PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of Materials Science and Engineering curriculum is designed

I. To prepare students to excel in research and to succeed in the areas of materials science and metallurgical engineering.

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve materials science and metallurgical engineering problems.

III. To train students with scientific and engineering knowledge so as to comprehend, select materials, process, characterize, analyze, design, and develop newer materials and solutions for the real time problems.

IV. To inculcate students with professional and ethical attitude, effective communication skills, teamwork skills and multidisciplinary approach.

V. To develop student with an academic excellence, leadership qualities, leading to life-long learning for a successful professional career.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.

2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.

3. Graduate will demonstrate ability to select the materials, process the materials, identify the suitable process, characterize, design and conduct experiments, analyze and interpret data.

4. Graduates will demonstrate an ability to select materials and process, as per needs and specifications.

5. Graduate will demonstrate skills to develop materials, characterize the materials, and identify the applications of the materials.

6. Graduates will demonstrate knowledge of professional and ethical responsibilities.

7. Graduate will be able to communicate effectively in their technical knowledge.

8. Graduate will understand the impact of engineering solutions on the societal transformation.

9. Graduate will develop confidence for self education and ability for life-long learning.
Mapping PEO with POs:

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ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. MATERIALS SCIENCE AND ENGINEERING
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI I - VIII SEMESTERS

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**Director**

Centre For Academic Courses
Anna University, Chennai-600 025
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COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students’ communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I  GREETING AND INTRODUCING ONESELF  12
Listening – Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage– Scanning for specific information; Writing – Guided writing - Free writing on any given topic ( My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II  GIVING INSTRUCTIONS AND DIRECTIONS  12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing –Process description( non-technical)- Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - Vocabulary – Compound words – Word formation – Word expansion (root words).

UNIT III  READING AND UNDERSTANDING VISUAL MATERIAL  12
Listening- Listening to lectures/ talks and completing a task; Speaking – Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative);Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary –Cause and effect words; Phrasal verbs in context.

UNIT IV  CRITICAL READING AND WRITING  12
Listening- Watching videos/ documentaries and responding to questions based on them; Speaking informal and formal conversation; Reading –Critical reading (prediction & inference);Writing–Essay writing ( compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V  LETTER WRITING AND SENDING E-MAILS  12
Listening- Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading –Extensive reading; Writing- Poster making – Letter writing (Formal and E-mail) ;Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary –Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.
EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS

OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005

MA7151 MATHEMATICS – I
(Common to all branches of B.E / B.Tech. Programmes in 1 Semester)

OBJECTIVES:
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES
UNIT III INTEGRAL CALCULUS
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by
parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by
partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS
Double integrals – Change of order of integration – Double integrals in polar coordinates –
Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in
double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS
Method of variation of parameters – Method of undetermined coefficients – Homogenous
equation of Euler’s and Legendre’s type – System of simultaneous linear differential
equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES:
- Understanding of the ideas of limits and continuity and an ability to calculate with
  them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an
  appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple
  standard examples.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications.
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics.
- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors.
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals.

UNIT I  PROPERTIES OF MATTER

UNIT II  ACOUSTICS AND ULTRASONICS

UNIT III  THERMAL AND MODERN PHYSICS

UNIT IV  APPLIED OPTICS

UNIT V  CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, detections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS
OUTCOME:
- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics.
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers and fiber optics.
- The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXTBOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY

OBJECTIVE
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY
UNIT IV   CHEMICAL THERMODYNAMICS
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V   NANO CHEMISTRY

OUTCOME
- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXT BOOKS

REFERENCES

GE7152   ENGINEERING GRAPHICS  L   T   P   C  3   2   0   4

OBJECTIVES
- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I   PLANE CURVES AND FREE HANDSKETCHING
Basic Geometrical constructions, Curves used in engineering practices- Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects
UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14
Orthographic projection - principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3
Introduction to drafting packages and demonstration of their use.

OUTCOMES:
On Completion of the course the student will be able to
- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, planes and solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

TEXT BOOK:

REFERENCES:
Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

GE7153 Engineering Mechanics

OBJECTIVE:
- The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I  STATICS OF PARTICLES  12

UNIT II  EQUILIBRIUM OF RIGID BODIES  12

UNIT III  DISTRIBUTED FORCES  16
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV  FRICTION  8
UNIT V DYNAMICS OF PARTICLES

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles.

OUTCOMES:
- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

REFERENCES

BS7161 BASIC SCIENCES LABORATORY

(Common to all branches of B.E. / B.Tech Programmes)

OBJECTIVES:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre-Determination of Numerical Aperture and acceptance angle
    b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

22
OUTCOMES:

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY:
(Minimum of 8 experiments to be conducted)

1. Estimation of HCl using Na$_2$CO$_3$ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Determination of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 60 PERIODS

TEXTBOOKS

GE7162 ENGINEERING PRACTICES LABORATORY
(Common to all Branches of B.E. / B.Tech. Programmes)

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OBJECTIVES
To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES

PLUMBING
Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump.
- Laying pipe connection to the delivery side of a pump.
- Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

15
WOOD WORK
Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICES 15
• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS) 15

3. MECHANICAL ENGINEERING PRACTICES
WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations.
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES 15
• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

OUTCOMES
• Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
• Ability to use welding equipments to join the structures
• Ability to do wiring for electrical connections and to fabricate electronics circuits.

HS7251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES
• To enable students acquire proficiency in technical communication.
• To enhance their reading and writing skills in a technical context.
• To teach various language learning strategies needed in a professional environment.

CONTENTS
UNIT I ANALYTICAL READING 12
Listening- Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing )-explaining how something works-describing technical functions and applications; Reading –Analytical reading, Deductive and inductive reasoning; Writing- vision statement–structuring paragraphs.
UNIT II  SUMMARISING  12
Listening- Listening to lectures/ talks on Science & Technology; Speaking –Summarizing/ Oral Reporting. Reading – Reading Scientific and Technical articles; Writing- Extended definition –Lab Reports – Summary writing.

UNIT III  DESCRIBING VISUAL MATERIAL 12
Listening- Listening to a panel discussion; Speaking – Speaking at formal situations; Reading – Reading journal articles - Speed reading; Writing-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV  WRITING/ E-MAILING THE JOB APPLICATION  12
Listening- Listening to/ Viewing model interviews; Speaking –Speaking at different types of interviews – Role play practice (mock interview); Reading – Reading job advertisements and profile of the company concerned; Writing- job application – cover letter –Résumé preparation.

UNIT V  REPORT WRITING  12
Listening- Viewing a model group discussion; Speaking –Participating in a discussion - Presentation; Reading – Case study - analyse -evaluate – arrive at a solution; Writing–Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format. - writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication. Interactive sessions.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS

OUTCOMES
• Students will learn the structure and organization of various forms of technical communication.
• Students will be able to listen and respond to technical content.
• Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  MATRICES
12

UNIT II  VECTOR CALCULUS
12
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III  ANALYTIC FUNCTION
12
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \ a z, \ \frac{1}{z}, \ z^2 \) - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION
12

UNIT V  LAPLACE TRANSFORMS
12

TOTAL: 60 PERIODS

OUTCOMES:
- Upon successful completion of the course, students should be able to:
- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
TEXTBOOKS:

REFERENCES:

CY7251 CHEMICAL REACTIONS DYNAMICS (Materials Science and Engineering) L T P C 3 0 0 3

OBJECTIVES
• To study the solid state chemistry and kinetics.
• To understand the basic concept of adsorption isotherms.

UNIT I SOLID STATE CHEMISTRY

UNIT II REACTION KINETICS IN SOLUTIONS
Determination of rate laws: Integral, Isolation, half-life and differential methods; comparison of different techniques. kinetic equations for complex reactions-chain, parallel, opposing and consecutive reactions; theory of reaction rates; temperature effect on reaction rates; rate constant for simple bimolecular reactions; collision theory; activated complex theory. Reactions in solutions: diffusion controlled and activation controlled reactions; thermodynamic formulation of rate constant: effect of pressure and ionic strength.

UNIT III REACTION KINETICS ON SURFACES

UNIT IV KINETICS OF SOLID STATE REACTIONS
Solid State Reactions: types; sintering; nucleation; factors influencing the reactivity of solids; precursors to solid state reactions; Tammann and Hedvall mechanism; Wagner’s diffusion theory, material transport in solid state reaction-counter diffusion, Kirkendall effect; Huttig’s mechanism; kinetic model-reaction in powder compact, parabolic rate law, Jander’s rate equation. atomic theory of diffusion-self diffusion mechanism.
UNIT V  PREPARATIVE METHODS  9
Vapour phase transport, preparation of thin films-electrochemical methods, chemical vapour deposition; crystal growth-Bridgman and Stokbarger methods, zone melting, high temperature ceramic methods, particle size reduction, precursor method, co-precipitation, sol-gel, microwave synthesis, combustion synthesis, high pressure methods, preparing single crystals- Czochralski, molecular beam epitaxy-temperature gradients, flame and plasma fusion, solution methods, Intercalation.

TOTAL: 45 PERIODS

OUTCOME
• Will know the solid state chemistry.
• Will know the preparative methods by various techniques.

TEXT BOOKS

REFERENCES

CE7251  STRENGTH OF MATERIALS  L  T  P  C
3  0  0  3

OBJECTIVE:
• To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  9

UNIT II  TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM  9

UNIT III  TORSION  9
Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.
UNIT IV  DEFLECTION OF BEAMS
Double Integration method – Macaulay’s method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V  THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theory – Application of theories of failure.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

REFERENCES:

GE7151  COMPUTING TECHNIQUES
(Common to all branches of Engineering and Technology)

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OBJECTIVE
- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I  INTRODUCTION
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II  C PROGRAMMING BASICS

UNIT III  ARRAYS AND STRINGS
UNIT IV  POINTERS
Macros - Storage classes – Basic concepts of Pointers – Pointer arithmetic - Example Problems - Basic file operations

UNIT V  FUNCTIONS AND USER DEFINED DATA TYPES

OUTCOME
At the end of the course, the student should be able to:
• Write C program for simple applications
• Formulate algorithm for simple problems
• Analyze different data types and arrays
• Perform simple search and sort.
• Use programming language to solve problems.

TEXTBOOKS:

REFERENCES:

CE7261  STRENGTH OF MATERIALS LABORATORY

OBJECTIVES
• To study the properties of materials when subjected to different types of loading.

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Double shear test on metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring
8. Deflection test on carriage spring

OUTCOMES
• Ability to perform different destructive testing
• Ability to characteristic materials

REFERENCE:
1. Relevant Indian Standards
OBJECTIVES

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENTS

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

OUTCOMES

At the end of the course, the student should be able to:

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

30 Systems with C compiler

UNIT I  INTRODUCTION TO POLYMERS

Fundamentals of polymers - monomer - functionality - Classification - polymerization - its types and techniques - Structure, property and applications of polyethylene, polypropylene, polyvinyl chloride, polystyrene, Polymethyl methacrylate, PTFE, polyamides, polyesters, polycarbonates and polyurethanes - copolymers - interfacial polymerization and cross linked polymers

UNIT II  MOLECULAR WEIGHTS OF POLYMERS

Number average and weight average molecular weights – degree of polymerization – molecular weight distribution – polydispersity – molecular weight determination- different methods – Gel Permeation Chromatography.
UNIT III  TRANSITIONS IN POLYMERS

UNIT IV  SOLUTION PROPERTIES OF POLYMERS

UNIT V  POLYMER PROCESSING

TOTAL: 45 PERIODS

OUTCOME
- Use of techniques for polymer processing.
- Ability to develop structure – property relationship in polymer.

TEXTBOOKS

REFERENCES
MA7352  APPLIED STATISTICS  L  T  P  C  4  0  0  4

OBJECTIVE
- The students will have a fundamental knowledge of the concepts of statistical inference and apply the tools in management problems.

UNIT I  TESTS OF SIGNIFICANCE  12
Sampling distributions – Central limit theorem-Tests for single mean, proportion and difference of means, proportions (large and small samples) - Tests for single variance and equality of variances- $\chi^2$ - test for goodness of fit - Independence of attributes.

UNIT II  NON-PARAMETRIC TESTS  12

UNIT III  DESIGN OF EXPERIMENTS  12
Completely randomized design - Randomized block design - Latin square design - $2^2$ factorial design - Taguchi’s robust parameter design.

UNIT IV  STATISTICAL QUALITY CONTROL  12
Control charts for variables - Control charts for attributes - Tolerance limits - Acceptance sampling by attributes.

UNIT V  TIME SERIES  12

TOTAL: 60 PERIODS

OUTCOME
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXTBOOKS

REFERENCES
OBJECTIVE

- To impart knowledge on the various foundry practices and secondary machining operations carried out in the Industry.

UNIT I  
PATTERN AND DIE MAKING  
9
Introduction to foundry process flow, Patterns – types, functions, allowances. Selection of pattern materials, colour codes, core boxes, - considerations in Core box manufacturing, Die materials, Die design and manufacturing techniques Computer applications in Pattern and Die making.

UNIT II  
CASTING DESIGN  
9
Solidification of pure metals and alloys – shrinkage in cast metals – Design of Sprue, runner, gates – problems in design and manufacture of thin and unequal sections, designing for directional solidification, Riser design-Chvorinov’s rule, Caines, Modulus, Naval Research Laboratory methods, feeding distances – Calculations and number of Risers required, chills and feeding aids – Exothermic And Insulating sleeves Design problems of L, T, V, X and Y junctions, Computer Applications in casting design—Software for casting design

UNIT III  
MOULDING AND CASTING PRACTICES  
9

UNIT IV  
MELTING AND POURING PRACTICES  
9
Principles of melting practice – Fluxing, Degasification, Modification, Deoxidation and Inoculation, Types of furnaces –Crucibles, Cupola, Oil fired furnaces, Electric furnaces – Arc and Induction types, Melting practices of Cast Iron, SG Iron, Carbon Steels, High alloy and Stainless steels, Aluminium and Copper alloys, Melt Quality control in all above processes.

UNIT V  
MACHINING  
9

TOTAL: 45 PERIODS

OUTCOMES

- Ability to understand and perform basic casting processes.
- Ability to design casting and select suitable casting process for different materials.
- Ability to perform basic machining operations in the cast components.

TEXT BOOKS


REFERENCES

ML7302  ELECTRICAL AND ELECTRONIC PROPERTIES OF MATERIALS  L  T  P  C  3 0 0 3

OBJECTIVE

- To equip the students to have a knowledge on different types of electron theory, basics of quantum mechanics and about energy bands
- To introduce the physics of semiconducting materials and applications of semiconductors in device fabrication
- To make the students to learn the mechanisms of polarization in dielectric materials, and about classification and properties of dielectric materials
- To make the students to learn the origin of magnetism in magnetic materials and their classification; to learn the physics of superconductivity and various properties exhibited by superconductors
- To make the students familiarize with the optical properties of materials.

UNIT I  ELECTRICAL PROPERTIES OF MATERIALS  9

UNIT II SEMICONDUCTOR PHYSICS  9

UNIT III DIELECTRICS AND FERROELECTRICS  9
Macroscopic description of the static dielectric constant. The electronic and ionic polarizabilities of molecules - orientational polarization - Measurement of the dielectric constant of a solid. The internal field - Lorentz, Clausius-Mosotti relation. Behaviour of dielectrics in an alternating field, elementary ideas on dipole relaxation, - Piezo, pyro and ferroelectric properties of crystals - classification of ferroelectric crystals - BaTiO₃ and KDP.

UNIT IV MAGNETISM AND SUPERCONDUCTIVITY  9

UNIT V OPTICAL PROPERTIES OF MATERIALS  9
Light waves in a homogeneous medium - refractive index - dispersion: refractive index-wave-length behaviour - group velocity and group index – NLO materials – phase matching - SHG, sum

TOTAL: 45 PERIODS

OUTCOME
Upon completion of this course, the students will be able to

- familiarize with theories of electrical and thermal conduction is solids, basic quantum mechanics, and energy bands
- gain knowledge on semiconducting materials based on energy level diagrams, its types, temperature effect.
- understand the mechanisms of various types of polarization and about classification and properties of ferroelectric crystals
- to learn the classification of magnetic materials, theory and applications of ferromagnetic materials and superconductors
- acquire knowledge on light waves, non-linear optical properties of materials and their applications

TEXTBOOKS

REFERENCES

ML7303 METALLURGICAL THERMODYNAMICS

OBJECTIVE
- To introduce the basic knowledge of thermodynamics required for understanding various alloy systems, phase transformations and interpreting properties

UNIT I FUNDAMENTAL CONCEPTS
Definition of thermodynamic terms; concept of states, systems, equilibrium. Equation of states, extensive and intensive properties, homogeneous and heterogeneous systems. Phase diagrams, Internal energy, heat capacity, enthalpy, isothermal, and adiabatic processes.

UNIT II INTERNAL ENERGY AND ENTROPY
First law of Thermodynamics: Relation between Heat and work, Internal energy, Enthalpy. The Second law of thermodynamics: Spontaneous process, Degree of measure of reversibility and irreversibility, Maximum work, criteria of equilibrium. Combined statement of first and second laws on thermodynamics. Statistical interpretation of entropy: Concept of microstate, most probable microstate, Thermal equilibrium, Boltzman equation
UNIT III  AUXILLARY FUNCTIONS AND THERMODYNAMIC POTENTIALS  10

UNIT IV  THERMODYNAMICS OF SOLUTIONS  10

UNIT V  THERMODYNAMICS OF REACTIONS  10

TOTAL: 45 PERIODS

OUTCOME
- A fundamental understanding of the first and second laws of thermodynamics and their application to a wide range of system.
- The student should be able to use thermodynamics on solid state equilibrium as well as on equilibrium between solids and gases

TEXTBOOKS

REFERENCES
OBJECTIVE

- The subject introduces the correlation of properties of materials and their structure. It revises student's knowledge of crystal structure and phase diagrams of various alloy systems. The course covers the structure and properties of ferrous and non-ferrous alloys, ceramics, polymers, elastomers and composite materials.

UNIT I STRUCTURE OF SOLIDS 9

UNIT II PHASE DIAGRAMS 9

UNIT III FERROUS AND NON-FERROUS MATERIALS 9

UNIT IV CERAMIC AND COMPOSITE MATERIALS 9

UNIT V POLYMERS AND ELASTOMERS 9

OUTCOMES

- Recognise basic nomenclature, basic microstructure, and associate terms with the appropriate structure / phenomena and be able to differentiate between related structure / phenomena.
- Perform simple calculations to qualify materials properties and microstructural characteristics.
- Recognise the effect of composition and microstructure on material properties.
- Ability to perform phase equilibrium calculation and construct phase diagram.
- Select suitable ferrous and non-ferrous materials for engineering application.

TEXT BOOKS
REFERENCES

ML7311

FOUNDARY AND MACHINING LABORATORY

OBJECTIVE
- To make students learn about melting of metals, casting of metals and various sand testing methods.
- To practice basic machining operations which can be carried out in general purpose and Special Purpose Machine Tools.

LIST OF EXPERIMENTS-FOUNDRY
1. Determination of Average Sand grain Fineness.
2. Determination of Moisture content in Sand
3. Determination of Permeability of Green Sand
4. Estimation of Active clay content in Sand
5. Loss on Ignition Test for Green moulding Sand
6. Determination of Green Compression and Shear Strength.
7. Determination of Dry Compression Strength.
8. Determination of Scratch Hardness.
10. Metal Casting by Green sand and full mould process.

LIST OF EXPERIMENTS-MACHINING
1. Machining practice in lathe: Taper Turning,
2. Drilling and Tapping
3. Machining practice in Grinding: Cylindrical, Surface, Tool and Cutter Grinding
5. Demonstration on CNC drilling

TOTAL: 60 PERIODS

OUTCOME
- This course will enable the student to know typical process of foundry covering melting of various metals, sand mould preparation and also the different testing methods.
- The student will gain knowledge on various machining operations and will have some hands on experience in machining operations like work piece mounting, tool selection, operating conditions for a process and cross check the dimensions of the machined component.
OBJECTIVE
- To gain knowledge on the microstructures of some common types of metals and alloys and to perform the grain size analysis of the given samples.

LIST OF EXPERIMENTS
3. Macro etching - cast, forged and welded components.
4. Microscopic examination of cast irons - Gray, White, Malleable and Nodular types
5. Microscopic examination of Plain carbon steels (low carbon, medium carbon, high carbon steels).
6. Microscopic examination of Austenitic Stainless steels and High Speed Steels.
7. Microscopic examination of banded structure in steels and welded joints.
8. Microscopic examination of Copper alloys
9. Microscopic examination of Aluminium alloys
10. Microscopic examination of Titanium alloys

TOTAL: 60 PERIODS

OUTCOME
- The student will acquire knowledge on the microstructural analysis of various metals and alloys with regard to sample preparation via polishing and etching and use and analysis of optical microscopy

UNIT I KINEMATICS OF MECHANISMS

UNIT II GEARS AND GEAR TRAINS

UNIT III FRICTION IN MACHINE ELEMENTS
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes– Friction in vehicle propulsion and braking.

UNIT IV FORCE ANALYSIS
UNIT V BALANCING AND VIBRATION

TOTAL: 45 PERIODS

OUTCOME
- The course will enable the student to understand the forces and torque acting on simple mechanical systems and also the importance of balancing and vibration and the effect of friction in different machine parts of practical significance.

TEXTBOOK

REFERENCES

ML7401 CHARACTERISATION OF MATERIALS - I

OBJECTIVE
- To have thorough understanding of theory, instrumentation and applications of analytical equipments used for chemical analysis.

UNIT I INTRODUCTION TO SPECTRAL METHODS
Molecular and atomic spectroscopy-interaction of electromagnetic radiation with matter- Energy levels in atoms and molecules – Absorption techniques and emission techniques: fluorescence, phosphorescence and chemiluminescence – Beer-Lambert law; qualitative and quantitative analyses – limitations – visible absorption spectroscopy.

UNIT II UV AND VISIBLE SPECTROCOPY
UNIT III IR, RAMAN AND ATOMIC SPECTROSCOPY


UNIT IV SEPARATION TECHNIQUES

Solvent extraction and ion exchange techniques – principles and applications; Chromatographic techniques – adsorption chromatography, thin layer chromatography, gas chromatography, high performance chromatography. Separation of organic compounds by column and thin layer and paper chromatographic techniques. Qualitative and quantitative analyses by GC and HPLC.

UNIT V THERMAL AND SURFACE ANALYTICAL METHODS

Thermal analytical techniques- TGA, DTA, DSC – principles, instrumentation and applications; Surface analysis – TEM, SEM and AFM – Principles, instrumentation and applications.

TOTAL: 45 PERIODS

OUTCOME

This subject familiarize the students about the principle and working of various sophisticated instruments (FTIR, UV vis, Raman, AAS, Flame photometry, ICP-AES, HPLC, GC, TGA, DSC and DTA; TEM, SEM and AFM) and their use in material analysis.

TEXTBOOKS


REFERENCES

6. Sharma, B.K., Instrumental Methods of Analysis, Goel publishing House, 1995
OBJECTIVE

- The course covers the fundamental aspects of the theory and practice of heat treatment of metals and alloys. It provides a comprehensive understanding of the various transformation reactions associated with the changes in microstructures and properties that occur due to controlled heat treatment.

UNIT I TRANSFORMATIONS IN STEELS


UNIT II HEAT TREATMENT PROCESSES


UNIT III CASE HARDENING


UNIT IV FURNACES, ATMOSPHERE AND PROCESS CONTROL

Various heating atmosphere used for heat treatment, temperature and atmosphere control– carburising atmosphere and carbon potential measurement, Temperature Measurement Control devices – Nitriding gas atmospheres, quenching media and their characteristics, Stages of Quenching, Various Heat Treatment furnaces- Roller and Mesh type continuous furnaces-fluidised bed furnaces, cryo-chamber, cryo-treatment of steels, sealed quenching furnace, Vacuum furnace, Plasma equipment-Elements of Process control systems-PLC ,PID controllers and continuous monitoring systems.

UNIT V HEAT TREATMENT OF SPECIFIC ALLOYS


TOTAL: 45 PERIODS

OUTCOME

- The students will be exposed to the various heat treatment processes that can be applied for different ferrous and non-ferrous alloys.
- The students will understand the effect of the various heat treatments on the microstructure and the properties of materials.
TEXTBOOKS

REFERENCES

ML7403 IRON AND STEEL MAKING L T P C 3 0 0 3

OBJECTIVE
- The course covers the production of iron and steel from raw material, primary processing and refinement to obtain special steels.

UNIT I RAW MATERIALS AND BURDEN PREPARATION 8
Iron ore classification, Indian iron ores, limestone and coking coal deposits, problems associated with Indian raw materials, Iron ore beneficiation and agglomeration, Briquetting, sintering, Nodulising and pelletizing, testing of burden materials, burden distribution on blast furnace performance.

UNIT II PRINCIPLES AND PROCESSES OF IRON MAKING 10
Blast furnace parts, construction and design aspects, ancillary equipment for charging, preheating the blast, hot blast stoves, gas cleaning, Blast furnace operation, irregularities and remedies, Blast furnace instrumentation and control of furnace Composition control of metal and slag in blast furnace, modern trends in blast furnace practice.
Reduction of iron ores and oxides of iron by solid and gaseous reductions-thermodynamics and kinetics study of direct and indirect reduction, Gruner’s theorem, blast furnace reactions. C-O and Fe-C-O equilibria, Rist diagrams, Ellingham diagram, material and heat balance- Sponge Iron making.

UNIT III PRINCIPLES OF STEEL MAKING 8
Development of steel making processes, physico-chemical principles and kinetic aspects of steel making, carbon boil, oxygen transport mechanism, desulphurisation, dephosphorisation, Slag Theories, slag-functions, composition, properties and theories, raw materials for steelmaking and plant layout.

UNIT IV STEEL MAKING PROCESSES 10
UNIT V  LADLE METALLURGY

TOTAL: 45 PERIODS

OUTCOME
• The course will enable the student to gain knowledge on the production processes of steel and iron. The student will understand the kinetics involved in the production of iron and steel. The student also gains knowledge on the refinement of steels to obtain a quality product.

TEXTBOOKS

REFERENCES

ML7404  MECHANICAL BEHAVIOUR OF MATERIALS  L T P C  3 0 0 3

OBJECTIVE
• The students having studied the basics of material structures and properties and strength of materials, shall be introduced to dislocation theories of plasticity behaviour, various strengthening mechanisms and fracture mechanics. It will expose students to failure mechanisms due to fatigue and creep as well as their testing methods.

UNIT I  ELASTIC AND PLASTIC BEHAVIOUR  9

UNIT II  STRENGTHENING MECHANISMS  10
Elementary discussion of cold working, grain boundary strengthening. Solid solution strengthening, Martensitic strengthening, Precipitation strengthening, Particulate Strengthening, Dispersion strengthening, Fiber strengthening, Examples of above strengthening mechanisms from ferrous and non-ferrous systems, Yield point phenomenon, strain aging and dynamic strain aging
UNIT III  FRACTURE AND FRACTURE MECHANICS

Types of fracture, Basic mechanisms of ductile and brittle fracture, Griffith’s theory of brittle fracture, Orowan's modification. Izod and Charpy Impacts tests, Ductile to Brittle Transition Temperature (DBTT), Factors affecting DBTT, Determination of DBTT.

Fracture mechanics-Introduction, Modes of fracture, Stress intensity factor, Strain energy release rate, Fracture toughness and Determination of KIC, Introduction to COD, J integral.

UNIT IV  FATIGUE BEHAVIOUR AND TESTING


UNIT V  CREEP BEHAVIOUR AND TESTING

Creep curve, Stages in creep curve and explanation, Structural changes during creep, Creep mechanisms, Metallurgical factors affecting creep, High temperature alloys, Stress rupture testing, Creep testing machines, Parametric methods of extrapolation. Deformation Mechanism Maps according to Frost/Ashby

TOTAL: 45 PERIODS

OUTCOME

- Students will demonstrate and understanding of the mechanical properties and behaviour of materials.
- In the concept of linear elastic fracture mechanics and estimate the effects of cracks in material and structure.
- Students will demonstrate the ability to identify engineering problem in using plastic deformation, fatigue, fracture and creep
- Assises and describe the mechanism loading to failure when provided with a failure example.

TEXTBOOKS


REFERENCES


ML7405  POWDER METALLURGY  L T P C

3 0 0 3

OBJECTIVE

- This course aims at teaching on powder preparation, characterization, compaction and sintering. This knowledge is essential to understand powder metallurgy applications in aerospace, automobile and machining materials.
UNIT I  POWDER MANUFACTURE AND CONDITIONING  12
Mechanical methods: Machine milling, ball milling, atomization, shotting. Chemical methods, condensation, thermal decomposition, carbonyl Reduction by gas-hydride, dehydride process, electro deposition, precipitation from aqueous solution and fused salts, hydrometallurgical method. Physical methods: Electrolysis and atomisation processes, types of equipment, factors affecting these processes, examples of powders produced by these methods, applications, powder conditioning, heat treatment, blending and mixing, types of equipment, types of mixing and blending, Self-propagating high-temperature synthesis (SHS), sol-gel synthesis- Nanopowder production methods.

UNIT II  CHARACTERISTICS AND TESTING OF METAL POWDERS  8
Sampling, chemical composition purity, surface contamination etc. Particle size and its measurement, Principle and procedure of sieve analysis, microscopic analysis: sedimentation, elutriation, permeability. Adsorption methods and resistivity methods: particle shape, classifications, microstructure. Specific surface area. Apparent and tap density, green density, green strength, sintered compact density, porosity, shrinkage.

UNIT III  POWDER COMPACTION  7
Pressureless compaction: slip casting and slurry casting. Pressure compaction- lubrication, single ended and double ended compaction, isostatic pressing, powder rolling, forging and extrusion, explosive compaction.

UNIT IV  SINTERING  8
Stage of sintering, property changes, mechanisms of sintering, liquid phase sintering and infiltration, activated sintering, hot pressing and Hot Isostatic Pressing (HIP), vacuum sintering, sintering furnaces-batch and continuous-sintering atmosphere, Finishing operations – sizing, coining, repressing and heat treatment, special sintering processes- microwave sintering, Spark plasma sintering, Field assisted sintering, Reactive sintering, sintering of nanostructured materials.

UNIT V  APPLICATIONS of P/M COMPONENTS  10

OUTCOME
• The students will have knowledge on the various ways by which the powder can be prepared, compaction and the sintering methods and mechanisms.
• The students will also be acquainted with the application of various powder metallurgy components.

TEXTBOOKS

REFERENCES

ML7411 HEAT TREATMENT LABORATORY

OBJECTIVE:
- This laboratory course offers practical knowledge of heat treatment processes applicable to Ferrous as well as Non-Ferrous materials and also to get conversant with the microstructural changes and hardness evaluation.

LIST OF EXPERIMENTS:
1. Annealing and normalising of hardened steels
2. Spheroidization annealing of high carbon steels
3. Effect of quenching media on hardening of steel
4. Effect of tempering temperature and time on tempering of steel
5. Effect of carbon percentage on the hardness of steel
6. Carburizing – Low carbon steel
7. Case hardness depth measurements
8. Austempering treatment
9. Hardenability test – Jominy End Quench Test
10. Heat treatment of cast iron
11. Heat treatment of Stainless Steels and High speed steels
12. Heat treatment of non-ferrous alloys

TOTAL: 60 PERIODS

OUTCOME:
- The students will gain practical knowledge on the various heat treatment processes and also understand the effect of heat treatment on the properties of various materials.

ML7412 POWDER METALLURGY LABORATORY

OBJECTIVE
- This laboratory course offers practical knowledge on powder metallurgy: powder synthesis, compaction and sintering and testing powder compacts and sinters.

LIST OF EXPERIMENTS
1. Powder Production by wet chemical synthesis
2. Powder size reduction by Ball Milling
3. Sieve Analysis Particle size distribution
4. Measurement of Apparent and Tap Density of Powders
5. Measurement of Flow Rate of Powders
6. Determination of optimum compaction pressure.
7. Density determination of sintered product.
8. Fracture Toughness determination of sintered product.
9. Preparation of porous ceramic product.

TOTAL: 60 PERIODS

OUTCOME:
- The course will enable a student to understand and carryout powder metallurgy route involving synthesis, compaction, sintering and appropriate testing methods.
OBJECTIVES:
To the study of nature and the facts about environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
Definition, scope and importance of environment – need for public awareness - 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 (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – 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.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.
UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

TOTAL: 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXTBOOKS:

REFERENCES:

ME7451 MACHINE DESIGN L T P C 3 2 0 4

(Use of P S G Design Data Book is permitted in the University examination)

OBJECTIVES
- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
UNIT I  STEADY STRESSES IN MACHINE MEMBERS  12
Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading -Factor of safety – Curved beams - theories of failure – Design for finite and infinite life under variable loading.

UNIT II  SHAFTS, COUPLINGS, JOINTS AND BEARINGS  12
Design of solid and hollow shafts based on strength, rigidity and critical speed –Keys, key ways and splines –Rigid and flexible couplings. Welded joints and riveted joints for structures, Sliding contact and rolling contact bearings (Simple problems).

UNIT III  ENERGY STORING ELEMENTS AND ENGINE COMPONENTS  12
Types of springs, Design of helical springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT IV  DESIGN FOR FLEXIBLE ELEMENTS  12
Design of Flat belts and pulleys - Selection of V belts and pulleys – Design of Transmission chains and Sprockets.

UNIT V  SPUR GEARS, HELICAL GEARS AND GEAR BOXES  12

L=45+T=30, TOTAL: 75 PERIODS

OUTCOME
- Upon completion of this course, the students can able to successfully design machine components

TEXTBOOKS

REFERENCES
ML7501 CHARACTERISATION OF MATERIALS -II L T P C 3 0 0 3

OBJECTIVE
- Characterisation of materials is very important for studying the structure of materials and to interpret their properties. The students study the theoretical foundations of metallography, X-ray diffraction, electron diffraction, scanning and transmission electron microscopy as well as surface analysis.

UNIT I METALLOGRAPHIC TECHNIQUES 8
Macroexamination - applications, metallurgical microscope - principle, construction and working, metallographic specimen preparation, optic properties - magnification, numerical aperture, resolving power, depth of focus, depth of field, different light sources lenses aberrations and their remedial measures, various illumination techniques - bright field, dark field, phase-contrast polarized light illuminations, interference microscopy, high temperature microscopy; quantitative metallography – Image analysis

UNIT II X-RAY DIFFRACTION TECHNIQUES 10

UNIT III ANALYSIS OF X-RAY DIFFRACTION 9
Line broadening, particle size, crystallite size, Precise parameter measurement, Phase identification, phase quantification, Phase diagram determination X-ray diffraction application in the determination of crystal structure, lattice parameter, residual stress – quantitative phase estimation, ASTM catalogue of Materials identification-

UNIT IV ELECTRON MICROSCOPY 9
Construction and operation of Transmission electron microscope – Diffraction effects and image formation, specimen preparation techniques, Selected Area Electron Diffraction, electron-specimen interactions, Construction, modes of operation and application of Scanning electron microscope, Electron probe micro analysis, basics of Field ion microscopy (FIB), Scanning Tunneling Microscope (STM) and Atomic Force Microscope(AFM).

UNIT V SURFACE ANALYSIS 9

TOTAL: 45 PERIODS

OUTCOME
- Ability to perform analysis of X ray diffraction and electron microscope images and the chemical and thermal analysis datas.

TEXTBOOKS
REFERENCES
3. Weinberg, F., “Tools and Techniques in Physical Metallurgy”, Volume I & II, Marcel and
   Decker, 1970.
5. Haines, P.J., “ Principles of Thermal Analysis and Calorimetry”, Royal Society of
   Chemistry (RSC), Cambridge, 2002.

ML7502 THEORY AND APPLICATIONS OF METAL FORMING L T P C
3 0 0 3

OBJECTIVE
• The basic knowledge on plasticity taught in mechanical metallurgy is extended to theory
  and applications of metal forming. Various metal forming processes and their analysis are
  studied in detail.

UNIT I STRESS - STRAIN TENSOR
State of stress, components of stress, symmetry of stress tensor, principle stresses, stress
deviator, Von Mises, Tresca Yield criteria, comparison of yield criteria, Octahedral shear stress and
shear strain, Slip, twinning, Forming load calculations, Strain Rate Tensor.

UNIT II FUNDAMENTALS OF METAL FORMING
Classification of forming process- Mechanics of metal working, Flow stress determination, Effect
of temperature, strain rate and metallurgical structure on metal working, Friction and lubrication.
Deformation zone geometry, Workability, Residual stresses.

UNIT III FORGING AND ROLLING
Forging-Hot, Cold and Warm Forging – types of presses and hammers. Classification, Open die
forging and Closed die forging, die design, forging in plane strain, calculation of forging loads, use
of software for analysis - forging defects – causes and remedies, residual stresses in forging.
Rolling: Classification of rolling processes, types of rolling mills, hot and cold rolling, rolling of bars
and shapes, forces and geometrical relationship in rolling, analysis of rolling load, torque and
power, rolling mill control, rolling defects- causes and remedies.

UNIT IV EXTRUSION AND DRAWING
Direct and indirect extrusion, variables affecting extrusion, deformation pattern, equipments, port –
hole extrusion die, hydrostatic extrusion, defects and remedies, simple analysis of extrusion ,tube
extrusion and production of seamless pipe and tube. Drawing of road, wires and tubes.

UNIT V SHEET METAL FORMING AND OTHER PROCESSES
Forming methods – Shearing, Fine and Adiabatic blanking, bending, stretch forming, deep
drawing, defects in formed part, sheet metal formability, forming limit diagram.
High velocity forming, Comparison with conventional forming, Explosive forming, Electro hydraulic,
Electro Magnetic forming, Dynapark and petroforge forming

TOTAL: 45 PERIODS
OUTCOME
- Ability to make use of mechanical and thermodynamics principle of plastic deformation to form the components using different techniques.

TEXTBOOKS

REFERENCES

ML7511 MATERIALS CHARACTERISATION LABORATORY-I L T P C
0 0 4 2

OBJECTIVE
- This laboratory course offers practical knowledge of analytical instruments to evaluate and analyse the samples.

LIST OF EXPERIMENTS:
1. Precision and validity in an experiment using absorption spectroscopy
2. Validating Lambert-Beer's law using KMnO4
3. Finding the molar absorbitivity and stoichiometry using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectroscopic techniques
6. Chromatography analysis using TLC.
7. Chromatography analysis using Column chromatography.
8. Determination of conductivity

TOTAL: 60 PERIODS

OUTCOME
- This lab enable student to select analytical technique to evaluate and analyse the samples. Students learn to use the instruments and get exposed to specimen preparation, validation of instrument, precise use of instrument to accurately estimate the given samples.
ML7512  METAL FORMING LABORATORY  

OBJECTIVE
- To acquire knowledge on basic metal forming processes by experimental study and analysis

LIST OF EXPERIMENTS:
1. Formability of sheet metal by Ericsson cupping test
2. Construction of Formability limit diagram
3. Water hammer test
4. Ring Compression test
5. Diameter reduction in Wire drawing
6. Deep drawing for simple cup shape
7. Extrusion of Cylindrical component
8. Thickness reduction in Sheet metal rolling.
9. Study of Sheet metal forming using FEA analysis software
10. Study of Super plastic forming Process

TOTAL: 60 PERIODS

OUTCOME
- Ability to perform metal forming and welding
- Ability to evaluate the properties of processed component.

ME7554  INDUSTRIAL MANAGEMENT

OBJECTIVE
- To develop modern concepts of Industrial Management

UNIT I  INTRODUCTION

UNIT II  FUNCTIONS OF MANAGEMENT

UNIT III  ORGANIZATIONAL BEHAVIOUR
UNIT IV  GROUP DYNAMICS


UNIT V  MODERN CONCEPTS


OUTCOME

• The course will enable student preparedness to technology management and the forms of organisation in an industry. This course also enables the student to understand the functions of Management and also the organisational behaviour. It also gives some knowledge on the modern concepts such as Strategic management, SWOT analysis, Business Process Re-engineering (BPR) and supply chain management (SCM).

TEXTBOOKS


REFERENCES


ML7601  COMPOSITE MATERIALS

L T P C
3 0 0 3

OBJECTIVE

• Composites are a relatively new class of materials. In this course the students learn about the benefits gained when combining different materials into a composite. The Motive is to make the students to understand different processing methods, issues, properties and testing methods of different composite materials

UNIT I  INTRODUCTION TO COMPOSITES

UNIT II POLYMER MATRIX COMPOSITES

UNIT III METAL MATRIX COMPOSITES

UNIT IV CERAMIC MATRIX COMPOSITES AND SPECIAL COMPOSITES

UNIT V MECHANICS OF COMPOSITES

OUTCOMES
- Use of different material to design composites
- Use of different techniques to process different types of composites and know the limitations
- Use of Mathematical techniques to predict the macroscopic properties of different Laminates

TEXTBOOKS

REFERENCES
OBJECTIVE
- To study and understand the various Non-Destructive Evaluation and Testing methods, Interpretation of results, theory and their industrial applications.

UNIT I INTRODUCTION & VISUAL INSPECTION METHODS
- NDT versus Mechanical testing, Need for NDT, Relative merits and limitations, various physical characteristics of materials and their applications in NDT.
- Visual Inspection - Unaided, Aided - Borescopes - Videoscopes, Special features in Borescopes, Selection of borescopes, Optical sensors, Microscopes & replication Microscopy Technique and applications

UNIT II LIQUID PENETRANT TESTING & MAGNETIC PARTICLE TESTING

UNIT III THERMOGRAPHY & EDDY CURRENT TESTING
- Thermography – Introduction, Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods and applications.
- Eddy current Testing – Principle, properties of eddy currents, Eddy current sensing elements, probes, Instrumentation, Types of arrangement, Advantages & Limitations, Interpretation of Results & applications.

UNIT IV ULTRASONIC TESTING & ACOUSTIC EMISSION TESTING
- Ultrasonic Testing-Principle, Basic Equipment, Transducers, couplants, Ultrasonic wave, Variables in UT, Transmission and Pulse-echo method, Straight beam and angle beam, A-Scan, B-Scan & C-Scan, PhasedArray Ultrasound & Time of Flight Diffraction, Advantages & Limitations, Interpretation of Results & Applications.

UNIT V RADIOGRAPHY

TOTAL: 45 PERIODS

OUTCOME
- Students will be in a better position to evaluate and interpret components / products through NDT either as Quality Assurance Team Member or Production Team Member.
TEXT BOOKS

REFERENCES

ML7603 WELDING METALLURGY L T P C
3 0 0 3

OBJECTIVE
- Metal joining is one of the most important fabrication processes used in the industry and requires both theoretical understanding of the process used and the allied welding metallurgy in order to make a successful weld, the content of the syllabus addresses to the above need.

UNIT I FUNDAMENTALS OF METAL JOINING 9

UNIT II WELDING METALLURGY PRINCIPLES 9
Thermal cycles in welding: basic heat transfer equations, temperature distributions and cooling curves, dependence of cooling rate on heat input, joint geometry, preheat and other factors. Comparison of welding processes based on these considerations.

UNIT III PHYSICAL METALLURGY OF WELDING 9
UNIT IV WELDING OF ALLOY STEELS AND NON-FERROUS METALS
Welding of stainless steels, types of stainless steels, overview of joining ferritic and martensitic types, welding of austenitic stainless steels, Sensitisation, hot cracking, sigma phase and chromium carbide formation, ways of overcoming these difficulties, welding of cast iron. Welding of non-ferrous materials: Joining of aluminium, copper, nickel and titanium alloys, problems encountered and solutions.

UNIT V DEFECTS, WELDABILITY AND STANDARDS
Defects in welded joints: Defects such as arc strike, porosity, undercut, slag entrapment and hot cracking, causes and remedies in each case. Joining of dissimilar materials, weldability and testing of weldments.
Introduction to International Standards and Codes

TOTAL: 45 PERIODS

OUTCOME
• The course will enable the student various welding processes used in the industry and solidification process involved in welding and its metallurgy to make a successful weld.

TEXTBOOKS

REFERENCES

ML7611 COMPOSITE MATERIALS LABORATORY

OBJECTIVE
• Students learn the fabrication processes of different composite materials and the mechanical characterization of these materials

LIST OF Experiments:
1. Preparation of Continuous Fiber reinforced Polymer Composites
2. Preparation of Discontinuous Fiber reinforced Polymer Composites
3. Study of Tensile strength and young’s modulus of FRP composites
4. Study of Flexural strength of FRP composites
5. Study of drop weight impact testing
6. Preparation of Al-TiB₂ composite by in-situ reaction
7. Study of Microstructure, hardness and density of Al-TiB₂ composites
8. Preparation of Al-SiC composites by stir casting method
9. Study of microstructure, hardness and density of Al-SiC composite
10. Study of Tensile strength of Al-SiC composites
11. Environmental Testing (Humidity and temperature)

TOTAL: 60 PERIODS
OUTCOME
- The course will enable the student to learn the different fabrication processes of different composite materials and the mechanical characterization of these materials.

ML7612 MATERIALS CHARACTERISATION LABORATORY -II  L  T  P  C
0 0 4 2

OBJECTIVE
- This laboratory gives practical exposure characterization techniques and teaches to interpret results with knowledge gained from the theory subject on characterization of materials.

LIST OF EXPERIMENTS:
1. Determination of precision determination of lattice parameters using an x-ray diffractometer pattern
2. Identification of an unknown structure with the use of database.
3. Fractography analysis using Scanning electron microscopy (SEM)
5. Line scan Analysis using SEM - Energy Dispersive Spectroscopy (EDS).
6. Elemental mapping using SEM-EDS
7. Quantitative image analysis of grain size, grain size distribution, and twin fraction using image analyzer.
   a) Phase fraction and grain size determination
   b) Nodularity and nodule count
8. Study of Wulff net diagram, Stereographic projection & Pole Figures
9. Indexing of SAED (Selected Area Electron Diffraction) patterns of Transmission electron microscopy (TEM)
10. Determination of flaw using Ultrasonic Flaw Detector (UFD)
11. Determination of Young's Modulus of a material using UFD.
12. Determination of index point of angle probe of UFD using Calibration Block. TOTAL: 60 PERIODS

OUTCOME
- Student will be familiarized to various instruments for characterisation, specific sample preparation, data interpretation, analysis and presentation like XRD, SEM, etc.

ML7701 NONFERROUS METALLURGY  L  T  P  C
3 0 0 3

OBJECTIVE
- To understand the structure, property relations of nonferrous alloys with special emphasis on engineering applications.

UNIT I COPPER AND COPPER ALLOYS 9
UNIT II ALUMINIUM AND ITS ALLOYS

UNIT III MAGNESIUM AND TITANIUM ALLOYS
Methods of Production of Magnesium- properties and uses. Magnesium alloys and designation. Methods of Production of Titanium- unique characteristics of the metal- alpha, alpha+beta and beta titanium alloys- major types. Titanium aluminides – their properties and uses. Typical microstructure of magnesium and titanium alloys- Applications of Ti alloys in Aircraft, Chemical and Medical industries.

UNIT IV NICKEL AND ZINC ALLOYS

UNIT V LEAD, TIN AND PRECIOUS METALS
Methods of Production of Lead and Tin-Major characteristics and applications of lead and tin and their alloys and designation. Low melting nature of solder alloys. Gold, silver and platinum – nobility of these metals. Engineering properties and applications of these metals and their alloys. Typical microstructure of solder alloys.

TOTAL: 45 PERIODS

OUTCOME
• The course will enable a student to understand the production of an alloy, correlate structure - property relations of nonferrous alloys with special emphasis on engineering applications.

TEXTBOOKS

REFERENCES
ML7751  SURFACE ENGINEERING  L T P C
3 0 0 3

OBJECTIVE
- The subject provides knowledge on various types of corrosion, their kinetics, testing and methods of protection as well as introduction to tribology.

UNIT I  INTRODUCTION  12
Introduction to tribology, surface degradation, wear and corrosion, types of wear, adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication-, expressions for corrosion rate. emf and galvanic series - merits and demerits -Pourbaix diagram for iron, magnesium and aluminium. Forms of corrosion - Uniform, pitting, intergranular, stress corrosion. corrosion fatigue. dezincification. erosion corrosion, crevice corrosion - Cause and remedial measures - Pilling Bedworth ratio - High temperature oxidation-Hydrogen embrittlement-Remedial Measures.

UNIT II  KINETICS OF CORROSION  8
Exchange current density, polarization - concentration, activation and resistance, Tafel equation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity, Effect of oxidising agents

UNIT III  CORROSION OF INDUSTRIAL COMPONENTS  8
Corrosion in fossil fuel power plants, Automotive industry, Chemical processing industries, corrosion in petroleum production operations and refining, Corrosion of pipelines.

UNIT IV  TESTING  8
Purpose of corrosion testing - Classification - Susceptibility tests for intergranular corrosion-Stress corrosion test. Salt spray test humidity and porosity tests, accelerated weathering tests. ASTM standards for corrosion testing and tests for assessment of wear

UNIT V  PROTECTION METHODS  9
Organic, Inorganic and Metallic coatings, Electroless plating and Anodising - Cathodic protection, corrosion inhibitors - principles and practice - inhibitors for acidic neutral and other media. Special surfacing processes - CVD and PVD processes, sputter coating. Laser and ion implantation, Arc spray, plasma spray, Flame spray, HVOF.

OUTCOME
- Ability to control the factors that affect the metal corrosion.
- Ability to measure the corrosion rate.
- Ability to prevent corrosion by coatings and inhibitors, etc.

TEXTBOOKS

REFERENCES
OBJECTIVE

- This laboratory course is train students to scientifically investigate of problem in the area of materials engineering, collect literature, hypothesize a solution, plan and execute activities of project with creativeness and innovation involving material processing, testing and characterization.

The goal of this course is to help students to identify innovative projects that promotes and inhibit creativity to explore the variables that affect creativity and innovation. By the end of the period, students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications.

The goal of this course is to drive them to learn concepts, models, frameworks, and tools that engineering graduates’ need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.

Each student will choose a nagging workplace problem or socially relevant problems that have been difficult for them to "solve." At the end of the semester, each or group of students have to submit a report for evaluation.

OUTCOME

- Student will know to define a problem, survey literature, systematic approach of planning and execution of activities as an individual or as a group in attempting a solution for a problem in materials engineering.

LIST OF EXPERIMENTS

1. Estimation of corrosion rate of mild steel by weight loss method and determination of inhibitor efficiency in acid and neutral media.
2. Electroplating of Cu and Ni
3. Electroless nickel coating
4. Oxalic acid etch test for intergranular corrosion (Streicher test)
5. Evaluation of corrosion characteristics by potentiostatic/galvanostatic polarisation techniques - Study of passivation characteristics of MS and SS steels in acid media
6. Evaluation of corrosion characteristics by potentiostatic/galvanostatic polarisation techniques - Determination of pitting potential of various steels
7. Evaluation of corrosion characteristics by potentiostatic/galvanostatic polarisation techniques – Potentiostatic investigation of the effectiveness of inhibitors
8. Determination of wear, wear rate and wear characteristics pin on disc wear testing

OUTCOME

- Student will be able to carry out surface modifications, evaluate their corrosion and wear characteristics by interpretation of results.
OBJECTIVE:
This course is mandatory to gain exposure to applications in industry.

The students have to undergo practical industrial training for four weeks (during vacation at the end of VI semester) in recognized industrial establishments. At the end of the training they have to submit a report with following information:

1. Profile of the Industry
2. Product range
3. Organisation structure
4. Plant layout
5. Processes/Machines/Equipment/devices
6. Personnel welfare schemes
7. Details of the training undergone
8. Projects undertaken during the training, if any
9. Learning points.

End Semester examination will be a Viva-Voce Examination.

OUTCOMES
- Ability to present the Industrial activities and know about process/product/magnet techniques under in the Industries.

ML7811  PROJECT WORK  L  T  P  C  0  0  20  10

OBJECTIVE:
To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
To train the students in preparing project reports and to face reviews and viva voce examination.
A project topic must be selected by the students in consultation with their guides.
The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and fabrication of a device for a specific application, a research project with a focus on an application needed by the industry/society, a computer project, a management project or a design project.
The progress of the project is evaluated based on a minimum of three reviews.
The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL :300 PERIODS

OUTCOME:
- Upon completion of this course, the students will be able to take up any challenging practical problems and find solution by formulating proper methodology.
OBJECTIVE

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I
INTRODUCTION TO DISASTERS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II
APPROACHES TO DISASTER RISK REDUCTION (DRR)

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III
INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV
DISASTER RISK MANAGEMENT IN INDIA

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V
DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS
OUTCOME

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

TEXTBOOKS


REFERENCES

3. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE7074 HUMAN RIGHTS

OBJECTIVES:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I


UNIT II


UNIT III

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V


OUTCOME:

- Engineering students will acquire the basic knowledge of human rights.
REFERENCES:

GE7652 TOTAL QUALITY MANAGEMENT

L T P C
3 0 0 3

AIM
• To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES
• To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
• To understand the TQM Principles.
• To learn and apply the various tools and techniques of TQM.
• To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Definition of TQM - Basic concepts of TQM - Gurus of TQM (Brief introduction) - TQM Framework - Barriers to TQM - Benefits of TQM.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II
Quality circles -- Quality Function Deployment (QFD) -- Taguchi quality loss function -- TPM -- Concepts, improvement needs -- Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS
OUTCOMES:
- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCE:

IE7751 DESIGN OF EXPERIMENTS

AIM:
- This course aims to introduce students how to statistically plan, design and execute industrial experiments for process understanding and improvement in both manufacturing and service environments

OBJECTIVES:
- To demonstrate knowledge and understanding of Classical Design of Experiments (DOE)
- To demonstrate knowledge and understanding of Taguchi’s approach
- To develop skills to design and conduct experiments using DOE and Taguchi’s approach
- To develop competency for analysing the data to determine the optimal process parameters that optimize the process.

UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS
Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

UNIT II SINGLE FACTOR EXPERIMENTS
Completely Randomized Design- effect of coding the observations- model adequacy checking - estimation of model parameters, residuals analysis- treatment comparison methods- Duncan’s multiple range test, Newman-Keuel’s test, Fisher’s LSD test, Tukey’s test- testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.
UNIT III FACTORIAL DESIGNS
Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares- $2^K$ Design with two and three factors- Yate’s Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS
Blocking and Confounding in $2^K$ Designs- blocking in replicated design- $2^K$ Factorial Design in two blocks- Complete and partial confounding- Confounding $2^K$ Design in four blocks- Two level Fractional Factorial Designs- one-half fraction of $2^K$ Design, design resolution, Construction of one-half fraction with highest design resolution, one-quarter fraction of $2^K$ Design- introduction to response surface methods, central composite design.

UNIT V TAGUCHI METHODS
Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal to noise ratios, Inner/outer OA design- case studies.

OUTCOMES:
- To understand the fundamental principles of Classical Design of Experiments
- To apply DOE for process understanding and optimisation
- To describe the Taguchi’s approach to experimental design for process performance robustness
- To apply Taguchi based approach to evaluate quality

REFERENCES:

ME7020 APPLIED THERMAL ENGINEERING

OBJECTIVE
- To apply the concepts and laws of thermodynamics for heat engines - Internal Combustion(IC) engines, Compressor, Gas Turbines, Boilers, Refrigeration and Air Conditioning Systems.

UNIT I GAS AND VAPOUR POWER CYCLES
Air Standard Cycles - Otto, Diesel, Dual, Brayton, Rankine – cycle Analysis and performance calculations

UNIT II INTERNAL COMBUSTION ENGINES AND ITS SYSTEMS
IC engine Classification, components and functions. Actual and theoretical - valve and port timing diagrams, Comparison of two stroke & four stroke engines and SI & CI engines. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines Ignition, lubrication and cooling systems. Exhaust gas analysis.
UNIT III STEAM NOZZLE AND BOILERS

UNIT IV GAS TURBINES AND STEAM TURBINES

UNIT V COMPRESSION, REFRIGERATION AND AIR – CONDITIONING
Classification and working principle, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor.
Vapour compression Refrigeration cycle, Superheat, Sub cooling, Performance calculations, Working principle of vapour absorption system, Air cycle refrigeration, Psychrometry and Psychrometric properties, Psychrometric chart, Instrumentation, Cooling load calculations and circulating systems, Air conditioning systems.

TOTAL: 45 PERIODS

OUTCOME
• Students will have overview of applied thermal engineering which will help to understand materials development and working conditions related to thermal shock, hot corrosion, etc.

TEXTBOOKS

REFERENCES

ME7071 AUTOMOBILE ENGINEERING L T P C 3 0 0 3

OBJECTIVE:
• To provide a first course of teaching such that the learners are able to visualise the scope of Automobile Engineering.
UNIT I INTRODUCTION TO AUTOMOTIVES 9
An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Quality standards, Trends in automobile design.

UNIT II POWER SOURCE FEATURES 9
Reciprocating Engine systems, Rotary Engine systems, Gas Turbine systems, Hybrid systems. Pollutant emissions and their control; Catalytic converter systems, Electronic Engine Management systems.

UNIT III TRANSMISSION, SUSPENSION AND BRAKING SYSTEMS 9
Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and preliminaries of suspension systems.

UNIT IV AUXILIARY SYSTEMS 9
Electrical and electronic systems, safety systems, Heating, Ventilation, and Air Conditioning (HVAC) systems, Vehicle Thermal Management System and vehicle body design features.

UNIT V TESTS, SERVICE AND MAINTENANCE 9
Engine Tuning, vehicle maintenance, engine and Chassis Dynamometry Pollutants and emissions check, Wind Tunnel Tests, preliminaries of engine and vehicle testing.

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
- Identify the different components in an automobile.
- Clearly understand different auxiliary and transmission systems.

TEXT BOOK:

REFERENCES:

ME7077 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:
The students will be provided with an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP 9

UNIT II MOTIVATION 9
UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of the course, the students will be able to:
- Gain knowledge and skills needed to run a business successfully.

TEXT BOOKS:

REFERENCES:

ME7080 MARKETING MANAGEMENT

OBJECTIVE:
- To expose the students to newer concepts of marketing principles like strategic marketing concepts, segmentation, pricing, advertisement and strategic formulation.

UNIT I CONCEPTS IN MARKETING

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION
Cultural, Demographic factors, Motives, Types, Buying Decisions, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation, Process, Patterns. Services marketing and Industrial marketing.

UNIT III PRODUCT, PRICE AND MARKETING RESEARCH
UNIT IV MARkETING PLANNING AND STRATEGY FORMULATION 9

UNIT V ADVERTISING, SALES PROMOTION & DISTRIBUTION 9

TOTAL:45 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
- Understand the philosophies of marketing and should able to formulate market planning, strategies and could promote sales in effective manner.

TEXT BOOKS:

REFERENCES:

ME 7351 DESIGN CONCEPTS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To impart the importance of design in todays context of global competition, environmental awareness and customer oriented market.
- To impart the basic concepts and various aspects of design using simple examples and case studies.

UNIT I DESIGN TERMINOLOGY 9
Definition-various methods and forms of design-importance of product design-static and dynamic products-various design projects-morphology of design-requirements of a good design-concurrent engineering-computer aided engineering-codes and standards-product and process cycles-bench marking.

UNIT II DESIGN PROCESS 9
Basic modules in design process-scientific method and design method-Need identification, importance of problem definition-structured problem, real life problem- information gathering -customer requirements- Quality Function Deployment (QFD)- product design specifications-generation of alternative solutions- Analysis and selection-Detail design and drawings-Prototype, modeling, simulation, testing and evaluation.
UNIT III  CREATIVITY IN DESIGN  9
Creativity and problem solving-vertical and lateral thinking-invention-psychological view, mental blocks-Creativity methods-brainstorming, synectics, force fitting methods, mind map, concept map-Theory of innovative problem solving (TRIZ) - conceptual decomposition creating design concepts.

UNIT IV  HUMAN AND SOCIETAL ASPECTS  9
Human factors in design, ergonomics, user friendly design-Aesthetics and visual aspects environmental aspects-marketing aspects-team aspects-legal aspects-presentation aspects.

UNIT V  MATERIAL AND PROCESSES IN DESIGN  9
Material selection for performance characteristics of materials-selection for new design substitution for existing design-economics of materials-selection methods-recycling and material selection-types of manufacturing process, process systems- Design for Manufacturability (DFM) - Design for Assembly (DFA).

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
- Understand the various design requirements and processes involved in product development.
- Be exposed to various creativity and problem solving techniques.

TEXT BOOK:

REFERENCES:

ME 7751  FINITE ELEMENT ANALYSIS  L  T  P  C  3  0  0  3

OBJECTIVES:
- To introduce the concepts of Mathematical Modeling and numerical solution of engineering problems.
- To appreciate the use of Finite Element Method to a range of engineering problems.

UNIT I  INTRODUCTION  9

UNIT II  ONE-DIMENSIONAL PROBLEMS  9
UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS

UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
- Understand the use of the FEM to solve problems in Mechanical Engineering.
- Use the Finite Element Method to solve Structural, thermal and Eigen value problems.

TEXT BOOKS:

REFERENCES:

MF7071 ADDITIVE MANUFACTURING TECHNOLOGY

OBJECTIVES:
- To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

UNIT I INTRODUCTION
UNIT II  DESIGN FOR ADDITIVE MANUFACTURING  9

UNIT III  PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES  9

UNIT IV  EXTRUSION BASED AND SHEET LAMINATION PROCESSES  9

UNIT V  PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES  9

TOTAL: 45 PERIODS

OUTCOME:
- On completion of this course, students will learn about a working principle and construction of Additive Manufacturing technologies, their potential to support design and manufacturing, modern development in additive manufacturing process and case studies relevant to mass customized manufacturing.

TEXT BOOKS:

REFERENCES:

MF7651 NON-TRADITIONAL MACHINING PROCESSES

OBJECTIVE:
At the end of this course the students are expected to
- Understand the working principles of various non-traditional machining processes, their applications, advantages and limitations.
- The students can also able to learn advanced nano finishing processes, recent developments in the non-traditional machining processes and to compare them.
UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9
Introduction to non-traditional machining processes, need for non-traditional machining, classification of non-traditional machining processes, their applications, advantages, limitations. Abrasive jet machining, abrasive water jet machining, ultrasonic machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9
Chemical machining, electro-chemical machining, electro-chemical honing, electro-chemical grinding, electro-chemical deburring their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9
Electric discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining, electron beam machining, ion beam machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT IV ADVANCED NANO FINISHING PROCESSES 9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students are expected to understand
• The working principles of various non-traditional machining processes, their applications, advantages and limitations.
• Advanced nano finishing processes.
• Recent developments in the non-traditional machining processes.
• Comparison of non-traditional machining processes.

TEXT BOOKS:

REFERENCES:
UNIT I  INTRODUCTION  9

UNIT II  ELECTRO-RHEOLOGICAL AND PIEZOELECTRIC MATERIALS  9

UNIT III  SHAPE MEMORY MATERIALS  9

UNIT IV  ORTHOPAEDIC AND DENTAL MATERIALS  9

UNIT V  APPLICATIONS OF BIO MATERIALS FOR CARDIOVASCULAR 9
OPHTHALMOLOGY AND SKIN REGENERATION

TOTAL: 45 PERIODS
OUTCOMES

- Use of Bio materials for cardiovascular Opthalmology and Skin Regeneration
- Use of Bio materials for Dental & Bone application
- Use of shape memory alloys in engineering application
- Explain the characteristics of Bio and smart materials
- Use of smart materials as sensors, actuators.

TEXTBOOKS


REFERENCES


ML7002 CASTING PROCESSES

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OBJECTIVE

- Metal casting is one of the important manufacturing processes used for manufacturing components, the content of the syllabus focuses on imparting knowledge on casting practices of Alloy steels, Magnesium, Aluminium, Zinc and Copper alloys.

UNIT I MAGNESIUM ALLOYS

Introduction to different types of Magnesium alloys – Process for Manufacturing Magnesium alloys – Production considerations – Die casting consideration – die life productivity – applications of Magnesium alloy cast parts

UNIT II ALUMINIUM ALLOYS

Introduction to different types of Aluminium alloys – Process for Manufacturing Aluminium alloys - Production considerations – die life – productivity – applications of Aluminium Cast Parts.

UNIT III ALLOY STEELS

Introduction to different types of Alloy steels – process for manufacturing alloy steels – production considerations – productivity – applications of alloy cast parts.

UNIT IV ZINC ALLOYS

UNIT V  COPPER ALLOYS

OUTCOMES
• Ability to design casting process for alloys, such as Magnesium and Aluminum, Steel, Zinc, copper and its alloy.
• Ability to perform die life calculation, productivity

TEXTBOOKS

REFERENCES

ML7003  COMPUTER APPLICATIONS IN MATERIALS SCIENCE  L  T  P  C
3  0  0  3

OBJECTIVE
• Computer applications have become important to solve, approximate, interpret and visualize problems in Materials Science. After reviewing the mathematical foundation, applications in Materials Science are introduced.

UNIT I  SOLUTIONS OF EQUATIONS AND INTERPOLATION

UNIT II  PARTIAL DIFFERENTIAL EQUATIONS
Applications in diffusion and mass transport in materials.

UNIT III  MONTE CARLO METHODS AND SIMULATION
Monte Carlo Method for simulating nucleation and growth of grains in materials.
UNIT IV  MATRIX ALGEBRA  9
Study of anisotropy in materials.

UNIT V  SELECTED APPLICATIONS IN MATERIALS SCIENCE  9
Modeling and property Prediction.

TOTAL: 45 PERIODS

OUTCOME
• Ability to use computational techniques the Materials Engineering
• Use of mathematical equation to predict the properties of materials

TEXTBOOKS

REFERENCES

ML7004  CREEP AND FATIGUE BEHAVIOUR OF MATERIALS  L  T  P  C
3  0  0  3

OBJECTIVE
• The useful life of components is often limited by the fracture, fatigue and creep properties of the materials used. The students study the fundamental processes leading to failure of technical components.

UNIT I  INTRODUCTION

UNIT II  HIGH – TEMPERATURE DEFORMATION RESPONSE  9

UNIT III  CYCLIC STRESS AND STRAIN FATIGUE  9
Macro fractography fatigue failures - cyclic stress and strain controlled fatigue - Fatigue life estimation for notched components – Crack initiation mechanisms.
UNIT IV  FATIGUE CRACK PROPAGATION
Stress and crack lengths correlations with FCP – Fracture modes in Fatigue – Microscopic fracture mechanisms – Crack growth behavior at Δk extremes – Influences – Micro structural aspects of FCP in metal alloys.

UNIT V  ANALYSIS OF ENGINEERING FAILURES
Typical defects – Microscopic surface examination – metallographic and fractographic examination – Component failure analysis – Fracture surface preservation – Cleaning and replication techniques and image interpretation.

OUTCOMES
• Identify the fracture due to creep and fatigue
• Use of suitable mathematical equation to predict ability the crack growth rate
• Ability to perform failure analysis

TEXTBOOKS

REFERENCES

OBJECTIVE
• Students are to study and become familiar with this very specialized form of material treatment at low temperature.

UNIT I  INTRODUCTION

UNIT II  CRYOCOOLERS
UNIT III CRYOGENIC PROCESSING

UNIT IV MATERIALS ENGINEERING
Desirable qualities for materials used in cryogenic applications, History and applications of metallic / non-metallic materials, Understanding properties and fabrication processes of superconducting Nb3Sn wires, High temperature superconductors. Characterization of cryogenically processed materials.

UNIT V APPLICATIONS
Cryogenic processing of materials for Space applications, Superconductivity, Medical applications, Food Preservation-Individual Quick Freezing, Tool Industry, Automobiles etc.

TOTAL: 45 PERIODS

OUTCOME
- Ability to perform cryogenic treatment of materials
- Ability to select materials for cryogenic treatment
- Discuss the properties and application after cryogenic treatment of materials

TEXTBOOKS

REFERENCES

OBJECTIVE
- The characterization of sub-micron to nano-structured materials to reveal the structure-property- correlation involves electron microscopy and thereby diffraction analysis of materials. The course provides an in-depth understanding of the crystal structure and symmetry elements, diffraction theory and analysis as well as spectroscopy and electron microscopy.

UNIT I BASICS OF CRYSTALLOGRAPHY AND ELECTRON OPTICS
Introduction – Electron Optics – microscopy and the concept of resolution – interaction of electrons with matter – depth of field and depth of focus, crystallography – symmetry elements – symmetry operations, point groups, space groups, indexing planes, indexing lattice directions – plane normals – zones and the zone law, stereographic projection – Wulff Net
UNIT II  ELECTRON DIFFRACTION THEORY
Basics of electron diffraction – scattering by an individual atom, scattering by a crystal – Bragg law – Laue conditions, reciprocal lattice and diffraction by a single crystal – Ewald sphere construction, elastic scattering, inelastic scattering, Structure Factor, intensity distribution in reciprocal space - standard spot patterns

UNIT III  TRANSMISSION ELECTRON MICROSCOPES
Working principle of TEM – important aspects of microscope operation and alignment – aberration correction – resolution, formation of diffraction patterns and images – SAED – bright and dark field images – Centered dark field images - weak beam images – sample preparation, advanced TEMs – HRTEM

UNIT IV  DIFFRACTION ANALYSIS

UNIT V  SCANNING ELECTRON MICROSCOPES

TOTAL: 45 PERIODS

OUTCOME
- The student will able to interpret characterization results of diffraction pattern and images of electron microscopy, so as to identify phase, symmetry, crystal structure, orientation, defects, etc. and elemental composition bulk from X-ray spectroscopy and of surface from electron energy loss spectroscopy.

TEXTBOOKS

REFERENCES
OBJECTIVE

- Traditional use of fuels for storage: Load management, Space conditioning, Transportation, Utility system, Variable energy sources, Role of different energy forms, Energy quality, Energy efficiency, Energy and power densities.
- Ability to converse about the working of a typical fuel cell, its types and to elaborate on its thermodynamics and kinetics. Able to analyze the cost effectiveness and eco-friendliness of Fuel Cells.

UNIT I  BATTERY CHARACTERISTICS

Voltage, current, capacity, electricity storage density, power, discharge rate, cycle life, energy efficiency, shelf life. Primary batteries: The chemistry, fabrication, performance aspects, packing and rating of zinc-carbon, magnesium, alkaline, manganous dioxide, mercuric oxide, silver oxide batteries, zinc/air and lithium button cells- solid electrolyte cells.

UNIT II  SECONDARY BATTERIES

The chemistry, fabrication and performance aspects and rating of lead acid and valve regulated (sealed) lead acid, nickel-cadmium, nickel-zinc, lithium and lithium ion batteries - Rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide, lithium anode cell, thermal batteries.

Batteries for electric vehicles: Metal/air, zinc-bromine, sodium-beta alumina and lithium/iron sulphide batteries. (outline only) Photogalvanic cells. Battery specifications for cars, heart pacemakers, computer standby supplies etc.

UNIT III  FUEL CELLS


UNIT IV  TYPES OF FUEL CELLS

Description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells. Proton Exchange Membrane fuel cells - basic aspects – working and high temperature operation – recent development in technology.

UNIT V  HYDROGEN AS FUEL, SOLAR CELL AND ENVIRONMENT


TOTAL: 45 PERIODS

OUTCOME

- Course enable student to understand latest energy storage and fuel cell technology and designing principle related to energy efficiency.

TEXT BOOKS
REFERENCES

ML7008 FRACTURE MECHANICS AND FAILURE ANALYSIS

OBJECTIVES
- To introduce the basic concept of fracture mechanics and failure analysis
- Import knowledge on mechanics of fracture during static and dynamic loading
- Understanding the failure mechanism of creep rupture.
- Understand the mechanism of wear and corrosion and knowledge on prevention

UNIT I BASIC CONCEPTS IN FRACTURE MECHANICS
The geometry of stress and strain, elastic deformation, plastic and elasto-plastic deformation, Brittle fracture: Griffiths theory, Ductile fracture, Probabilistic aspects of fracture mechanics - Microstructure

UNIT II MECHANICS OF FRACTURE- STATIC LOADING

UNIT III FAILURE ANALYSIS OF FATIGUE FRACTURE

UNIT IV FAILURE ANALYSIS OF CREEP RUPTURE
Fracture at elevated temperature: Time dependent mechanical behavior, stress rupture, Microstructural changes during creep, Mechanism of creep deformation and Creep deformation maps, Prediction of time to rupture, Creep-fatigue interaction. Some case studies in analysis of creep failures.

UNIT V FAILURE ANALYSIS OF CORROSION AND WEAR

TOTAL: 45 PERIODS
OUTCOME

- Ability to design structure to prevent failure from the internal defect that unit within the structure
- Ability to design structure to prevent fatigue and creep
- Ability to define different deformation and related theories
- Ability to analyse the corrosion and wear failure and system methods to prevent corrosion and wear.

TEXT BOOKS


REFERENCES


ML7009 FUELS, FURNACES AND REFRACTORIES L T P C 3 0 0 3

OBJECTIVE

- Many industries require process heat in the production and treatment of materials.
- This course teaches fundamentals and applications of fuels, furnaces sand Refractories.

UNIT I FUNDAMENTALS 9

UNIT II FUELS 9

UNIT III FURNACES 9
Firing, electric Resistance, Radiation, Induction. Temperature control - PID. Multi zone furnaces. Batch and tunnel furnaces.

UNIT IV REFRACTORIES 9
Heat resistant materials in steel making and non ferrous production plants. Applications in the power, energy conversion, petroleum and chemical industries.

UNIT V ADVANCED ISSUES 9

TOTAL: 45 PERIODS
OUTCOME
- Use of different fuels for energy generation system
- Use of Refractories in furnace
- Ability to discuss the issues in environmental.

TEXT BOOKS

REFERENCES

ML7010
INDUSTRIAL TRIBOLOGY

L T P C
3 0 0 3

OBJECTIVE
- To introduce and expose students to the field and fundamentals in tribology and its applications.

UNIT I SURFACES AND FRICTION
- Topography of Engineering surfaces
- Contact between surfaces
- Sources of sliding Friction
- Adhesion-Ploughing
- Energy dissipation mechanisms
- Friction Characteristics of metals
- Friction of non-metals
- Friction of lamellar solids
- Friction of Ceramic materials and polymers
- Rolling Friction
- Source of Rolling Friction
- Stick slip motion
- Measurement of Friction.

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 of Ceramics and Polymers
- Wear Measurements.

UNIT III LUBRICANTS AND LUBRICATION TYPES
- Types and properties of Lubricants
- Testing methods
- Hydrodynamic Lubrication
- Elasto-hydrodynamic lubrication
- Boundary 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 Coefficient of friction
- The Sommerfield 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.

TOTAL: 45 PERIODS
OUTCOME

- Ability to design friction, wear and Lubrication
- Ability to identify different types of sliding & rolling friction, Wear and related theories
- Ability to distinguish among the different Lubricant regime.
- Select materials for bearing.

TEXT BOOKS

REFERENCES

ML7011 INTRODUCTION TO TRANSPORT PHENOMENA L T P C
3 0 0 3

OBJECTIVE

- The subject introduce the students about the fundamental fluid mechanics, flow and energy transfer, in order understand and analysis the transport phenomena occurs in casting, welding, energy storing /transferring devices, mineral processing, chemical processing etc.

UNIT I FLUID MECHANICS

Properties of fluids such as density, viscosity and specific weight. Fluid statics - Pressure at a point - Pressure variations in horizontal and vertical directions - Concept of gauge and absolute pressure. Use of manometer for pressure measurements. Introduction to Hydrostatic Forces.
Energy Balance in Fluid Flow: Types of flow - continuity equation - Application to one dimensional problems. Derivation of Bernoulli’s equation and Euler’s equation - Examples illustrating the use of energy equation in metallurgical processes.

UNIT II INTERNAL AND EXTERNAL FLOW

Classification of flow - Reynolds number - Laminar flow between parallel plates and circular pipes - Simple problems.
Pressure in Fluid Flow: Head loss due to friction -Darcy - Weisbach equation - flow through pipes - use of Moody diagram - Minor losses - Simple problems.

UNIT III CONDUCTION HEAT TRANSFER

Steady state heat conduction - simple examples. Transient heat conduction - Systems with negligible internal resistance - Lumped heat analysis - Response time of a temperature measuring instrument - System with negligible surface resistance- heat flow in an infinitely thin plate (Semi infinite body) - System with finite surface and internal resistance - Chart solutions of transient heat conduction problems – Examples on Heat Treatment
UNIT IV CONVECTIVE HEAT TRANSFER
Forced and free convention - Boundary layer concept - velocity and thermal boundary layers (no derivation) - Simple problems - Flow over flat plate - laminar and turbulent boundary layers (no derivation) - Simple problems – Boundary layer development in a circular duct (no derivation) - Flow over cylinders and spheres - Simple problems - applications in metallurgical processes.

UNIT V RADIATION HEAT TRANSFER

TOTAL: 45 PERIODS

OUTCOME
• This course enables the students apply the knowledge of fluid mechanics, mass transport with respect to temperature and pressure as specific to mineral processing, liquid metal – solidification, etc. of materials technology.

TEXT BOOKS

REFERENCES

ML7012 LASER PROCESSING OF MATERIALS

OBJECTIVE
• To impart the knowledge about the principles of industrial lasers such as laser generation, mode selection, beam mechanisms, modifications and characteristics, types of lasers etc. Also to introduce the concepts of laser processing of materials which includes background of laser systems, process parameters, material considerations and specific applications.

UNIT I PRINCIPLES OF INDUSTRIAL LASERS

UNIT II THERMAL PROCESS- HEAT AND FLUID FLOW
Heat flow in the work piece: thick plate with point heat source, thin plate with line heat source, peak temperature and cooling rates Fluid flow in molten pool: continuity equation, navier-stokes equation and surface tension effects.
UNIT III  LASER METALLURGY  9
Process microstructure- fusion zone, zone of partial melting, haz, discontinuities- porosity, cracking, lack of fusion, incomplete penetration and undercut.

UNIT IV  LASER WELDING AND SURFACE MODIFICATIONS  9

UNIT V  LASER MACHINING  9

TOTAL: 45 PERIODS

OUTCOMES
• Discuss the Laser principles and use of it in processing of Engineering materials.
• Use of it for Welding and surface modification of different Engineering materials.
• Perform Machining using Laser.

TEXT BOOKS

ML7013  MAKING AND METALLURGY OF STAINLESS STEELS  L  T  P  C
3  0  0  3

OBJECTIVE
• Products made out of various types of Stainless steels find extensive applications both in domestic and Industrial applications. The aim of this subject is to provide a comprehensive knowledge on various aspects of Stainless steel making, metallurgy, Properties and its applications.

UNIT I  HISTORY AND EVOLUTION OF STAINLESS STEEL  9
Essential elements, evolution, development of alloys, selection of Stainless steels, Recent processing enhancements.

UNIT II  CLASSIFICATION OF STAINLESS STEELS  9

UNIT III  MELTING AND SECONDARY REFINING OF STAINLESS STEELS  9
Raw Materials selection, Melting Furnaces ( EAF, ELF), melt treatment, secondary refining –AOD, VOD, IOC converters processing, advantages and limitations.

UNIT IV  CORROSION BEHAVIOUR OF STAINLESS STEELS  9
Atmospheric, aqueous, stress corrosion, cracking and Hydrogen Embrittlement, High Temperature corrosion, Corrosion of Cast stainless steels, PREN Index, Corrosion rate estimations- ASTM Practices.
UNIT V  APPLICATIONS OF STAINLESS STEELS


TOTAL: 45 PERIODS

OUTCOME
- The students will understand the production methodology of stainless steel making and also gain knowledge on the metallurgy of stainless steel making.

TEXTBOOKS

REFERENCES

ML7014  MATERIALS FOR AUTOMOTIVE APPLICATION  L T P C
3 0 0 3

OBJECTIVE
- Knowledge on properties of engineering materials
- To select suitable materials for design
- Materials selection criteria for engine and transmission systems
- Different materials used for automotive structures.
- Different electronic materials for automotive applications

UNIT I  ENGINEERING MATERIALS AND THEIR PROPERTIES

Classes of engineering materials - the evolution of engineering materials, Definition of materials properties, Displaying material properties using materials selection charts, Forces for change in materials selection and design, Materials and the environment - selection of materials for automotive, aerospace, marine and defence applications.

UNIT II  BASIS OF MATERIAL SELECTION


UNIT III  MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS

Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.
UNIT IV  MATERIALS FOR AUTOMOTIVE STRUCTURES  9
Materials selection for bearings, leaf springs, chasis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials , damping and antifriction fluids, Tyres and tubes.

UNIT V  ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS  9
Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

TOTAL: 45 PERIODS

OUTCOMES
• Discuss different materials used for automotive component manufacturing.
• Select proper material for Automobile applications

TEXT BOOKS

REFERENCES

ML7015  METALLURGY OF TOOL MATERIALS  L  T  P  C
3  0  0  3

OBJECTIVE
• Tooling materials require special considerations in production and applications. Students will learn about the various heat treatment processes that can be applied to the conventional tool materials as well as the advanced tool materials.

UNIT I  CLASSIFICATION AND MANUFACTURE OF TOOL STEELS  9
Classification – AISI system, selection of tool steels from the point of view of mechanical properties, Effect of alloying elements such as W, Mo, Ni, V, Ti etc., in Tool steels, Production techniques – problems in melting – powder metallurgy route, Refining methods like VAR, ESR – forming of tool steels.

UNIT II  HEAT TREATMENT OF TOOL STEELS AND DEFECTS  9
HEAT TREATMENT AND METALLURGY OF H, T, M, SPECIAL PURPOSE TOOL STEELS-Hot work tool steels, high speed tool steels, maraging tool steels, special purpose tool steels: constitution, classification of principal types, heat treatment process, specific requirements and applications.

UNIT III  PROPERTIES, TESTING AND FAILURE OF TOOL STEELS  9

UNIT IV  ADVANCED TOOL MATERIALS  9

UNIT V  SURFACE TREATMENTS AND COATINGS  9

TOTAL: 45 PERIODS

OUTCOME
- The students will gain knowledge on the classification of various tool materials and they will be exposed to the heat treatments that can be performed on the various tool materials and their effect on the properties and their performance

TEXTBOOKS

REFERENCES

OBJECTIVE
- To introduce the various types of micromachining processes and their Applications.

UNIT I  INTRODUCTION  9
Introduction to micromachining process – Classification of micromachining and nanomachining processes – Molecular dynamics, principle of molecular dynamics simulation- potential energy function – Boundary condition – MD simulation procedure.

UNIT II  MICROFABRICATION METHODS  9
Methods of Microfabrication – Maleno deposition – Electro discharge deposition, Chemical vapour deposition physical vapour deposition – Electro Chemical spark deposition – LIGA.
UNIT III  MECHANICAL MICROMACHINING  9
Ultrasonic machining – Abrasive jet machining – Abrasive water jet machining, water jet machining – Beam energy micromachining – Electron beam machining, electro discharge machining, ion beam machining, focused ion beam machining.

UNIT IV  MICROMACHINING AND NANO FUNCTIONING WITH ABRASIVE FLOW  9

UNIT V  HYBRID MICRO MACHINING  9
Chemical Mechanical polishing – Electro chemical spark micro machining – Electro discharge grinding – Electrolytic in process dressing – Application.

OUTCOME
- The student will gain knowledge of material removal mechanism and technology of various types of micromachining processes and their applications.

TEXTBOOKS

REFERENCES

ML7017 MODELING AND SIMULATION IN MATERIALS ENGINEERING  L T P C
            3 0 0 3

OBJECTIVE
Modeling and simulation are important tools in understanding physical effects in many technological applications. This course should enable students to use standard packages for modeling and simulation applicable to Materials Science and Engineering.

UNIT I  INTRODUCTION TO MODELING AND MATHEMATICAL CONCEPTS  9
Mathematical modeling, physical simulation, advantages and limitations - Review of differential equations, numerical methods, introduction to FEM, FDM- Governing differential equations of elastic, plastic deformation, fluid flow and heat transfer – basic steps in FEM

UNIT II  ONE DIMENSIONAL PROBLEMS  9

UNIT III  TWO DIMENSIONAL AND AXISYMMETRIC CONTINUUM  9
UNIT IV SOFTWARE PACKAGES
Introduction to standard software packages – General purpose FEA packages such as ANSYS, ABAQUS, NASTRAN etc. – Special purpose packages such as DEFORM, OPTIFORM, ProCAST, etc. - Applications of FEA in simulation of sheet metal and bulk forming, solidification of casting and weldment, Concepts of coupled analysis

UNIT V COMPUTER APPLICATIONS IN PHYSICAL METALLURGY
Use of computers for the construction of phase diagrams, Features of CALPHAD – Expert system for alloy design and selection of materials – computer applications in crystallography.

TOTAL: 45 PERIODS

OUTCOMES
- Apply numerical techniques to a variety of materials process including solidification, heat treatment, grain from the recovery stabilization
- Able to evaluate the capabilities and limitation of commercial software.

TEXT BOOKS

REFERENCES

ML7018 NANOSTRUCTURED MATERIALS

OBJECTIVE
- To motivate the students to understand the evolution of nanomaterials in the scientific era and make them to understand different processing methods, properties of nanomaterials for the future engineering applications.

UNIT I INTRODUCTION TO NANOMATERIALS
Amorphous, Crystalline, microcrystalline, quasicrystalline and nanocrystalline materials- historical development of nanomaterials – Nanomaterials classification (Gleiter’s Classification) – properly changes done to size effects, Hall – Petch, inverse Hall- Petch effects - polymeric nanostructures.

UNIT II ZERO DIMENSIONAL NANOMATERIALS

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UNIT III  ONE DIMENSIONAL NANOMATERIALS  9

UNIT IV  SUPER HARD COATINGS AND BULK NANOSTRUCTURED MATERIALS  9
Superhard coating- types – characteristics – thermal stability- case studies (nc-TiN/a-Si3N4 coating) – Applications. Buck nanostructured materials - Equal Channel Angular pressing(ECAP) – High Pressure Torsion(HPT), Accumulative roll bending – Reciprocating extrusion- compression, cyclic close die forging – Repetitive corrugation and straightening – Grain refinement mechanisms

UNIT V  CHARACTERIZATION OF NANOMATERIALS  9

OUTCOME
• Ability to design nanostructure using Building blocks of Nanotechnology
• Ability to use OD, 1D, 2D nano building block to process bulk nano structures
• Use of difficult characterization techniques to study the Fundamental properties.

TEXTBOOKS

REFERENCES
OBJECTIVE

- The students having been taught the fundamentals of thermodynamics, physical metallurgy and diffusion processes can undergo an in depth study of the various phase transformation processes that take place in metals and alloys.

UNIT I DIFFUSION MECHANISMS  

UNIT II DIFFUSION CONTROLLED PHASE TRANSFORMATIONS  

UNIT III DIFFUSIONLESS PHASE TRANSFORMATIONS  

UNIT IV PRECIPITATION REACTIONS  

UNIT V RECOVERY, RECRYSTALLISATION AND GRAIN GROWTH  
Cold working and hot working, recovery – polygonisation and dislocation movements in polygonisation, recrystallisation – effect of time, temperature, strain and other variables – mechanism of nucleation and growth, grain growth – grain growth law, geometrical collisions, preferred orientation, secondary recrystallisation.

TOTAL: 45 PERIODS

OUTCOME

- Student will able apply knowledge of physical metallurgy related to phase transformation of ferrous and non ferrous alloys, to understand heat treatment, material processing condition and service conditions.

TEXTBOOKS

REFERENCES
OBJECTIVE
- To learn about metal cutting operations from the theoretical and practical perspective.

UNIT I CUTTING TOOL NOMENCLATURE
Single point tool-significance of the various angles - Machine reference system- normal toll reference system- ORS – interrelation between different tool nomenclatures - Nomenclature of drills, milling cutters and broaches

UNIT II CHIP FORMATION MECHANISM AND FORCES IN MACHINING

UNIT III THERMAL ASPECTS IN MACHINING, TOOL WEAR AND LIFE

UNIT IV CUTTING TOOL MATERIALS
Requirements of tool materials-properties of HSS - advances in tool materials- carbides and coated carbides, ceramic, cermets, CBN, Diamond, PCD - ISO-specifications for inserts and tool holders - Need for chip breakers – types of chip breakers

UNIT V MODELING OF METAL CUTTING
Introduction to modeling – empirical models – mechanistic models – FEA based models –artificial intelligence based models for turning, milling and drilling

OUTCOME
- The course will enable a student to gain practical knowledge on the metal cutting operations and design of cutting tool.

TEXT BOOKS

REFERENCES
OBJECTIVE
- To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

UNIT I  RELIABILITY CONCEPT
Reliability definition – Reliability parameters - f(t), F(t) and R(t) functions - Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

UNIT II  LIFE DATA ANALYSIS

UNIT III  RELIABILITY ESTIMATION
Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye’s method – Minimal path and cut sets - Fault Tree analysis – Standby system.

UNIT IV  RELIABILITY MANAGEMENT

UNIT V  RELIABILITY IMPROVEMENT

TOTAL: 45 PERIODS

OUTCOME
- The course enable student the application of reliability in various field of engineering.

REFERENCES
UNIT II PREPARATION OF THIN FILMS


UNIT III DEPOSITION MONITORING AND CONTROL

Microbalance, Crystal oscillator thickness monitor, optical monitor, Resistance Monitor. Thickness measurement: Multiple Beam Interferometer, Fizeau (Tolansky) technique - Fringes of equal chromatic order (FECO) method - Ellipsometry (qualitative only).

UNIT IV PROPERTIES OF THIN FILM


UNIT V APPLICATION OF THIN FILMS


TOTAL: 45 PERIODS

OUTCOME

• The student will gain knowledge on surface modification technologies of deposition of thin film for different application like optical emission, abrasion resistance, dielectric, electronic applications, energy conversion, etc.

TEXT BOOKS


REFERENCES

GE7072  FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT  L T P C  3 0 0 3

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II  REQUIREMENTS AND SYSTEM DESIGN

UNIT III  DESIGN AND TESTING

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES: