COURSE STRUCTURE

AND

DETAILED SYLLABUS

R16

MECHANICAL ENGINEERING

For

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the students admitted into Academic Year 2016-17)

(I – IV Years Syllabus)

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES

Basar, Nirmal, Telangana - 504107

COURSE STRUCTURE (R16) FOR B.TECH.(REGULAR)

Applicable for the students of B.Tech. (Regular) from the Academic Year 2016-17 and onwards

I YEAR
I SEMESTER

Subject Code	Subject Name	L-T-P	Credits
MA1101	Mathematics-I	4-0-0	4
CY1001	Engineering Chemistry	4-0-0	4
CS1101	Programming in C	4-0-0	4
ME1101	Engineering Drawing and Computer Drafting-I	2-0-3	4
ME1001	Engineering Mechanics	4-0-0	4
HS1101	Communication Skills-I	2-0-0	1
CY1601	Engineering Chemistry Lab	0-0-3	2
CS1701	Programming in C Lab	0-0-3	2
ME1601	Engineering Workshop	0-0-3	2
Total		20-0-12	27

I YEAR
II SEMESTER

Subject Code	Course Name	L-T-P	Credits
HS1001	English for Communication	4-0-0	3
MA1201	Mathematics-II	4-0-0	4
PH1001	Engineering Physics	4-0-0	4
CS1201	Scripting Languages	4-0-0	3
ME1201	Engineering Drawing and Computer Drafting-II	2-0-3	4
HS1201	Communication Skills-II	2-0-0	1
PH1601	Engineering Physics Lab	0-0-3	2
HS1601	English for Communication Lab	0-0-3	2
Total		20-0-9	23

II YEAR
I SEMESTER

Subject Code	Course Name	L-T-P	Credits
MA2102	Mathematics -III	4-0-0	4
ME2101	Kinematics of Machinery	4-0-0	4
ME2102	Thermodynamics	4-0-0	4
ME2103	Mechanics of Solids	4-0-0	4
ME2104	Material Science & Metallurgy	4-0-0	4
HS2101	Soft Skills-I	2-0-0	1
ME2701	Mechanics of Solids Lab	0-0-3	2
ME2702	Material Science & Metallurgy Lab	0-0-3	2
ME2901	Seminar-I	0-0-2	1
Total		22-0-8	26

II YEAR
II SEMESTER

Subject Code	Course Name	L-T-P	Credits
MA2202	Mathematics -IV	4-0-0	4
ME2201	Dynamics of Machinery	4-0-0	4
ME2202	Fluid Mechanics	4-0-0	4
ME2203	Manufacturing Processes	4-0-0	4
EE2001	Basic Electrical and Electronics Engineering	4-0-0	4
BM2201	Personality Development-I	2-0-0	1
EE2601	Electrical and Electronics Engineering Lab	0-0-3	2
ME2801	Manufacturing Processes Lab	0-0-3	2
ME2902	Seminar-II	0-0-2	1
	Total	22-0-8	26

III YEAR
I SEMESTER

Subject Code	Course Name	L-T-P	Credits
ME3101	Hydraulic Machines	4-0-0	4
ME3102	Metrology & Instrumentation	4-0-0	4
ME3103	Design of Machine Elements-I	4-0-0	4
BM3001	Managerial Economics and Financial Analysis	4-0-0	3
BSBE3001	Environmental science	4-0-0	3
BM3101	Personality Development-II	2-0-0	1
ME3701	Fluid Mechanics & hydraulic machines Lab	0-0-3	2
ME3702	Metrology & Instrumentation Lab	0-0-3	2
ME3703	Machine Drawing Practice	1-0-3	2
ME3901	Seminar-III	0-0-2	1
Total		23-0-11	26

III YEAR
II SEMESTER

Subject Code	Course Name	L-T-P	Credits
ME3201	Machining and Machine Tools	4-0-0	4
ME3202	Applied Thermodynamics-I	4-0-0	4
ME3203	Design of Machine Elements-II	4-0-0	4
ME3204	Heat Transfer	4-0-0	4
CS3001	Object oriented programming through Java	4-0-0	4
HS3201	Soft Skills-II	2-0-0	1
ME3801	Heat Transfer Lab	0-0-3	2
CS3601	Object oriented programming through Java Lab	0-0-3	2
ME3902	Seminar-IV	0-0-2	1
ME3000	Comprehensive Viva-I		1
Total		22-0-8	27

IV YEAR
I SEMESTER

Subject Code	Course Name	L-T-P	Credits
ME3900	Summer Internship	-	6
ME4101	Applied Thermodynamics-II	4-0-0	4
ME4102	CAD/CAM	4-0-0	4
ME4103	Refrigeration and Air Conditioning	4-0-0	4
ME440X	Elective-I	4-0-0	3
ME441X	Elective-II	4-0-0	3
ME4701	Applied Thermodynamics Lab	0-0-3	2
ME4702	CAD/CAM Lab	0-0-3	2
ME4703	Automation and Robotics Lab	0-0-3	2
Total		20-0-9	30

Elective-I			
ME4401	Composite Materials	4-0-0	3
ME4402	Non-Traditional Manufacturing Processes	4-0-0	3
ME4403	Advanced Fluid Mechanics	4-0-0	3
ME4404	Tribology	4-0-0	3
IM4405	Production Planning & Control	4-0-0	3
Elective-II			
ME4411	Welding Technology	4-0-0	3
ME4412	Automobile Engineering	4-0-0	3
ME4413	Computational Fluid Dynamics	4-0-0	3
ME4414	Finite Element Methods in Engineering	4-0-0	3
ME4415	Experimental Stress Analysis	4-0-0	3

IV YEAR
II SEMESTER

Subject Code	Course Name	L-T-P	Credits
XXxxxx	Open Elective	4-0-0	3
ME4800	Project	0-0-24	16
ME4000	Comprehensive Viva-II		1
Total		4-0-24	20

L : Lecture hours per week
T: Tutorial hours per week
P: Practical hours per week
C: Credits per subject

CURRICULUM OF MECHANICAL ENGINEERING
RGUKT BASAR

I YEAR
I SEMESTER

Subject Code	Subject Name	L-T-P	Credits
MA1101	Mathematics-I	4-0-0	4
CY1001	Engineering Chemistry	4-0-0	4
CS1101	Programming in C	4-0-0	4
ME1101	Engineering Drawing and Computer Drafting-I	2-0-3	4
ME1001	Engineering Mechanics	4-0-0	4
HS1101	Communication Skills-I	2-0-0	1
CY1601	Engineering Chemistry Lab	0-0-3	2
CS1701	Programming in C Lab	0-0-3	2
ME1601	Engineering Workshop	0-0-3	2
Total		20-0-12	27

MA1101 **MATHEMATICS - I**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

Objectives:

- To give a thorough explanation of real sequences and series.
- To introduce the concepts of Euclidean space and the behavior of functions in them.
- To emphasize the applications of differentiation on real functions and their geometrical inferences.
- Introduction to Numerical analysis.
- To Introduce Fourier series and it's applications.

Learning Outcomes:

At the end of the course student will be able to

- Explain concept of limit of function of two variables
- Understand the two path criterion to show that a limit does not exist and apply it to solve problems about limits
- Memorize definition of partial derivative and illustrate geometric meaning withthe aid of sketches.
- Provide geometrical meaning of second partial derivative with respect to onevariable
- Calculate directional derivatives and gradients &Apply it to solve problems involving steepest ascent and normal vectors to level curves.
- Apply the method of Lagrange Multipliers to solve such constrained optimization problems.
- Understand & apply various theorems like, Rolle's theorem.Lagrange's Mean value theorem, Cauchy Mean Value theorem in Calculus.
- Understand & Apply various tests for convergence of sequences & series
- Find the find the fourier series of periodic functions
- Find the Fourier sine and cosine series for functions defined on an interval.
- Use to numerical methods in modern scientific computing
- Find the roots of various types of equations using Numerical methods & find the area under the curve using Trapezoidal Rule, Simpson $\frac{1}{3}$ Rule, Simpson $\frac{3}{8}$ Rule

UNIT-I

Sequence: Definition of sequence, convergence, limit of a sequence, divergence, oscillation, bounded and monotonic sequences, Bounded sequences, Sandwich theorem, Algebra of limits, L'Hospital Rule in sequences, subsequences and its limit.

Series: Infinite series, partial sum, convergence, divergence, oscillation, Geometric series, Telescoping series, Algebra of Limits, n^{th}- term test, Comparison test, Comparison test (Limit Form), Integral test, D'Alembert's Ratio test, Cauchy's Root test, Alternating series, Leibnitz's

Rule, Absolute convergence, Conditional convergence, Power series, Radius of convergence for a power series.

UNIT-II

Differential calculus: Rolle's theorem, Lagrange's mean value theorem, Cauchy's Mean-value theorem, Taylor's Theorem and Expansion, Maclaurin's Theorem and Expansion, Indeterminate forms and application of L'Hospital Rule. Radius of curvature, Envelope, Increasing and decreasing functions, concavity, convexity and point of inflexion, Asymptotes-Curve Tracing(Sketching)

UNIT-III

Functions of Several Variable Calculus:

Definition of continuity and differentiability in single variable, n-dimensional Euclidean space, Neighborhood of a point in n-dimensional Euclidean space, Functions in n-variables, Functions in 2 & 3 variables, Interior points, Boundary points, open and closed regions, Limit and continuity, Two-path test, Discontinuities, Partial Differentiation, Clairaut's theorem(for mixed Partial Derivatives), Laplace equation, Homogeneous functions , Euler's theorem for Homogeneous functions, Differentials and derivatives, Derivatives of composite functions, Chain Rule, Jacobians, Taylor's Theorem, Maxima and minima, Lagrange's method of multipliers.

UNIT-IV:

Fourier Series:

Definition of Fourier Series, Fourier Series representation of function, Limit of Convergence of Fourier Series, Even & Odd functions, Gibb's Phenomenon, Sine and Cosine Series, Limit of Convergence of Sine & Cosine Series. Integration and Differentiation of Fourier Series, Bessel's Inequalities, Parseval's Theorem.

UNIT-V

Numerical Methods:

Introduction: True value, Approximate Value, Error, Error percentage, Application of Numerical Analysis in various fields.

Numerical Analysis in solving Algebraic equations: Algebraic equations, Transcendental equations, Bisection Method, Regula -Falsi Method, Newton-Raphson Method.

Numerical Integration: Trapezoidal Rule, Simpson $\frac{1}{3}$ Rule, Simpson $\frac{3}{8}$ Rule

Text Books:

1. Thomas Calculus, Maurice D.Wier, Joel Hass Eleventh Edition, Pearson Education ,2008

2. R.K. Jain & S.R.K.Iyengar, Advanced Engineering Mathematics, Third Edition, Narosa publications, 2007.

3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons Ltd 2006.

Suggested References:

1. B.S. Grewal and J.S. Grewal, "Higher Engineering Mathematics",(40th Edition), Khanna Publishers,2007
2. S.S. Sastry ,Introductory Methods of Numerical Analysis ,Third Edition, Prentice Hall India

*L-T-P-C stands for number of lectures, tutorials, practices and credits

CY1001 **ENGINEERING CHEMISTRY**

Externals: 60 Marks **L-T-P-C**
Internals: 40 Marks **4-0-0-4**

Objectives:

1. To understand the basic concepts of phase rule and catalysis with examples
2. To understand the importance of the spectroscopy in determining the structures of chemical compounds
3. To understand the importance of electrochemistry in technical filed
4. To understand the corrosion and types of corrosion
5. To understand the rates of some of the reactions and derivation of their rate laws
6. To understand the basic concepts of polymers, lubricants, and nanomaterials

Outcomes:

1. Will be able to understand the structural elucidation of organic compounds using spectroscopy.
2. Will gain knowledge on basic electrochemical reactions, corrosion and prevention of corrosion.
3. Will gain knowledge on rate law, kinetic reactivity of complex reactions and phase rule.
4. Will gain necessary knowledge in catalysis.
5. Will understand the basic concepts of polymers, lubricants, and nanomaterials, essential for engineering graduates

Unit 1: Phase Rule & Catalysis (7 classes)

Phase Rule: Terminology, One component system (H_2O system and CO_2 – system), two components system, Simple eutectic system (Pb – Ag), system with congruent melting point (Zn – Mg), system with incongruent melting point (Na_2SO_4 –H_2O), Cooling curves.

Catalysis : Mechanism of catalytic reactions: catalyst definition, characteristics and types of catalysis, theories of catalysis, intermediate compound formation theory with examples and mechanism, drawbacks of intermediate compound formation theory, adsorption or contact theory with examples and mechanisms, enzyme catalysis, characteristics and mechanism of enzyme catalysis, concepts of promotors, inhibitors, and poisioners.

Unit 2: Spectroscopy (7 classes)

Introduction to spectroscopy, electromagnetic radiations, different types of spectroscopy, principle of spectroscopy, spectrophotometer Microwave spectroscopy: principle, microwave spectra of diatomic molecules, selection rules for microwave spectra, applications of microwave spectroscopy: determination of bond length, dipole moment measurement, determination of isotopic mass of an element. Infrared spectroscopy: introduction and principles of IR, types of vibrations: bending and stretching, Hooke's law for stretching vibrations, characteristic frequencies of common functional groups, IR instrumentation, interpretation and applications of IR spectrum with examples. Ultra-violet spectroscopy: Introduction and principle of UV spectroscopy, color interpretation with VBT and MOT, types of electronic transitions, selection rules, chromophores and auxochromes with examples, conjugation effect, absorption and intensity shifts, applications of UV spectroscopy.

Unit 3: Electrochemistry (8 classes)

Types of electrodes: introduction, metal-metal ion electrodes, metal-insoluble salt-anion electrodes, calomel electrode, gas-ion electrodes, hydrogen and chlorine electrodes, oxidation-reduction electrodes, amalgam electrodes. Types of cells: classification into chemical and concentration cells, chemical cells with transference and without transference, classification of concentration cells into electrolyte and electrode concentration cells, electrolyte concentration cells with and without transference, amalgam and gas concentration cells, examples for these cells. EMF and applications of EMF: determination of pH, determination of the valency of the ions, potentiometric titrations. pH: definition of pH and determination of pH by various methods, acid-base titrations. Thermodynamic data: enthalpy and entropy of cell reactions, Gibbs-Helmholtz equation and applications.

Unit 4: Corrosion and its prevention (4 classes)

Mechanism of Dry and wet corrosion (rusting of iron), Types of corrosion, galvanic corrosion, differential aeration corrosion, stress corrosion. Factors affecting corrosion, preventive measures (proper design, Cathodic and Anodic protection, Electroplating , tinning, galvanization).

Unit 5: Chemical kinetics (6 classes)

Complex reactions: definition and classification of complex reactions, definition of reversible reactions with examples, rate law derivation for reversible reactions. Consecutive reactions: definition, rate law derivation and examples of consecutive reactions. Parallel reactions: definition, rate law derivation and examples of parallel reactions. Steady-state approximation: introduction, kinetic rate law derivation by applying steady state approximation in case of the oxidation of NO and pyrolysis of methane. Chain reactions: introduction, types and mechanism of chain reactions, stationary and non-stationary chain reactions with examples, deriving the kinetic rate equation using a general chain reaction. Photochemical reactions: introduction, Stark-Einstein law of photochemical equivalence, photophysical processes: IC, ISC, fluorescence and phosphorescence with examples, kinetic rate law derivation incase of photochemical decomposition of HI and photochemical combination of H_2 and Br_2.

Unit 6: Engineering Materials (8 classes)

Polymers: Types of polymerization (chain & step growth). Plastics: Thermoplastic & Thermo setting resins; preparation, properties, engineering applications of PVC, Teflon and Bakelite. Conducting polymers: polyacetylene, polyaniline, mechanism of conduction, doping; applications of conducting polymers.

Cement: composition of portland cement, setting & hardening of cement (reactions).
Lubricants: Classification with examples-Characteristics of a good lubricant & mechanism of lubrication (thick film, thin film and extreme pressure) –properties of lubricants: viscosity, cloud point, flash and fire points.

Refractories: Classification, characteristics of a good refractory and applications.
Nanomaterials: Introduction, preparation by sol-gel & chemical vapour deposition methods, applications of nanomaterials.

Reference Books

1. Chemistry for Engineers, B. K. Ambasta
2. Engineering Chemistry, H. C. Srivastava
3. Applied Chemistry – A textbook for engineers and technologist by H.D. Gesser
4. Engineering Chemistry: by P C Jain & Monika Jain
5. A Text Book of Engineering Chemistry: by Shashi Chawla
6. Fundamental of Organic Spectroscopy by Y. R. Sharma
7. Introduction to spectroscopy by Pavia, Lampman, Kriz

CS1101 **PROGRAMMING IN C**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

Prerequisites

1. No prerequisites
2. Requires analytical skills and logical reasoning.

Objectives

This course starts from the basics of computers and program development

- It covers various concepts of C programming language
- To learn how to write modular and readable C Programs
- To learn to write programs (using structured programming approach) in C to solve problems.
- To introduce the students to basic data structures

Outcomes

1.Develop C programs for computing and real life applications using basic elements like control statements, arrays, functions, pointers and strings and Implement searching and sorting algorithms

UNIT – I

Introduction to Computer Programming: Computing Environments, Computer Languages, Creating and Running Programs. Algorithms and Flow charts : Definition of Algorithms, examples, Symbols used in Flow chart, examples. Introduction to C Language - Background, C Identifiers, Data Types, Operators, Variables, Constants, Input / Output, Expressions, C Programs, Precedence and Associativity, Evaluating Expressions, Type Conversion, Statements, Bitwise Operators.

UNIT-II

Selection: Logical Data and Operators, if-else, switch Statements, Standard Functions. Repetition: loops, while, for, do-while statements, Loop examples, break, continue, go to. Arrays - Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection, Bubble, Insertion Sorts.

UNIT – III

Functions: Designing Structured Programs, Functions Basics, User Defined Functions, Inter Function Communication, Standard Functions, Scope, Storage Classes-auto, Register, Static, Extern, Scope Rules, and Type Qualifiers. Recursion- Recursive Functions, Preprocessor Commands. Strings - Concepts, C Strings, String Input / Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – IV

Pointers - Introduction, Pointers to Pointers, Compatibility, void Pointers, Arrays and Pointers, Pointer constants, Pointers and Strings, Pointers to Functions, Point ers to Constant Objects, Constant Pointers, Pointer Arithmetic.Call-by-reference: Pointers for Inter-Function Communication, Passing Arrays to a Function.Dynamic Memory Allocation: Memory Allocation Functions, Programming Applications, Command-line Arguments.

UNIT – V

The Type Definition (type def), Enumerated Types Structure: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self Referential Structures, Unions. Input and Output: Files, Streams, Standard library Input Output Functions, Character Input Output Functions.

Suggested References:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice

Hall of India.

2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.

5. Ellis Horowitz, SatrajSahni and Susan Anderson-Freed, Fundamentals of Data Structures

in C, W. H. Freeman and Company.

6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

ME1101 ENGINEERING DRAWING AND COMPUTER DRAFTING -I

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **2-0-3-4**

COURSE OBJECTIVES:

- To evaluate the language of the drawing for-geometric constructions and to understand the engineering perspective of drawings
- To understand projection of points and lines using 2-Dimensional drawing tools
- To learn the section of solids or To learn the engineering graphics through AutoCAD
- To draw the object from various views / angles etc.,

COURSE OUTCOMES:

- Able to prepare the working drawing to communicate the ideas
- Able to draw the graphics through Auto CAD
- Able to understand the projection of points, lines and planes
- Able to construct various conic sections.
- Able to visualize the orthographic projections of the various components

UNIT-I

Introduction to Engineering drawing: Size of Drawing Sheet, Drawing sheet format, Types of lines, lettering, types of dimensioning, Title Block, Engineering Scales. Free hand sketches: Sketch straight line, circles, arcs, and fillet.

Introduction to AutoCAD: Initial setup commands, utility commands, function keys, entity draw commands, display commands, edit commands, setting limits of sheet size, dimensioning and dimension style, Tile Block.

UNIT-II

Engineering curves: Conic sections, Cycloids, Involutes.

Projections: Elements of projections, multi view projections, principal plane of projections, Methods of projections, first angle and third angle projection methods.

Orthographic projections: Concept of quadrant, projection of point, projection of a line inclined to one plane and parallel to other plane, line inclined to both the planes, lines parallel to profile plane, Traces of line.

UNIT-III

Projection of Planes: Introduction, Types of planes, Traces of a planes, Projection of a planes parallel to one reference planes, projections of planes inclined to one reference planes and perpendicular to the other, projections of oblique planes.

Auxiliary projections: Types of auxiliary projection planes, Single and double auxiliary views.

UNIT-IV

Projection of Solids: Introduction, Types of solids, Projection of solids in simple positions, Projections of solids axes inclined to one of the reference planes and parallel to the other, Axis inclined to the V.P. and parallel to the H.P. , Axis inclined to the H.P. and parallel to the H.P. and parallel to the V.P., Transfer of point from one view to other.

UNIT-V

Sections of Solids: Introduction- Section planes, Sections, True shape of a section, Sections of Prisms, Sections of Pyramids, Sections of Cylinders, Sections of Cones and Sections of Spheres.

Suggested Reading:

1. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K. (2013). "Engineering Graphics with AutoCAD." *PHI publications*, New Delhi.
2. Butt,N.D. (2011). " Engineering Drawing." *5th Edition, Charotar publishing house Pvt. Ltd.*
3. Sham Tickoo, and Saravanan, D. (2010). "AutoCAD 2010 for engineers and designers." *Dreamtech Press.*
4. Sham Tickoo. (2011). "AutoCAD 2011: A Problem solving approach" *Autodesk Press*, USA
5. Venugopal, K. (1998). "Engineering Drawing and Graphics + Autocad", *New Age International [P] Ltd*., New Delhi.

ME1001 ENGINEERING MECHANICS

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVES:

- To solve for the resultants & moments of any force systems and determine equivalent force systems
- To determine the internal forces in plane trusses and frames
- To analyze the types of friction for moving bodies and problems related to friction forces
- To obtain the centroid, first moment and second moment of an area
- To describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference and analyze the forces causing the motion of a particle

COURSE OUTCOMES:

- Able to determine the resultants & moments of any force systems and determine equivalent force systems
- Able to differentiate among the structures such as plane trusses, frames and machines.
- Able to find the internal forces in plane trusses and frames
- Able to understand the basic concepts of friction and its effect on moving bodies such as Wedges and Screw jack
- Able to determine the location of the centroid of an area and also value of first moment and second moment of an area
- Able to describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference and analyze the forces causing the motion of a particle

UNIT I–

BASIC CONCEPTS - System of forces– Moment of forces and its Application – Couples and Resultant of Force System

EQUILIBRIUM OF SYSTEM OF FORCES: Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II–

ANALYSIS OF PERFECT FRAMES: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, Tension Coefficient method and methods of sections for vertical loads, horizontal loads and inclined loads.

UNIT III–

FRICTION: Types of friction– laws of Friction–Limiting friction–Cone of limiting friction– static and Dynamic Frictions –Motion of bodies – Wedge, Screw jack and differential Screw jack.

UNIT IV–

CENTROID AND CENTER OF GRAVITY: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Centre of Gravity of Composite figures. (Simple problems only).

AREA MOMENT OF INERTIA - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures

MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids, Moment of Inertia of composite masses. (Simple problems only)

UNIT V–

KINEMATICS : Rectilinear and Curve linear motion –Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

KINETICS : Analysis as particles and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work Energy Method– Equation for Translation – Work – Energy application to Particle Motion, Connection System – Fixed axis Rotation and Plane Motion.

TEXT BOOKS:

1. Engineering Mechanics, Shames & Rao – Pearson Education.
2. Engineering Mechanics, Fedrinand L.Singer – B.S. Publishers.
3. Engineering Mechanics, Bhavikatti and Rajasekharappa

REFERENCES:

1. Engineering Mechanics-Statics and dynamics, A.Nelson, Tata McGraw-Hill Company
2. Mechanics of Materials by Timoshenko & Gere, CBS
3. Engineering Mechanics – B. Bhathacharya- Oxford University Publications
4. Mechanics of Materials - Dr. B. C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publication
5. Engineering Mechanics –Arthur P. Boresi and Richard J.Schmidt. – Brooks/Cole – Cengage Learning

HS1101 **COMMUNICATION SKILLS-I**

Externals: 60 **L-T-P-C***
Internals: 40 **2-0-0-1**

Objectives:

1. To make the students efficient communicators via experiential learning.

2. To enhance learners' analytical and creative skills, so that they will be capable to address a wide variety of challenges in their professional lives.

3. To help learners to improve the leadership qualities and professional etiquette

4. To expose learners to an effective communicative environments.

OUTCOMES:

Students will be able to:

1. develop interpersonal communication, small group interactions and public speaking.

2. exercise the writing assignments, precise writing for informational, persuasive and creative purposes.

3. apply right form of structural usage of sentences in their written and oral communication.

4. develop confidence and skills related reading comprehension.

5. improve a logical framework for the critical analysis of spoken, written, visual and mediated messages upon a diverse platforms.

6. demonstrate the ability to apply vocabulary in practical situations.

Unit I – Introduction to communication

Introduction – Importance of Communication Skills – Definition – Scope and Nature – Verbal and Nonverbal communication

Unit II – Reading Skills

Reading Comprehension of unseen passage – Prose – News Paper Reading and Analysis (Editorial)

Unit III - Grammar

1. Parts of Speech
2. Subject and predicate
3. Articles – Determiners
4. Conjunctions (Linkers; connectors; cohesive devices)
5. Verbs – Transitive and Intransitive - Finite and Infinite - Regular and Irregular - Modals
6. Tenses
7. Prepositions/ Prepositional verbs
8. Adverbs – types and their order in sentences
9. Adjectives
10. Including Degrees of Comparison and also Quantifiers

Unit IV – Enhancing Vocabulary

Developing Professional vocabulary – Using Dictionary: Spelling – Grammar and Usage

Unit V - Composition

Paragraph – Essay - Expansion - Describing the Pictures – Giving Directions – Situational Dialogue writing – Social and Professional Etiquette – Telephone Etiquette

Suggested References:

1. Joseph Mylal Biswas book of English Grammar

2. R. Murphy -Cambridge Press

3. Wren and Martin

4. The Good Grammar book by OUP

5. Communication skills by M. Raman and Sangeeta Sharma

6. How to Win Friends and Influence people by Dale Carnigie

7. How to Read and Write Better by Norman Lewis

8. Better English by Norman Lewis

9. Use of English Collocations by OUP

10. www.humptiesgrammar.com

11.www.bbcenglisgh.com

12.www.gingersoftware.com

13. www.pintest.com

CY1601 ENGINEERING CHEMISTRY LABORATORY

Externals: 60 Marks **L-T-P-C**
Internals: 40 Marks **0-0-3-2**
Objectives:

1. To learn the preparation of organic compounds in the laboratory
2. To estimate the hardness and alkalinity of the given sample of water
3. To understand the Job's method for determining the composition
4. Learns how to use the pH meter and polarimeter

Outcomes:

Minimum knowledge on basic synthesis, quantitative and qualitative analysis is being imparted.

1. **Synthesis**
   i. Synthesis of soap from cheap oil.
   ii. Synthesis of Thiokol rubber

2. **Volumetric analysis**
   i. Estimation of alkalinity of water
   ii. Estimation of total hardness of water by EDTA method

3. **Job's method**
   i. Determination of composition of Ferric-Thiocyanate complex by Job's method

4. **pH meter**
   i. Estimation of the strength of a weak acid by pH metry

5. **Polarimeter**
   i. Determination of specific rotation of sucrose by polarimeter

Reference books:

1. College Practical Chemistry by V K Ahluwalia, Sunita Dhingra, Adarsh Gulati
2. Practical Engineering Chemistry by K Mukkanti
3. A Text Book of Engineering Chemistry: by Shashi Chawla
4. Essentials of Experimental Engineering Chemistry by Shashi Chawla
5. Comprehensive Practical Organic Chemistry – Preparation and Quantitative analysis byV K Ahluwalia, Renu Aggarwal

CS1701 **PROGRAMMING IN C LAB**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Objectives:

1. Able to have fundamental concept on basics commands in Linux.

2. Able to write, compile and debug programs in C language.

3. Able to formulate problems and implement algorithms in C.

4. Able to effectively choose programming components that efficiently solve computing problems in real-world

Experiments:

Suggested assignments to be conducted on a 3-hour slot. It will be conducted in tandem with the theory course so that the topics for problems given in the lab are already initiated in the theory class. The topics taught in the theory course should be appropriately sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below:

1. Familiarization of a computer and the environment and execution of sample programs
2. Expression evaluation
3. Conditionals and branching
4. Iteration
5. Functions
6. Recursion
7. Arrays
8. Structures
9. Files

For the detailed list of programs refer the lab manual.

Note: Any experiment according to the syllabus of CS1101 can be substituted

ME1601 ENGINEERING WORKSHOP

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Objectives:

The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

1. TRADES FOR EXERCISES:

a. Carpentry shop–

Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock

b. Fitting shop–

Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock

c. Sheet metal shop–

Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet

d. House-wiring–

Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.

e. Foundry–

Preparation of two moulds (exercises): for a single pattern and a double pattern.

f. Welding –

Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint

2. TRADES FOR DEMONSTRATION:

a. Plumbing

b. Machine Shop

c. Metal Cutting

REFERENCE BOOKS:

1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas
4. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House.

I YEAR
II SEMESTER

Subject Code	Course Name	L-T-P	Credits
HS1001	English for Communication	4-0-0	3
MA1201	Mathematics-II	4-0-0	4
PH1001	Engineering Physics	4-0-0	4
CS1201	Scripting Languages	3-0-0	3
ME1201	Engineering Drawing and Computer Drafting-II	2-0-3	4
HS1201	Communication Skills-II	2-0-0	1
PH1601	Engineering Physics Lab	0-0-3	2
HS1601	English for Communication Lab	0-0-3	2
Total		19-0-9	23

HS1001 ENGLISH FOR COMMUNICATION

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-3**

Objectives:

- To complement the comprehensibility of the Technical subjects in a better way.
- To make them competent to attempt and qualify in various tests.
- To develop the study skills in formal and informal situations.

Learning outcomes:

Students will be able

* To learn the impacts of technology on language and personal life.
* To pronounce better and enhance their reference skills.
* To appreciate the aesthetic understanding and pleasure reading.
* To improve analysis skills through movies.
* To strengthen public speaking skills.
* To refine their comprehensive writing skills

UNIT-I

A Road Not Taken by Robert Frost: Understanding the Poem- Importance of the poem – Figures of Speech –Simile- Metaphor- Alliteration- Onomatopoeia - Invictus (2009)

UNIT-II

Phonetics: Consonants, Vowels with examples from BBC -Commonly Mispronounced Words - Consonants - Vowels – Voiced & voiceless - BBC Phonetic Transcription – Syllabification - Word Stress - Tongue Twisters – The King'sSpeech (2010) – My Fair Lady (1968)

UNIT-III

What's Up? An Excerpt from The Hindu (September 29, 2015) – Binomials and Portmanteau - Common errors in English Usage

UNIT-IV

Mark Antony's speech (Julius Caesar by Shakespeare): Figures of Speech - One Word Substitutes - Homophones, Homonyms and Homographs - Debate - Group Discussion

UNIT-V

The Nightingale and the Rose by Oscar Wilde: - Skimming and Scanning - Dialogue writing: Seeking Permission, Requesting, and Interrupting – Tangled (2010)

UNIT –VI

Anand's Super 30 for IIT - JEE: An Excerpt from The India Today (July 11,15): Letter Writing - Formal Letter - Informal Letter - Notice Writing - Email writing – Freedom Writers (2007)

UNIT –VII

Interview – Metro man Sreedharan: Comprehension Questions –Vocabulary- Match the following- sentence completion- JAM/PPT Presentations - Essay Writing

UNIT –VIII

A Missile Man's Wings of Fire – Dr. APJ Kalam: Writing Book Review – Interviews - Curriculum Vitae or Resume preparation – I am Kalam (2010)

FURTHER STUDIES (SELF STUDY): U-I: Capitalization, Punctuation (commas, full stop, inverted marks) - **U-II:** Words often Confused, Affixes (Prefixes and Suffixes), Commonly Mispronounced Words, Tongue Twisters - **U-III:** Articles - Prepositions, Spotting the Error – **UIV:** Tenses – **U-V:** Active and Passive, Direct and Indirect Speech – **U-VI:** Understanding the rules of spelling Part1&2 – **U-VII:** Commonly Used Phrasal Verbs & Idioms – **U-VIII:** Antonyms and synonyms

Suggested References:

1. Meenakshi Raman, Sangeetha Sharma. "***Effective Technical Communication****."* Oxford: Oxford University, New Delhi, 2015.
2. Murali Krishna, ***"English for Engineers."*** Pearson Education, Inc. New Delhi, 2015.
3. 3. E. Suresh Kumar, P. Sreehari and J. Savithi***. "English for Success."*** Foundation Books, Inc. New Delhi, 2014.
4. 4. Ashraf. M. Rizvi, ***"Effective Technical Communication."*** Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2015.
5. 5. Hari Mohan Prasad and Rajnish Mohan, ***"How to prepare for Group for Group Discussion and Interview."*** 2nd Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2015.
6. 6. R.P Bhatnagar and Bhargava Rajal, ***"English for Competitive Examinations".*** McMillan India limited, 1989.

7. 7. Upendran. S, ***"Foundation Course in Spoken English Part I".*** McMillan India limited, 1989.
8. 8. Upendran. S, ***"Foundation Course in Spoken English Part II".*** McMillan India limited,1989.

Web sources:

1. www.usingenglish.com
2. www.talkenglish.com
3. www.oxforduniversity.com
4. www.wikipedia.com
5. www.about.com

For Literature:

1. www.cliffsnotes.com
2. www.sparksnotes.com
3. www.gradesaver.com
4. www.nofearshakespeare.com

MA1201 **MATHEMATICS-II**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

Learning Objectives:

- To learn the concepts of Eigen values, Eigen vectors, vector spaces and its basis.
- To provide an overview of ordinary differential equations
- To study the methods of solving improper integrals and the concepts of multiple integrals
- To study vector differential and integral calculus

Learning Outcomes:

At the end of the course student will be able to

- Understand the definitions of Vector Spaces, Basis and Dimension of Vector Space.
- Understand the concept Linear Transforms and related theorems.
- Find the Eigen values & Eigen vectors of a given Matrix
- Apply Cayley Hamilton theorem for problems in Matrices
- Identify an ordinary differential equation and its order
- Classify ordinary differential equations into linear and nonlinear equations
- Model radioactive decay, compound interest, and mixing problems using first order equations
- Solve first order linear differential equations and special non linear first order equations like Bernouli , Riccati &Clairaut's equations
- Find the general solution of second order linear homogeneous equations with constant coefficients
- Use the method of undetermined coefficients to solve second order, linear homogeneous equations with constant coefficients
- Use the method of variation of parameters to find particular solutions of second order, linear homogeneous equations
- Compute double integrals over rectangles and \type I and II" regions in the plane
- Compute double integrals over a sector of an annulus using polar coordinates
- Memorize the statement of the change of variables theorem for double integrals, illustrate its geometric meaning with the aid of sketches, and apply it to computeintegrals over regions that are neither type I nor type II.
- Explain the concept of a vector field and make sketches of simple vector fields inthe plane.
- Memorize statement and understand proof of Fundamental Theorem of Calculusfor functions on curves.
- Explain concept of a conservative vector field, state and apply theorems that give necessary and sufficient conditions for when a vector field is conservative, and describe applications to physics
- Memorize Green's Theorem, and make sketch illustrating it. Explain how Green's Theorem is a generalization of the Fundamental Theorem of Calculus.

- Recognize the statements of Stokes' Theorem and the Divergence Theorem and understand how they are generalizations of the Fundamental Theorem of Calculus.Be aware of applications of these theorems in Physics and Mechanical Engineering.

UNIT-I

Linear Algebra: System of Linear equations ,Vector spaces, Subspaces, Linear combination of vectors, linear dependence and independence of vectors, Basis and Dimension of Vector Space.

Linear transformations, Range and Kernel of Linear Transformations, Rank-Nullity theorem. Matrix representations of Linear Transformation.Eigenvalues and Eigenvectors of a Linear Transformation and their properties ,Cayley - Hamilton Theorem, Hermitian and skew Hermitian matrices. Quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

UNIT-II

Ordinary Differential Equations of first order: Exact first order differential equation, finding integrating factors, linear differential equations, Bernoulli's , Riccati , Clairaut's differential equations, finding orthogonal trajectory of family of curves, Newton's Law of Cooling, Law of Natural growth or decay.

UNIT-III

Ordinary Differential Equations of higher order: Linear dependence and independence of functions, Wronskian of n- functions to determine Linear Independence and dependence of functions, Solutions of Second and higher order differential equations (homogeneous & non-homogeneous) with constant coefficients, Method of variation of parameters, Euler-Cauchy equation.

UNIT-IV

Integral Calculus : Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties, differentiation under integral sign, differentiation of integrals with variable limits - Leibnitz rule. Rectification, double and triple integrals, computations of surface and volumes, change of variables in double integrals - Jacobians of transformations, integrals dependent on parameters – applications.

UNIT-V

Vector Calculus : Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line and surface integrals, theorems of Green, Gauss and Stokes.

Text Books:

1.Advanced Engineering Mathematics (3rd Edition) by R. K. Jain and S. R. K. Iyengar, Narosa Publishing House, New Delhi

References Books

1. Advanced Engineering Mathematics (8th Edition) by Erwin Kreyszig, Wiley-India.

2. Dr. M.D. Raisinghania,Ordinary andPartialdifferentialequations,S.CHAND,17thEdition2014.

PH 1001 ENGINEERING PHYSICS

Externals: 60Marks **L-T-P-C***

Internals: 40Marks **4-0-0-4**

Objectives:

1. To inculcate in the Students a sense of yearning to learn the basic Physics behind the applications that we look around in day to day life.

2. To deliver the basic Principles of Physics that forms the basis for the development of Technology.

3. The basic details of Solid state Physics, Optics and Electrodynamics and Quantum Physics provided in a subtle fashion dealt in finer details to have strong basics in these areas.

Course Outcomes:

1. The Students would be in a position to understand the innate Physics principles that go into the day to day phenomenon specifical to Optical domain.
2. The Students would get hold of the basic Electro magnetic Wave concepts that are crucial in understanding the Communication Phenomenon.
3. The Students would have realized the difference between the Newtonian Domain(Classical Physics) and quantum domain(Quantum Mechanics) and get to know the Physics that happens at the Quantum Domain.
4. The Students would be equipped with concepts in understanding the crystals and materials from a basic point of view which form a backbone in understanding the properties exhibited by these materials.

UNIT – I

MATHEMATICAL PHYSICS (3)

Gradient, Divergence, Curl and their physical significance

Scalar and Vector point Functions, Differential operator, Gradient , Physical significance, Divergence, Significance, Curl, Physical Significance, Vector Identities

1. Stokes theorem & Gauss theorem

   Vector Integral Theorems, Line Integral, Surface and Volume Integrals, Stokes Theorem, Gauss-Divergence Theorem, Application

1. Curvilinear coordinates

   Types of Coordinate systems, Polar coordinates, Cylindrical and Spherical coordinates, Equations Relating Cartesian, Spherical and Cylindrical coordinate

UNIT – II
ELECTRODYNAMICS (6)

1. Maxwell's Equations
   Electrodynamics before Maxwell, Fixing of Ampere's Law, Maxwell Equation in matter, Boundary Conditions.

2. Poynting theorem and conservation laws
   Continuity Equation, Poynting Theorem, Conservation Law Newton Third law in Electrodynamics

2.3 Wave equation
   Wave equation, wave form Boundary conditions, Reflection and Transmission for a string

2.4 Electro Magnetic Waves in vacuum
   Wave equation for E and B, Monochromatic Plane Waves, Energy and Momentum in EM Waves in vacuum

1. Electro Magnetic waves in Matter
   Propagation in Linear Media, Reflection and Transmission at Normal Incidence Oblique Incidence

1. EM wave in conducting surface.

Reference Books :

1. Electrodyamics by David j.Griffiths

UNIT – III
OPTICS (12)

1. Interference by division of wave front (Biprism)
   Introduction , Interference of Light Waves, Interference Pattern , Intensity Distribution, Fresnel Biprism

3.2 Interference by division of amplitude (Newton's rings)
   Interference by Plane parallel Wave, Cosine Law, Interference by a film with Non-Parallel reflecting surface, Wedge, Newton's Rings.

3.3 Michelson's interferometer
   Interference by Plane film illuminated by a point source, Michelson's Interferometer.

3.4 Fraunhoffer diffration (Single slit)
   Introduction, Types of Diffraction,Single Slit Frauhoffer Diffraction, Position of Maxima and Minima,Graphical Method for determining roots

3.5 Frauhoffer diffraction Double slit & multiple slits

Double slit Fraunhoffer diffraction by N- Parallel slits

3.6 Diffraction Gratings, Grating and Resolving Power

Diffraction Grating, Construction of Grating, Grating Spectrum, Resolution, Resolving Power of a diffraction Grating

3.7 Fresnel diffraction and Zone Plate

Types of Diffraction, Fresnel diffraction, Fresnel Half Period zones, Zone plate Application of Zone, Lens

3.8 Production of Plane Polarised light & double refraction

Introduction , Polarisation of Light waves, Representation of various types of light, Polarization by Reflection,Brewster's Law, Laws of Malus and proof, Geometry of Calcite Crystal, Double Refraction, Nicol's Prism, Applications.

3.9 Quarter & Half – wave plate, elliptical & circular polarized lights

Huygen's Theory of Double Refraction, Quarter Wave plate, Half Wave Plate, Elliptically and Circularly Polarised light.

3.10 Production & detection of elliptical & circular Polarised lights

Elliptically polarised Light, Circularly polarised light, Conversion of Elliptically polarized light to Circularly polarised light, Analysis of polarized light of Different Kinds.

3.11 Theory of Laser

Introduction, Spontaneous Emission, Stimulated Emission, Relation between Spontaneous and Stimulated emission Probabilities, Population Inversion, Pumping, Active systems.

3.12 Different kinds of Lasers

Ruby laser Working Semiconductor laser,He-Ne laser ,Application of Laser.

Reference Books :

1. Engineering Physics By Malik and Singh
2. Optics by Ajoy Ghatak
3. Optics by Pedrotti and Pedrotti.

UNIT – IV

QUANTUM MECHANICS (6)

4.1 Failures of classical physics

Limitations of classical physics, Blackbody Radiation, Spectral Lines, Photoelectric Effect, Planck's Quantum Hypothesis, Einstein's Theory of photoelectric Effect, Compton effect, Existence of stationary states, Stern-Gerlach Experiment

4.2 DeBroglie waves & Uncertainity Principle

Introduction, Matter waves Electron Diffraction Experiment Standing waves of an electron in orbit, Uncertainity Principle Single Slit Experiment, Application of Uncertainty Principle.

4.3 Wave function, Schrodinger Equation & probablity interpretation

Time Dependent Schrodinger Equation ,1- D Equation for a free particle, extension to 2-D, Inclusion of forces, Probability current Density

4.4 Operators , expectation values & Time independent Schrodinger Equation

Operators ,Expectation Value, Ehrenfest Theorem, time independent schrodinger Equation and Admissibility Conditions on Wave function.

4.5 Solution for generalised potential

Motion of a particle in a Potential – Classical view .

4.6 Particle in a box

Square well potential with Rigid walls, Energies and Wave functions

Reference Books:

1. Modern Physics by A. Beiser
2. Quantum Mechanics by Aruldhas.

UNIT – V
CONDENSED MATTER PHYSICS (6)

5.1 CRYSTALLOGRAPHY-I

Introduction, Crystal ,Single, poly and Amorphous state, Lattice Points and Space Lattice, Unit cell, Primitive Unit Cell in 2-D ,Non-primitive Unit Cell in 2-D lattice ,Primitive unit cell in 3-D ,Non Primitive unit cell in 3-D,Bravais Lattice and crystal systems, Atomic Packing, Crystal structure

5.2 Crystallography-II

Miller Indices, Positions, Directions, Planes Obtaining Miller indices, Important Cubic crystal structures, SC, BCC, FCC, Closed Packed structures, Packing fraction, NaCl Structure, Diamond , ZnS Structure.

5.3 X-ray diffraction

Introduction, Bragg's Law, Diffraction Direction Experimental Methods of x-Ray Diffraction, Powder method Debye - Scherrer Method Measurement of Bragg Angle

5.4 Defects in crystals

Introduction, Classification of Imperfections, Point Defects, vacancies, Schottky defects, Intersitial, Frenkel defects, Impurities, Colour centres, Line defect Planar Defects, Volume Defects, Thermodynamical consideration for Existence of Defect equilibrium concentration of Schottky defects in metals, Equilibrium concentration of schottky defects in Ionic crystals, Frenkel defect in metals, Frenkel defects in ionic crystals

5.5 Electron theory of metals

Important properties of metals, electron theory of solids, classical free elecrtron theory, DC Electrical Conductivity, Gains of Drude Model, Sommerfeld quantum Model, Fermi Energy, Density of Energy States, carrier Concentration, Drawbacks of Sommerfeld Theroy

5.6 Band theory of solids

Introduction, Formation of Energy Bands in Crystals, Characteristics, Bonding, Classification, Intrinsic and Extrinsic Semiconductors, Band structure, Energy Bands, Fermi Level and Fermi Energy, Carrier Concentration, Density of electrons in Conduction band, Position of Fermi level, Hall Effect, Applications

Reference Books:

1. Solid state Physics by Dekker
2. Solid state Physics By C.Kittel

CS1201 SCRIPTING LANGUAGES

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-3**

Prerequisites

1. Programming in C and Data Structures.

Objectives

1. To learn scripting languages- Python, Perl, PHP

Outcome

1. Student will be able to write dynamic web pages and will also be able to build a basic search engine using python and also search through text files using Perl.

UNIT-I

Python - Introduction-Variables, Strings, numbers, comments, Lists- introducing list, lists and looping, common list operations, removing items from list, numerical lists, list comprehensions, strings as lists, tuples, file I/O, functions, conditional statements and iterative statements.

UNIT –II

Python - Dictionaries, common operations with dictionaries, looping through dictionaries, nesting, classes, inheritance, modules and classes, exceptions and testing. Exceptions, sorting, introduction to standard libraries, building a Search Engine using all the above concepts.

UNIT-III

Perl – Data types, scalar functions, Quoting Basics, Functions, Control Structures, Inputs, Error Handling.

UNIT-IV

Perl – File input output, text processing functions, Hashes, DBM Databases, Regular Expressions.

UNIT- V

HTML – Styles, links, images, Static and Dynamic pages, Paragraphs and Fonts, Lists, CSS introduction, Introduction to HTML5 and semantics. PHP – Loops, String Functions, Email function, Data and time, Image Uploading, Error Handling.

Text Books:-

1. Programming Python, 4th Edition Powerful Object-Oriented Programming By Mark Lutz
2. Learning Perl, Randal L Schwartz.
3. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech

ME1201 ENGINEERING DRAWING AND COMPUTER DRAFTING -II

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **2-0-3-4**

COURSE OBJECTIVES:

- To understand the Engineering drawing concepts of section of solids and development of their surfaces.
- To know basic concepts of isometric projections.
- To determine the orthographic projections for solid sections.
- To analyze and obtain the perspective views for different solid bodies

COURSE OUTCOMES:

- Able to construct engineering scales
- Able to understand the basic concepts of isometric projections
- Able to understand the intersection of solids
- Able to understand the different projections of the machinery parts
- Able to draw the simple geometries by using computer aided drafting

UNIT – I

Scales: Construction of Plain, Diagonal, Comparative, Vernier Scales and Scale of chords.

UNIT – II

Intersection of Similar and Dis-similar Solids: Line method, Cutting plane method, Intersection of Prism Vs Prism, Cylinders Vs Cylinder (Under Similar category) and Cylinder Vs Prism (Under Dis-similar category)

UNIT – III

Isometric Projections/views: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines.

Conversion of Orthographic Views to Isometric Views of simple objects.

Transformation of Projections: Conversion of isometric views to orthographic views of simple objects.

UNIT –IV

Perspective Projections: Principle, Perspective elements, Perspective View of Points, Lines, Plane Figures and Simple Solids - Vanishing Point Method, Visual ray method.

UNIT –V

Introduction to Computer Aided Drafting: Generation of points, lines, curves, polygons, simple solids, dimensioning.

TEXT BOOKS:

1. Bhatt, N.D. (1998). Elementary Engineering Drawing", Charotar Publisher.
2. Narayana, K.L. and Kannaiah, P. (2001). "Text book on Engineering Drawing" SciTech Publications.
3. French, T.E. et al. (1993). "Engineering Drawing and Graphic Technology McGraw-Hill International Editions.
4. Venugopal, K. (1998). "Engineering Drawing and Graphics plus AutoCAD New Age International (P) Ltd, New Delhi.
5. Siddique, N et al. (2004). "Engineering Drawing with a Primer.c AutoCAD" Prentice Hall of India Pvt., Ltd., New Delhi.

REFERENCES:

1. Engineering graphics with Auto CAD- R.B Choudary / Anuradha Publishes
2. Engineering Drawing, K.Venugopal/G.Sreekanjana, New Age International Publishers.
3. Engineering Drawing, B.V.R.Gupta, M.Raja Roy/I.K.International Publishing House.

HS1201 **COMMUNICATION SKILLS-II**

Externals: 60 **L-T-P-C***
Internals: 40 **2-0-0-1**

Objectives:

- To develop the learners ability to read fluently and critically.
- To make awareness of the common punctuation marks and the importance of it in writing
- To build academic vocabulary of the learners
- To offer the learners opportunity to practice creative writing
- To make the learners apply the skills and strategies of a successful listener

Outcomes:

The learners will be able to:

- make use of contextual clues to infer meanings of unfamiliar words from context and make inferences and predictions based on comprehension of a text
- punctuate simple sentences correctly
- produce appropriate vocabulary and correct word forms;
- Write creatively and accurately. They will also have a critical awareness of their writing in terms of unity, content, coherence and linguistic accuracy (grammatical structure and choice of vocabulary).
- Comprehend the talks and presentations, take organized notes on lectures and listening passages

Unit I - Reading

Reading Skills – Importance - Definition –Types -Techniques and strategies

Unit II – Punctuation and Capitalization

Punctuation - Use of Capital Letters

Unit III – Vocabulary

1. Antonyms
2. Synonyms
3. Affixation
4. Vocabulary in context
5. Proverbs /Collocations
6. One word substitutes
7. Idioms and Phrasal verbs

Unit IV – Writing Skills

Creative writing – Story Writing – Precise - Letter writing

Unit V - Listening

Listening Skills – Academic Listening – Listening to Talks and Presentations – Note Taking

References:

1. Meenakshi Raman and Sangeeta Sharma ***"Communication skills"*** Oxford University press, 2013
2. Wren and Martin, NDV Prasad Rao. *"**High School English Grammar and Composition***" S. Chand& Compay Ltd, 2012
3. Michael Swan, ***"Practical English Usage"*** 3rd edition: guide to problems in English, Oxford University press, 2011
4. Edgar Thorpe and Showick Thorpe, ***"Objective English"*** 3rd Edition, Pearson, 2010

PH 1601 ENGINEERING PHYSICS LAB

Externals: 60Marks **L-T-P-C***

Internals: 40Marks **0-0-3-2**

1. Coupled Pendula
2. Specific rotation - Polarimeter
3. Diffraction Grating
4. Dispersive power of a prism
5. Franck Hertz experiment
6. Photoelectric effect
7. Four probe Experiment
8. Hall effect
9. Ultrasonic Waves

HS1601 ENGLISH FOR COMMUNICATION LAB

Externals: 50Marks **L-T-P-C**

Internals: 50Marks **0-0-3-2**

Objectives:

* To sensitize students to their communication skills.
* To make the students practice the language skills (L, S, R, W).

Outcomes:

1. Students will be able to write essays and paragraphs that demonstrate proper usage of grammar.
2. Students will demonstrate the ability to critique their grammar assignments.
3. Students will be able to assess their pronunciation of words.
4. Students will analyze the forms of different expressions in English Language that reflect the individual, social, and cultural values.
5. Students will demonstrate the proficiency in oral and written communication.

UNIT-I –

Grammar – Adjectives – Comparatives and Superlatives – Adverbs – Countable and Uncountable Nouns – Pronouns – Simple present – Present continuous – Simple past- Conjunctions – Prepositions – Plurals – Articles a, an, the – Infinitive or –ing – Questions and Negatives -1 - Questions and Negatives -2

UNIT-II

Pronunciation – Pill/Fill – Buy/My – Tie/Die – Ship/Chip – Yet/ Jet – Game/ Came – Wail/Veil – Think/Sink – There/Dare – Price/ Prize – Asia/ Hard – Ran/Rang – Right/Light – Ship/Sheep – Head/Had- Schwa – Luck/ Look - Hat/Heart – But/Boot – Who/ Her – Pot/Port – Hair/ Hear – Pay/Pie – Boy/Buy – Know/ Now

UNIT-III

Writing – Writing a Thank You Letter – Writing about your life – Writing Instructions – Writing a Story – Writing an Essay – Writing a Business Letter – Writing a Film Review – Writing a Biography – Writing a Complaint Letter – Writing a Covering Letter - Writing a Pen friend Post - Writing about a Special Day - Writing an E-mail of Apology - Writing a Short Report - Writing a Post Card

UNIT – IV

Reading - The diamond thief – The guru and sweets – Taking a course – Reading a story - Using a dictionary – Making a journey – Reading a newspaper – Making friends – Reading an email – Finding information – A pen friend letter – The doctor says…- Choosing a holiday – Struck by lightning – Health matters :Yoga

UNIT – V

Listening – What shall we play? – An exciting weekend – A school outing – The morning assembly – Instructions on planting – Excuse me, can you lend me…- Manish's summer – Vignesh's hobby – What can I do for you? – What are you doing Ramesh? – I've got a few questions…- Geetha's day – Anil's new purchase – What are we having tonight? – What is the problem?

Suggested References:

1. Clarity English Success - Software
2. http://www.clarityenglish.com/program/practicalwriting/
3. http://www.clarityenglish.com/program/roadtoielts/
4. http://www.clarityenglish.com/program/clearpronunciation1/
5. http://www.clarityenglish.com/program/resultsmanager/

II YEAR
I SEMESTER

Subject Code	Course Name	L-T-P	Credits
MA2102	Mathematics -III	4-0-0	4
ME2101	Kinematics of Machinery	4-0-0	4
ME2102	Thermodynamics	4-0-0	4
ME2103	Mechanics of Solids	4-0-0	4
ME2104	Material Science & Metallurgy	4-0-0	4
HS2101	Soft Skills-I	2-0-0	1
ME2701	Mechanics of Solids Lab	0-0-3	2
ME2702	Material Science & Metallurgy Lab	0-0-3	2
ME2901	Seminar-I	0-0-2	1
Total		22-0-8	26

MA2102 **MATHEMATICS-III**

TRANSFORM CALCULUS

EXTERNAL: 60MARKS **L-T-P-C***

INTERNAL: 40MARKS **4-0-0-4**

Learning Objectives:

- To understand the basic concept of the different Transforms.
- To Solve the Differential & integral equations using Laplace Transform.
- To know the Applications of Laplace Transforms, Fourier Transforms and Z-Transforms

Learning Outcomes:

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

- Compute the Laplace transform of a function
- Use shift theorems to compute the Laplace transform and inverse Laplace transform
- Use the Laplace transform to compute solutions of second order, linear equations with constant coefficients
- Use the Laplace transform to compute solutions of equations involving impulse functions
- Compute the Fourier transform and Inverse Transform of a function
- Use shift theorems to compute the Fourier transform and inverse Fourier transform
- Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions using Laplace and Fourier transforms.
- Compute the Z-transform and Mellin Transform of a given sequence.
- Find the series solution of Bessel's and Legendre's Differential equations.

UNIT-I

Laplace Transform: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First and second shifting properties, Laplace Transform of derivatives and integrals, unit step functions, Dirac delta-function, error function. Differentiation and integration of transforms, convolution theorem,

UNIT-II

Inverse Laplace Transform, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial and boundary value problems and solving Differential Equations & Integral Equations.

UNIT-III

Fourier Transform: Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting and time shifting properties.Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems.

UNIT-IV

Z-Transform: Definition of Z-Transform, Properties, inverse of the Z-Transforms. Finite difference equations,Definition of Mellin Transform, Properties of MellinTransforms

UNIT-V:

Special Functions:

Solution of ODE by Series,Legendre's Differential equation and Legendre's polynomial,Roudrigue's formula, Legendre's recurrence relation ,Generating function for Legendre's polynomial $P_n(x)$,orthogonal and orthonormal funtions, Orthogonal property of Legendre's polynomial $P_n(x)$ Bessel's differential equation, Bessel's functions, Recurrence relation for $J_n(x)$, Generating function for $J_n(x)$, Orthogonal property of Bessel's polynomial

Text Books

1. Jain. R.K. Iyengar. S.R.K., Advanced Engineering Mathematics, 3rd Edition, Narosa.
2. Churchill. R.V. Brown. J.W., Fourier series and boundary value problems, McGraw. Hill

Reference Books

1. E. Kreyszig Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons (1999)
2. H.Dym and H.P Mc Kean, Fourier series and integrals, Academic press, Newyork (1972)

ME2101 KINEMATICS OF MACHINERY

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVES:

- To familiarize students with basic types of mechanisms, joints and degrees of freedom to perform position, velocity and acceleration analysis using graphical and analytical methods.
- To provide students an understanding of different types of mechanisms.
- To teach the basics of synthesis of simple mechanisms.
- To teach students the kinematic analysis of cam-follower motion and gear train configurations, belt drive etc.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to

- Explain the basic concepts of mechanisms, identify the types of kinematic pairs and also calculate the degrees of freedom for a given mechanism.
- Perform velocity and acceleration analysis of simple mechanisms.
- Explain the kinematics of straight line generating mechanisms.
- Design a layout of cam for specified motion.
- Perform Kinematic analysis belt drives
- Explain the types of gears, gear trains and their nomenclature. Perform Kinematic analysis of gear trains.

UNIT-I
Definitions of link, pair, chain mechanism, degrees of freedom, Kutzbach's and Grubbler's criterion. Grashof's Law, Inversions of four bar mechanisms with all revolute joints, single and double slider crank mechanisms. Instantaneous Centre, Space Centrode and Body Centrode, Kennedy Theorem. Definitions and scope of Type, Number and Dimensional Synthesis. Pantograph and Geneva mechanisms. Ackerman and Davis steering gear mechanisms and Hooke's Joint. Peaucellier, Hart, Scott-Russel, Watt and Tchebicheff mechanisms.

UNIT-II
Velocities in mechanisms by instantaneous centre method, velocity and acceleration of mechanisms by using relative velocity method including Coriolis component of acceleration, Klien's construction

UNIT- III
Types of belt drives, Action of Belts on pulleys, Velocity ratio, Slip, material for belts & ropes, Crowing of pulleys, Types of pulleys, Law of belting, Length of belt in case of open belt drive

and crossed-belt drive, Ratio of friction tensions, power transmitted, Centrifugal effect on belts, Maximum power transmitted by a belt, initial tension, Creep

UNIT-IV

Types of Cams and followers, motion of the follower, follower displacement diagram, Cam profile for specified follower motion and Cams with specified contours.

UNIT-V

Theory of Gearing, Terminology and Definitions, Law of Gearing, Tooth profiles, Path of contact and Arc of contact. Interference, methods of avoiding interference. Contact Ratio. Introduction to Helical, Bevel and worm gears.

Gear Trains: Simple, Compound, Reverted and Epicyclic gear trains. Differential of an Automobile.

Suggested Reading:

1. "Theory of Machines", S.S Rattan, 3rd Edition, 2009, Tata Mc-Graw Hill.
2. "Kinematics and Dynamics of machinery", Robert Norton, 2009, Tata Mc- Grawhill
3. "Theory of Machines", Thomas Bevan, 3rd Edition, 2005, CBS Publishers and Distributors
4., "Mechanisms and Machine Theory", J.S. Rao and R.V. DukkipatiWiley Eastern Limited, 1992.
5. "Theory of Machines and Mechanisms", Shigley J.E and Uicker J.J, 3rd Edition, 2009, Oxford university press

ME2102 THERMODYNAMICS

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

Course objective:

- To understand the basic concepts of thermal engineering.
- To study the concepts of thermodynamics useful in thermal design of devices/machines employed in industries/other applications.
- To lays the groundwork for subsequent studies in fields such as Fluid mechanics, Heat transfer, Refrigeration and Air Conditioning, Turbo machinery, Automobile Engineering and Gas Dynamics.
- To gain the knowledge to effectively apply thermodynamics in the practice of engineering.

COURSE OUTCOMES:

- Able to understand the thermodynamic properties, process, cycle, equilibrium and concepts of systems, surroundings and universe.
- Able to understand the energy transfer in the form of work and heat. Andstudent will learn the transformation of energy from one form to another form in open and closed systems and applying the mass conservation equations and energy conservation equations to various applications.
- Able to understand the Carnot cycle and major difference in the working principles of heat engine, heat pump and refrigerator to calculate the maximum efficiency of the cycle. Also student will learn the irreversibity processes, entropy change and maximum available energyby a process.
- Able to understand the concept of phase change of a pure substance and graphical representation of a pure substance on p-v, p-T, T-v, h-s and T-s diagrams, the usage of Steam tables and Mollier diagrams to solve problems. And student will also learn to derive the thermodynamics relations involving entropy, enthalpy and internal energy.
- Able to draw P-V, T-S and H-S diagrams for Carnot cycle and Rankine cycle and to evaluate the performance parameters such as efficiency, work ratio, specific steam consumption and heat ratio, etc.
- Able to understand the basic laws of ideal gas and gas mixtures. Student will understand psychrometric process and how to use psychrometric chart and tables. Also student will get the basic concepts of air-conditioning.

UNIT-I

Concepts of System, **surroundings and Universe**. Types of systems. Classification of Properties- fundamental and secondary, intensive and extensive. Temperature Scales. International Practical Temperature Scale (IPTS). Zeroth law and thermodynamic equilibrium.
Ideal Gases- Equation of State. Specific Heats, Enthalpy, Internal energy, & Entropy. Real Gases-vander Waals Equation of State, Compressibility Factor.

Types of thermodynamic processes and their representation of P-V and T-s plots. Types of cycles- Open and Closed

UNIT-II

Forms of Energy. Heat and Work Transfers. First law of thermodynamics. Energy conservation equation for a closed system. Calculation of Work Transfer, Heat Transfer, and Internal Energy changes.

First Law analysis of flow processes. Steady Flow Energy Equation and its applications. Calculation of Work Transfer, Heat Transfer, and Enthalpy changes. Thermodynamic analysis of flow through Nozzles, Diffusers, Turbines, Compressors, Throttling devices and Heat Exchangers.

First law applied to Unsteady flow Processes. Calculation of Heat transfer during charging /evacuation of a Cylinder.

UNIT-III

Carnot Cycle- Efficiency of Carnot Cycle in terms of ratio or temperatures and heat transfers. Applications of Carnot cycle -Heat Engine, Refrigerator and Heat Pump.

Second Law of Thermodynamics: Statements of Second Law of thermodynamics. Equivalence of Kelvin-Planck and Clausius Statements.

Carnot Theorems, Thermodynamic Temperature Scale, Clausius Inequality. Concept of Entropy. Reversible and Irreversible processes. Calculation of Entropy change during various thermodynamic processes.

Principle of Increase of Entropy. Second law analysis of a control Volume. Concepts of Exergy and Anergy. Loss in available energy. Second law efficiency of Turbines and Compressors

Thermodynamic analysis of Air Standard Cycles- Otto, Diesel, Dual and Joule/ Brayton.

UNIT-IV

Pure Substances. Concept of Phase Change. Graphical representation of thermodynamic processes on P-V, P-T, T-V, T-S, H-S, P-H and P-V-T diagrams. Thermodynamic relations involving Entropy, Enthalpy and Internal Energy. Maxwell's relations. Clapeyron equation.

Properties of Steam- Use of Steam Tables and Mollier diagram.

Power Plant Cycles-Carnot and Rankine Cycles and their representation on P-V, T-S and H-S diagrams. Evaluation of performance parameters–Efficiency, Work ratio, Specific Steam Consumption and Heat Rate.

UNIT-V

Non reactive Ideal homogenous gas Mixtures: Determination of properties of Mixture in terms of properties of individual components of the mixture. Gibbs Phase Rule.

Psychrometry. Moist Air Properties. Use of Psychrometric Chart and Tables.

Concept of Air-Conditioning. Heating, Cooling, Humidification and De-humidification and other psychrometric processes. Adiabatic Mixing of two Streams of Moist Air. Sensible heat factor and Bypass factor for heaters/coolers.

Introduction to summer and winter Air-Conditioning Processes with a brief overview on devices used in Air Conditioning.

Suggested Reading:

1. Yunus A Cengel and Michael A Boles, "*Thermodynamics-An Engineering Approach*", Tata Mc Graw Hill Publishing Company Ltd. ,6th Edn., Fifth Reprint, 2009.
2. Nag P.K, "*Engineering Thermodynamics'*: Tata McGraw Hill Publishing, 8th Edn, 3rd Reprint 2010.
3. Nag P.K, "*Basic & Applied Thermodynamics'*: Tata McGraw Hill Publishing, 8th Reprint 2006.
4. Richard E.Sonntag, C.Borgnakke, G.J Van Wylen, "Fundamentals of Thermodynamics': John Wiley & Sons, 7th Edn., 2009.
5. Rajput R K, " *Engineering Thermodynamics*" Laxmi Publications, 4th Edition, 2010

REFERENCES :

1. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd.
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles, TMH
3. Thermodynamics – J.P.Holman, McGrawHill
4. An introduction to Thermodynamics, YVC Rao, New Age
5. Engineering Thermodynamics – Jones & Dugan

ME2103 MECHANICS OF SOLIDS

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVE:

- To understand the basic concept of stress and strains for different materials
- To know the mechanism of the development of shear force and bending moment in beams
- To know the theory of simple bending, direct & bending stress and distribution of shear stress
- To study the deflections and its applications
- To analyze and understand shear stress, torsional stress and spring applications

COURSE OUTCOMES:

- Able to understand the basic concept of stress and strains and deformation for basic geometries subjected to axial loading and thermal effect.
- Able to find the maximum shear force and maximum bending moment by drawing the shear force and bending moment diagrams for different types of beams with different lateral loading condition.
- Able to find the strength of the various cross sectional beams such as rectangular, hollow circular, circular T, I sections etc.
- Able to calculate the deflections of the beam using different methods under different boundary and loading conditions
- Able to find the shear strength of the solid and hollow shafts which are subjected to torsional loading in power transmission.
- Able to learn about closed and open coiled helical springs

Unit – I

Simple stresses and strains: Types of stresses and strains. Hooks's Law, Stress- Strain curve for ductile materials, moduli of elasticity.Poisson's ratio, linear strain, volumetric strain, relations between elastic constants. Bars of varying sections, bars of uniform strength, compound bars and temperature stresses, change in length.

Compound Stresses: Stresses on oblique planes, principle stresses and principle planes. Mohr circle of stress.

Unit-II

Shear Force and Bending Moment: Relation between intensity of loading. Shear force and bending moment, shear force and bending moment diagrams for cantilever and simply supported beams for point loads, uniformly distributed loads, uniformly varying loads and couples.

Unit-III

Theory of simple bending: Assumptions derivation of basic equation: $M/I = fb/y = E/R$
Modulus of section, Moment of resistance, determination of flexural stresses.
Direct and Bending Stresses: Basic concepts, core of sections for rectangular, solid and hollow circular and I sections.

Unit-IV

Distribution of shear stress: Equation of shear stress, distribution across rectangular, circular, T and I sections.
Deflections: Deflections of cantilever and simply supported beams for point loads and uniformly distributed loads by double integration and Macaualay's method.
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Unit-V

Strain Energy: Strain energy in bars due to gradually applied loads, sudden loads, impact loads and shock loads.
Torsion-Theory of pure torsion- derivation of basic equation $T/J = y/R = G\Theta/L$ and hollow circular shafts, power transmission, combined bending and torsion.

Suggested Readings:

1. D.S. Prakash Rao, Strength of Materials – A practical Approach, Universities Press, 1999.
2. R.K. Rajput, Strenght of Materials, S. Chand & Co., 2003.
3. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi, 2000.
4. Ferdinand P Beer et.al., Mechanics of Materials, Tata McGraw-Hill, 2004.
5. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan Indian Limited, Delhi, 2002.
6. S. Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, 1993.
7. S.S. Bhavakatti, Strength of Materials, Vikas Publications, 2003.

REFERENCES :

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timshenko

ME2104 MATERIAL SCIENCE & METALLURGY

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVE:

- To understand the relationship between the structure, properties, processing, testing, heat treatment
- To understand the fundamentals of fatigue, fracture, creep and diffusion
- To familiarize the importance of phase diagrams and principles of heat treatment
- To know the applications of metallic , non metallic, ceramic and composite materials

COURSE OUTCOMES:

- Students will get knowledge on bonds, crystallization of metals and effect of grain boundaries on the properties
- Students will be able to carry out the different mechanical testing methods to determine the mechanical properties of the materials.
- Students will be able to construct the equilibrium diagrams by experimental methods and knowing all types of equilibrium diagrams
- Students will be able to learn the structure and properties of all cast irons, steels and Non-ferrous metal alloys

Unit I:

Introduction: Why study properties of materials, classification of materials, advanced material, future and modern materials. Atomic structure, inter atomic bonding and structure of crystalline solids, Influence on properties of materials. Crystal structures, crystallography, planes and directions.

Imperfections in solids: Solidification process and Imperfections point, line, surface and volume defects, characteristics of dislocations, interactions between dislocations.

Unit II:

Deformation behaviors of materials: Elastic deformation, plastic deformation, and time dependent deformation processes, failure of materials, Fracture, fatigue and creep concepts and their significance.

Mechanical Properties of material and testing: Stress vs Strain graph, Tension test, Compression Test, Brinells, Vickers, Rockwell hardness test and micro hardness testing. Impact testing, creep test, fatigue test and fracture of materials and testing.

Unit III:

Phase Diagrams: Gibbs phase rule, cooling curves for pure metals and alloy, construction of phase diagrams, Equilibrium of phase diagrams (isomorphous, eutectic, partial eutectic and layered system), lever and tie line rule, phase transformation, iron-iron carbide phase diagram, different phases and applications in iron carbon system.

Unit IV:

Heat treatment and TTT curves: Transformation rate effects and TTT and CCT diagrams, microstructure and property changes in iron-carbon diagrams. Heat treatment of steel, Annealing, Normalizing, Hardening, Tempering, Austempering and Martempering of steels. Surface hardening of steels. Carburizing, Nitriding, Cyaniding, Flame and induction hardening methods.

Unit V:

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, tool and die steels.

TEXT BOOKS :

1. Introduction to Physical Metallurgy, Sidney H. Avener.
2. Essential of Materials Science and Engineering, Donald R.Askeland, Thomson.

REFERENCES :

1. Material Science and Metallurgy, kodgire.
2. Science of Engineering Materials, Agarwal
3. Materials Science and Engineering, William and collister.
4. Elements of Material science, V. Rahghavan
5. Engineering Materials and Their Applications – R. A Flinn and P K Trojan, Jaico Books.
6. Engineering materials and metallurgy, R.K.Rajput, S.Chand.

HS2101 SOFT SKILLS-I

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **2-0-0-1**

Objectives:

1. To make the students to understand the pattern of the Various Competitive Exams

2. To make them to enhance Grammar, Comprehension and Vocabulary to appear for the Exams

3. To make them practice the sentence building, correct usage, comprehension, and composition

Outcomes:

1. Students will be able to get the clarity of various exams of SSC, AEE, TSPSC and UPSC

2. Students will be able to improve their Grammar, Comprehension and Vocabulary

3. Students will be able to get the confidence enough to appear for the Exams

Unit – I – Grammar-I

1. Previous question papers of AEE/TSPSC/SSC/Banking
2. Error Correction and Sentence Rearrangement
3. Clauses (Noun Clauses – Adjective Clauses; Adverbial Clauses) and Phrases (Noun phrases; verb phrases; adverbial phrases), If clauses
4. Types of sentences Positive/Negative/Interrogative/Negative interrogative
5. Transformations (Simple, Complex and Compound)

Unit – II – Grammar-II

1. Voice
2. Direct and Indirect Speech
3. Infinitives; Gerunds; Participles
4. Phrasal verbs; Idioms; Prepositional phrases
5. Forming Questions and Question Tags

Unit – III - Pronunciation

Aspects of Pronunciation

1. Consonant, Vowel Sounds and Diphthongs
2. Syllabification – Stress - Word Stress
3. Intonation: Falling – Raising – Falling and Raising

Unit – IV – Appreciation of poetry

Critical Appreciation of Selected Poems

Unit – V – Essay Writing

Opinion Essay – Argumentative Essay – Article Writing – Report Writing

REFERENCES:

5. R.P Bhatnagar and Bhargava Rajal, ***"English for Competitive Examinations".*** McMillan India limited, 2016.
6. Wren and Martin, NDV Prasad Rao. "***High School English Grammar and Composition***" S. Chand& Compay Ltd, New Delhi.
7. Murali Krishna, ***"English for Engineers."***Pearson Education, Inc. New Delhi, 2015.
8. E. Suresh Kumar, P. Sreehari and J. Savithi***. "English for Success."*** Foundation Books, Inc. New Delhi, 2014.
9. RS Agarwal, Vikas Agarwal, ***"Objective English"***S. Chand & Compay Ltd, New Delhi, 2016
10. http://www.bankexamstoday.com/2015/09/bank-exams-question-papers.html

ME2701 MECHANICS OF SOLIDS LAB

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **0-0-3-1**

Objectives:

- To know and understand the experiments on various materials to assess their behavior/limitations.
- To know the brittle and ductile material failure patterns etc., by conducting experiments
- To understand shear force, bending moment and deflections for different types of beams
- To know the rigidity modulus by conducting spring and torsion test.

Cycle – I

1. Direct tension test on metal bars
2. Young's modulus of metal specimen
3. Harness tests: Brinell and Rockwell
4. Compression test on bricks
5. Impact test
6. Shear force and bending moment tests

Cycle – II

7. Spring test
8. Torsion test
9. Bending test on simply supported beam
10. Bending test on continuous beam
11. Bending test on fixed beam
12. Curved beam

Note: *At least ten experiments should be conducted in the Semester*

1. To carry out tension shear test of material supplied
2. To carry out charpy test, Tension impact test, Izod test.
3. To study the stress strain tension characteristics of metals by using UTM
4. To study the stress strain compression characteristics of metals by using UTM
5. To find out the modulus of elasticity of the specimen supplied and to verify the Maxwells theorem
6. To determine the hardness using different hardness testing machines: Brinnels, Vickers and Rockwell's.
7. To calibrate the given proving ring by applying compressive force by U.T.M
8. Deflection test on beams using U.T.M

ME2702 MATERIAL SCIENCE & METALLURGY LAB

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **0-0-3-1**

Objectives:

- To familiarize the procedure for specimen preparation
- To prepare different metal specimen for identification
- To study the microstructure of metals and alloys
- To understand the heat treatment procedures
- To study the microstructure after heat treatment

List of Experiments:

1. Study of: Metallurgical Microscope

Iron-Iron Carbide diagram
Procedure for specimen preparation

2. Metallographic Study of Pure Iron
3. Metallographic Study of Low carbon steel
4. Metallographic Study of Medium carbon steel
5. Metallographic Study of Eutectoid steel
6. Metallographic Study of Hyper Eutectoid steel
7. Metallographic Study of Wrought iron
8. Metallographic Study of Grey cast iron
9. Metallographic Study of White cast iron
10. Metallographic Study of Black heart Malleable cast iron
11. Metallographic Study of white heart Malleable cast iron
12. Metallographic Study of Brass and Bronze
13. Study of microstructure after hardening, normalizing and annealing of steel specimen.

Note: *At least ten experiments should be conducted in the Semester*

1. Metallographic Preparation and microstructural study of pure metals (Fe, Cu, Al)
2. Metallographic Preparation and microstructural study of mild steel, low-carbon steel and high carbon steel
3. Microstructural study of Cast Iron
4. Microstructural study of Heat treated Steels

5. Jominy End quench test (hardness of the samples to be tested in “Mechanics of Solid Lab)
6. Melting of aluminum (or its alloy) and casting in sand molds, chilled sand molds and steel molds, and microstructural study of the samples (Hardness study of the samples will be done in “ Mechanics of Solids Lab)

CODE: ME2901 **SEMINAR-I**

Scheme of Internal Exam : 25 Marks
Credits : 1

Objectives:
Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

- Problem definition and specification
- Literature survey, familiarity with research journals
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
- Presentation - oral and written.

The evaluation is purely internal and will be conducted as follows:

Preliminary Report on progress of the work and viva	05 marks
Final report	05 marks
Presentation and Defence before a departmental committee consisting of Head, a senior faculty and supervisor	15 marks

II YEAR

II SEMESTER

Subject Code	Course Name	L-T-P	Credits
MA2202	Mathematics -IV	4-0-0	4
ME2201	Dynamics of Machinery	4-0-0	4
ME2202	Fluid Mechanics	4-0-0	4
ME2203	Manufacturing Processes	4-0-0	4
EE2001	Electrical and Electronics Engineering	4-0-0	4
BM2201	Personality Development-I	2-0-0	1
ME2801	Manufacturing Processes Lab	0-0-3	2
EE2601	Electrical and Electronics Engineering Lab	0-0-3	2
ME2902	Seminar-II	0-0-2	1
	Total	22-0-8	26

MA2202 **MATHEMATICS-IV**

EXTERNALS: 60MARKS **L-T-P-C***
INTERNALS: 40MARKS **4-0-0-4**

Learning Objectives:

- To introduce Linear and higher order Partial differential equations.
- To learn the different methods of solving partial differential equations.
- To study the applications of Partial differential equations.
- To Introduce Functions of Complex variables, Power series, Bilinear Transformations & Conformal Mapping.

Learning Outcomes:

- Students will become knowledgeable about partial differential equations (PDEs) and how they can serve as models for physical processes such as mechanical vibrations, transport phenomena including diffusion, heat transfer, electrostatics.
- Students will master how solutions of PDEs are determined by conditions at the boundary of the spatial domain and initial conditions at time zero. Students will also master the technique of separation of variables to solve PDEs
- Students will also master the use of the Fourier transform to analyze and solve the wave equation using d'Alembert's formula.
- Students will be able to determine continuity/differentiability/analyticity of a function and find the derivative of a function
- To enable students to evaluate a contour integral using parameterization, fundamental theorem of calculus and Cauchy's integral formula
- To enable the students to compute the residue of a function and use the residue theory to evaluate a contour integral or an integral over the real line

Unit-I:

Introduction to PDE, formation of PDE, order, degree of PDE.Linear, semi-linear, quasi-linear, non-linear PDE of first order. Linear PDE of order one, Lagrange's method of solution and geometrical interpretation, non-linear PDE of order one, classification of integrals, compatibility condition, Charpit's method standard formulas.

Unit-II:

Solving higher order PDE

Homogeneous linear PDE of higher order with constant coefficients, non-homogeneous linear PDE with constant coefficients, non-linear second order PDE, Monge's method.

Unit-III:

Applications of PDE

Method of separation of variables, Wave equation, Heat equation, and Laplace's equation, integral transforms method to solve second order PDE.

Unit-IV:

Functions of Complex Variables: Limits and continuity of function, differentiability and analyticity, necessary and sufficient condition for function to be analytic, Cauchy Riemann Equations in polar form, Harmonic functions.

Complex Integration: Definition, Cauchy's integral theorem for multiple connected regions, Cauchy's integral formula, Cauchy's formula for derivatives and their application

UNIT-V

Power Series, Taylor's Series, Laurent's Series, Zeroes and Singularities, Residues, Residue theorem, Evaluation of real integrals using residue theorem, Bilinear Transform, Conformal Mapping.

Text Books:

1. R.K. Jain &S.R.K.Iyengar, Advanced Engineering Mathematics, Third Edition, Narosa publications, 2007.
2. Dr. M.D. Raisinghania,OrdinaryandPartialdifferentialequations,S.CHAND,17thEdition2014.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons Ltd 2006.

Reference Books:

1. Ian N.Sneddon,Elements of Partial Differential EquationsDover publication (2006)
2. T.Amarnath, An elementary course in Partial Differential equations, Narosa Publishing house
3. R.V.Churchill, " Complex Variables & its applications",McGraw-Hill Company,INC.
4. B.S. Grewal and J.S. Grewal, "Higher Engineering Mathematics",(40th Edition), Khanna Publishers,2007
5. Lawrence C.Evans, Partial differential equations,AMS Publications(1949)

ME2201 DYNAMICS OF MACHINERY

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVES:

- To find static and dynamic forces on planar mechanisms.
- To know the causes and effects of unbalanced forces in machine members.
- To determine natural frequencies of undamped, damped and forced vibrating systems of one, two and multi degree freedom systems.

COURSE OUTCOMES:

- Able to analyze the planar mechanism by performing static and dynamics force analysis.
- Able to apply gyroscopic principles on Aero plane, ship, four wheel and two wheel vehicles
- Able to understand the basic concepts of friction in inclined plane, in screw and nuts, pivots and collars with uniform pressure and uniform wear
- Able to understand how to draw turning moment diagram and can design a flywheel for IC engine
- Able to understand the basics concepts of governors and forces acting on various governors and able to solve numerical problems on different governors
- Able to balance rotating and reciprocating mass in various planes and able to understand balancing of V- engine and multi cylinder engines
- Able to perform analysis of the response of one degree of freedom systems with free and forced vibrations and can evaluate the critical speed of the shaft and can understand torsional vibrations
- Able to understand two and three rotor systems and can solve simple vibration calculations of rotor systems.

UNIT – I

STATIC AND DYNAMIC:
Static Force Analysis: Reciprocating Engine Mechanism, Quick Return Mechanism, Four Link Mechanism, Friction in Linkages, Slider in Equilibrium under the Action of Concurrent Forces, Slider in Equilibrium under the Action of Non concurrent Forces, Friction in Turning Pairs.
Inertia Force Analysis: Inertia Forces of a Reciprocating Engine Mechanism, Four Link Mechanism, Quick Return Mechanism. Correction Torque.

UNIT –II

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

TURNING MOMENT DIAGRAM AND FLY WHEELS:
Turning moment diagram for steam engine, I.C. engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design.

UNIT – III

GOVERNORS: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting –effort and power of a governor.

BALANCING: Balancing of rotating masses - single and multiple – single and different planes.

UNIT – IV

BALANCING OF RECIPROCATING MASSES: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V, multi cylinder, in -line and radial engines for primary and secondary balancing, locomotive balancing – Hammer blow, Swaying couple, variation of tractive force.

LONGITUDINAL VIBRATIONS: Free Vibration of mass attached to vertical spring – oscillation of pendulums, centers of oscillation

UNIT – V

TRANSVERSE VIBRATIONS: Transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerley's method, Rayleigh's method. Whirling of shafts, critical speeds.

TORSIONAL VIBRATIONS: two and three rotor systems. Simple problems on forced, damped vibration, Vibration Isolation & Transmissibility.

TEXT BOOKS:

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill Publ.
2. Theory of machines / Khurmi/S.Chand.

REFERENCES:

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Dynamics of Machinery/Balleney/Dhanpat Rai
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of Machines / Jagadish Lal & J.M.Shah /Metropolitan.

ME2202 FLUID MECHANICS

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVES:

- To know various fluid properties, concept and method of fluid pressure measurement.
- To understand the basic concepts of fluid motion.
- To study different equations of fluid motion and fluid dynamics
- To analyze different flow characteristics of laminar and turbulent flows
- To study the motion of gases for different conditions of expansion

COURSE OUTCOMES:

- Able to know the fluid properties and their engineering significance.
- Able to determine the pressure at a point and identify the variation of pressure in a fluid.
- Able to understand the basic concepts of fluid motion.
- Able to analyze different flow characteristics of laminar and turbulent flows
- Able to understand the boundary layer and its significance along with the various concepts of boundary layer like its growth, thickness and separation.
- Able to understand the concept of flow around the submerged objects
- Able to know the characteristics of compressible fluids flow and Mach number and its significance

UNIT-I

Properties of Fluids: Introduction, definition of luid, Units of measurement, Fluid Properties-mass density, specific weight, specific gravity, Viscosity, Newton's law of viscosity – Newtonian and non Newtonian fluids. Classification of fluids- Ideal and real.

Fluid Statics: Fluid pressure at a point, variation of Pressure in a fluid, measurement of Pressure-simple manometers, differential manometers.

UNIT-II

Fluid Kinematics: Fundamentals of fluid flow –types of fluid flow, description of flow pattern, basic principles of fluid flow, continuity equation, acceleration of a fluid particles.
Fluid dynamics: Introduction, forces acting on a fluid in motion, Euler's equation of motion, Bernoulli's equation, application of Bernoulli's equation – venturimeter, pilot tube. Impulse momentum equation, application of impulse momentum equation – Forces on a pipe bend.

Dimensional analysis and similarity - Buckingham Pi theorem

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UNIT-III

Flow through pipes: Introduction, two types of flow – laminar and turbulent – Reynold's experiment. Laws of fluid friction, Darcy- Weisbach equation. Steady laminar flow- circular pipes – Hagen-Poiscuille's law. Hydrodynamically smooth and rough boundaries and it's criteria and resistance to flow of fluid in smooth and rough boundaries – variation of friction factor.

UNIT-IV

Boundary layer theory: Introduction, thickness of boundary layer, boundary layer along a flat thin plate and its characteristics. Laminar and turbulent boundary layer, laminar sub layer, separation of boundary layer and its control.

Fluid flow around submerged objects: Drag and lift – Introduction, types of drag, drag on a flat plate. Development of lift on immersed bodies – lift of an airfoil

UNIT-V

Flow of compressible fluids: Introduction, concepts of compressible flow, continuity and energy equation, propagation of elastic waves due to compression of fluid, velocity of sound, Mach number and its significance, propagation of elastic waves due to disturbance of fluid stagnation properties, area velocity relationship for compressible flows.

Suggested Reading:

1. K.Subramanya,Theory and Applications of fluid Mechanics, Tata McGraw-Hill Publishing Company Ltd., New Delhi,1993.

2. Vijay Gupta and Santhosh K. Gupta, Fluid Mechanics and its applications, wiley Eastern Ltd.,New Delhi,1984.

3. K.L.Kumar, Engineering Fluid Mechanics, Eurasia Publishing House PVT Ltd, New delhi,2009.

4. P.N.MOdi,and S.M.Seth., Hydralics and Fluid Mechanics, Standard Book House, 1995.

5. Fluid Mechanics & Hydraulic Machines, S.C. Gupta, Pearson Publishers.

ME2203 MANUFACTURING PROCESSES

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVES:

- To know the various manufacturing processes
- To understand the basic concepts of casting and welding
- To understand the manufacturing of plastics and composites
- To familiarize the forming processes and forming load estimation.
- To understand the principle of high energy rate forming processes

COURSE OUTCOMES:

- Able to understand the elements of casting, construction of patterns and gating systems, moulds, methods of moulding, moulding machines and solidification of castings of various metals.
- Able to understand the different types of welding processes, welds and weld joints, their characteristics, cutting of ferrous and non-ferrous metals by various methods.
- Able to understand the basic concept on one, two and three dimensional stress analysis, theory of plasticity; strain hardening, hot and cold working process.
- Able to understand the principles of Extrusion, rolling, forging processes, wire drawing and sheet metal processes, their applications and defects.

UNIT – I

Casting: Definition, elements, Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

UNIT – II

Special Casting Processes: Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting.

Risers – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks

Methods of Melting: Crucible melting and cupola operation, steel making processes. Casting inspection and defects

UNIT – III

Welding : Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding. Defects, causes and remedies.

Cutting of Metals: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals.

UNIT – IV

Forming: Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills. Forces in rolling and power requirements, plastic blow and injection moulding.

Extrusion: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.

UNIT - V

Forging processes: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

Sheet metal working: stamping, forming and other cold working processes: Blanking and piercing – Bending.

Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.

UNIT - V

TEXT BOOKS:

1. Manufacturing Technology, P.N. Rao,TMH
2. Manufacturing Technology, Kalpak Jain, Pearson education

REFERENCES:

1. Production Technology, R.K. Jain
2. Process and materials of manufacturing –Lindberg, PE
3. Principles of Metal Castings, Rosenthal.
4. Welding Process, Parmar
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub
6. Rapid Prototyping Principles and Applications, Rafiq Noorani, Wiely Pub.
7. Unconventional Machining Processes, V.K. Jain, Allied Pub.
8. Production Technology, K.L Narayana, I.K. International Pub

EE2001 ELECTRICAL & ELECTRONICS ENGINEERING

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

Objectives:
This course introduces the concept of

- Electrical DC and AC circuits, basic law's of electricity, different methods to solve the electrical networks
- Construction operational features of energy conversion devices i.e., DC and AC machines, transformers.
- It also emphasis on basics of electronics, semiconductor devices and their characteristics and operational features.

Course Outcomes: At the end of the course the student will be able to:

- Evaluate steady state behavior of single port networks for DC and AC excitations.
- Analyze and solve magnetic circuits and 3-phase circuits

UNIT- I DC CIRCUIT ANALYSIS
Electrical Circuits - R-L-C Parameters, Voltage and Current Independent and Dependent Sources, Source Transformation – V–I relationship for Passive elements, Kirchoff's Laws, Network reduction techniques – series, parallel, series parallel, star–to-delta, delta-to-star transformation, Mesh Analysis and Nodal Analysis

UNIT- II AC CIRCUIT ANALYSIS
Single Phase AC Circuits - R.M.S. and Average values, Form Factor, steady state analysis of series, Parallel and Series parallel Combinations of R, L and C with Sinusoidal excitation, concept of reactance, Impedance, Susceptance and Admittance – phase and phase difference, Concept of Power Factor, j-notation, complex and Polar forms of representation.
Resonance – Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor, Locus Diagrams for RL, RC and RLC Combinations for Various Parameters.

UNIT- III NETWORK THEOREMS AND THREE PHASE AC CIRCUITS
Network Theorems - Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity, Tellegen's, Millman's and Compensation theorems
Three phase ac circuits -Three phase EMF generation, delta and Y connections, line and phase quantities, solution of three phase circuits, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits

UNIT- IV BASIC ELECTRONICS

Introduction to electronics and electronic systems, Semiconductor and devices like diodes, zener diode, BJT, FET, MOSFET, Rectifier and ripple Filters, Transistor biasing. Small signal transistor amplifiers, Operational amplifiers, Feedback and Oscillators, Introduction to digital circuits

UNIT- V ELECTRICAL MACHINES

DC machines: Construction, EMF and Torque equations, Characteristics of DC generators and motors, speed control of DC motors and DC motor starters.

Transformers : Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers.

Induction motors: The revolving magnetic field, principle of orientation, ratings, equivalent circuit, Torque-speed characteristics, starters for cage and wound rotor type induction motors.

TEXT BOOKS:

1. Electrical Technology- Hughes Prentice Hall, 7th edition
2. Problems In Electrical Engineering- S. Parker Smith, 9 edition
3. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
4. Millman's Electronic Devices and Circuits – J.Millman and C.C.Halkias, Satyabratajit, TMH, 2/e, 1998.
5. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6th edition.
6. Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7th Edition.2005

REFERENCES:

1. Electronic Devices and Circuits - K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
2. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal –Wiley India Pvt. Ltd. 1/e 2009.
4. Network Theory by N.C.Jagan & C.Lakshminarayana, B.S. Publications.
5. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
6. Electrical machines-PS Bhimbra, Khanna Publishers.

BM2201 PERSONALITY DEVELOPMENT-I

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **2-0-0-1**

Guidelines: Learning approach is based on Real time case studies with class room activities

Course Objectives:

1. To develop interpersonal skills and be an effective goal oriented team player.
2. To develop professionals with idealistic, practical and moral values.
3. To develop communication and problem solving skills.
4. To re-engineer attitude and understand its influence on behavior.
5. To enhance holistic development of students and improve their employability skills.

Course Outcomes:

After the successful completion of this course, the learner will be able to know:

1. Self analysis and self analysis techniques there by learning the various aspects of their personality.
2. SWOT Analysis, and use SWOT in their life for various opportunities.
3. Set Goals and prioritize their resources to achieve them.
4. Diversify career risk and optimize results.
5. Understand; realize the importance of team work.
6. Upgrade their interpersonal skills.
7. Overcome fear of public speaking and effective group participation.
8. How to think in a creative way and rationalization of ideas.

UNIT I-SELF ANALYSIS

SWOT Analysis, Who am I, Personality Traits, Importance of Self Confidence, Self Esteem.

UNIT II-GOALS SETTINGS

Short term , Long term goal settings, SMART concept

Diversifying Risk and Optimizing Returns

UNIT III- Team Dynamics with Interpersonal Skills

Team Dynamics, Team Work, Interpersonal Skills

Behavioral Skills GD, PI, Body Language Public Speaking, Verbal, Non Verbal Communications

UNIT IV-CREATIVITY and Rationality

Out of Box thinking, Idea Generation with creativity

Brain Storming, Effective group meetings, Rationalization of ideas and way to effective implementation

Note: Class room activities coupled with group tasks will be taken depending upon time availability

ME2801 MANUFACTURING PROCESSES LAB

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **0-0-3-2**

Objectives:

List of experiments in Machining:
1. Milling of Spur gear
2. Effect of process parameter and machining involvement on chip formation in turning
3. Effect of process parameters in turning on cutting forces & temperatures
4. Regrinding of single point cutting tool

List of experiments in Casting:
1. Study on moulding properties like permeability, Green hardness, Dry tensile & compression strength, Green tensile & compression strength, Moisture measurement.
2. Study on riser design & shieve analysis.

List of experiments in Welding:
1. Study the characteristics of MIG welding with movable work table
2. Study of arc welding characteristics using automatic moving torch.
3. Demo of TIG and Resistance spot welding

List of experiments in Forming
1. Disc compression & Ring compression test
2. Extrusion & deep drawing

EE2601 ELECTRICAL & ELECTRONICS ENGINEERING LAB

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **0-0-3-2**

List of Experiments:

1. Verification of Network Theorems
2. R-L-C Series Circuit
3. Series and parallel resonanance
4. Three phase power measurement by two Wattmeter method
5. Speed control of DC motor
6. OC and SC Test of Single Phase Transformer
7. OCC of separately excited DC Shunt Generator
8. V-I characteristics of Diodes and BJT
9. Half-wave and full-wave rectifiers, rectification with capacitive filters, zener diode

Studies on logic gates

CODE: ME2902 **SEMINAR-II**

Scheme of Internal Exam : 25 Marks
Credits : 1

Objectives:
Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

- Problem definition and specification
- Literature survey, familiarity with research journals
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
- Presentation - oral and written.

The evaluation is purely internal and will be conducted as follows:

Preliminary Report on progress of the work and viva	05 marks
Final report	05 marks
Presentation and Defence before a departmental committee consisting of Head, a senior faculty and supervisor	15 marks

III YEAR
I SEMESTER

Subject Code	Course Name	L-T-P	Credits
ME3101	Hydraulic Machines	4-0-0	4
ME3102	Metrology & Instrumentation	4-0-0	4
ME3103	Design of Machine Elements-I	4-0-0	4
BM3001	Managerial Economics and Financial Analysis	4-0-0	3
BSBE3001	Environmental science	4-0-0	3
BM3101	Personality Development-II	2-0-0	1
ME3701	Fluid Mechanics & hydraulic machines Lab	0-0-3	2
ME3702	Metrology & Instrumentation Lab	0-0-3	2
ME3703	Machine Drawing Practice	1-0-3	2
ME3901	Seminar-III	0-0-2	1
Total		23-0-11	26

ME3101 HYDRAULIC MACHINES

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVE:

- The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow
- To introduce the concepts of flow measurements and flow through pipes
- To introduce the concepts of momentum principles
- To impart the knowledge on pumps and turbines

COURSE OUTCOMES:

- Able to make the students familiar with the different components of a hydroelectric machine and operate hydraulic machines.
- Able to understand the working principle of hydraulic machines, their features of design and working proportions.
- Able to analyze and identify various factors affecting the performance of machine
- Able to solve flow problems through the hydraulics machines and use of appropriate equations.
- Able to apply principles of fluid mechanics to the operation, design, and selection of fluid machinery such as pumps and turbines.
- Able to solve the simple problems on hydraulic ram, hydraulic accumulator, hydraulic intensifier, hydraulic press etc.

Unit-I

Introduction: Classification of Hydraulic machinery. Energy transfer in hydraulic turbines. Positive displacement and Rotodynamic pumps and description of their working principles. Dynamic action of water: Impact of water jets on flat plates and curved surfaces – single and series, stationary and moving types. Forces on hinged plates and pipe bends. Impulse – momentum equation. Flow over radial and curved vanes.

Unit-II

Reciprocating pumps: Classification, working details, theory and terms used for single and double acting pumps. Effect of acceleration head and friction. Indicator diagrams. Effect of cavitation and limiting suction head on pump speed. Variation of pressure inside pump cylinder during suction and delivery strokes. Work done, power required and efficiency. Functions of air vessels. Work saved and rate of flow from air vessels. Losses and performance curves for reciprocating pumps. Industrial applications.

Unit-III

Centrifugal pumps: Working and constructional details of single stage centrifugal pump. Installation. Priming – significance and methods of priming. Basic classification of CF pumps. Types of impellers, casings and vane shapes used. Simple and multistage pumps and their applications. Series and parallel operation of CF pumps. Theory and terminology used CF

pumps. Manometric head and its importance. Manometric efficiency and other efficiencies. Losses in CF pumps. Velocity diagrams. Effect of number of vanes and outlet angle of vane on head developed. Design of radial impellers and volute casing. Origin of cavitation. Limiting suction lift and NPSH. Principles of similarity: Unit quantities, specific speed, performance prediction from model testing. Performance and characteristic curves. Methods of balancing of end thrust in CF pump installations.

Unit-IV

Hydraulic Turbines: Classification of impulse and reaction turbines and their differences in working. Impulse turbines: Salient features and working details of Pelton wheel installation. Velocity diagrams. Calculation of number of buckets, bucket sizes and power developed. Overall efficiency, speed regulation methods. Reaction turbines: Constructional details and working of Francis and Kaplan turbines. Draft tube in reaction turbines. Theory, types and efficiency of draft tubes. Velocity diagrams. Blade angles and blade dimensions. Power developed and efficiencies, pressure head at inlet of the runner.

Unit-V

Principles of similarity applied to hydraulic turbines. Unit quantities, specific speed and its significance for turbine selection. Performance prediction from model tests. Performance and characteristic curves for Pelton wheel, Francis and Kaplan turbines. Characteristic diagram. Automatic speed regulation in power plants. Losses in turbine operation. Cavitation effects in reaction turbines and remedial measures. Functions and types of surge tanks.

Suggested Reading

1. Jagdish Lal, *Hydraulic Machines*, Metropolitan Book Co., 1965.
2. Modi, P.N. & Seth, S.M., *A Text book of Fluid Mechanics and Hydraulic Machines*, Standard Book House, New Delhi, 2007.
3. N.S. Govind Rao, *Fluid Flow*, Tata Mc Graw Hill, 1983.
4. R.K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publications (P) Ltd., 2004.

ME3102 METROLOGY & INSTRUMENTATION

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVES:

- To familiarize with Limits & Fits, ISO system and the instruments used to measure these limits.
- To have knowledge of various precision linear and angular measuring instruments.
- To learn the importance of form and how to measure form errors.
- To understand the working principles of various instruments used for the measurement of strain, forces, pressure, temperature and vibrations.

COURSE OUTCOMES:

- Able to understand the limits, fits and tolerances Indian standard system, international standard organization system
- Able to know the principles of working of the most commonly used instruments for linear and angular measurements
- Able to study the different types of comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness
- Able to understand the strain gauge circuits used to measure axial load, bending load and torque by using strain gauge circuits and also able to understand how to measure displacements by using LVDT and LASER ineterferometry
- Able understand about the force, pressure, vibrations and temperature measuring devices

Unit-I

Limits and Fits, ISO system. Types of interchangeability. Slip gauges and end bars. Height gauges, Abbe's rule, Types of micrometers. Tomlinson gauges, sine bar, autocollimator, calibration of precision polygons and circular scales. Dial indicator, Sigma mechanical comparator. Free flow and back pressure type Pneumatic comparators. Contact & non-contact tooling, Applications of single and multijet gauge heads; computation and match gauging.

Unit-II

Optical projector - measurement by comparison, movement and translation, chart gauge types and microgauge bridge lines. Tool maker's microscope, Floating carriage diameter measuring machine and coordinate measuring machine. Measurement of straightness and flatness using autocollimator. Roundness measurement with intrinsic datum (V-block, Bench centers) and extrinsic datum (TALYROND).

Unit-III

Taylor's principles for plain limit gauges. Usage and limitations of Ring and Snap gauges. Indicating type limit gauges. Position and receiver gauges, principles of thread gauging. Gauge materials and steps in gauge manufacture. General geometrical tests for machine tools. Surface roughness characteristics and its measurement.

Elements of instrumentation system. Static characteristics, Systematic and random errors. Dynamic response of first and second order instruments.

Unit-IV

Strain Measurement: Wire and foil type resistance strain gauges, Evaluation of principal strains with Rosette gauges. Desirable characteristics of gauge material, backing material and adhesive. Ballast and bridge circuits. Lead resistance compensation. Adjacent arm and self temperature compensating methods. Strain gauge calibration. Strain gauge circuits for measuring axial load, bending load and torque.

Measurement of displacement with LVDT and Lasers interferometry.

Unit-V

Force Measurement: Proving ring, Strain gauge load cells, Piezo-electric load cell, Ballastic weighing, Pneumatic and hydraulic force meters.

Pressure Measurement: Vacuum gauge, High and Low pressure measuring devices. Pirani gauge, Bourdon gauge and Bulk modulus gauge, calibration methods.

Vibration measurement: accelerometers, vibration exciters, calibration of vibrometers.

Temperature measurement: Laws of thermo electricity, types of materials and junctions used in thermocouples, lead and extension wires, ambient temperature compensation, protection tubes, series and parallel circuits. RTD. Total radiation and Optical Pyrometers.

Suggested Reading

1. R.K. Jain, *Engineering Metrology*, Khanna Publications, 2008.
2. I.C. Gupta, *A Text Book of Engineering Metrology*, Dhanpat Rai & Sons, 1984.
3. Bechwith, Marangoni, Lienhard, *Mechanical Measurements*, LPE; Pearson Education Asia 2000.
4. D.S. Kumar, *Mechanical Measurements*, Metropolitan Book Co., New Delhi, 2001.
5. Rega Rajendra, *Principles of Engineering Metrology*, Jaico Pub-lishing House,Mumbai.

REFERENCES:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. G. Schlesinger, *Testing Machine Tools*, Pergamon Press, Oxford, 8th Ed, 1978
3. Fundamentals of Dimensional Metrology , Connie Dotson,4th Ed, Thomson
4. Doeblin, *Measurement Systems Application and Design*,Tata McGraw Hill, 5th Ed., 2004.
5. Beckwith, Buck, Lienhard, *Mechanical Measurements,* Pearson Education Asia.

ME3103 DESIGN OF MACHNE ELEMENTS-I

EXTERNAL: 60MARKS **L-T-P-C***
INTERNAL: 40MARKS **4-0-0-4**

COURSE OBJECTIVES:

- To understand the basics of mechanics of materials and design of machine components subjected to static and fatigue loading
- To develop an ability to design a machine element to meet desired requirement out of a machine within the specified constraints.
- To develop an ability to identify, formulate, and solve engineering problems.

COURSE OUTCOMES:

- Student will be able to apply the knowledge of stress analysis, theories of failure, manufacturing and material science, and ergonomics principles in design of machine elements.
- Student will be able to analyze the stress and strain on mechanical components under different loadings; and understand, identify and quantify failure modes for mechanical parts
- Students will be able to design various machine elements such as shafts, couplings, belt drives and pressure vessels.
- Students will be able to design temporary and permanent fasteners
- Students will be able to make proper assumptions, perform correct analysis and finally decide the size of machine elements while giving due consideration to material, manufacturing method and cost of the element.
- With a given practical situation, students will be able to approach design problem successfully, and will be able to take decisions when no unique solution exists.

Unit-I

Introduction, Materials used in machine design and their specifications to Indian standards. Important mechanical properties of materials used in design. Codes and standards used in design. Reliability, Principles of good Ergonomic Design, Manufacturing considerations. Preferred numbers. Value analysis.

Analysis of Stress and Strain : Definition of stress and strain, Types of loading, Direct normal stress, bending stress, Torisonal stress, crushing and bearing stresses, Biaxial stress and Triaxial stress.

Theories of elastic failure, Stress concentration factor, factor of safety, Design of components for static loads, Introduction to thermal stresses.

Unit-II

Design for Fatigue and Impact loads; Importance of fatigue in design, Fluctuating stresses, fatigue strength and endurance limit. Factors affecting fatigue strength. S-N Diagram, Soderberg and Modified Goodman's diagrams for fatigue design. Cumulative fatigue, Miner's rule, Design of components for fatigue. Design of components for impact loading.

Unit-III
Design of keys, shafts – solid hollow stepped shafts and splined shafts under torsion and bending loads. Design of belt drive systems, selection of belts and design of pulleys.

Unit-IV
Design of cotter and knuckle joints, riveted and welded joints under direct and eccentric loading. Design of couplings – Muff and Split Couplings, Flange, Flexible and Marine type of couplings.

Unit-V
Design of bolts and nuts, locking devices, bolt of uniform strength, design of gasket joints, design of power screws and screw jack. Thick and thin cylinders.

Suggested Reading
1. V.B. Bhandari, *Machine Design*, Tata Mc Graw Hill Publication, 1991.
2. J.E. Shigley, C.R. Mischne, *Mechanical Engineering Design*, Tata Mc Graw Hill Publications, 2003.
3. Robert C. Juvinall, *Fundamentals of Machine Component Design*, John Wiley & Sons, 2005
4. Robert L. Norton, *Machine Design: An Integrated Approach*,2/e Pearson Education, 2000
5. M.F. Spotts, *Design of Machine Elements*, Prentice Hall of India, 1964.

REFERENCES:
1. Machine design- J.E.Shigley
2. Machine design- R S Khurmi and J K Gupta
3. Design Of Machine Elements - M.F.Spotts-PHI
4. Machine Design - Kannaiah/ Scietech.

BM3001 MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-3**

Course Objective:

- Enable the students to learn managerial economics principles applied in industries and equip them to handle the tasks in their career by making a real sense of what is happening economically in the organization.
- The course describes the Nature and Scope of Managerial Economics. It gives complete study on the demand and elasticity of demand and methods of demand forecasting.
- It provides a detailed structure on the pricing strategies and shows clear picture methods and sources of raising finance.
- It gives clear cut information of preparing final accounts and capital Budgeting techniques.

Course Outcome:

After the successful completion of this course, the learner will be able to know:

1. The dynamic game of demand and supply, and how the trinity of Economics i.e. Demand, Supply and Scarcity make the things move around the globe.
2. Principles of Microeconomics applied to industries.
3. Concept of forecasting and applying forecasting techniques to address the challenges and opportunities in the organization they work.
4. Cost and Production analysis, Break-Even analysis, Opportunity Cost, how to optimize organizational resources and how to minimize cost and maximize production, revenue and profit
5. Different pricing structure and discount mechanism suitable for business firms.
6. Market structure and how to exploit market structure for optimizing the benefits of organization.
7. Capital requirements and sources of capital.

UNIT I: Introduction to Managerial Economics:

Definition, Nature and Scope of Managerial Economics-Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT II: Theory of Production and Cost Analysis:

Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs. Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

Cost Analysis: Cost concepts, Opportunity cost. Fixed vs. Variable costs, Explicit costs Vs. Implicit costs. Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA.

UNIT III: Markets & Pricing Policies:

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Objectives and Policies of Pricing- Methods of Pricing: Cost Plus Pricing. Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing.

UNIT IV: Introduction to Financial Accounting: Introduction to Financial Accounting: Double entry Book Keeping, Journal, Ledger, Trail Balance and Final Accounts (Trading account, Profit and Loss Account and Balance sheet with simple adjustments).

UNIT V: Capital and Capital Budgeting:

Capital and Capital Budgeting: Capital and its significance. Types of Capital. Estimation of Fixed and Working capital requirements. Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals. Methods of Capital Budgeting: Payback Method. Accounting Rate of Return (ARR) and Net Present Value Method, Internal Rate of Return (IRR).

Reference Books:

1. Aryasri: Managerial Economics and Financial Analysis, TMH,2009.
2. Varshney & Maheswari : Managerial Economics, Sulthan Chand,2009.
3. Raghunatha Reddy & Narasimhachary: Managerial Economics& Financial Analysis, Scitech. 2009.
4. V.Rajasekarn & R.Lalitha. Financial Accounting, Pearson Education. New Delhi. 2010
5. Suma Damodaran, Managerial Economics, Oxford University Press. 2009.

BSBE3001 ENVIRONMENTAL SCIENCE

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **4-0-0-3**

Learning Objectives:

1. Stimulate interest in the environment and endeavours to generate awareness about environmental concerns among students.
2. Develop an understanding of how natural resources and the environment affect quality of life and the quest for sustainable development.
3. Develop knowledge and understanding of environmental issues and principle and apply their knowledge to mitigate the environmental problems.
4. Understand and resolve some of today's most challenging scientific and policy issues—including global climate change, pollution, biodiversity conservation, sustainability, environmental pollution and toxic waste disposal, disease control, disaster management, socio-environmental issues and balancing resource use and preservation.
5. Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.
6. Recognizes the global changes and responses for attaining a more sustainable environment.

LEARNING OUTCOMES:

The Environmental Science minor supplements other majors to facilitate students' understanding of complex environmental issues from a problem-oriented, interdisciplinary perspective.
Students:

- ❖ Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.
- ❖ Appreciate key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- ❖ Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- ❖ Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- ❖ Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex.

UNIT 1: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance, need for public awareness.

UNIT 2: NATURAL RESOURCES:

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- .Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

UNIT 3: ECOSYSTEMS & BIODIVERSITY

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
b. Biodiversity- Definition : genetic, species and ecosystem diversity. Biogeographical classification of India Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
c. Biodiversity at global, National and local levels. Inida as a mega-diversity nation Hot-sports of biodiversity.

d. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 4: ENVIRONMENTAL POLLUTION

Definition, Cause, effects and control measures of :- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

- Solid waste Management: Causes, effect s and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Environment Protection Act., Air (Prevention and Control of Pollution) Act. Water Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act .

UNIT 5 : SOCIAL ISSUES & THE ENVIRONMENT

Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

Field work : Visit to a local area to document t environmental assets river/ forest/grassland/hill/mountain Visit to a local polluted site-Urban/Rural/Industrial/Agricultural . Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCES :

a). Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

b). Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad- 380 013, India, Email:mapin@icenet.net (R)

c). Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

d) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

e). Cunningham, W.P. Cooper, T.H. Gorhan i, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 116p .

BM3101 PERSONALITY DEVELOPMENT-II

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **2-0-0-1**

Guidelines: Learning approach is based on Real time case studies with class room activities

Course Objectives:

1. To develop interpersonal skills and be an effective goal oriented team player.
2. To develop professionals with idealistic, practical and moral values.
3. To develop communication and problem solving skills.
4. To re-engineer attitude and understand its influence on behavior.
5. To enhance holistic development of students and improve their employability skills.

Course Outcomes:

After the successful completion of this course, the learner will be able to know:

1. Students will bring out optimistic aspects of their personality whereas suppress pessimistic one.
2. Internal and External motivating factors to keep themselves motivated in testing times.
3. Learn different leadership styles and choose one which suits them.
4. Communicate effectively and can act as change agent in the fast moving dynamic world.
5. Would identify the crisis and problems, and be able to address them through suitable channel.

.UNIT I-ATTITUDE

Factors influencing attitude, Challenges and lessons from Attitude, Etiquette and Confidence.

UNIT II-MOTIVATION

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

Maslow's Motivation Theory, Herzberg theory, Hygiene theory, XY theory.

UNIT III-LEADERSHIP

Leadership Styles, Skills for a good Leader, Assessment of Leadership Skills.

UNIT IV- Communication Management, Change Management, Crisis Management
Meaning, Types of communication, Barriers to effective communication, using communication skills to manage conflicts. Change Management: Internal, External parameters, Business communication. e-mail writing, Presentations, Report writing , Letters etc…Feedback System

Class room activities coupled with group tasks will be taken depending upon time availability

CODE: ME3701 FLUID MECHANICS & HYDRAULIC MACHINES LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-3-2**

Course Educational Objectives:

- To familiarize with conservation laws, dimensional analysis to fluid flow problems and hydraulic machines.

Course Outcomes:

Students undergoing this course are able to

- Measurement of various fluid properties and relate to practical applications.
- Design and conduct an experiment, as well as analyze and interpret data

LIST OF EXPERIMENTS

1. Verification of Bernoulli's theorem.
2. Coefficient of discharge of given Orifice meter / Venturi meter.
3. Coefficient of discharge of given Pitot tube.
4. Friction Factor of fluid flow by Major loss / Minor loss equipments.
5. Rate of flow using Rota meter.
6. Characteristic curves of Centrifugal Pump / Reciprocating Pump.
7. Characteristic curves of Gear Pump /Jet Pump.
8. Characteristic curves of Submersible Pump.
9. Characteristic curves of Pelton Wheel Turbine.
10. Characteristics curves of Francis Turbine.
11. Characteristic curves of Kaplan Turbine.

LIST OF EQUIPMENTS:

For a student's strength of 40

S. No.	Equipment Name	Nos. Required
1	Bernoulli's Theorem Apparatus	1
2	Orificemeter	1
3	Venturimeter	1

4	Pitot tube	1
5	Major Loss for friction factor	1
6	Minor Loss for friction factor	1
7	Rotometer	1
8	Centrifugal Pump	1
9	Reciprocating Pump	1
10	Submersible Pump	1
11	Submersible Pump	1
12	Jet Pump	1
13	Pelton Wheel Turbine	1
14	Francis Turbine	1
15	Kaplan Turbine	1
16	Stop Watch	8
17	Steel Ruler	2

Note: one teaching staff and one lab assistants required for a student's strength of 40

BEYOND THE SYLLABUS:

- Study about Cut section of turbines
- Study about Cut section of pumps
- Experiment in Impulse turbine

CODE: ME3702 METROLOGY & INSTRUMENTATION LAB

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **0-0-3-2**

Course Educational Objectives:

- To understand by conducting experiments, (i) the linear and angular measurements and calibration (ii) the measurements of displacement, force, torque, temperature and vibration (iii) checking the limits of dimensional tolerance.

Course Outcomes:

Students undergoing this course are able to

- Design of measurement experiments to measure various parameters and correlate with theoretical knowledge.
- Ability to report the results of a laboratory experiment in written, oral & graphical manner.

LIST OF EXPERIMENTS

1. Measurement of Length, Height, Depth and Diameter by Veriner Caliper, Veriner Depth Micrometer Screw gauge
2. Angular Measurement by Bevel Protractor.
3. Angular Measurement by Sine Bar and Slip gauges.
4. Study and Applications of Surface Roughness Tester (Surftest SJ-210).
5. Study and Applications of Profile Projector- Model :300 TE
6. Study and Applications of Tool Maker's Microscope – Metzer.
7. Calibration of Pressure Gauge by Dead Weight Tester.
8. Calibration of Strain gauge
9. Measurement of Static Torque
10. Measurement of Displacement
11. Measurement of Force
12. Measurement of Dynamic Torque.

BEYOND THE SYLLABUS:

1. Coordinate Measuring Machine.

2. Study and Applications of Pyrometer, Stroboscope, Tachometer and Proving Ring.

3. Machine Vision System

4. Laser Measuring Instruments

ME3703 MACHINE DRAWING PRACTICE

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **1-0-3-2**

Objectives:

- To understand format of drawing sheet, angle of projections and practice of simple machine elements
- To practice free hand sketching of machine elements
- To understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Machine vice, Screw jack, Non-return valves, Safety valves, Bearings, Tail stock etc.

I. Machine Drawing Conventions:

Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

d) Title boxes, their size, location and details – common abbreviations & their liberal usage

e) Types of Drawings – working drawings for machine parts.

II. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.

b) Keys, cottered joints and knuckle joint.

c) Rivetted joints for plates

d) Shaft coupling, spigot and socket pipe joint.

e) Journal, pivot and collar and foot step bearings.

III. Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.

b) Other machine parts – Screws jacks, Machine Vices Plummer block, Tailstock.

c) Valves : Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS :
Machine Drawing – Dhawan, S.Chand Publications
Machine Drawing - K.L.Narayana, P.Kannaiah & K. Venkata Reddy, New Age Publishers

REFERENCES :
Machine Drawing – P.S.Gill.
Machine Drawing – Luzzader
Machine Drawing – Rajput
Textbook of Machine Drawing –K.C.John, 2009, PHI learning

CODE: ME3901 **SEMINAR-III**

Scheme of Internal Exam **: 25 Marks**
Credits **: 1**

Objectives:
Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

- Problem definition and specification
- Literature survey, familiarity with research journals
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
- Presentation - oral and written.

The evaluation is purely internal and will be conducted as follows:

Preliminary Report on progress of the work and viva	05 marks
Final report	05 marks
Presentation and Defence before a departmental committee consisting of Head, a senior faculty and supervisor	15 marks

III YEAR
II SEMESTER

Subject Code	Course Name	L-T-P	Credits
ME3201	Machining and Machine Tools	4-0-0	4
ME3202	Applied Thermodynamics-I	4-0-0	4
ME3203	Design of Machine Elements-II	4-0-0	4
ME3204	Heat Transfer	4-0-0	4
CS3001	Object oriented programming through Java	4-0-0	4
HS3201	Soft Skills-II	2-0-0	1
ME3801	Heat Transfer Lab	0-0-3	2
CS3601	Object oriented programming through Java Lab	0-0-3	2
ME3902	Seminar-IV	0-0-2	1
ME3000	Comprehensive Viva-I		1
Total		21-0-8	26

ME3201 MACHINING AND MACHINE TOOLS

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVES:

- To learn the tool material, geometry and mechanics of metal cutting for turning, drilling milling.
- To know the heat distribution, tool wear, tool life, various machining processes like lathe, milling, drilling, grinding etc.
- To learn various types of fixtures, conventional and unconventional machining

COURSE OUTCOMES:

- Able to understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. Student will understand the effect of various cutting parameters on cutting forces
- Able to know the various concepts about tool wear, tool life, cutting fluid etc.,
- Able to understand about machine tools such as Lathe, Drilling, Milling etc.,
- Able to calculate the machining time
- Able to understand the principles of design of Jigs and fixtures and their uses

UNIT-I

Tool Geometry: Single point cutting tool-types of reference systems–ASA,ORS and NRS systems and their Inter-relationships. Mechanism of chip formation, shear plane model. types of chips, effect of cutting parameters Forces in chip formation-Cutting force analysis- Ernst and Merchant analysis-theory of Lee and Shaffer. Effect of various cutting parameters on cutting forces, Theory of strain and strain rate in metal cutting and Energy considerations.

UNIT-II

Tool Wear: Different causes-various forms of tool wear-measurement of tool wear. Tool life. Machinability-criterion for machinability-influence of variables affecting machinability. Measurement of Cutting Forces and Temperatures Tool Materials: Various tool materials, their properties and general guidelines for selection. Cutting Fluids: Functions, properties, types and selection. Economics of Metal Cutting: Various types of costs and their estimation. Determination of cutting speed for maximum production rate and minimum cost criteria.

UNIT – III

Introduction to machine tools: Lathe: Description, types, operations, accessories, attachments and machine time calculations. Introduction to Capstan and Turret Lathe and Automatic Machine. Drilling: Description, types of drilling machines, drilling operations, machine time Calculations

UNIT-IV

Milling: Description, types of milling machines, Mounting of milling cutters, types of milling operations, machining time calculation, types of indexing methods. Shaping, Planning and Slotting: Description, types of machines and operations, tool setting and quick return mechanisms. Machining time calculations.

UNIT V

Grinding machine –Theory of grinding – classification of grinding machine – cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel, Different types of abrasives – bonds, specification and selection of a grinding wheel

Principles of design of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices.

TEXT BOOKS :

1. Metal cutting and machine tools by P.N.Rao.

2. Workshop Technology by S.K.HAJRA CHOUDHURY

3. Ghosh and Mallik, Manufacturing Science, Affiliated East-West Press, New Delhi.

REFERENCES:

1. Machine Tools – C.Elanchezhian and M. Vijayan /Anuradha Agencies Publishers.

2. Manufacturing Technology-KalpakJian- Pearson

3. P.C.Sharma, Production Engineering, Dhanpat Rai & Sons, New Delhi.

ME3202 APPLIED THERMODYNAMICS-I

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVE:

- To understand the operating principles of air standard and actual cycles involved in power producing devices.
- To understand the working principles and performance characteristics of I.C engines and compressors
- To understand combustion process in S.I and C.I engines

COURSE OUTCOMES:

- Student will learn about IC engine, classifications, its major components and performance parameters, and also working principles of both SI and CI engines with their indicator diagrams. Student will be able to differentiate air-standard cycles and actual cycles.
- Student can understand and draw the valve and port timing diagrams. Also student can understand the fuel injection systems, ignition systems, cooling and lubrication systems and their importance in increasing engine performance.
- Student will learn the combustion process, flame propagation and the stages of combustion in both SI and CI engines, and fuel requirements. Student will learn about the abnormal combustion phenomenon in both SI and CI engines, and losses due to this knocking phenomenon.
- Student will be able to calculate the indicated power, brake power and the friction power with their methods of measurement. Student can understand the methods to increase the engine performance. And student will also be able to calculate the engine performance parameters such as specific fuel consumption, mean effective pressure, estimated heat losses, etc.
- Student will learn the importance of compressors, working of reciprocating and rotary type compressors.
- Student can calculate the work output, volumetric efficiency, isothermal efficiency, etc. in single-stage and multi-stage reciprocating air compressor and also in rotary type compressor.

UNIT – I

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT-II

I.C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles – Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication.

UNIT – III

Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

Combustion in C.I. Engines : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT IV

Testing and Performance : Parameters of performance – measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

COMPRESSORS – Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating : Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, undercooling, saving of work, minimum work condition for stage compression.

UNIT-V

Rotary (Positive displacement type) : Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Dynamic Compressors : Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors : Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency-pressure rise calculations – Polytropic efficiency.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.

REFERENCES:

1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI
3. Thermal Engineering, Rudramoorthy - TMH

4. Thermodynamics & Heat Engines, B. Yadav, Central Book Depot., Allahabad
5. I.C. Engines, Heywood, McGrawHIll.
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta –S.Chand
7. Thermal engineering data book-B.Srinivasulu Reddy, JK International Pub.

ME3203 DESIGN OF MACHINE ELEMENTS-II

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVE:

- To learn design criteria of machine components, selection of materials and manufacturing process.
- To learn application of principles to design helical coiled and leaf springs, gears, curved beams, sliding contact and rolling element bearings, chain drives, IC engine components and fly wheels.

COURSE OUTCOMES:

- Students are able to design helical coiled springs used for two wheel vehicle and laminated springs for trucks
- Students are able to design spur, helical, bevel and worm gears for different input conditions and able to identify which gears can be used in the various applications
- Students are able to design journal bearings, roller bearings and ball bearings and to know the advantages of rolling contact bearings over sliding contact bearings
- Students are able to identify the various forces acting on the I.C engine parts, failure criteria to be adopted for different parts
- Able to know the importance of fly wheel in engines and able to design the fly wheel
- Students are able to identify the different stresses in the curved beams, know the design criteria for crane hook, C clamp and chain drives

Unit-I

Mechanical springs: Introduction. Different types of springs. Materials used for springs.
Helical Springs: Whal factor, calculation of stress, Deflection and energy stored in spring. Design for static and fluctuating loads.
Leaf Springs: Stress and Deflection. Nipping of Leaf springs. Design for static and fluctuating loads.

Unit-II

Gears: Introduction of gear drives, different types of gears, Materials used for gears. Standards for gears and specifications.
Spur Gear Design: Lewis equation, Beam strength of gear tooth and static design. Wear load and design for Wear. Dynamic loads on gear tooth. Design of Helical, Bevel and Worm gears, concepts of Design for manufacturability.

Unit-III

Bearings: Introduction. Materials used for Bearings. Classification of bearings and mounting of bearings.

Design of sliding contact bearings: Properties and types of Lubricants, Design of Hydrostatic and Hydrodynamic sliding contact bearings.

Design of Rolling Contact Bearings: Different types of rolling element bearings and their constructional details, static load carrying capacity. Dynamic load carrying capacity. Load-life relationship, selection of bearing life. Design for cyclic loads and speeds. Design of Ball and Roller bearings.

Unit-IV

I.C. Engine parts: Introduction. Materials used. Design of piston, connecting rod and crank for I.C. Engines.

Fly wheels: Introduction. Design of solid disk type and rimmed fly wheels.

Unit-V

Design of curved beams: Introduction stresses in curved beams, expression for radius of curvature of neutral axis for rectangular, circular, trapezoidal and T-sections. Design of crane Hook, C-clamp.

Design of chain drives: Power rating of roller chains. Strength of roller chains.

Suggested Reading

1. Bhandari V.B. *Machine Design*, Tata Mc Graw Hill Publications, 1994.
2. J.E. Shigley , C.R. Miskhe, *Mechanical Engineering Design*, Tata Mc Graw Hill Publication, 2003.
3. P. Kannaiah, *Machine Design*, Science-Tech Publications, 2003.
4. M.F. Spotts, *Design of Machine Elements*, Prentice Hall, 1964.
5. Robert L. Norton, *Machine Design: An Integrated Approach*,2/e PearsonEducation, 2000

ME3204 HEAT TRANSFER

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVE:

- To understand the basic concepts of heat transfer.
- To study the concepts of conduction, convection, radiation and heat exchangers applicable for commercial and industrial use.
- To study and solve problems on different modes of heat transfer which are related to thermal power plants, refrigeration and air conditioning.

COURSE OUTCOMES:

- Able to grasp the concept of steady state conduction. Student can learn representing conduction equation in various forms
- Able to understand the concept of extended surfaces and its applications. Also, will aware transient heat conduction and how it vary w.r.t time.
- Expected to develop the ability to formulate practical conduction heat transfer problems by transforming the physical system into a Mathematical model and selecting an appropriate solution technique and evaluating the significance of results
- Able to formulate practical forced and natural convection heat transfer problems by transforming the physical system into a mathematical model.
- Able to calculate heat transfer in condensation and boiling systems, turbulent and laminar film condensation.

UNIT – I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

UNIT – II

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – boundary and Initial conditions.

One Dimensional Steady State Heat Conduction: in Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius/thickness of insulation-with Variable Thermal conductivity –with internal heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to errors in Temperature measurement.

One Dimensional Transient Heat Conduction: in Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Problems on semi-infinite body.

UNIT – III

Convective Heat Transfer: Dimensional analysis–Buckingham π Theorem and its application for developing semi – empirical non- dimensional correlations for convective heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

Forced convection: External Flows: Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer for flow over-Flat plates, Cylinders and spheres..

Internal Flows: Division of internal flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of empirical relations for convective heat transfer in Horizontal Pipe Flow, annular flow.

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation.

UNIT IV

Heat Transfer with Phase Change: Boiling: Pool boiling – Regimes, determination of heat transfer coefficient in Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

Heat Exchangers:

Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT V

Radiation Heat Transfer

Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities– laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between gray bodies – radiation shields– electrical analogy for radiation networks.

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer / R.C. Sachdeva / New Age International
2. Fundamentals of Heat and Mass Transfer/M.Thirumaleswar/Pearson Edu.

REFERENCE BOOKS:

1. Heat Transfer – P.K.Nag/ TMH
2. Heat Transfer / Holman .J.P/TMH
3. Heat and Mass Transfer –Cengel- McGraw Hill.
4. Heat and Mass Transfer – R.K. Rajput – S.Chand & Company Ltd.
5. Heat and Mass Transfer-Kondandaraman

CS3001 OBJECTED ORIENTED PROGRAMMING THROUGH JAVA

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

Objectives:

- To be able to differentiate between structures oriented programming and object oriented programming.
- To be able to use object oriented programming language like Java and associated libraries to develop object oriented programs.
- To Able to understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using Java language.
- To be able to apply concepts of operator overloading, constructors and destructors.
- To be able to apply exception handling and use built-in classes

COURSE OUTCOMES:

CO 1: Learning principals of object oriented programming paradigm in Java including classes, Objects, Methods, Abstraction, encapsulation, inheritance and polymorphism.

CO 2: Understand fundamentals of programming such as variables, conditional and iterative execution, methods, packages & interfaces etc.

CO 3: Learning the concept of inheritance to create new classes from existing one & Design the classes needed given a problem specification;

CO 4: Learning how to detect exceptions and to handle strings & Implement the designed classes using the object oriented programming language

CO 5: Learn how to test, verify, and debug object-oriented programs; and Learning about multithreading and multitasking.

CO 6: Creating and Demonstrating Applications using the concept of OOPS, event handling, JDBC Connectivity used in GUI with Java.

UNIT-1:

Introduction to OOPS: Paradigms of Programming Languages, Basic concepts of Object Oriented Programming, Differences between Procedure Oriented Programming and Object Oriented Programming, Objects and Classes, Data abstraction and Encapsulation, Inheritance,

Polymorphism, Dynamic binding, Message communication, Benefits of OOP , Application of OOPs.

Java : History, Java features, Java Environment, JDK, API.

Introduction to Java : Types of java program, Creating and Executing a Java program, Java Tokens, Keywords, Character set, Identifiers, Literals, Separator, Java Virtual Machine (JVM), Command Line Arguments, Comments in Java program.

UNIT -2:

Elements: Constants, Variables, Data types, Scope of variables, Type casting, Operators: Arithmetic, Logical, Bit wise operator, Increment and Decrement, Relational, Assignment, Conditional, Special operator, Expressions – Evaluation of Expressions

Decision making and Branching: Simple if statement, if, else statement, Nesting if, else, else if Ladder, switch statement, Decision making and Looping: While loop, do, While loop, for loop, break, labelled loop, continue Statement.-, Simple programs

Arrays: One Dimensional Array, Creating an array, Array processing, Multidimensional Array, Vectors, Wrapper classes, Simple programs

UNIT-3:

Strings: String Array, String Methods, String Buffer Class, Simple programs

Class and objects: Defining a class, Methods, Creating objects, Accessing class members, Constructors, Method overloading, Static members, Nesting of Methods, this keyword, Command line input, Simple programs

Inheritance: Defining a subclass, Deriving a sub class, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Overriding methods, Final variables and methods, Final classes, Finalizer methods, Abstract methods and classes, Visibility Control: Public access, Private access, friend, protected. Interfaces: Multiple Inheritance, Defining interface, Extending interface, Implementing Interface, Accessing interface variables, Simple programs

UNIT- 4:

Packages: Java API Packages, System Packages, Naming Conventions, Creating & Accessing a Package, Adding Class to a Package, Hiding Classes, Programs

Applets: Introduction, Applet Life cycle, Creating & Executing an Applet, Applet tags in HTML, Parameter tag, Aligning the display, Graphics Class: Drawing and filling lines, Rectangles, Polygon, Circles, Arcs, Line Graphs, Drawing Bar charts, Programs

AWT Components and Even Handlers: Abstract window tool kit, Event Handlers, Event Listeners, AWT Controls and Event Handling: Labels, TextComponent, ActionEvent, Buttons, CheckBoxes, ItemEvent, Choice, Scrollbars, Layout Managers- Input Events, Menus, Programs

UNIT-5:

Exception Handling: Limitations of Error handling, Advantages of Exception Handling, Types of Errors, Basics of Exception Handling, try blocks, throwing an exception, catching an exception, finally statement

Multithreading: Creating Threads, Life of a Thread, Defining & Running Thread, Thread Methods, Thread Priority, Synchronization, Implementing runnable interface, Thread Scheduling.

I/O Streams: File, Streams, Advantages, The stream classes, Byte streams, Character streams.

JDBC, ODBC Drivers, JDBC ODBC Bridges, Seven Steps to JDBC, Importing java SQL Packages, Loading & Registering the drivers, Establishing connection. Creating &Executing the statement.

Suggested References:

1. Programming with Java - E. Balagurusamy
2. Java the complete reference, 7th editon, Herbert schildt, TMH.
3. Understanding OOP with Java, updated edition, T. Budd, pearsoneduction.
4. Object oriented Programming in Java - Dr. G.Thampi
5. Let us Java – Yashavant Kanetkar - BPB Publications, New Delhi - First Edition 2012

An Introduction to Oops with Java - C Thomas WU - TataMc-Graw Hill, 4th Edition

HS3201 **SOFT SKILLS-II**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **2-0-0-1**

Objectives:

1. To enable students speak effectively in formal and informal situations
2. To equip the students with necessary writing skills in order to face the corporate world
3. To strengthen the writing skills of the students and help them in documentation
4. To enable students sharpen their communication skills towards writing a persuasive resume and effective job application letters
5. To equip students with pre-presentation steps, to understand the structure of a good presentation, and devise various techniques for delivering a successful presentation
6. To make students understand the importance of team work and group presentations and group discussions

Outcomes:

Students will be able:

1. communicate effectively in formal and informal situations
2. understand the structure and mechanics of writing resumes, reports, documents and e-mails
3. present effectively in academic and professional contexts
4. develop communication in writing for a variety of purposes
5. identify areas of evaluation in Group Discussions conducted by organizations as part of the selection procedure
6. overcome stage fear and tackle questions

UNIT-I

Activities on Fundamentals of Inter-personal Communication

Starting a conversation - responding appropriately and relevantly - using the right body language-Role Play in different situations & Discourse Skills using visuals.

UNIT-II

Activities on Reading Comprehension

General Vs Local comprehension- reading for facts- guessing meanings from context- scanning-skimming- inferring meaning- critical reading - effective googling.

UNIT-III

Activities on Writing Skills

Structure and presentation of different types of writing- Resume writing/ e-correspondence/ Technical report writing- planning for writing - improving one's writing.

UNIT-IV

Activities on Presentation Skills

Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations

UNIT-V

Activities on Group Discussion and Interview Skills - Dynamics of group discussion- intervention-summarizing-modulation of voice-body language-relevance-fluency and organization of ideas and rubrics for evaluation- Concept and process-pre-interview planning-opening strategies-answering strategies-interview through tele-conference & video-conferencing - Mock Interviews.

Suggested References:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.

2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.

3. Technical Communication by Paul V. Anderson , 2007. Cengage Learning pvt. Ltd. New Delhi.

4. Business and Professional Communication: Keys for Workplace Excellence, Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications, 2011.

5. The Basics of Communication: A Relational Prespective, Stev Duck & David T. Mc Mahan. Sage South Asia Edition. Sage Publications, 2012.

6. English Vocabulary in Use series, Cambridge University Press 2008.

7. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley, 2012. Cengage Learning.

9. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.

10. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

ME3801 HEAT TRANSFER LAB

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Course Educational Objectives:

- To understand the principles of conduction, convection and radiation heat transfer and their applications in the design of heat exchangers and insulations.

Course Outcomes:

Students undergoing this course are able to

- Design of experiments to study thermal power cycles and other thermal systems including compressors, turbines and combustion systems.

LIST OF EXPERIMENTS

1. Evaluation of thermal conductivity using lagged pipe apparatus.
2. Determination of thermal conductivity using guarded plate apparatus.
3. Evaluation of Stefan Boltzmann Constant.
4. Determination of radiation from a grey body.
5. Determination of heat transfer co-efficient using pin-fin apparatus.
6. Evaluation of COP of refrigerant
7. Experiment on parallel flow heat exchanger
8. Experiment on counter flow heat exchanger
9. Determination of convective heat transfer coefficient during natural convection.
10. Determination of convective heat transfer coefficient during forced convection.
11. Study of air-conditioning test rig
12. Study of air blower
13. Study of air compressor

LIST OF EQUIPMENTS

For a student's strength of 40

S. No.	Equipment Name	Nos. Required
1	Lagged Pipe Apparatus	1
2	Guarded Hot Plate Apparatus	1
3	Stefan Boltzmann Apparatus	1
4	Emissivity Measurement Apparatus	1
5	Heat Transfer Through Pin Fin Apparatus	1
6	Refrigeration Test Rig	1
7	Parallel Flow And Counter Flow Heat Exchanger	1
8	Natural Convection Apparatus	1
9	Forced Convection Apparatus	1
10	Horizontal Single Stage Double Acting Compressor	1
11	Air Conditioning Test Rig	1

BEYOND THE SYLLABUS:

1. Shell and tube heat exchanger
2. Thermal convective coefficient for AL using natural convection
3. Thermal convective coefficient for AL using forced convection
4. Study of vapour absorption refrigeration system

CS3601 OBJECTED ORIENTED PROGRAMMING LAB

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Objectives:

- To be able to apply an object oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
- To be able to reuse the code and write the classes which work like built-in types.
- To be able to design applications which are easier to debug, maintain and extend.
- To be able to apply object-oriented concepts in real world applications.

Outcomes:

CO 1: Be able to analyze and design a computer program to solve real world problems based on object-oriented principles.

CO 2: Be able to write simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles.

CO 3: A competence to design, write, compile, test and execute straightforward programs using a high level language.

CO 4: Demonstrate the ability to employ various types of selection constructs in a Java program. Be able to employ a hierarchy of Java classes to provide a solution to a given set of requirements.

CO 5: Become familiar with the fundamentals and to acquire programming skills in the Java language.

Experiments:

1. A program to illustrate the concept of class with constructors, methods and overloading.
2. A program to illustrate the concept of inheritance and dynamic polymorphism.
3. A program to illustrate the usage of abstract class.
4. A program to illustrate multithreading.
5. A program to illustrate thread synchronization.
6. A program to illustrate Exception handling.
7. A program to illustrate user-defined Exceptions
8. A program to demonstrate use of User-defined Packages.
9. A program using String Tokenize.
10. A program using Linked list class
11. A program using Tree Set class

12. A program using Hash Set and Iterator classes
13. A program using Map classes.
14. A program using Enumeration and Comparator interfaces.
15. A program using File and Filename Filter
16. A program to illustrate the usage of Byte and Character I/O streams.
17. A program to illustrate the usage of Serialization.
18. Program using Data class.\
19. An application involving GUI with different controls, menus and event handling.
20. A program to implement an applet.

For the detailed list of programs refer the lab manual.

Note: Any experiment according to the syllabus of CS3001 can be substituted

CODE: ME3902 **SEMINAR-IV**

Scheme of Internal Exam **: 25 Marks**
Credits **: 1**

Objectives:
Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

- Problem definition and specification
- Literature survey, familiarity with research journals
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
- Presentation - oral and written.

The evaluation is purely internal and will be conducted as follows:

Preliminary Report on progress of the work and viva	05 marks
Final report	05 marks
Presentation and Defence before a departmental committee consisting of Head, a senior faculty and supervisor	15 marks

CODE: ME3000 COMPREHENSIVE VIVA-I

Scheme of External Exam **: 50 Marks**
Credits **: 1**

Students are assessed in the courses they have undergone till the completion of that academic year. They are asked to comprehend the concepts in the core subjects and the elective subjects, to make them ready to face technical interviews which improve their employability skills.

There are no sessional marks. The end examination shall be conducted by a committee consisting of an External examiner, Head of the department and two senior faculty members. The evaluation is purely external and it carries marks 50.

IV YEAR
I SEMESTER

Subject Code	Course Name	(L-T)-P	Credits
ME3900	Summer Internship	-	6
ME4101	Applied Thermodynamics-II	4-0-0	4
ME4102	CAD/CAM	4-0-0	4
ME4103	Refrigeration and Air Conditioning	4-0-0	4
ME440X	Elective-I	4-0-0	3
ME441X	Elective-II	4-0-0	3
ME4701	Applied Thermodynamics Lab	0-0-3	2
ME4702	CAD/CAM Lab	0-0-3	2
ME4703	Automation and Robotics Lab	0-0-3	2
Total		20-0-17	30

Sem 1 Electives			
ME4401	Composite Materials	4-0-0	3
ME4402	Non-Traditional Manufacturing Processes	4-0-0	3
ME4403	Advanced Fluid Mechanics	4-0-0	3
ME4404	Tribology	4-0-0	3
IM4405	Production Planning & Control	4-0-0	3

Sem 2 Electives			
ME4411	Welding Technology	4-0-0	3
ME4412	Automobile Engineering	4-0-0	3
ME4413	Computational Fluid Dynamics	4-0-0	3
ME4414	Finite Element Methods in Engineering	4-0-0	3
ME4415	Experimental Stress Analysis	4-0-0	3

ME4101 APPLIED THERMODYNAMICS-II

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVE:

- This subject is designed to provide a sound knowledge in various aspects of thermal equipments.
- This subject has an increasingly dominant role to play in the vital areas of power generation, energy sector.
- The course contents aims at developing the necessary analytical and technical contents among engineers in these areas.
- The students shall become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions.
- This subject is designed to know how the efficiencies have increased from starting stage to till now

COURSE OUTCOMES:

2. Student can be able to illustrate the power generation through Rankine cycle. Student can able understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation
3. Student can able to understand the working of different high pressure and low pressure boilers. Student can distinguish mountings and accessories. The student can calculate the chimney height for maximum discharge. Student can know the draughts and its application in the steam generator.
4. Students are advised to visit the Boilers in the power generation units to get better expose
5. Student can be able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle. Student can able to entail the concept of Critical pressure ratio in calculations
6. At the end of turbines chapter, student can able to distinguish the working of impulse and reaction turbines. Student can able to construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine
7. At the end of jet propulsion unit, student can be familiar with the basic components of a gas turbine power plant. Student can illustrate the power generation using Joule Cycle. Student can know the methods to increase the specific power output and efficiency of the cycle. Also, Student can able to know the working of various propulsive devices

UNIT – I

Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration – reheating- combined- cycles.

Boilers : Classification based on Working principles & Pressures of operation -L.P & H.P.Boilers – Mountings and Accessories – Boiler horse power, equivalent evaporation, efficiency and heat balance – **Draught**: classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced draught.

UNIT – II

Steam Nozzles: Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions –velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio. Criteria for design of nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line –Shock at the exit.

UNIT – III

Impulse turbine; Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval Turbine - its features. Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.

UNIT IV

Steam Condensers : Requirements of steam condensing plant, rare fraction – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its effects, air pump- cooling water requirement.

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UNIT – V

Gas Turbines : Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi closed cycles – merits and demerits

TEXT BOOKS:

1. Thermal Engineering / R.K. Raj put / Lakshmi Publications
2. Basic and Applied Thermodynamics / P.K. Nag/TMH

REFERENCES:

1. Gas Turbines – V.Ganesan /TMH
2. Thermodynamics and Heat Engines / R. Yadav / CentralBook Depot
3. Gas Turbines and Propulsive Systems – P.Khajuria &S.P.Dubey - /Dhanpatrai
4. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
5. Thermal Engineering-M.L.Mathur & Mehta/Jain bros.
6. Thermal Engineering Data Book – B. S. Reddy and K. H. Reddy / I.K. International

ME4102 **CAD/CAM**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVE:

- To help the students in understanding the functioning of computer numerical control machine tools and also in writing programs for operating this machines.
- To help the student in understanding advanced manufacturing concepts like Group technology, flexible manufacturing systems, Computer aided Process Planning, Computer aided quality control, Artificial Intelligence etc.

COURSE OUTCOMES:

- Able to understand the basic concepts Automation, components of CAD/CAM, input and output components of CAD, Steps involved in computer aided design.
- Able to understand the geometric model of the component in CAD technology of computer graphics.
- Able to understand the techniques of raster technology, scan conversion, clipping, removal of hidden lines and hidden surfaces, color, shading and texture.
- Able to understand the principle of NC, CNC , Machining Centre and various methods of part programming.
- Understanding the need of GT as a means of bringing the benefits of mass production to relatively smaller production.
- Understanding the need of computers in process planning and QC
- Understanding the definition and concept of FMS, and its elements etc.

Unit-I

CAD Fundamentals: Classification and basic elements of CAD work station hardware, Hardware integration and networking. CAD Software: Definitions of system software and application software. Graphic Standards and Exchange Formats. CAD database and structure.

Automatic 2-D facilities such as Fillets, Chamfers, Hatching, Dimensioning, Editing, Windowing & Zooming. 2-D & 3-D Geometric Transformations.

Unit-II

Geometric modeling: 3-D wire frame modeling: wire frame entities and their definitions, Interpolation and approximation of curves, synthetic curves and curve fitting. Definitions of cubic, Bezier, and B-spline curves.

Surface modeling: Definitions of basic surfaces, surface of revolution, blends, intersection, and Cubic, Bezier, B-spline surfaces.

Solid Modeling: Solid entities, Boolean operations, B-rep and C-rep approaches. Feature based modeling: Concepts and applications, Assembly modeling.

Finite element modeling: Introduction, modeling, Meshing, Characteristics of different elements, different solvers and post processing.

Unit-III

Numerical Control of machine Tools: Features and elements of NC. Positional, paraxial and contouring types. Definitions of axes, punched type, formats of tape preparation. Definitions of interpolation, post-processor, preparatory and miscellaneous functions, canned cycles, tool length and cutter radius compensation. Manual and computer aided part programming (APT) for simple components. Programming with MACROS.

Unit-IV

Computer Control in NC and Robots: Machining centers, CMC, DNC and adaptive control systems. Their types, typical configurations and relative features.

Industrial Robots: Classification based on manipulator configurations, relative characteristics, Online and offline programming methods, controls and drives, applications.

Unit-V

Group Technology: Organization, G.T. layout, part classification and coding, CAPP: Variant and Generative approaches and their relative features.

Computer Aided Quality Control: Computer in quality control, Contact and non contact inspection, optical and non optical computer aided testing.

Others: Basic concepts of FMS, Experts systems. Artificial intelligence, Typical Applications of computer in manufacturing viz. management, in-process measurement, CAD/CAM integration.

Suggested Reading

1. Ibrahim Zeid, "CAD/CAM, theory and practice", McGraw Hill Inc, N.Y.1991.
2. Grover, MP and Zimmers E.W., "CAD/CAM", Prenctice Hall of India 1989.
3. Rao P.N., Tiwari N.K., Kundra T.K., "Computer Aided Manufacturing", Tata McGraw Hill, New Delhi, 1993.
4. Radhakrishnan. P, Subramanyan. S, Raju. V, "CAD/CAM/CIM", New Age international (P) Ltd., 2nd Edn., 2004.

REFERENCES:

1. Automation, Production systems & Computer integrated Manufacturing, Groover,P.E
2. CAD / CAM / CIM , Radhakrishnan and Subramanian, New Age
3. Principles of Computer Aided Design and Manufacturing , Farid Amirouche, Pearson
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH
5. Computer aided design and manufacturing, Lalit Narayan/ PHI.

ME4103 REFRIGERATION & AIR CONDITIONING

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

COURSE OBJECTIVE:

- To enable the students to understand the various types refrigeration and air conditioning systems
- To create confidence to solve complex problems in the field refrigeration and air conditioning
- To provide knowledge on various refrigeration cycles, system components and refrigerants.

COURSE OUTCOMES:

- Students will demonstrate an understanding of the need and importance of HVAC technology, the typical and some advanced and innovative schematic designs, and the goals of HVAC engineering and HVAC systems.
- Students will demonstrate an understanding thermal comfort conditions with respect to temperature and humidity and human clothing and activities and its impact on human comfort, productivity, and health.
- Students will demonstrate an understanding of the needs and requirements for ventilation and its impact on design and energy and its impact on human comfort, productivity, and health.
- Students will demonstrate an understanding of psychrometrics and its application in HVAC engineering and design and will practice or observe psychrometric measurements.
- Students will demonstrate an understanding of heat transfer in buildings with a given architectural design and its application to heating and cooling load estimation especially including thermal lag effects by conducting a detailed annual load analysis for a representative building and present the results of this analysis in a formal report possibly including recommendations for energy conservation.
- Students will demonstrate an understanding of the engineering and operation of vapor compression and possibly heat-driven refrigeration systems and evaporative cooling systems and understand contemporary issues of ozone depletion and global warming potential with respect to refrigeration systems.
- Students will demonstrate an understanding of fluid mechanics in building air or coolant distribution systems and in room air distribution and its application to efficient piping and duct systems and effective room air distribution systems and associated flow machines and control systems.
- Students will demonstrate a working understanding of energy prediction methods and energy related codes and standards and understand contemporary issues of energy conservation and global warming potential with respect to HVAC systems.

UNIT I : REFRIGERATION SYSTEM

Introduction to Refrigeration system : Necessity and applications – Unit of refrigeration and C.O.P. Mechanical Refrigeration – Types of Ideal cycles of refrigeration. Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems Refrigeration needs of Air crafts.

UNIT II :VAPOUR COMPRESSION AND ABSORPTION REFRIGERATION

Vapour compression refrigeration – working principle and essential components of the plant simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p h charts effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems

Vapor Absorption System – Calculation of max COP – description and working of NH3 water system and Li Br –water (Two shell & Four shell) System. Principle of operation Three Fluid absorption system, silent features

UNIT III SYSTEM COMPONENTS

System Components : Compressors – General classification – comparison – Advantages and Disadvantages. Condensers classification Working Principles Evaporators classification Working Principles Expansion devices Types Working Principles Refrigerants – Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion Global Warming

UNIT IV AIR CONDITIONING

Introduction to Air Conditioning Review of fundamental properties of psychometric – use of sychometric charts – psychometric processes – Grand and Room Sensible Heat Factors – by pass factor – requirements of comfort air conditioning –factors governing optimum effective temperature, recommended design conditions and ventilation standards. Concept of ESHF and ADP Requirements of human comfort and concept of effective temperature- Comfort chart – Comfort Air conditioning – Requirements of Industrial air conditioning, Air conditioning Load Calculations.

UNIT V AIR CONDITIONING SYSTEMS AND HEAT PUMP

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat Pump – Heat sources – different heat pump circuits, air conditioning applications

TEXT BOOKS:

1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw Hill.2010
2. Ballany P.L., Refrigeration and Air Conditioning, Khanna Publications,2009

REFERENCE BOOKS:

1. Domkundwar, Refrigeration and Air Conditioning, Dhanpat Rai,2010
2. Ashrae Hand Book', 4 Vol., Current Ed., Carrier Air Conditioning Co., 'Hand Book of Air Conditioning', Prentice Hall of India, 1982
3. Basic Refrigeration and Air Conditioning**,** Tata McGraw-Hill Education, Apr-2005.

URL:

1. http://en.wikipedia.org/wiki/Refrigeration

2. http://www.youtube.com/watch?v=b527al9D_rY
3. http://home.howstuffworks.com/refrigerator4.htm

BEYOND THE SYLLABUS:

1.HVAC system
2.More depth in P-H Problems
3. Alternative Refrigerants
4. cryo systems

ME440X **ELECTIVE-I**

Externals: 60Marks **L-T-P-C**
Internals: 40Marks **4-0-0-3**

COMPOSITE MATERIALS (ME 4401)

UNIT – I

Introduction to composites: Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC, Fiber reinforced composites. Applications of various types of composites.

UNIT – II

Polymer matrix composites: Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand layup processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP).

UNIT III

Metal matrix composites: Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix.. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

UNIT IV

Ceramic matrix composites: Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V

Advances in composites: Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

Text Books:

1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall,London, England, 1st edition, 1994.

2. Chawla K.K., Composite materials, Springer – Verlag, 1987

Reference Books:

1. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press,1993.

2.Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.

3.Sharma S.C., Composite materials, Narosa Publications, 2000.

4.Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT- Madras, December 2001.

NON-TRADITIONAL MANUFACTURING PROCESSES (ME 4402)

UNIT— I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications.

Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT—II

Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters, applications and limitations.

UNIT – III

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT—IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations.

Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT-V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

TEXT BOOK

- Advanced machining processes – VK Jam, Allied publishers.
- Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.

REFERENCES

- Modern Machining Process – Pandey P.C. and Shah H.S., TMH.
- New Technology – Bhattacharya A, The Institution of Engineers, India 1984.
- Unconventional Machining Processes – C. Elanchezhian,, B. Vijaya Ramnath and M Vijayan, Anuradha Publications, 2005.
- Unconventional Manufacturing Processes – M.K. Singh, New Age International Publishers.

ADVANCED FLUID MECHANICS (ME 4403)

UNIT- I

Inviscid flow of incompressible fluids: Lagrangian and Eulerain Descriptions of fluid motion- Path lines, Stream lines, Streak lines, stream tubes – velocity of a fluid particle, types of flows, Equations of three dimensional continuity equation- Stream and Velocity potential functions.

Basic Laws of fluid Flow: Condition for irrotationality, circulation & vorticity Accelerations in Cartesystems normal and tangential accelerations, Euler's, Bernouli equations in 3D– Continuity and Momentum Equations

UNIT- II

Viscous Flow: Derivation of Navier-Stoke's Equations for viscous compressible flow – Exact solutions to certain simple cases : Plain Poisoulle flow - Coutte flow with and without pressure gradient – Hagen Poisoulle flow - Blasius solution.

UNIT- III

Boundary Layer Concepts : Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate – Approximate solutions – Creeping motion (Stokes) – Oseen's approximation - Von-Karman momentum integral equation for laminar boundary layer — Expressions for local and mean drag coefficients for different velocity profiles.

UNIT- IV

Introduction to Turbulent Flow: Fundamental concept of turbulence – Time Averaged Equations – Boundary Layer Equations - Prandtl Mixing Length Model - Universal Velocity Distribution Law: Van Driest Model –Approximate solutions for drag coefficients – More Refined Turbulence Models – k-epsilon model - boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders

Internal Flow: Smooth and rough boundaries – Equations for Velocity Distribution and frictional Resistance in smooth rough Pipes – Roughness of Commercial Pipes – Moody's diagram.

UNIT- V

Compressible Fluid Flow – I: Thermodynamic basics – Equations of continuity, Momentum and Energy - Acoustic Velocity Derivation of Equation for Mach Number – Flow Regimes – Mach Angle – Mach Cone – Stagnation State

Compressible Fluid Flow – II: Area Variation, Property Relationships in terms of Mach number, Nozzles, Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock: Expansion and Compressible Shocks – Supersonic Wave Drag.

TEXT BOOKS:

1.Fluid Mechanics / L.Victor Steeter / TMH

2.Fluid Mechanics / Frank M.White / MGH

REFERENCES:

1.Fluid Mechanics and Machines/Modi and Seth/Standard Book House

2.Fluid Mechanics/Cohen and Kundu/Elsevier/5th edition

3.Fluid Mechanics/Potter/Cengage Learning

4.Fluid Mechanics/William S Janna/CRC Press

5.Fluid Mechanics / Y.A Cengel and J.M Cimbala/MGH

6.Boundary Layer Theory/ Schlichting H /Springer Publications

7.Dynamics & Theory and Dynamics of Compressible Fluid Flow/ Shapiro.

8.Fluid Dynamics/ William F. Hughes & John A. Brighton/TMH

TRIBOLOGY (ME 4404)

UNIT I

Surfaces and friction: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction - Adhesion Ploughint- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction - Stick slip motion - Measurement of Friction.

UNIT II

Wear: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear - Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III

Lubricants and lubrication types: Types, properties, Requirements of Lubricants - Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication, Mist lubrication, Requirements of lubrication, Solid Lubrication, Hydrostatic Lubrication.

UNIT IV

Film lubrication theory: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

UNIT V

Surface engineering and materials for bearings: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Text Books:

1. I.M. Hutchings, Tribology, " Friction and Wear of Engineering Material ", Edward Arnold, London, 1992.

Reference Books:

1. T.A. Stolarski, " Tribology in Machine Design ", Industrial Press Inc., 1990.

2. Kenneth C Ludema, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press,1996.

3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.

4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1975.

5. B.C. Majumdar "Introduction to Tribology bearings", S. Chand

PRODUCTION PLANNING & CONTROL (IM 4405)

UNIT-I

Introduction: Definitions — objectives of production planning and control- functions of production planning and control-elements of production control- types of production- organization of production planning and control — internal organizations department

UNIT-II

Forecasting — Importance of forecasting — types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III

Inventory management — Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model — Inventory control systems — P- Systems and Q — Systems Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

UNIT- IV

Routing — Definition — routing procedure- Route sheets — Bill of material- factors affecting routing procedure. Schedule — definition — difference with loading. Scheduling polices — techniques, standard scheduling methods- job shop, flow shop,. Line balancing, aggregate planning- methods for aggregate planning- Chase planning, expediting, control aspects.

UNIT-V

Dispatching — Activities of dispatcher- Dispatching procedure – follow up — definition — reasons for existence of functions — types of follow up, applications of computer in production planning and control

TEXT BOOKS

- Production Planning and Control! M.Mahajan/ Dhanpati ral & Co.
- Production Planning and Control/ Jam & Jam! Khanna publications

REFERENCE BOOKS

- Production Planning and Control- Text & cases! SK Mukhopadhyaya/PHI.
- Production and operations ManagemenU R.Panneer Selvam/PHI.
- Operations Managemen UChase/PHI.
- Operations managemenU Heizer/Pearson. Production and Operations Management (Theory and Practice) / Dipak
- Kumar Bhaffacharyya/University Press.
- Operations Managemen US.N. Chary ITMH.

ME441X ELECTIVE-II

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-3**

WELDING TECHNOLOGY (ME 4411)

UNIT-I

Introduction: Welding as compared with other fabrication processes, Importance and application of welding, classification of welding processes, Health & safety measures in welding. Welding Power Sources: Physics of welding Arc, Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.

Physics of Welding Arc: Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow. Metal Transfer: Mechanism and types of metal transfer in various arc welding processes.

UNIT-II

Welding Processes: Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrogas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding & Microwave welding.

UNIT-III

Heat Flow Welding: Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates; weld thermal cycles; residual stresses and their measurement; weld distortion and its prevention.

UNIT-IV

Repair & Maintenance Welding: Hardfacing, Cladding, Surfacing, Metallizing processes and Reclamation welding. Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, Cast Iron and aluminium. Micro & Macro structures in welding.

UNIT-V

Weld Design: Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testing of welds.

Books and References:

1. Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.
2. Welding Principals and Practices, by- Edwars R. Bohnart, McGraw Hill Education.
3. Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishsers.
4. Welding Handbooks (Vol. I & II).

AUTOMOBILE ENGINEERING (ME 4412)

UNIT I

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit –Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive – Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

UNIT II

Emissions from Automobiles – Pollution Standards National and International – Pollution Control–Techniques – Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits. Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Température Indicator.

UNIT III

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter. Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

UNIT IV

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

UNIT V

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System. Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors, 13th edition, 2013.

2. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.

Reference Books:

1. Automobile Engineering , R.K.Rajput,Laxmi Pub, 1st edition, 2013.

2. Automobile Engineering , K.K.Ramalingam/Scitech Pub, 2nd edition.

3. Automotive engines , Newton, Steeds & Garret.

COMPUTATIONAL FLUID DYNAMICS (ME 4413)

UNIT I

Introduction: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

UNIT II

Finite differences: Discretization, consistency, stability, and fundamentals of fluid flow modeling. Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT III

Errors and stability analysis: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme. Review of equations governing fluid flow and heat transfer: Introduction, Conservation of mass Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

UNIT IV

Steady flow: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

UNIT V

Simple cfd techniques: Viscous flows conservation form space marching, relovation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high reynolds number models and their applications.

Text Books:

1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press, India.

2. Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.

Reference Books:

1. Computational Fluid Dynamics for Engineers, Ronnie Anderson (2012), 2nd edition, Cambridge University Press, India.

2. Computational aerodynamics and fluid dynamics an introduction, Jean-Jacques Chattot, (2010),3rd edition, Springer, Germany.

3. Essential computational fluid Dynamics – olegzikanov, wiley India.

4. Introduction to computational fluid dynamics – pradip, Niyogi S.K. Chakrabary, M.K. Laha

FINITE ELEMENT METHODS IN ENGINEERING (ME 4414)

UNIT I

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions.

Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.

Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems. Solution methods for solving simultaneous equations.

UNIT II

Problems with One-dimensional geometry: Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.

Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations.

Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

UNIT III

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.

Higher Order and Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

UNIT IV

Finite Element Application in Solid Mechanics: Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Isoparametric, subparametric and superparametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.

Axi-symmetric triangular elements: formulation of stiffness and load vectors. Introduction to 3D stress analysis.

UNIT V

Heat Transfer and Fluid Mechanics Problems: Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems.

Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces. Two dimensional potential flow problems: Potential function formulation and stream function formulation

Text Books:

1. Introduction to Finite Element in Engineering, Tirupati Chandrapatla and Bellagundu, Pearson Education, New Delhi.

2. Finite Element Methods, S. S. Rao , Pergamom Press, New York

Reference Books:

1. Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.

2. Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.

3. Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.

EXPERIMENTAL STRESS ANALYSIS (ME 4415)

UNIT – I :

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, mohrs circle for stress strain, Three-dimensional stress strain relations.

UNIT – II :

Strain Measurement and Recordings: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT – III :

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics
Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

UNIT – IV :

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT – V :

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire- Fringes, experimental procedure and techniques.

TEXT BOOKS

- Theory of Elasticity by Timoshenke and Goodier Jr.
- Experimental stress analysis by Dally and Riley, Mc Graw-Hill.

REFERENCES

- A treatise on Mathematical theory of Elasticity by LOVE .A.H.
- Photo Elasticity by Frocht.
- Experimental stress analysis, Video course by K.Ramesh / NPTEL.

ME4701 APPLIED THERMODYNAMICS LAB

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

List of experiments:

1. To study Vapour Compression Refrigeration cycle with the help of refrigeration circuit under variable load conditions
2. To determine the Coefficient of Performance, Refrigeration capacity & Compressor work of Vapour Compression Refrigeration cycle with the help of refrigeration circuit under variable load conditions
3. To study Vapour Absorption Refrigeration cycle
4. To determine the Coefficient of Performance, Refrigeration capacity & Compressor work of Vapour Absorption Refrigeration cycle
5. To compare heat transfer for different heating elements in a cross flow heat exchanger
6. To study fundamental principles and various controls used in room air conditioning
7. To study different psychometric processes and estimating the change of state of air using air conditioner and illustrating them on psychometric diagram
8. Study on the characteristics of flame stability and methods to improve stability limits
9. Determination of flame speed based on the cone method
10. Determination of the relationship between flame speed and air/fuel ratio
11. flame separation demonstration

ME4702 CAD/CAM LAB

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Course Objectives:

- To understand the various features of geometric modeling packages like Creo(Pro-E) /CATIA/Solid Works like 2d-Sketching, Part Modeling and Assembly
- To understand the application of Finite Element Analysis packages like ANSYS/ NASTRAN/ADINA in solving structural and thermal problems
- To develop NC part program, simulate and manufacture components on CNCmachine

Computer Aided Design

1. Introduction to various features of geometric modeling packages like: Creo (Pro-E) /CATIA/Solid Works.
2. Practicing problems on 2D-Sketching.
3. Practicing problems on Part Modeling
4. Practicing problems on Assembly Modeling.
5. Static Structural Analysis using 2D truss/beam/etc. for different types of loads using ANSYS/NASTRAN/ADINA etc.
6. Steady state heat transfer and transient heat transfer analysis.

Computer Aided Manufacturing

7. Development of CNC part program for turning, facing, step turning, taper turning etc with and without canned or fixed cycle.
8. Tool path simulation using any CAM software
9. Demonstration of manufacturing of simple parts on CNC machine
10. Programming for simulation of integrating various machines, robots and material handling equipment using plant layout simulation software like FlexSim/Arena/Promodel etc.

ME4703 AUTOMATION &ROBOTICS LAB

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Objectives:

- To understand basic experiments related to robot programming and CNC programming
- To understand basic experiments related to wire EDM and CMM Machines

Experiments:

1. Experiments using wire EDM machine
2. Experiments using CMM machine
3. Experiments using Robotic arm machine
4. Experiments using CNC lathe machine
5. Experiments using TIG and MIG welding machines

II SEMESTER

Subject Code	Course Name	(L-T)-P	Credits
	Open Elective	4-0-0	3
ME4800	Project	0-0-15	16
ME4000	Comprehensive Viva-II		1
Total		4-0-15	20

CODE: ME4800 PROJECT

Scheme of External Exam : 100 Marks
Credits : 16

Student has to do literature review on the chosen/ allotted area of project work and must submit a report.

CODE: ME4000 **COMPREHENSIVE VIVA-II**

Scheme of External Exam **: 50 Marks**
Credits **: 1**

Students are assessed in the courses they have undergone till the completion of that academic year. They are asked to comprehend the concepts in the core subjects and the elective subjects, to make them ready to face technical interviews which improve their employability skills.

There are no sessional marks. The end examination shall be conducted by a committee consisting of an External examiner, Head of the department and two senior faculty members. The evaluation is purely external and it carries marks 50.