Principles, Benefits, Methods - Automated Material Handling.

Performance Measurement and Costs

Need, System, Levels and Dimensions - Internal and External Performance Measurement - Logistics Audit, Total Logistics Cost Concept, Cost Identification - Time Frame and Formatting.

Transportation and Packaging

Transportation System Evolution - Infrastructure and Networks, Freight Management , Route Planning, Containerization - Design considerations, Material and Cost, Packaging as Unitization - Consumer and Industrial Packaging.

Current Trends

E-Logistics Structure and Operation - Logistics Resource Management, Automatic Identification Technologies - Warehouse Simulation, Reverse Logistics - Global Logistics , Strategic logistics Planning.

Total hours to be taught: 45

Text Book(s):

1	SopleVinod V, “Logistics Management – The Supply Chain Imperative”, Pearson Education, 2010

Reference(s):

1	Ailawadi C Sathish&Rakesh Singh, “Logistics Management”, Prentice Hall India, 2005
2	Coyle, “The Management of Business Logistics”, Thomson Learning, 2010
3	Bloomberg David J, “Logistics”, Prentice Hall India, 2005

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E21 – Flexible Manufacturing System								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	To impart knowledge on group technology, simulation, computer control, automatic manufacturing systems and factory of the future.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Explain the various products in the production system. 2. Interpret the different types of scheduling system. 3. Select appropriate type of computer control in production system. 4. Recognize the concepts and apply the software to FMS. 5. Apply the various simulation techniques to FMS. 6. Use database techniques to Planning for FMS database. 7. Describe the various group technology used in FMS. 8. Apply various concepts of FMS to production system. 9. Select appropriate type of FMS techniques to specific application like aerospace machining, sheet metal fabrication and prismatic component. 10. Design the Philosophy and Characteristics for factory future.							

Planning, Scheduling and Control of Flexible Manufacturing Systems
Introduction – Single product, N-product, Single batch, N-Batch scheduling problem – Modeling of N operations in M machines – Knowledge based scheduling system.

Computer Control and Software for Flexible Manufacturing Systems
Introduction – Composition of FMS – Hierarchy of computer control – Computer control of work center and assembly lines – FMS supervising computer control. Types of software – specification and selection – trends.

FMS Simulation and Data Base
Application of simulation – Model of an FMS – Simulation software –Manufacturing data systems – Data flow – CAD/CAM considerations in planning the FMS data base – FMS database systems – Planning for FMS database.

Group Technology and FMS
Introduction – matrix formulation – Mathematical Programming formulation – Graph Formulation – Knowledge based system for Group Technology. Application of possibility distributions in FMS systems justification.

Factory of the Future
FMS application in aerospace industries, sheet metal fabrication and prismatic component production. FMS development towards factories of the future – Artificial intelligence and Expert systems in FMS – Design Philosophy and Characteristics for Future.

Total hours to be taught: 45

Text Book(s):

1	MikellP.Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, 4th edition, Pearson Education India Pvt. Ltd.,Noida, India, 2015.

Reference(s):

1	K.C Jain and Sanjay Jain, “Principles of Automation and Advanced Manufacturing Systems” 1st Edition, Khanna Publishers, New Delhi, 2004.
2	Raouf, A. and Ben-Daya, M, “Flexible manufacturing systems: recent development”, Elsevier Science, 1995.
3	Kalpakjian S and Steven R Schmid, “Manufacturing engineering and technology”, 7th edition, Pearson Education India Pvt. Ltd.,Noida, India, 2014.
4	Radhakrishnan P. and Subramanyan S., “CAD/CAM/CIM”, 4th edition, New Age International (P) Ltd., New Delhi, 2016.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME E22 – Energy Storage devices and Fuel Cells								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To understand the concepts and working principles in different types of batteries and use of batteries in electric vehicles. • To develop skills in analyze the various energy storing devices like hydrogen and fuel cells technology. • To make students learn about the importance of renewable energy and to relate the future prospects of energy and environmental applications.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Outline the characteristics of battery. 2. Describe the concept and working of different types of primary batteries. 3. Apply the secondary batteries in electric vehicles and working of secondary batteries 4. Discuss the types of reserve batteries and battery specifications 5. Describe the working principle of fuel cells and its applications. 6. Discuss the environmental aspects of fuel cells. 7. Explain the working of hydrogen as fuel cell. 8. Discuss the different methods of storage of hydrogen and its applications. 9. Explore the importance of renewable energy. 10. Explain the working of solar cells and applications of energy storage systems.							

Batteries

Characteristics: Voltage –Current –Capacity - Electricity storage density, - Power -Discharge rate - Cycle life-Energy efficiency - Shelf life. Primary batteries: **I**ntroduction - Zinc – Carbon - Magnesium –Alkaline-Manganous dioxide-Mercuric oxide - Silver oxide batteries-Recycling/Safe disposal of used cells.

Batteries for Electric Vehicles

Secondary batteries: Introduction -Cell reactions -Cell representations and applications- Lead acid -Nickel-Cadmium and lithium ion batteries - Rechargeable zinc alkaline battery - Reserve batteries: Zinc silver oxide-Lithium anode cell, - Photo galvanic cells - Battery specifications for cars and automobiles – Life cycle analysis of batteries.

Fuel Cells

Design of fuel cells - Reliability - Importance and classification of fuel cells: Description - Working principle - Components. Applications and environmental aspects of the following types of fuel cells: Alkaline fuel cells - Phosphoric acid -Solid oxide-Molten carbonate and direct methanol fuel cells - Life cycle analysis of fuel cells.

Hydrogen as a Fuel

Sources of hydrogen - Production of hydrogen - Electrolysis - Photocatalytic water splitting -Biomass pyrolysis -Gas clean up - Methods of hydrogen storage - High pressurized gas - Liquid hydrogen type - Metal hydride - Hydrogen as engine fuel. Features application of hydrogen technologies in the future limitations.

Energy and Environmental Applications

Future prospects of renewable energy and efficiency of renewable fuels. Solar Cells: Energy conversion devices - Photovoltaic and photo-electro-chemical cells – photo-bio-chemical conversion cell - Solar waste. Applications – Food preservation - Green house heating – Automotive applications.

Total hours to be taught: 45

Text Book(s):

1	B. Viswanathan, M. AuliceScibioh, “Fuel Cells: Principles and Applications”, 1st edition, CRC Press, India, 2008.
2	FranoBarbir, “PEM fuel cells: Theory and practice” , 2nd edition, Elsevier Academic press , 2012.
3	R M Dell, D A J Rand, “Understanding Batteries”, Royal Society of Chemistry, 2001.

Reference(s):

1	M. A. Christopher Brett, “Electrochemistry: Principles, Methods and Applications”, Oxford University press, 1993.
2	J. S. Newman and K. E. Thomas-Alyea, “Electrochemical Systems”, 3rd edition, Wiley publications, Hoboken, NJ, 2004.
3	G. Hoogers, “Fuel Cell Handbook”, CRC press, 2002.
4	Lindon David, “Handbook of Batteries”, 3rd edition, McGraw Hill company, 2002.
5	H. A. Kiehne , “Battery Technology Hand Book”, CRC Press, 2003.
6	Shripad T. Revankar and PradipMajumdar, “Fuel Cells: Principles, Design, and Analysis”, CRC press, 2014.
7	http://www.sciencedirect.com/science/journal/09270248/open-access

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E23 – Thermal Turbo Machines								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)	• To understand the various systems, principles, operations for different types of turbo machinery components. • To understand the concept of velocity triangles, losses in turbo machines and combustion phenomena. • To familiarize the working principles of compressor, gas turbines and jet engines.
Course Outcomes	**At the end of the course, the student will be able to** 1. Explain the concepts of energy transfer using velocity diagram. 2. Analysis the phenomena of turbo machine with isentropic, mechanical, thermal and polytrophic. 3. Describe the working principle and performance of centrifugal compressors. 4. Describe the working principle and performance of axial flow compressors. 5. Analysis the combustion phenomena and flame stability. 6. Describe the construction of combustion chamber and its 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 blade cooling in radial flow turbines. 9. Analysis the different types gas turbine cycles. 10. Explain the various gas turbine vehicles used for real time applications.

Basic concept of Turbo machines

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 - Polytrophic.

Centrifugal and Axial Flow Compressors

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.

Combustion Chamber

Basics of combustion –Combustion chamber arrangements - Flame stability - Fuel injection nozzles - Swirl for stability - Cooling of combustion chamber – Combustion process simulation studies.

Axial and Radial Flow Turbines

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.

Gas Turbine and Jet Engine Cycles

Gas turbine cycle analysis: Simple and actual - Reheater, Regenerator and Intercooled cycles. Working principles of Turbojet, Ramjet, Scarmjet and Pulsejet engines - Cycle analysis – Thrust - Specific impulse – SFC - Thermal and Propulsive efficiencies – Governing mechanism in Gas turbines.

Total hours to be taught: 45

Text Book(s):

1	Khajuria P.R and Dubey S.P., “Gas Turbines and Propulsive Systems”, DhanpatRai Publications, 2014.
2	Ganesan, V., “Gas Turbines”, 3rdedition,Tata McGrawHill company, New Delhi, 2012.

Reference(s):

1	Cohen H, Rogers G F C and Saravanamuttoo H I H, “Gas Turbine Theory, 6th Edition, John Wiley & Co, 2009.
2	Philip Hill and Carl Peterson C R, “Mechanics and Thermodynamics of Propulsion”, 2nd edition, Pearson Education India Pvt. Ltd., 1992.
3	Jack Mattingly, “Elements of GasTurbine Propulsion”, 1st Edition, McGraw Hill Company, New Delhi, 2005.
4	“The jet engineolls”, 5th edition, Rolls Royce plc, 1996.
5	Erian A. Baskharone, “Principles of Turbomachinery in Air-Breathing Engines”, 1st edition, Cambridge University Press, USA, 2006.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E24 – Design of Heat Exchangers								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To build up necessary background for the design of various types of heat exchangers. • To learn the sizing of heat exchangers, thermal and mechanical pressure analysis for various heat exchange applications. • To provide the fundamental knowledge of condenser, evaporator and cooling towers.							
Course Outcomes	**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. Explain the operation of heat exchangers and its classification 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 and cooling tower.							

Design Methods of Heat Exchangers

Introduction: Arrangement of flow path in heat exchangers - Basic equations in design - Overall heat transfer coefficient – logarithmicmean 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.

Classification of Heat Exchangers

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.

Shell and Tube Heat Exchangers

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 coefficien - shell-side pressure drop -Tube-side pressure drop.

Compact and Plate Heat Exchangers

Introduction: Plate-fin heat exchangers -Tube-fin heat exchangers - Heat transfer and pressure drop for finnedtube exchangers - Pressure drop for plate-fin exchangers.

Condensers, Evaporators and Cooling Towers

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.

Total hours to be taught: 45

Text Book(s):

1	Arthur P. Fraas, “Heat Exchanger Design” 2nd Edition, Wiley India Pvt. Ltd, 2012.
2	SadikKakac and Hongtan Liu, "Heat Exchangers", 3rd edition, CRC Press, 2012.

Reference(s):

1	J.P.Gupta, “Fundamentals of Heat Exchangers and Pressure Vessel Technology”, Springer-Verlag, Berlin – Heidelberg, 1987.
2	T.Taborek, G.F.Hewitt and N.Afgan, “Heat Exchangers - Theory and Practice”, 1st edition, McGraw-Hill Book Co., 1983.
3	Ramesh K. Shah, Dusan P. Sekulic, “Fundamentals of Heat Exchanger Design”, John Wiley & Sons, 2013.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E25 – Advanced IC Engines								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To understand the underlying principles of operation of different IC Engines and components. • To provide knowledge on pollutant formation, control, alternate fuel etc.							
Course Outcomes	**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. Characterize 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.							

Spark Ignition Engines

Air-fuel ratio requirements, Gasoline Direct Injection Engine – MPFI, fuel jet size, Stages of combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process.

Compression Ignition Engines

Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Common Rail Direct Injection Diesel Engine. Introduction to Thermodynamic Analysis of CI Engine Combustion process.

Engine Exhaust Emission Control

Formation of NOX , HC/CO mechanism , Smoke and Particulate emissions, Green House Effect , Methods of controlling emissions , Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NOX) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms: Euro and Bharat emission norms.

Alternate Fuels

Alcohols, Vegetable oils and bio-diesel, Bio-gas, Natural Gas, Liquefied Petroleum Gas, Hydrogen, Suitability, Engine Modifications, Performance , Combustion and Emission Characteristics of SI and CI Engines.

Recent Trends

Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

Total hours to be taught: 45

Text Book(s):

1	John B. Heywood, “Internal Combustion Engine Fundamentals", 1st edition, McGraw Hill Company, New Delhi, 2011.
2	V.Ganesan, “Internal Combustion Engines”, 4thedition,Tata McGraw Hill Company, New Delhi, 2012.

Reference(s):

1	Rowland S.Benson and N.D.Whitehouse,"Internal combustion Engines", Vol.I& II, Pergamon Press, 2013.
2	James E Duffy and Howard Smith, “Auto fuel Systems", Goodheart-Wilcox Publisher,2010.
3	Dr.K.K.Ramalingam “Internal Combustion Engines Theory and Practice”, Scitech Publications (India) Pvt. Ltd., Chennai, 2012.

K.S. Rangasamy College of Technology – Autonomous					R 2014			
40 ME E26 – Industrial Safety and Hazards Management								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	To provide comprehensive knowledge of safety and hazards aspects in industries and the management of hazards.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Recognize the industrial processes and hazard potential. 2. Explain the vapour cloud and boiling liquid expanding vapours explosion. 3. Know preventive and protective management from fire and explosion. 4. Outline and apply relief systems. 5. Identify types of hazards. 6. Analyse the hazard indices and operability. 7. Estimate the leak through different channels. 8. Analyse the effect of momentum and buoyancy. 9. Catogarise the safety regulations in industry. 10. Know the certification norms for safety and hazard management.							

Fire and Explosion

Introduction-Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Industrial hygiene. Factories Act, 1948 and Environment (Protection) Act, 1986 and rules thereof. Shock wave propagation, vapour cloud and boiling liquid expanding vapours explosion (VCE and BLEVE), mechanical and chemical explosion, multiphase reactions, transport effects and global rates.

Relief Systems

Preventive and protective management from fires and explosion-inerting, static electricity passivation, ventilation, and sprinkling, proofing, relief systems – relief valves, flares, scrubbers.

Toxicology

Hazards identification-toxicity, fire, static electricity, noise and dust concentration; Material safety data sheet, hazards indices- Dow and Mond indices, hazard operability (HAZOP) and hazard analysis (HAZAN).

Leaks and Leakages

Spill and leakage of liquids, vapors, gases and their mixture from storage tanks and equipment; Estimation of leakage/spill rate through hole, pipes and vessel burst; Isothermal and adiabatic flows of gases, spillage and leakage of flashing liquids, pool evaporation and boiling; Release of toxics and dispersion. Naturally buoyant and dense gas dispersion models; Effects of momentum and buoyancy; Mitigation measures for leaks and releases.

Safety Regulation and Certifications

Overview of Factories Act 1948 and Tamil Nadu Factories Rules 1950 – ISO 9001, ISO 14001, OHSAS 18001 and Integrated Management.

Total hours to be taught: 45

Text Book(s):

1	John V.Grimaldi and Rollin H.Simonds, “Safety Management”, 5th edition, All India Travelers Book Seller, New Delhi, 2001.
2	Crowl D.A and Louvar J.F, “Chemical Process Safety: Fundamentals with Applications”, 3rd edition, Pearson India Publication, 2014.

Reference(s):

1	L M Deshmukh, “Industrial Safety Management: Hazard Identification and Risk control”, 1st Edition, Tata Mcgraw Hill, New Delhi, 2005.
2	“Occupational Safety Manual”, BHEL, Trichy, 1988.
3	“Accident Prevention Manual for Industrial Operations”, National Safety Council, Chicago, 1982.
4	“Hand book of Occupational Safety and Health”, National Safety Council, Chicago, 1982.

K.S.Rangasamy College of Technology – Autonomous					R 2014		
40 HS 001 – Professional Ethics							
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks	
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To create an awareness on Ethics and Human Values and instill Moral and Social Values in students							
Course Outcomes	**At the end of the course, the students will be able to** 1. Know the concept of ethics and engineering as a profession. 2. Learn the core qualities of professional practitioners. 3. Realize engineering as experimentation. 4. Study the role of codes and industrial standards as per law. 5. Understand the need of safety in testing and designing. 6. Know about risk benefit analysis and reducing risk. 7. Understand the importance of collegiality, conflict of interest, and professional rights. 8. Know the employee rights and IPR. 9. Understand the ethics in MNC's, Computers and Social Medias. 10. Know the values of engineers as managers and engineers responsibilities in weapons development.							

Introduction

Morals, values and ethics – Integrity – Respect for others, Honesty – Commitment – Character– Core qualities of professional practitioners –Theories of right action – Types of inquiry – Kohlberg's stages of moral development – Carol Gilligan theory – Moral dilemmas – Moral autonomy.

Engineering as Social Experimentation

Engineering as Experimentation – Engineers as Responsible Experiments – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study and Volks Wagon's Case Study.

Engineers Responsibility for Safety and Risk

Safety and Risk – Assessment of Safety and Risk – Risk Benefit analysis and reducing Risk – The Three Mile Island Disaster Case Study and Chennai Moulivakkam Building Accident case study.

Responsibilities and Rights

Collegiality and Loyalty – Respect for Authority – Conflict of Interest – Collective Bargaining – Confidentiality - Occupational Crime – Professional Rights – Employee Rights – Customers Rights - Intellectual Property Rights (IPR) – Discrimination – Nestle Maggi Case Study.

Global Issues

Multinational corporations(MNC) – Environmental Ethics – Computer ethics – Social Media Ethics – Engineers as Managers, Expert Witnesses and Advisors – Moral leadership - Weapons development – The Bhopal Gas Tragedy Case Study.

Total hours to be taught: 45

Text Book(s):

1	Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India (P) Ltd, New Delhi, 10th Reprint, 2009.

Reference(s):

1	Govindan K.R., and Sendhil Kumar S., "Professional Ethics and Human Values", Anuradha Publications, Chennai, 2011.
2	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw -Hill Publishing Company Limited, New Delhi, 2007.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E31 – Industrial Robotics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To impart the basic knowledge about the components of robot and sensors used. • To analyze robot manipulators in terms of their kinematics and control. • To Enable to program and control an industrial robot system that performs a specific task. • To discuss various applications of industrial robot systems.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Learn the fundamentals of the robot. 2. Study the different classification of the robot. 3. Understand the representation of transformations. 4. Know about the basic kinematics of robot. 5. Understand the different types of sensors used. 6. Study the different types of gripper. 7. Understand the concept of robot programming methods. 8. Know the characteristics of robot languages. 9. Understand the concept of robot cell layout. 10. Study the different industrial applications of robot.							

Fundamentals of Robot

Robotics-History of robotics-components of industrial Robot-Basic structure of robot –classification of robot and robotic system-laws of Robotics-Robot motion workspace precision of movement.

Kinematics of Robot

Introduction- matrix representation-homogeneous transformation matrices-representation of Transformations-Inverse of transformation matrices-forward and inverse kinematics of robots-degeneracy-dexterity.

Robot Sensors and End Effectors

Transducers and sensors- sensors in robot- tactile sensors-proximity and range Sensors-Sensing joint forces – robotic vision systems- mechanical grippers - types of gripper mechanism - other types of grippers – vacuum cups – magnetic gripper –adhesive grippers.

Robot Programming and Languages

Methods of robot programming-characteristics of task level languages lead through programming methods-motion interpolation-textual robot languages-robot language structure – VAL programming -motion command-end effector and sensor commands-communications and data processing –monitor mode commands.

Applications of Robotics

Robot cell design and control – economic analysis for robotics -Material transfer and machine loading/unloading – Processing operation: Assembly and inspection.

Total hours to be taught: 45

Text Book(s):

1	Saeed B. Niku, “Introduction to Robotics:Analysis, Systems, Applications”, 2nd edition, Pearson Education India, 2008.
2	M.P.Groover, “Industrial Robotics-Technology, Programming and Applications”, 2nd edition, Tata McGraw Hill Education, New Delhi, 2012.

Reference(s):

1	Ramesh Jain, RangachariKasturi, Brain G. Schunck, “Machine Vision”, Tata McGraw Hill, 1995.
2	YoremKoren, “Robotics for Engineers”, Tata McGraw Hill, USA. 1990.
3	Janaki Raman P A, “Robotics and Image Processing”, Tata McGraw Hill, 1995

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E32 – Computational Fluid Dynamics								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• To provide a thorough background into basic computational fluid dynamics analysis. • To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Perceive and solve the governing equations numerically. 2. Apply the boundary conditions for engineering problems and delineate about the grid. 3. Discretize the fluid flow problems. 4. Apply the finite volume method to fluid flow problems. 5. Solve the steady state heat transfer problems numerically. 6. Perceive about the convection diffusion problem in 1D and 2D steady state condition. 7. Formulate the pressure viscous flow in incompressible flow analysis. 8. Recognize the incompressible flow analysis with finite difference method. 9. Identify the turbulence model to engineering fluid flow problems. 10. Employ the standard codes to develop the CFD models.							

Governing Equations and Boundary Conditions

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations - Physical boundary conditions - Classification, Initial and boundary conditions, Initial and boundary value problems - Numerical errors, Grid independence test.

Discretization Methods

Nature of numerical methods - Method of deriving discretization equations - Taylor series formulation – Variational formulation - Method of weighted residuals - Control volume - Formulation.

Heat Conduction, Convection and Diffusion

Steady one-dimensional conduction - Two and Three dimensional conduction- Steady one - dimensional convection and diffusion - Discretization equations for two dimensional convection and diffusion - applications

Incompressible Fluid Flow

Governing Equations - Stream Function – Vorticity method, Determination of pressure for viscous flow - Computation of boundary layer flow - Finite difference approach - applications

Turbulence Models

Algebraic Models – One equation model, K-Є models, High and Low Reynolds number models, Unsteady turbulent model – applications, Prediction of fluid flow and heat transfer using standard codes.

Total hours to be taught: 45

Text Book(s):

1	Muralidhar K. and Sundararajan T, "Computational Fluid Flow and Heat Transfer ", 2nd Ed., Narosa Publishing House, New Delhi, 2014.
2	Versteeg, H.K., and Malalasekera, W., “An Introduction to Computational Fluid Dynamics”, Pearson India 2nd edition, 2009.

Reference(s):

1	T.J. Chung, Computational Fluid Dynamics, McGraw-Hill Education,Second revised edition, 2010.
2	John F.Wendt, “Computational Fluid Dynamics”, Springer Publisher, 3rd edition, 2012.
3	Patankar, S.V. “Numerical Heat Transfer and Fluid Flow”, Taylor & Francis group, 2015.
4	Anderson D.A., Tannehill J.C., and Pletcher P.H., “Computational Fluid Mechanics and Heat Transfer”, CRC Press, 3rd edition, 2012.
5	John D Anderson, “Computational Fluid Dynamics”, McGraw hill Education, 1st Indian edition, 2012.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E33– Computer Integrated Manufacturing								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	To apply the computer technology in various aspects of manufacturing viz., proper planning and control, manufacturing layout, material handling and storage system.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Identify the various manufacturing system. 2. Explain the role of CIM in design and production processes. 3. Describe the concept of Computer Aided Process Planning. 4. Explain the phases of shop floor control activities. 5. Describe the application of Automated Guided Vehicle System (AGVS) in FMS. 6. Utilize the industrial robots in material handling operations. 7. Design the automated assembly system. 8. Implement the automated inspection systems in quality control. 9. Implement the automated storage/retrieval system in manufacturing. 10. Explain the role of management in CIM using various techniques.							

Introduction to CIM

Types of manufacturing - continuous and discrete manufacturing - raw material to final product –Brief introduction of CAD and CAM - Concurrent Engineering - Definition of CIM, CIM wheel - evolution of the CIM concept - CIM II - benefits of CIM - Needs of CIM hardware, CIM software, CIM workstations - Introduction to Just-In-Time Production (JIT) and Lean manufacturing.

Computer Aided Process Planning and Control

Process planning - Computer Aided Process Planning (CAPP)–Types of CAPP - Master Production Schedule – - Material Requirement planning – Capacity Planning –Inventory Management - Manufacturing Resource Planning-II (MRP-II) - Enterprise Resource Planning (ERP).

Automated Guided Vehicle System (AGVS) and Industrial robotics

Flexible Manufacturing System (FMS) - components – application and benefits –Automated Guided Vehicle System (AGVS) – applications – vehicle guidance technology – vehicle management and safety - Basics of industrial robotics – classification – control systems – end effectors - robot sensors –applications of robots in manufacturing..

Automated assembly and Inspection system

Fundamentals of automated assembly system – system configuration, parts delivery at workstation, applications- Design for automated assembly –Inspection fundamentals and procedure – Automated inspection– Off-line and On-line inspection - Coordinate Measuring Machine(CMM) - multi-sensor measurement.

Automated storage/Retrieval System (AS/RS) and Management of CIM

Conventional storage methods and equipments - Types and applications of AS/RS - Carousel storage system - vertical lift module –horizontal carousel- Role of management in CIM - cost justification - expert systems - participative management - outlook – CIM open system architecture (CIMOSA).

Total hours to be taught: 45

Text Book(s):

1	Mikell. P. Groover “Automation, Production Systems and Computer Integrated Manufacturing”, 4th edition, Pearson Higher Education India, New Delhi, 2015.

Reference(s):

1	Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, PHI Learning Private Limited, New Delhi, 2010
2	Rao P N, CAD/CAM Principles and Applications”, 3rd Edition, Tata McGraw Hill Publications, New Delhi, 2010.
3	Radhakrishnan P, Subramanyan S and Raju V, “CAD/CAM/CIM”, 4th Edition, New Age International (P) Ltd., Publishers, New Delhi, 2016.
4	Roger Hanman “Computer Intergrated Manufacturing”, 1st Edition, Addison –Wesley Publications,2007.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E34 - Cryogenic Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100

Objective(s)	• To understand the physical behavior of the materials at cryogenic temperature. • To understand the concepts of Liquefaction and gas separation systems. • To enhance students' knowledge of theoretical and modern technological aspects in Cryogenic Engineering • To enable the students to correlate the theoretical principles with application oriented studies.
Course Outcomes	**At the end of the course, the student will be able to** 1. Define the mechanical properties of 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.

Introduction to Cryogenic Systems

Thermodynamics principle of cryogenic system- Mechanical Properties at low temperatures – Properties of cryogenic fluids. Gas Liquefaction: Minimum work for liquefaction – Methods to produce low temperature: Linde Hampson system – Claude system - Linde dual pressure system– Liquefaction systems for gases other than Neon, Hydrogen and Helium.

Liquefaction Systems

Liquefaction systems for Neon, Hydrogen and Helium Components of Liquefaction systems-Magnetic cooling, magnetic refrigeration systems– Heat Exchangers – Compressors and Expanders – expansion valve – Losses for real machines.

Gas Separation and Purification Systems

Gas separation and purification systems – Properties of mixtures – Principles of mixtures – Principles of gas separation – Air separation systems and Safety in handling of cryogens-Cryogenic instrumentation and Measurement.

Cryogenic Refrigeration Systems

Cryogenic Refrigeration Systems – Working media – Solids, Liquids and gases. Cryogenicfluid storage and transfer – Cryogenic storage systems and Optimization of tank design – Insulation – Fluid transfer mechanisms – Cryostat – Cryo Coolers.

Applications of Cryogenic Refrigeration Systems

Applications – Space technology – In-flight air separation and collection of LOX – Gas Industry – Biology – Medicine – Electronics- nuclear propulsions, chemical propulsions.

Total hours to be taught: 45

Text Book(s):

1	S.S. Thipse "Cryogenics - A Text book",1st Edition, Narosa publishing house, Newdehli, March 2013.
2	Randall F. Barron, "Cryogenics Systems", 2nd Edition OxfordUniversity Press New York, Clarendon Press, Oxford, 1985.

Reference(s):

1	M.Mukhopadhyay, "Fundamentals of Cryogenic Engineering", 2nd edition, PHI learning publications, Delhi, March 2014.
2	G.K. White. "Experimental Techniques in Low Temperature Physics", 4th Edition,Oxford Press, 2002.
3	Robert Ackermann. "Cryogenic Regenerative Heat Exchangers",1st Edition Plenum Press, 2013.
4	Timmerhaus, Flynn, "Cryogenics Process Engineering", 1st Edition, Plenum Press,New York,1989.
5	Fredrick J. Edeskutty and Watter F. Stewart "Safety in Handling of Cryogenic Fluids", 1st Edition,Plenum Press, 2012.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME E35– Refrigeration and Air conditioning								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	50	50	100
Objective(s)	• 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.							
Course Outcomes	**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 vapour absorption refrigeration \ system. 3. Describe the components of refrigeration system (compressors, condensers, evaporators, expansion valve and cooling towers). 4. Identify the desirable properties of refrigerants and select the alternate refrigerants. 5. Perform the calculations for various properties of air for various psychometric processes. 6. Evaluate the effective and grand sensible heat factor for Air conditioning systems. 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. Various Components and working of air conditioning systems. 10. Explain the air distribution system and applications of air conditioning systems.							

Refrigeration Cycle and Systems

Basic cycles - Reverse Carnot cycle - Simple Vapor compression cycle (sub-cooling, superheating) - Actual vapour compression cycle - Bell Coleman. Multistage and Multiple evaporator systems - Cascade system -Vapor absorption refrigeration system (Ammonia water and Lithium Bromide water) - Steam jet refrigeration system - COP comparison.

Refrigerants, System Components and Balancing

Compressors: Reciprocating and Rotary (elementary treatment) - Scroll compressors - 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.

Psychrometry

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 - ventilation standards.

Cooling Load Calculations

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 - industrial systems - central air conditioning systems. Computerized cooling load calculations-Packages –simulation of psychrometric process-simulation of air flow in AC systems-Computerized calculation.

Air-Conditioning and Components

Air conditioning equipments: air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser – Temperature sensor - Pressure sensors - Humidity sensors - Actuators - Safety controls- cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems. Applications: car – industry – stores - public buildings.

Total hours to be taught: 45

Text Book(s):

1	Manohar Prasad, "Refrigeration and Air Conditioning", 3rd edition, Wiley Eastern Ltd., 2014.
2	C. Billy and Langley., "Refrigeration and Air conditioning" Ed.3, Engle wood cliffs (NJ), Prentice Hall, 1986.
3	C.P .Arora. "Refrigeration and Air Conditioning", 3rd edition, Tata McGraw-Hill, New Delhi, 2014.

Reference(s):

1	Roy.JDossat, “Principles of Refrigeration”, Pearson Education, New Delhi, 2011.
2	Jordon and Prister, “Refrigeration and Air Conditioning”, Prentice Hall of India Pvt Ltd., New Delhi, 1985.
3	N.F.Stoecker and Jones, "Refrigeration and Air Conditioning", Tata McGraw hill company, New Delhi, 1983.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME E41– Advanced Manufacturing Processes								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• The objective of this course is to introduce to students the principle of working, constructional details, design feature and performance characteristics of various advanced manufacturing process							
Course Outcomes	**At the end of the course, the student will be able to** 1. Understand the basic principle of advanced casting process. 2. Select various casting process used in ceramic materials. 3. Select cost effective type of manufacturing process for deferent domestic and industrial application. 4. Compute merits and demerits of manufacturing process is selection of an end product. 5. Able to understand the concept of green manufacturing and environment friendly system. 6. Select and design a process extensively for automobile sector. 7. Understand small independent project and write a professional report and present it to a selected audience. 8. Selection and analysis of different chip less manufacturing process. 9. Identify suitable nontraditional machining process. 10. Differentiate between various nontraditional machining processes.							

Advanced Casting Processes

Introduction – Metal mould casting, Continuous casting, Squeeze casting, Vacuum mould casting, Ceramic shell casting Evaporative pattern casting – Advantages – Applications.

Advanced Welding Processes

Introduction – Types – Working principle - Electron beam welding (EBW) - Laser beam welding (LBW) –Hybrid welding- Ultrasonic welding (USW) – Friction stir welding – Friction surfacing – Applications – Advantages.

Advanced Metal Forming Processes

Introduction - High Energy Rate Forming (HERF) process, Electro-magnetic forming, Explosive forming, Electro-hydraulic forming, Stretch forming, Contour roll forming – Advantages - Applications.

Advanced Chemical and Thermal Machining process

Introduction – Process principle - Electrochemical machining (ECM) - Electrochemical Grinding (ECG) - Electro discharge machining (EDM) - Electron beam machining (EBM) – Ion beam machining– Applications – Advantages.

Advanced Machining Processes

Introduction, Process principle, Material removal mechanism, Parametric analysis and applications of processes such as ultrasonic machining (USM), Abrasive jet machining (AJM), Water jet machining (WJM), Abrasive water jet machining (AWJM) – Application – Advantages.

Total hours to be taught: 45

Text Book(s):

1	Hofy H.E, “Advanced Manufacturing Process”, B and H Publication.

Reference(s):

1	Pandey P.C. and Shah H.S, “Modern Machining Processes”, 1st Edition, Tata McGrawHill, New delhi, 2010.
2	SeropeKalpakjian and Steven Schmid, “Manufacturing Engineering and Technology”, 7th Edition, Pearson education India Ltd, New Delhi, 2014.
3	V. K. Jain, “Advanced machining processes”, 1st Edition, Allied publishers, Bengaluru, 2010.
4	Singh K K, “Unconventional Manufacturing Process”,DhanpatRai& Company, New Delhi, 2007.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E42 / 40 ME L02 – Composite Materials								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	This course aims to impart knowledge on processing techniques, physical properties and applications of Polymer, Metal and Ceramic matrix composites.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Explain the properties and manufacturing processes of synthetic and natural fibers. 2. Explain the properties and applications of Polymer, Metal and Ceramic matrices. 3. Describe the manufacturing methods used for thermoset polymer matrix composites. 4. Describe the manufacturing methods used for thermoplastic polymer matrix composites and explain the properties and applications of PMCs. 5. Describe the various types of metallic matrices and explain the different liquid state processing techniques of MMCs. 6. Explain the various solid state processing techniques and list the properties and applications of MMCs. 7. Explain the Processing of CMCs through Cold Pressing and Sintering, Hot Pressing, Reaction Bonding and Infiltration. 8. Explain the Processing of CMCs through Sol–Gel, Polymer infiltration and Pyrolysis (PIP) and list the properties and applications. 9. Explain the processing, properties and applications of carbon – carbon, sandwich structured, hybrid and biogradable green composites. 10. Describe the production, properties and applications of nano composites.							

Introduction to composites

Classification–fibrous, laminated and particulate composites - characteristics of fiber reinforced composites - fibers - glass, carbon, aramid, ceramic and natural fibers - matrix materials– Polymer, Ceramic and Metal matrices –Mechanical behaviour of composites – lamina and laminates - fillers and additives – applications of composites.

Polymer matrix composites (PMC)

Processing of PMCs - Thermoset Matrix Composites - Hand Layup technique - Filament Winding – Pultrusion - Resin Transfer molding - bag molding processes - Thermoplastic Matrix Composites - Sheet Molding Compound (SMC) – Interface, Structure and properties of PMCs – applications of PMCs.

Metal Matrix Composites (MMC)

Types of MMCs – Metallic matrices - aluminium, titanium and magnesium alloys – Processing of MMCs – Liquid state processes – liquid infiltration and squeeze casting - Solid state processes – powder metallurgy, diffusion bonding and vapor deposition techniques - In situ processes – Interface and properties of MMCs – applications of MMCs.

Ceramic Matrix Composites (CMC)

Need for CMCs - Processing of CMCs - Cold Pressing and Sintering - Hot Pressing - Reaction Bonding – Infiltration - In Situ Chemical Reaction - Sol–Gel – Polymer infiltration and Pyrolysis - – Interface and properties of CMCs – applications of CMCs.

Advanced composites

Carbon-Carbon composites – processing, properties and applications –sandwich-structured composites – hybrid composites – Biodegradable green composites – Polymer nano composites – nano clay – carbon nanofibers – carbon nanotubes(CNTs) – production and properties of CNTs – applications of nano composites.

Total hours to be taught: 45

Text Book(s):

1	Chawla K.K, “Composite Materials and Engineering”, Springer Verlag, New York, 2nd Edition, 2008

Reference(s):

1	Mallick P.K, “Fiber Reinforced Composites: Materials, Manufacturing and Design”, 3rdEdition, CRC press, 2015.
2	Kaw and Autar K, “Mechanics of Composite Materials”, 2nd Edition, CRC Press, 2006.
3	Robert M Jones, “Mechanics of Composite Materials ", 2nd Edition, CRC Press, 2015.
4	Matthews F.L and Rawlings R.D., “Composite Materials: Engineering and Science”, 1st Edition, Wood head Publishing, England, 2002.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E43 – Entrepreneurship Development								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• The course is designed for those who at some point of their career want to start their ownVentures and to run their own family businesses. • To understand with the special challenges of starting new ventures and introducing new product and service ideas.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Learn the concept of entrepreneurship 2. Understand about entrepreneurship in economic growth and factors affecting the growth. 3. Characterize the concept of motivation. 4. Understand the concept of stress management and EDPs. 5. Identifying and selecting good business opportunity. 6. Learn the preparation of preliminary project report. 7. The source of finance and working capital for starting a business. 8. Learn the break even and network analysis of PERT /CPM of a project. 9. Understand the causes and consequences, corrective measures related to industrial sickness. 10. Outline the concept of growth strategies in small industries.							

Entrepreneurship

Introduction - Definition of Entrepreneur - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur- Myths of Entrepreneurship - Entrepreneurship in Economic Growth-Factors Affecting Entrepreneurial Growth. Make in India, Technology Business Incubator – Start up.

Entrepreneurship Motivation

Need for Motivation-Characters and Competencies Required For a Successful Entrepreneur- Innovation and the Entrepreneur- case study. Stress management- Entrepreneurship Development Programs - Need, Objectives.

Identifying and Evaluating Business Opportunities

Idea Generation- Methods of Generating Ideas- Opportunity Recognition-Ownership Structures Expansion, Diversification, Joint Venture, Merger and Sub Contracting - Project Formulation - Steps involved in setting up a Business.

Marketing and Finance

Feasibility Analysis- Market Survey and Research, Techno Economic Feasibility Assessment - Preparation of Preliminary Project Reports. Need - Sources of Finance, Term Loans, Capital Structure, and Financial Institution-Working capital management-Break even Analysis- Taxation -Sales Tax, Income Tax, and Excise Duty.

Business Plan and Support for an Entrepreneur

Business Plan and its Benefits- Elements of Business Plan-Preparation and presentation of Business Plan-Central and State Government Agencies and Schemes - Importance of Tamilnadu Industrial Investment Corporation (TIIC)-Role of MSME,CII, Banks and Financial Institutions.

Total hours to be taught: 45

Text Book(s):

1	S.S.Khanka, “Entrepreneurial Development”, S.Chand& Co. Ltd, New Delhi, 2010.
2	Hisrich R D and Peters M P, “Entrepreneurship” 10thEdition Tata McGraw-Hill, New Delhi, 2016.

Reference(s):

1	Kuratko Hodgetts, “Entrepreneurship in the New Millennium”, Cengage Learning, 2009.
2	Jeffry Timmons and Stephen Spinelli, “New Venture Creation”, 7th Edition, Tata McGraw Hill, 2009.
3	Brian Finch, “How to write a Business Plan”, 5thEdition, Kogan Page India, New Delhi, 2016.
4	Rajeev Roy, “Entrepreneurship”, 2nd Edition, OXFORD University Press, 2011.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME E44 – MEMS Devices – Design and Fabrication								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• To give an introduction to the concepts in micro electro mechanical systems and understand the various sensors. • To impart the knowledge about the materials used in MEMS Devices. • To apply knowledge of micro fabrication techniques and applications to the design and manufacturing of a MEMS device.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Know the concepts in micro electro mechanical systems and understand the losses in miniaturization. 2. Understand the physics, materials, basic structures and properties of MEMS. 3. Comprehend the working principle of Micro sensors and Actuators. 4. Realize the concepts of Micro fluidics and the applications of MEMS. 5. Fine tune their designs in to working MEMS devices. 6. Understand the fundamentals and design of microsystems. 7. Gain knowledge about the various Micro manufacturing Techniques. 8. Recognize a fundamental understanding of standard micro fabrication techniques and issues surrounding them. 9. Know the overview of packaging of microelectronics. 10. Identify the assembly of micro systems.							

Introduction to Microsystems.

Introduction - Micro system and microelectronics - Working principle of MEMS - scaling losses in miniaturizations - materials for MEMS - Silicon as MEMS materials - Crystal structure and compounds of silicon - Properties of MEMS - Polymers for MEMS - Quartz.

MEMS Devices

Micro sensors - Types - Micro actuation techniques - Micro actuators - Micro motors - Micro valves - Micro grippers - Micro accelerometer – introduction-Fundamentals of micro fluidics- Micro-pump- Types, Actuating Principles, Design rules ,modeling and simulation, Verification and testing - Applications.

Micro Systems Design

Engineering science for microsystems design - atomic structure of matter, ions and ionization, molecular theory, doping of semiconductors, diffusion process, and quantum physics, plasma physics, electrochemistry.
Engineering mechanics for micro system design - static thin plates, mechanical vibration, thermodynamics, fracture mechanics, thin film mechanics, overview of finite element stress analysis.

Micro Systems Fabrication

Introduction - Photolithography, Ion Implantation, and Diffusion - Oxidation, CVD, PVD, Deposition by Epitaxy, Etching. Overview of Micro Machining - Bulk Micro Machining, Surface Micro Machining, LIGA Process.

Micro Systems Packaging

Overview of mechanical packaging of microelectronics, microsystems packaging. Essential packaging techniques, 3D packaging, assembly of micro systems - signal mapping and transduction.

Total hours to be taught: 45

Text Book(s):

1	Tai-Ran Hsu, "MEMS and Microsystems Design Manufacture and nanoscale Engineering", 2nd Edition, Wiley Publications, New Delhi, 2008.
2	Mohamed Gad-el-Hak, "The MEMS Hand book", 2nd Edition, CRC press, 2005.

Reference(s):

1	Chang Liu, "Foundations of MEMS", 2nd Edition, Pearson Education India, New Delhi, 2012.
2	NaldimMaluf," An Introduction to Microelectromechanical Systems Engineering**",** 2nd Edition, Artech House, London,2003.
3	Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices and Structures", CRC Press, 2002**.**
4	Sami Franssila, "Introduction to Micro Fabrication", Wiley publication, 2005.
5	Julian W. Gardner, Vijay K. Varadan and Osama O. Awadelkarim, "Microsensors MEMS and Smart Devices", John Wiley & sons Ltd., New York, 2001.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E45 – Process Planning and Cost Estimation								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• 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.							
Course Outcomes	**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 planning. 3. Define the importance and objectives of cost estimation. 4. Outline the type and method of costing. 5. Differentiate the estimation and costing. 6. Practice the various components of cost involved in cost estimation and allocate the overhead cost to the job. 7. Determine the machining time for lathe, milling, shaping grinding and drilling operations. 8. List the allowances and losses in forging, welding and foundry operations. 9. Describe the concept of budgetary control. 10. Identify the make or buy decision.							

Process Planning

Introduction - 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.

Estimation and Costing

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.

Elements of Costs

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.

Cost Estimation

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.

Cost Economics

Budget - Essentials of budgeting - Types of Budgets - Budgetary control - Objectives - Benefits - Measures of cost economics - Make or buy decision and Analysis.

Total hours to be taught: 45

Text Book(s):

1	G.B.S.Narang and V.Kumar, “Production and Costing”, 4th Edition, Khanna Publishers, New Delhi 2013.
2	T.R.Banga and S.C.Sharma, “Mechanical Estimating and Costing Including costing”, 16th Edition, Khanna Publishers, New Delhi, 2006.

Reference(s):

1	M.Adithan and B.S.Pabla, “Production Engineering Estimating and Costing”, Konark Publishers Pvt. Ltd., New Delhi, 2004.
2	A.K.Chitale and R.C.Gupta, “Product Design and Manufacturing”, 6th Edition, Prentice Hall Pvt. Ltd., new Delhi, 2015.
3	Nanua Singh, “System approach to Computer Integrated Design and Manufacturing”, Wiley publications, New Delhi, 2013.
4	Joseph G.Monks, “Operations Management, Theory & Problems”, 2nd Edition, McGraw Hill Book Company, 2006.

K.S.Rangasamy College of Technology – Autonomous R 2014								
40 ME E51 – Non Destructive Materials Evaluation								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	To study and understand the various Non-Destructive Evaluation and Testing methods for industrial applications.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Describe the science and engineering of various NDT techniques. 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 consumer oriented products in the field of inspection. 5. Apply the specific NDT method depends on suitability and past experience. 6. Illustrate the components, construction and working principles of various NDT 7. Acquire the basic knowledge of ultrasonic testing which enables them to perform inspection of samples. 8. Apply the concept of acoustic emission for a better inspection and evaluation of components. 9. Impart knowledge on the different radiographic testing techniques 10. Interpret and evaluate the characteristic curves and charts in radiography.							

Overview of NDT

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT. Visual inspection – Unaided and aided.

Surface NDE Methods

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing - Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

Thermography and Eddy Current Testing

Thermography - Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy current testing, Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Interpretation/Evaluation, advantages, Limitations, Applications with few case studies.

Ultrasonic Testing and Acoustic Emission

Ultrasonic Testing - Principle, Transducers, transmission and pulse - echo method, straight beam and angle beam, instrumentation, Data representation: A-scan, B-scan and C-scan. Phased Array Ultrasound - Time of Flight Diffraction. Acoustic Emission Technique - Principle, AE parameters, Applications - Case studies.

Radiography

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy - Xero-Radiography, Computed Radiography, Computed Tomography, Applications with few case studies.

Text Book(s):

1	Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2015.
2	Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.

Reference(s):

1	ASM Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Volume-17.
2	Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, New Jersey, 2nd Edition, 2005
3	Charles, J. Hellier,“ Handbook of Nondestructive evaluation”, McGraw Hill, New York, , 2nd Edition, 2013.
4	ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT 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, Vol.8 Magnetic Testing.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E52 – Fundamentals of Nanoscience								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• To impart knowledge on the basics of nano science and its application							
Course Outcomes	**At the end of the course, the student will be able to** 1. Deliver the scientific revolutions in nano engineering and technology. 2. Describe nanostructures and dimensions of nanoscale materials. 3. Describe the surface chemistry and physics of nanoparticles. 4. Explain the properties of nanoparticles and structures. 5. Perform physical and chemical synthesis of nanomaterials. 6. Synthesis and process the nano composite materials. 7. Report on the microscopic characterization of nano materials. 8. Report on the spectroscopy characterization of nano materials. 9. Analyze the fabrication of nanostructures. 10. Explain the mechanism of Nanostructured materials applications.							

Introduction

Scientific revolutions – Nano engineering and technology; atomic and molecular size and structure. Introduction to nanoscale materials - top down and bottom up approach; nanostructures and dimensions -shape and morphology; scope for nanotechnology.

Nanoscale Properties

Surface to volume and surface to mass ratio; size dependent properties -quantum size effect; inter dynamic aspects of inter molecular forces; surface chemistry and physics of nanoparticles; mechanical, optical, electronic, magnetic, thermal and chemical properties of nano particles and structures.

Synthesis of Nanomaterials

Chemical approaches - wet chemical synthesis, sonochemical method, microemulsion technique and solGel processing; physical approaches - mechanical milling, spray phyrolysis, gas phase synthesis, gas condensation processing, physical and chemical vapor deposition and condensation; synthesis of bulk nanostructured materials - sol-gel processing, mechanical alloying and mechanical milling, nanocomposite materials synthesis and processing. Nano - polymers.

Nanomaterials Characterization

X-ray powder diffraction(XRD), thermo gravimetric analysis (TGA), differential thermal analysis (DTA); scanning and transmission electron microscopy technique (SEM and TEM); atomic force microscopy (AFM); nanoindentation; X - ray fluoresce spectroscopy (XRF), UV Visible spectroscopy, Fourier Transform Infrared spectroscopy (FTIR)

Fabrication of Nanostructures And Applications

Self - assembly, self - assembled monolayers (SAMs), microencapsulation, nanolubricants, nanofluids, nanoscaled, pizeoelectrometrials, Nanocombustion.

Total hours to be taught: 45

Text Book(s):

1	Charles P. Poole, Frank J. Owens, “Introduction to Nanotechnoogy”, Wiley Interscience, 2003.
	A.K. Sen, John Damewood, “Coated Textiles: Principles and Applications” 2nd Edition, CRC Press, 2007.

Reference(s):

1	J. Dutta, H.Hoffmann, “Nanomaterials”, Topnano -21, 2003.
2	Anthony L. Andrad, “Science and Technology of polymer nanofibers” Wiley John Wiley & Sons, 2008
3	C RicbardBrundle Charles A. Evans, Jr. SbaunWihon and Lee E. Fitzpatrick “Encyclopedia of Materials Characterization” Manning publications, 1992
4	T. Pradeep, “NANO: The Essential”, 1st Edition, Tata McGraw hill Publishers, New Delhi, 2007.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E53 – Supply Chain Management								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	To understand the basics of supply chain concepts, associated networks, tools and techniques required for evaluating various supply chain processes.							
Course Outcomes	**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. Categorize the role of sourcing in a supply chain. 4. Demonstrate the facility networks and design options. 5. Understand the role of forecasting for both an enterprise and a supply chain. 6. Develop a frame work for making network design decisions. 7. Understand the role of transportation in a supply chain. 8. Identify the conditions of effective revenue management. 9. Assess the role of IT in supply chain. 10. Select the decision support system for supply chain.							

Introduction

Evolution of supply chain-essentials of SCM-structure of supply chain, examples-process views-decision phases, issues - aligning supply chain with business strategy –supply chain decision variables, performance measures-new challenges - reverse logistics.

Sourcing decision and Network design

Supply chain configuration design - factors involved - sourcing, models for strategic alliances – supplier selection, outsourcing and procurement process – facility location and capacity allocation - modeling approaches LP, MILP - network design in uncertain environment – evaluation using simulation models.

Planning Demand, Inventory and Supply

Demand forecasting-collaborative forecasting models-bullwhip effect-information sharing - aggregate planning in supply chain - strategies-multi echelon inventory planning-models- discounting- risk pooling- centralized versus decentralized systems.

Transportation in Supply Chain

Roles of transportation- tradeoffs in transportation design-modes of transportation and their design - vehicle routing and scheduling - models - packaging-pricing and revenue management.

Information Technology in supply Chain

Role of IT in supply chain -IT infrastructure-CRM-SRM-e-business-RFID-supply chain collaboration-Decision Support System (DSS) for supply chain- selection of DSS for supply chain.

Total hours to be taught: 45

Text Book(s):

1	Sunil Chopra and Peter Meindl, “Supply Chain Management, Strategy, Planning, and operation”, 6th Edition, Pearson Education India Ltd., New Delhi, 2016.

Reference(s):

1	Jeremy F.Shapiro, “Modeling the supply chain”, 2nd Edition, CengageHigherEducation, New Delhi, 2007.
2	James B.Ayers, “Handbook of Supply chain management”, 2nd Edition, CRC Press, 2006.
3	David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi,Designing and Managing the Supply Chain: Concepts, Strategies, and Cases- Tata McGraw Hill, 3rd edition, 2007.

K.S.Rangasamy College of Technology – Autonomous								R 2014
40 ME E54 – Lean Manufacturing								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• To attain optimum level in quality without any or low fluctuation in operating cost. • To impart knowledge to increase productivity, reduce waste and optimum utilization of resources.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Describe the brief history of manufacturing approaches employed and the philosophy of lean production. 2. Explain the concept of value creation and waste elimination. 3. Describe the concept of various organizational element. 4. Apply the concept of various logistic element in lean manufacturing. 5. Apply the tools in lean manufacturing to analyze a manufacturing system and plan for its improvements. 6. Relate the different methodologies in lean manufacturing tools. 7. Describe the concept of various process driven measures. 8. Implement the concepts and methodologies of lean manufacturing. 9. Recognize the future state map and factory simulation scenario. 10. Initiate a continuous improvement change program in a manufacturing organization.							

Introduction

Holistic view of lean principles - Five primary elements, Comparison of Mass Manufacturing and Lean Manufacturing, , Types of Wastes, Types of activities – Value Added, Non Value Added.

Organizational and Logistic Element

Organization element: Communication planning, product-focused responsibility, leadership development, workforce preparation. Logistics element**:** Planning/control function, A,B,C material handling, service cells, customer/supplier alignment, cell team work plan, level loading, mix-model manufacturing, workable work.

Manufacturing and Process Control Element

Manufacturing Flow Element: Product/quantity analysis, process mapping, routing analysis, takt time, workload balancing and one-piece flow, cellular manufacturing, pull system and kanban sizing.

Process Control Element: Single minute exchange of dies, poka-yoke, 7S, visual controls, graphic work instructions.

Metrics Element

DuPont model, output-based measures, process-driven measures, goal alignment through policy deployment, measurement definition and understanding.

Implementing Lean

Lean implementation, Reconciling lean with other systems -Toyota production system, lean six sigma-lean and ERP- lean with ISO 9001: 2015.

Value Stream Mapping

Introduction - Primary icons - Customer and supplier icons - Production control icon - Data box icon - Truck icon - Material direction arrow icon - Process icon - Push icon - Pull icon - Information and communication flow icons - Secondary icons - Developing the VSM - Current state mapping - Future state mapping

Total hours to be taught: 45

Text Book(s):

1	William M Feld, “Lean Manufacturing, Tools, Techniques and How To Use Them”, The St. Lucie Press/APICS Series on Resource Management, 2001.

Reference(s):

1	Joseph De Feo, William Barnard , “Juran Institute's Six Sigma Breakthrough and Beyond”, Tata McGrawHill, New Delhi, 2004.
2	Micheal Wader, “Lean Tools: A Pocket guide to Implementing Lean Practices”, Productivity and QualityPublishingPvt Ltd, 2002.
3	Askin R.G, Goldberg J.B, “Design and Analysis of Lean Production Systems”, John Wiley & Sons, New York,2003.
4	Michael L George, David T Rowlands, Bill Kastle, “What is Lean Six Sigma”, McGraw Hill Inc., New York,2004

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E55 – Welding Technology								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100
Objective(s)	• To understand the basics of welding and to know about the various types of welding processes. • To learn the welding techniques, application of welding and welding aspects of different materials. • To impart the knowledge of testing of weldments.							
Course Outcomes	**At the end of the course, the student will be able to** 1. Explain the principle of gas welding process. 2. Explain the types and principle of arc welding process. 3. Relate the different types of resistance welding process 4. List and explain the high frequency resistance welding process. 5. Explain the different types of solid state welding process 6. Identify the application of hot pressure welding process. 7. Categorize and explain the special welding process. 8. Recognize welding automation in aerospace, nuclear and surface transport vehicles. 9. List and explain the weldability of different materials. 10. Interpret and report the destructive and non-destructive testing of weldments.							

Gas and Arc Welding Processes

Fundamental principles - Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, Activated TIG and MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

Resistance Welding Processes

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

Solid State Welding Processes

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

Other Welding Processes

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles –

Design of Weld Joints, Weldability and Testing of Weldments

Basic principles – Weld symbols – Residual stress – Defects in welding – Various welded joint designs. Weldability of Aluminium, Copper and Stainless Steel. Destructive and Non-Destructive testing of weldments.

Total hours to be taught: 45

Text Book(s):

1	Parmer R.S., “Welding Engineering and Technology”, 2nd Edition, Khanna Publishers, New Delhi, 2010.
2	Parmer R.S., “Welding Processes and Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2012.

Reference(s):

1	Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.
2	“Welding Hand Book”, 9th Edition, Vol- 2, American welding Society, Miami, Florida.
3	Nadkarni S.V. “Modern Arc Welding Technology”, 2nd Edition, Oxford& IBH Publishers, New Delhi, 2005.

K.S.Rangasamy College of Technology – Autonomous					R 2014			
40 ME E56 / 40 ME L03 - Additive Manufacturing								
Semester	Hours / Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	3	0	0	45	3	50	50	100

Objective(s)	• To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies. • To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
Course Outcomes	**At the end of the course, the student will be able to** 1. Describe the brief history of manufacturing approaches employed and the philosophy of additive manufacturing. 2. Analyse the concept of different materials and tooling. 3. Describe the concept of various data processing techniques. 4. Apply the concept of various tools in reverse engineering. 5. Describe the concept of liquid based additive manufacturing system. 6. Describe the concept of solid based additive manufacturing system. 7. Explain the principle of laser sintering process 8. Implement the concepts and methodologies of three dimensional printing. 9. Recognize the future state customized implants and prosthesis. 10. Initiate a continuous improvement in bio additive manufacturing.

Introduction

Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling - Applications.

CAD and Reverse Engineering

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation –Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

Liquid Based and Solid Based Additive Manufacturing Systems

Classification – Liquid based system – Stereolithography Apparatus (SLA) - Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing.

Powder Based Additive Manufacturing Systems

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

Medical and Bio-Additive Manufacturing

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies.

Total hours to be taught: 45

Text Book(s):

1	Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, 3rd Edition, World Scientific Publishers, 2010.
2	Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2003.

Reference(s):

1	Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2007.
2	Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
3	Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000.