ANNA UNIVERSITY CHENNAI
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012
CURRICULA AND SYLLABI FOR
I TO VIII SEMESTERS

B.E. MATERIALS SCIENCE AND
ENGINEERING (FULL TIME)
# I Semester

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*FOUR WEEKS INDUSTRIAL TRAINING DURING SIXTH SEMESTER HOLIDAYS*
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**TOTAL -182 CREDITS**
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OBJECTIVES

• To enable all students of engineering and technology develop their basic communication skills in English.
• To give special emphasis to the development of speaking skills amongst the students of engineering and technology.
• To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
• To inculcate the habit of reading for pleasure.

UNIT I

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; writing - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; writing - Jumbled sentences - Coherence and
cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations & acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V
Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

OUTCOMES:
Learners should be able to
• Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
• Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
• Read different genres of texts adopting various reading strategies.
• Listen/view and comprehend different spoken discourses/excerpts in different accents

TOTAL: 60 PERIODS

TEXT BOOKS
REFERENCE BOOKS:

EXTENSIVE READERS:

WEBSITE RESOURCES
- www.uefap.com
- www.eslcafe.com
- www.listen-to-english.com
- www.owl.english.purdue.edu
- www.chompchomp.com

MA8151 MATHEMATICS – I
(Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4

OBJECTIVES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I  MATRICES**  
9+3

**UNIT II  INFINITE SERIES**  
9+3

**UNIT III  FUNCTIONS OF SEVERAL VARIABLES**  
9+3

**UNIT IV  IMPROPER INTEGRALS**  
9+3

**UNIT V  MULTIPLE INTEGRALS**  
9+3

**OUTCOMES:**
- This course equips students to have basic knowledge and understanding in one field of materials, integral and differential calculus

**TExT BOOKS:**
REFERENCES:

PH8151  ENGINEERING PHYSICS  L T P C
(Common to ALL Branches of B.E./B.Tech. Programmes)  3 0 0 3

OBJECTIVE:
To introduce the basic physics concepts relevant to different branches of Engineering and Technology

UNIT I  PROPERTIES OF MATTER

UNIT II  ACOUSTICS AND ULTRASONICS

UNIT III  THERMAL PHYSICS

**UNIT IV APPLIED OPTICS**


**UNIT V SOLID STATE PHYSICS**

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

**OUTCOMES:**

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

**TEXT BOOKS:**


**REFERENCES:**

OBJECTIVES:
- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I CHEMICAL THERMODYNAMICS
Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. 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 II POLYMER CHEMISTRY
Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY

UNIT V NANOCHEMISTRY
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis:
Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXTBOOKS:


REFERENCES: BOOKS:


GE8151 COMPUTING TECHNIQUES L T P C 3 0 0 3

OBJECTIVES:
The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION
UNIT II  C PROGRAMMING BASICS

UNIT III  ARRAYS AND STRINGS

UNIT IV  FUNCTIONS AND POINTERS

UNIT V  STRUCTURES AND UNIONS
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
•   Design C Programs for problems.
•   Write and execute C programs for simple applications.

TEXTBOOKS:

REFERENCES:
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 HAND SKETCHING
Basic Geometrical constructions, Curves used in engineering practices
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
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
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above 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
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)
Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOKS:

REFERENCES:

PUBLICATION OF BUREAU OF INDIAN STANDARDS:
Special points applicable to University Examinations on Engineering Graphics:
• There will be five questions, each of either or type covering all units of the syllabus.
• All questions will carry equal marks of 20 each making a total of 100.
• 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.
• The examination will be conducted in appropriate sessions on the same day.

PH 8161
PHYSICS LABORATORY
(Common to all branches of B.E. / B.Tech. Programmes)

OBJECTIVES:
• To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and 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. Lee’s disc
   Determination of thermal conductivity of a bad conductor
4. Potentiometer
   Determination of thermo e.m.f. of thermocouple
5. Air wedge
   Determination of thickness of a thin sheet of paper
6. i. Optical fibre
   Determination of Numerical Aperture and acceptance angle
   ii. Compact disc
   Determination of width of the groove using laser
7. Acoustic grating
   Determination of velocity of ultrasonic waves in liquids
8. Potentiometer
   Determination of Band gap of a semiconductor
9. Spectrometer
   Determination of wavelength using grating
10. Viscosity of liquids
    Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

TOTAL: 30 PERIODS

OUTCOMES:
• The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

CY8161
CHEMISTRY LABORATORY
(Common to all branches of engineering and technology)

OBJECTIVES:
• To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
• To acquaint the students with the determination of molecular weight of a polymer by vacometry.

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity
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. Estimation 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.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:
• The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters

REFERENCE BOOKS

GE8161 COMPUTER PRACTICES LABORATORY

OBJECTIVES:
The student should be made to:
• Be familiar with the use of Office software.
• Be exposed to presentation and visualization tools.
• Be exposed to problem solving techniques and flow charts.
• Be familiar with programming in C.
• Learn to use Arrays, strings, functions, structures and unions.
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 and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

GE8162 ENGINEERING PRACTICES LABORATORY L T P C
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 3 2

OBJECTIVE:
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 PRACTICE 12

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 – inlet.
Laying pipe connection to the delivery side of a pump – outlet.
Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
**wood work**
Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

**Study**
Study of joints in door panels, wooden furniture
Study of common industrial trusses using models.

2. **ELECTRICAL ENGINEERING PRACTICE** 9
   - Basic household wiring using switches, fuse, indicator – lamp etc.,
   - Preparation of wiring diagrams
   - Stair case light wiring
   - Tube – light wiring
   - Study of iron-box, fan with regulator, emergency lamp

**GROUP – B (MECHANICAL AND ELECTRONICS)** 15

3. **MECHANICAL ENGINEERING PRACTICE**

**welding**
- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.
- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:
  - Centrifugal pump, mixies and air conditioners.
  - Demonstration on Smithy operations like the production of hexagonal bolt.
  - Foundry operation like mould preparation for grooved pulley.

4. **ELECTRONIC ENGINEERING PRACTICE** 9
   - Soldering simple electronic circuits and checking continuity.
   - Assembling electronic components on a small PCB and testing.
   - Study of Telephone, FM radio, low-voltage power supplies.

**TOTAL: 45 PERIODS**
OUTCOMES:
- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures
- Ability to fabricate electrical and electronics circuits

HS8251 TECHNICAL ENGLISH II L T P C
(For all branches of B.E / B.Tech programmes) 3 1 0 4

OBJECTIVES
- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

UNIT I
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; writing - Effective use of SMS for sending short notes and messages - Using ‘emoticons’ as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. ‘can’) - Homophones (e.g. ‘some’, ‘sum’); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II
Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one’s friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - Language Lab
- Dialogues (Fill up exercises), Recording students’ dialogues.

**UNIT III**

**Listening** - Listening to the conversation - Understanding the structure of conversations;  
**Speaking** - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.);  
**Reading** - Speed reading – reading passages with the time limit - Skimming;  
**writing** - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies;  
**Grammar** - Conditional clauses - Cause and effect expressions;  
**Vocabulary** - Words used as nouns and verbs without any change in the spelling (e.g. ‘rock’, ‘train’, ‘ring’);  
**E-materials** - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

**UNIT IV**

**Listening** - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices;  
**Speaking** - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills;  
**Reading** - Reading the job advertisements and the profile of the company concerned – scanning;  
**writing** - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate;  
**Grammar** - Numerical expressions - Connectives (discourse markers);  
**Vocabulary** - Idioms and their meanings – using idioms in sentences;  
**E-materials** - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

**UNIT V**

**Listening** - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener;  
**Speaking** - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique;  
**Reading** - Note making skills – making notes from books, or any form of written materials - Intensive reading  
**writing** - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation);  
**Grammar** - Use of clauses;  
**Vocabulary** – Collocation;  
**E-materials** - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

**TOTAL: 60 PERIODS**
OUTCOMES:
Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXT BOOKS:

REFERENCE BOOKS:

EXTENSIVE READERS

WEB RESOURCES
- www.esl-lab.com
- www.englishgrammar.org
- www.englishclub.com
- www.mindtools.com
- www.esl.about.com
MA8251 MATHEMATICS II L T P C
(Common to all branches of B.E. / B.Tech. Programmes in ii semester) 3 1 0 4

OBJECTIVES:

• To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
• 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 the of 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 DIFFERENTIAL EQUATIONS 9+3
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.

UNIT II VECTOR CALCULUS 9+3
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 9+3
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - w = z+ c, az, 1/z, z2 - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3

UNIT V LAPLACE TRANSFORMS 9+3

TOTAL : 60 PERIODS
OUTCOMES:
- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

REFERENCES:

CY8201 CHEMICAL REACTIONS DYNAMICS L T P C 3 0 0 3

OBJECTIVE:
To study the kinetics and solid state chemistry.

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
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

OUTCOMES:
• Upon completion of this course, the students can able to understand fundamentally kinetics and solid state chemistry

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

UNIT I  BASICS & STATICS OF PARTICLES  12

UNIT II  EQUILLIBRIUM OF RIGID BODIES  12
Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  12

UNIT IV  DYNAMICS OF PARTICLES  12

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as disc/wheel and sphere.

TOTAL: 60 PERIODS
OUTCOMES:
- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

REFERENCES:

ME8251 DESIGN CONCEPTS IN ENGINEERING

OBJECTIVES:
- To impart the importance of design in today’s 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
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
Basic module in design process-scientific method and design method-Need identification, importance of definition of problem-structured problem, real life problem- gathering information-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 (Basics only)

UNIT III  CREATIVITY IN DESIGN  
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  
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  
Material selection for performance characteristics of materials-selection from 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:
- Ability to comprehend the steps in the new product design
- Understanding of customer equipments for new product and making specifications.
- Knowledge in the role of creativity in product design
- Ability to decide materials and processes in product development.

TEXTBOOK:

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 not only covers metals, mainly ferrous and non-ferrous alloys, but also structures and properties of ceramics, polymers, elastomers and composites.

UNIT I  STRUCTURE OF SOLIDS  10

UNIT II  PHASE DIAGRAMS  10

UNIT III  FERROUS AND NON FERROUS MATERIALS  9

UNIT IV  CERAMIC AND COMPOSITE MATERIALS  8

UNIT V  POLYMERS AND ELASTOMERS  8
OUTCOMES:

- Recognise basic nomenclature, basic microstructure, 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.

TEXTBOOKS:


REFERENCES:

OBJECTIVE:
To familiarise students on methods of determination of composition of different materials by wet chemical methods.

LIST OF EXPERIMENTS
1. Determination of Cu in Brass Sample.
2. Determination of Fe in Iron Ore.
3. Determination of Mn in Steel.
4. Determination of Cr in steel.
5. Determination of Si in cast iron.
7. Determination of Ca in Limestone.
8. Identification of functional groups in organic compounds
9. Identification of monomers in polymers

TOTAL: 45 PERIODS

OUTCOME
- This lab is about the quantitative and qualitative analysis of chemical elements. The student will able to identify and determine the specific element present in the given material sample (metal alloy, ceramics and organic compounds).

ML8211 MICROSTRUCTURAL ANALYSIS LAB

OBJECTIVE:
To have knowledge on the microstructures of some common types of metals and alloys and the grain size analysis of the given microstructure.

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: 45 PERIODS

OUTCOME
The student will obtain 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.

MA8352 APPLIED STATISTICS L T P C
(Branch specific course in III or IV Semester) 3 1 0 4

OBJECTIVES:
• To make the students acquire a sound knowledge in statistical techniques that model engineering problems.

UNIT I TESTING OF HYPOTHESIS 9+3
Sampling distributions-Tests for single mean, proportion and difference of means, proportions (large and small samples)-Tests for single variance and equality of variances-χ² test for goodness of fit- Independence of attributes.

UNIT II NON-PARAMETRIC TESTS 9+3
Advantages and drawbacks over parametric methods-Sign test-Median test-Mann-Whitney Wilcoxon u-test-Wald-Wolfowitz run test.

UNIT III DESIGN OF EXPERIMENTS 9+3
Completely randomized design-Randomized block design-Latin square design -2² factorial design-Taguchi’s robust parameter design.

UNIT IV STATISTICAL QUALITY CONTROL 9+3
Control charts for variables-Control charts for attributes-Tolerance limits-Acceptance sampling by attributes.

UNIT V TIME SERIES 9+3

TOTAL: 60 PERIODS
OUTCOMES:
After successfully completing the course, students should be able to do the following:

- Use statistical methodology and tools in the engineering problem-solving process.
- Compute and interpret descriptive statistics using numerical and graphical techniques.

TEXT BOOKS:

REFERENCES:

CY8302 POLYMER SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
The subject exposes students to the basics of polymer, polymerisation, condensation, their properties and overview of manufacturing.

UNIT I POLYMERIZATION
9

UNIT II MOLECULAR WEIGHTS OF POLYMERS
9
Number average and weight average molecular weights – Degree of polymerization – molecular weight distribution – Polydispersity – Molecular weight determination- Different methods – Gel Permeation Chromatography

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UNIT III  TRANSITIONS IN POLYMERS

UNIT IV  SOLUTION PROPERTIES OF POLYMERS

UNIT V  POLYMER PROCESSING

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

CE8353  STRENGTH OF MATERIALS

OBJECTIVE:
- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.
UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses –
Deformation of simple and compound bars – Thermal stresses – Elastic constants –
Volumertric strains – Stresses on inclined planes – principal stresses and principal planes
– Mohr’s circle of stress.

UNIT II  TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM
Beams – types transverse loading on beams – Shear force and bending moment in beams –
Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending
– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched
beams – Shear stress distribution.

UNIT III  TORSION
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:
**ML8301 CASTING AND MACHINING PROCESSES**

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**OBJECTIVE:**

To impart knowledge on the various foundry practices being carried out in the Industry.

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**UNIT I  PATTERN AND DIE MAKING**

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.

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**UNIT II  CASTING DESIGN**

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.

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**UNIT III  MOULDING AND CASTING PRACTICES**


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**UNIT IV  MELTING AND POURING PRACTICES**

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.

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**UNIT V  MACHINING**


**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:

ML8302 SOLID STATE PHYSICS  L T P C  3 1 0 4

OBJECTIVE:
- This subject provides the insight to physics of material starting with basics of matter waves, lattice vibrations and band theories to understand properties of metals, semiconductors, electric conductors, dielectrics, ferroelectrics, superconductors and thermal properties of materials

UNIT I INTRODUCTION TO MODERN PHYSICS AND LATTICE DYNAMICS  12
Matter waves – Heisenberg’s uncertainty principle - Schrodinger’s time independent wave equation – Physical significance of wave function (y) – Application to a particle in a one dimensional box (infinite potential well)- Interatomic forces and lattice dynamics and simple metals, ionic and covalent crystals. Elastic waves in one dimensional array of identical atoms, vibrational modes of a diatomic linear lattice and dispersion relations, acoustic and optical modes, phonon dispersion relation.

UNIT II BAND THEORY OF SOLIDS AND SEMICONDUCTOR PHYSICS  12
Fermi- Dirac distribution function, density of states, temperature dependence of Fermi energy, specific heat, use of Fermi- Dirac statistics in the calculation of thermal conductivity and electrical conductivity, Widemann -Franz ratio, susceptibility, width of conduction band,
Drude theory of light, absorption in metals. Bloch theorem. Behaviour of electrons in periodic potentials, Kronig-Penny model, E vs k relation, Density of states in a band, effective mass of electron, physical basis of effective mass, Intrinsic semiconductors. Band model, Fermi level, Expressions for electron and hole concentration in intrinsic and extrinsic semiconductors, Thermal ionization of impurities, Hall effect in semiconductors (p-type and n-type).

UNIT III  DIELECTRICS AND FERROELECTRICS  12
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 of Lorentz, Clausium-Mosotti relation. Behaviour of dielectrics in an alternating field, elementary ideas on dipole relaxation, classification of ferroelectric crystals - BaTiO3 and KDP. Thermodynamics of ferroelectric crystals - Devonshire theory.

UNIT IV  MAGNETISM  12

UNIT V  SUPERCONDUCTIVITY  12
Occurrence of superconductivity, Destruction of superconductivity by magnetic fields Meissner effect, Heat capacity, Energy gap and Isotope effect. London’s equations, Penetration depth, Coherence length, Cooper-pairs; elements of BCS theory, Giaver tunneling, Josephson effects (basic ideas), Elements of high temperature superconductivity (basic concepts only).

TOTAL: 60 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to use semiconductor materials for the application.

TEXTBOOKS:

REFERENCES:

Attended

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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

UNIT IV THERMODYNAMICS OF SOLUTIONS

UNIT V THERMODYNAMICS OF REACTIONS
vacancies and interstitials in solid metals.

TOTAL: 45 PERIODS

OUTCOMES:

- 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:

CE8362 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

ML8311 FOUNDRY PRACTICES LABORATORY

OBJECTIVE:
To make students learn about melting of metals, casting of metals and various sand testing methods.

LIST OF EXPERIMENTS
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.

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.

ML8312 MANUFACTURING TECHNOLOGY LABORATORY L T P C
0 0 3 2

OBJECTIVE:
Student should have knowledge on common basic machining operations which can be carried out in general purpose and Special Purpose Machine Tools.

LIST OF EXPERIMENTS
1. Machining practice in lathe: Taper Turning, Thread Cutting, Eccentric Turning and Knurling
2. Study of Turret and Capstan lathe
3. Machining practice in Shaper: Square and Hexagonal Shaping
4. Drilling and Tapping
6. Machining practice in Horizontal and Vertical Milling machine: Polygonal milling, contour milling, spur and helical gear milling
7. Gear generation by Hobbing & Shaping
8. Machining practice in Grinding: Cylindrical, Surface, Tool and Cutter Grinding

TOTAL: 45 PERIODS
OUTCOME

- 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.

GE8351 ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJECTIVES

To the study of nature and the facts about environment.

- To finding and implementing 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


UNIT V HUMAN POPULATION AND THE ENVIRONMENT


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 environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS

REFERENCE BOOKS
2 Cunningham, W.P. Cooper, T.H. Gorhani, ‘Environmental Encyclopedia’, Jaico
ME8452  MECHANICS OF MACHINES

OBJECTIVES:
- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyze the forces and torque acting on simple mechanical systems
- To understand the importance of balancing and vibration.

UNIT I  KINEMATICS OF MECHANISMS

UNIT II  GEARS AND GEAR TRAINS

UNIT V  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.

TEXT BOOK:

REFERENCES:

STANDARDS:
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

ML8402  IRON AND STEEL MAKING

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

UNIT I  RAW MATERIALS AND BURDEN PREPARATION
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
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 Compositional 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
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 steel making and plant layout.

UNIT IV  STEEL MAKING PROCESSES

UNIT V  STEELS AND CAST IRON 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:
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

UNIT II STRENGTHENING MECHANISMS
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
Fatigue: Stress cycles, S-N curves, Effect of mean stress, Factors affecting Fatigue, Structural changes accompanying fatigue, Cumulative damage, HCF / LCF, thermomechanical fatigue, application of fracture mechanics to fatigue crack propagation, fatigue testing machines- Pari’s Equation, Residual life prediction under Fatigue.

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

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OUTCOMES
- 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.
- Assues and describe the mechanism loading to failure when provided with a failure example.

TEXTBOOKS:

REFERENCES:

ML8404 POWDER METALLURGY

OBJECTIVE:
- This course teaches 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
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...
UNIT II CHARACTERISTICS AND TESTING OF METAL POWDERS
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
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
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

OUTCOMES:
- Upon completion of this course, the students can able to apply the student will have knowledge about powder metallurgical material and their fabrication processes.

TEXTBOOKS:

REFERENCES:
ML8411 ANALYTICAL INSTRUMENTION LABORATORY

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 absorbtivity 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 : 45 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.

ATTENDED

SALIM
DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.
OBJECTIVE
This laboratory course offers practical knowledge of powder metallurgy: powder synthesis, compaction and sintering.

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 : 45 PERIODS

OUTCOME
- The course will enable a student to understand and carryout powder metallurgy route involving synthesis, compaction, sintering and appropriate testing methods.

ME8553 MACHINE DESIGN

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

UNIT III ENERGY STORING ELEMENTS AND ENGINE COMPONENTS
Various types of springs, optimization 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
Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT V SPUR GEARS, HELICAL GEARS AND GEAR BOXES
Speed ratios and number of teeth- Force analysis - Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations.
Geometric progression - Standard step ratio - Ray diagram, kinematics layout - Design of sliding mesh gear box - Constant mesh gear box. – Design of multi speed gear box for machine tool applications – Variable speed gear box

TOTAL: 60 PERIODS

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

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

TEXT BOOK:

REFERENCES:


STANDARDS:

ML8501 CHARACTERISATION OF MATERIALS 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 ANALYSIS OF X-RAY DIFFRACTION

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

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


OUTCOMES:

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

TEXTBOOKS:


REFERENCES:

5. Haines, P.J.,“ Principles of Thermal Analysis and Calorimetry”, Royal Society of
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 microstructure and property 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 quenched 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

OUTCOMES:
- Ability to select and perform heat treatment for different ferrous and non-ferrous alloy.
- ability to identify the microstructure and analyse different phase after heat treatment.

TEXTBOOKS:

REFERENCES:
studied in detail.

UNIT I  STRESS - STRAIN TENSOR

UNIT II  FUNDAMENTALS OF METAL FORMING

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

TOTAL : 45 PERIODS

OUTCOMES:
• Ability to make use of mechanical and thermodynamics principle of plastic deformation to form the components using different techniques.

TEXT BOOKS:

REFERENCES:

ML8511 HEAT TREATMENT LABORATORY LTCP 0032

OBJECTIVE:
This laboratory course offers practical knowledge of heat treatment applicable to Ferrous as well as Non-Ferrous materials and studies microstructural changes and hardness evaluation.

LIST OF EXPERIMENTS
1. Annealing and normalising of hardened steels
2. Spheroidisation 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 of 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
13. Estimation of Ferrite

TOTAL : 45 PERIODS

OUTCOMES:
Ability to perform different heat treatment operation and characterise the microstructure.

ML8512 METAL FORMING LABORATORY LTCP 0032

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

[Signature]
Director
Centre for Academic Courses
Anna University, Chennai-600 025.
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 : 45 PERIODS

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

ME8652 INDUSTRIAL MANAGEMENT

OBJECTIVES:
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

TOTAL:45 PERIODS

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).

TEXT BOOKS:

REFERENCE BOOKS:
OBJECTIVE:
The subject is intending to inoculate the basics of conventional, functional ceramics, etc., method of preparation, fabrication and testing for engineering application.

UNIT I INTRODUCTION

UNIT II PROPERTIES AND APPLICATIONS OF ENGINEERING CERAMICS

UNIT III PREPARATION AND FORMING OF CERAMICS
Preparation of Alumina, Zirconia, Silicon carbide, Silicon Nitrides, Boron Nitride, Brief description of slip and slurry casting - applications. Powder processing equipment and process details of hot pressing, Hot Isostatic Pressing and Cold Isostatic Pressing. Liquid Phase sintering. shock wave compaction, reaction sintering, cermets

UNIT IV GLASSES
Types of glasses - structure, properties and applications of various types of glasses. Silicate-Glass ceramics - heat flow and precipitation from glasses – growth controlled by diffusion of solutes – crystalline glasses – enamels – photosensitive and photochromic glasses; Blowing, pressing, drawing, rolling and casting - Pilkington process for float glass.

UNIT V PROPERTY EVALUATION

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the students can able to do the method of preparation, fabrication and testing for engineering application.
TEXT BOOKS:


REFERENCES:


ML8602 COMPOSITE MATERIALS LTPC 3003

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 8

UNIT II POLYMER MATRIX COMPOSITES 12

UNIT III METAL MATRIX COMPOSITES 9
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 of each process
- Use of Mathematical techniques to predict the macroscopic properties of different Laminates

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To study and understand the various Nondestructive Evaluation and Testing methods, theory and their industrial applications.

UNIT I INTRODUCTION TO NDT
NDT Versus Mechanical testing, Need for Nondestructive testing Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided- Standards

UNIT II SURFACE NDE METHODS

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)
Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitations - infrared radiation and infrared detectors, Instrumentations and methods, applications.


UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)

UNIT V RADIOGRAPHY (RT)

TOTAL: 45 PERIODS

OUTCOMES:
- Identify suitable Non destructive technique to inspect industrial component
- Ability to use the different technique and know its applications and limitations
TEXT BOOKS:

REFERENCES:

HS8561 EMPLOYABILITY SKILLS L T P C 0 0 2 1
(LAB / PRACTICAL COURSE)
(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES
• To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
• To help them improve their soft skills, including report writing, necessary for the workplace situations
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying
skills – mock GD
8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

OUTCOME
• The students will have enough confidence to present themselves well using proper oral and written communication skills to any interview (or) discussion (or) presentation.

REFERENCE BOOKS:

EXTENSIVE READERS

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com

ML8611 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 Dis-Continuous 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 Hardness of FRP composites
6. Study of drop weight impact testing
7. Preparation of Al-SiC composites by stir casting method
8. Study of microstructure, hardness and density of Al-SiC composite
9. Study of Tensile strength of Al-SiC composites
10. Environmental Testing (Humidity and temperature)

TOTAL: 45 PERIODS

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

ML8612 CREATIVE AND INNOVATIVE PROJECT L T P C 0 0 3 2

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.

TOTAL: 45 PERIODS
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.

ML8613 MATERIALS CHARACTERISATION LABORATORY L T P C 0 0 3 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: 45 PERIODS

OUTCOME
- Student will be familiarised to various instruments for characterisation, specific sample preparation, data interpretation, analysis and presentation like XRD, SEM, etc.
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
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
Exchange current density, polarization - concentration, activation and resistance, Tafel quation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity, Effect of oxidising agents

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

UNIT IV TESTING
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
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.

OUTCOMES

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

TEXTBOOKS:
REFERENCES:

ML8702 METAL JOINING PROCESSES AND METALLURGY

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

UNIT II WELDING METALLURGY PRINCIPLES
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
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

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

UNIT I  COPPER AND COPPER ALLOYS  10

UNIT II  ALUMINIUM AND ITS ALLOYS  9

UNIT III  MAGNESIUM AND TITANIUM ALLOYS  9
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  9

UNIT V  LEAD, TIN AND PRECIOUS METALS  8
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.

TEXT BOOKS:

REFERENCES:

ML8711 INDUSTRIAL/ FIELD TRAINING

OBJECTIVE:
This course is mandatory to gain exposure to applications in industry.

The students have to undergo practical industrial training for six weeks (during vacation at the end of VI semester) in recognised 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 undergo
8. Projects undertaken during the training, if any
9. Learning points.

End Semester examination will be a Viva-Voce Examination.

TOTAL : 45 PERIODS

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

ML8712 SURFACE ENGINEERING LABORATORY L T P C 0 0 3 2

OBJECTIVE:
This laboratory course offers hands on experience on some surface modification technologies, corrosion and wears studies.

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

TOTAL: 45 PERIODS

OUTCOME
- Student will be able to carry out surface modifications, evaluate their corrosion and wear characteristics by interpretation of results.

ML8811 PROJECT WORK L T P C 0 0 1 2 6

OBJECTIVE:
In the project work the students demonstrate their ability to apply knowledge studied during the course. Students show their ability to collect information from literature, design, perform and interpret experiments. The successful project work is documented in a formal project report and technical presentation.

A project topic must be selected either from published lists or the students themselves may
propose suitable topics in consultation with their guides. The aim of the project work is to
deepen comprehension of the principles by applying them to a new problem which may be
the design and manufacture of a device, a research investigation, a computer or management
project or design problem. The problem may be selected in areas of material synthesis or
processing, material characterization, material joining, metal forming or casting or mechanical
behaviour of materials or material testing and analysis.

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.

OUTCOMES:
- On Completion of the project work students will be in a position to take up any
  challenging practical problems and find solution by formulating proper
  methodology.

ML8001 BIO AND SMART MATERIALS

OBJECTIVE:
To study applications of materials in biomedical engineering and special materials for actuators,
sensors, etc.

UNIT I INTRODUCTION
Intelligent / Smart materials – Functional materials – Polyfunctional materials – Structural materials,
Electrical materials, bio-compatible materials. – Intelligent biological materials – Biomimetics –
Wolff’s Law – Biocompatibility – Material response: swelling and leaching, corrosion and dissolution,
deforation and failure, friction and wear – host response: the inflammatory process – coagulation
and hemolysis – in vitro and in vivo evaluation of biomaterials.

UNIT II ELECTRO-RHEOLOGICAL AND PIEZOELECTRIC MATERIALS
The principal ingredients of smart materials –microsensors- hybrid smart materials - an algorithm
for synthesizing smart materials – active, passive reactive actuator based smart structures-
suspensions and electro-rheological fluids - Bingham body model – principal characteristics
of electro-rheological fluids – charge migration mechanism for the dispersed phase – electro-
rheological fluid domain – fluid actuators- design parameter – application of Electro-rheological
fluids – Basics, Principles and instrumentation and application of Magnetorheological fluids
– Piezoelectric materials: polymers and ceramics, mechanism, properties and application.
Introduction to electro-restrictive and magneto-restrictive materials
UNIT III SHAPE MEMORY MATERIALS

UNIT IV ORTHOPAEDIC AND DENTAL MATERIALS

UNIT V APPLICATIONS OF BIO MATERIALS FOR CARDIOVASCULAR OPTHALMOLOGY AND SKIN REGENERATION

OUTCOMES:
- Use of Bio materials for cardiovascular Ophtalmology 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:
3. Mohsen Shahinpoor and Hans-Jo¨rg Schneider “Intelligent Materials”, RSC
OBJECTIVE:
Metal casting is one of the important manufacturing process 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  8
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  10
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  10
Introduction to different types of Alloy steels – process for manufacturing alloy steels – production considerations – productivity – applications of alloy cast parts.

UNIT IV  ZINC ALLOYS  8

UNIT V  COPPER ALLOYS  9

TOTAL : 45 PERIODS

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:

ML8003 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 9
Application for the fitting and interpolation of experimental data in Materials Science
Roots of equations – Methods of bisection and false position – Newton-Raphson method
– Simultaneous equations – Gauss elimination – Gauss Jordan method - Newton’s and Langrange’s interpolation methods.

UNIT II PARTIAL DIFFERENTIAL EQUATIONS 9
Applications in diffusion and mass transport in materials.
Diffusion – The Dufort-Frankel Method – Conservative methods – The Equation of continuity
– The Diffusion equations.

UNIT III MONTE CARLO METHODS AND SIMULATION 9
Monte Carlo Method for simulating nucleation and growth of grains in materials.
Monte Carlo – Random Number Generators – Monte-Carlo Integration – The Metropolis Algorithm – Thermodynamic Averages – Quantum Monte-Carlo – Molecular Dynamics –
General Principles.

UNIT IV MATRIX ALGEBRA 9
Study of anisotropy in materials.
Introduction – types of matrix– simple matrix problems – elliptic equations – Poisson’s equation
– systems of equations and matrix inversion – Exact Methods – Iterative Methods - The Jacobi

UNIT V SELECTED APPLICATIONS IN MATERIALS SCIENCE

Modeling and property prediction.

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXTBOOKS:


REFERENCES:


ML8004 CREEP AND FATIGUE BEHAVIOUR OF MATERIALS

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

materials for elevated temperature rules.

UNIT III CYCLIC STRESS AND STRAIN FATIGUE
Macrofractography 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 ∆k 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:

ML8005 CRYOGENIC TREATMENT OF MATERIALS

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

UNIT I INTRODUCTION
Insight on Cryogenics-Basics, Properties of Cryogenic fluids, Liquefaction Cycles - Carnot

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.

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

TEXTBOOK:

REFERENCES:
ANALYSIS OF MATERIALS

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  7
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  9
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  9
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  10

UNIT V  SCANNING ELECTRON MICROSCOPES  10

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:

ML8007 ENERGY STORING DEVICES AND FUEL CELLS  L T P C  3 0 0 3

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:

ML8008 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  9
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  9

UNIT III  FAILURE ANALYSIS OF FATIGUE FRACTURE  9

UNIT IV  FAILURE ANALYSIS OF CREEP RUPTURE  9
Fracture at elevated temperature: Time dependent mechanical behavior, stress rupture, Micro Structural 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  9

TOTAL: 45 PERIODS

OUTCOMES:
- 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:

ML8009 FUELS, FURNACES AND REFRACTORIES

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

OUTCOMES
• Use of different fuels for energy generation system
• Use of refractories in furnace
• Ability to disscuss the issues in environmental.
TEXTBOOKS:

REFERENCES:

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

UNIT I SURFACES AND FRICITION
9

UNIT II WEAR
9

UNIT III LUBRICANTS AND LUBRICATION TYPES
9

UNIT IV FILM LUBRICATION THEORY
9

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS
9
Surface modifications - Transformation Hardening, surface fusion - Thermo chemical

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<th>OUTCOMES:</th>
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<td>• Ability to design friction, wear and Lubrication</td>
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<tr>
<td>• Ability to identify different types of sliding &amp; rolling friction, Wear and related theories</td>
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<td>• Ability to distinguish among the different Lubricant regime.</td>
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<td>• Select materials for bearing.</td>
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**TEXTBOOK:**

**REFERENCES:**

**ML8011 INTRODUCTION TO TRANSPORT PHENOMENA**

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**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 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 problem - applications in metallurgical processes.

UNIT V RADIATION HEAT TRANSFER

Nature of thermal radiation, Concept of Black body, Emissive power – Gray body - Shape factor - Simple problems on Radiation heat transfer between surfaces. Introduction to Gas radiation.
Mass Transfer: Diffusion mass transfer. Simple problems using Fick’s law of diffusion. Introduction to convective mass transfer - Introduction to computational fluid dynamics - software.

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:
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 9
Principle of laser generation, optical resonators, laser modes- mode selection, line- broadening mechanisms, laser beam modifications and types of industrials lasers.

UNIT II THERMAL PROCESS- HEAT AND FLUID FLOW 9
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 10

UNIT V LASER MACHINING 8

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.

TEXTBOOKS:
REFERENCES:

ML8013 MAKING AND METALLURGY OF STAINLESS STEELS

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  8
Essential elements, evolution, development of alloys, selection of Stainless steels, Recent processing enhancements.

UNIT II  CLASSIFICATION OF STAINLESS STEELS  10

UNIT III  MELTING AND SECONDARY REFINING OF STAINLESS STEELS  9
Raw Materials selection, Melting Furnaces (EAF, EIF), 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  9

TOTAL: 45 PERIODS
OUTCOME:
- The student will understand the production methodology of stainless steel making and also he gains knowledge on the metallurgy of stainless steel making.

TEXT BOOKS:

REFERENCES:

ML8014 METALLURGY OF TOOL MATERIALS

OBJECTIVE:
Tooling materials require special considerations in production and applications. Students will learn the metallurgical processes and applications in producing toolings

UNIT I  CLASSIFICATION AND MANUFACTURE OF TOOL STEELS
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
- 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


UNIT IV ADVANCED TOOL MATERIALS


UNIT V SURFACE TREATMENTS AND COATINGS


OUTCOME:

- Student will understand the type and process undergone by a cutting tool by their specification, technology like heat treatment and coating techniques for better machining characteristics.

TEXT BOOK:


REFERENCES:


ML8015 MICRO MACHINING AND FABRICATION

OBJECTIVE:

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

UNIT I INTRODUCTION

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

Methods of Microfabrication – Maleno deposition – Electro discharge deposition, Chemical vapour deposition physical vapour deposition – Electro Chemical spark deposition – LIGA.
UNIT III  MECHANICAL MICROMACHINING
Ultrasound 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

UNIT V  HYBRID MICRO MACHINING
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.

TEXT BOOK:

REFERENCES:

ML8016  MODELING AND SIMULATION IN MATERIALS ENGINEERING

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
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  CONSTITUTIVE MODELING
Elastic Medium, visco-elastic constitutive equations.
UNIT III  CONSTITUTIVE MODELING

Plastic Medium.

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.

OUTCOMES:

Upon completion of this course, the students can able to

- 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.

TEXTEBOOKS:


REFERENCES:

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  7
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  10

UNIT III ONE DIMENSIONAL NANOMATERIALS  10

UNIT IV SUPER HARD COATINGS AND BULK NANOSTRUCTURED MATERIALS  9

UNIT V CHARACTERIZATION OF NANOMATERIALS  9

TOTAL: 45 PERIODS

OUTCOMES:
- 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.
ML8018  NUCLEAR MATERIALS  L T P C  3 0 0 3

OBJECTIVES:
- To impart knowledge about different nuclear materials and technology
- To get awareness about nuclear waste and prevention techniques
- To know about irradiation effects in nuclear fuels.

UNIT I  INTRODUCTION  8
General nuclear physics, binding energy curves, fission and fusion reactions, nuclear reactor types, Indian energy scenario, inevitability of nuclear energy in India, 3 stage nuclear power programme. Ores and beneficiation – Uranium and thorium ores, availability in India, solvent extraction and ore beneficiation.

UNIT II  NUCLEAR FUELS FABRICATION AND CHARACTERISATION  10
Fuels of different types – metallic, alloy and dispersion fuels for research reactors, ceramic (oxide, carbide and nitride) fuels for thermal power reactor and fast reactors.

Fabrication of oxide, mixed-oxide and mixed-carbide fuel for power reactors. Fabrication, characterization and property evaluation of advanced fuel type, processes encountered in fabrication, fuel property evaluation – thermal and physical properties.

UNIT III  HANDLING OF PU AND IRRADIATION EFFECTS IN NUCLEAR FUELS  10
Health physics, radioactivity and safety aspects. Equipment and laboratory facility for Pu fuel fabrication. Irradiation behaviour and Post – Irradiation examination of Fuel. Irradiation
behaviour of metallic uranium – irradiation growth, thermal cycling, swelling, adjusted uranium, blistering in uranium rods. Irradiation effects in ceramic oxide and mixed oxide fuels, definition and units of burnup, main causes of fuel element failure in power reactors and remedies to avoid failures. Behaviour of fuel under off normal and accident condition, criteria for fuel failure during LOCA: oxidation, deformation, stored energy.

UNIT IV STRUCTURAL MATERIALS

Zirconium based alloys for PHWRs – Zircaloy and Zr-Nb based alloy, alloy design philosophy, hydride cracking and role of texture, pilgering and clad fabrication routes. Stainless steels for FBRs – Alloy design, irradiation behaviour of austenitic stainless steels, futuristic ferritic / martensitic and ODS ferritic stainless steels.

Ferritic steels for steam generator materials – alloy development, inherent creep strength concepts, SCC resistance. Irradiation hardening, irradiation swelling, irradiation embrittlement, irradiation induced and irradiation enhanced creep, irradiation assisted SCC.

UNIT V REPROCESSING AND WASTE MANAGEMENT MATERIAL


OUTCOMES:

- Familiarize students of the present and latest fuel and technology in Nuclear reactor
- Ability to discuss the Nuclear radiation and the controlling methods.
- Ability to realize the importance of nuclear waste, handling and disposal.

TExT BOOKS


REFERENCES


ML8019 PHASE TRANSFORMATIONS

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

atomic mechanisms of diffusion, Fick’s 1st and 2nd law – solution to the diffusion equation – error functions – application of the non-steady state diffusion, spinodal decomposition

UNIT II  DIFFUSION CONTROLLED PHASE TRANSFORMATIONS  10

UNIT III  DIFFUSIONLESS PHASE TRANSFORMATIONS  9

UNIT IV  PRECIPITATION REACTIONS  9

UNIT V  RECOVERY, RECRYSTALLISATION AND GRAIN GROWTH  8
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.

TEXT BOOKS:

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

UNIT I  CUTTING TOOL NOMENCLATURE  9
Single point tool-significance of the various angles - Machine reference system- normal tool
reference system- ORS – interrelation between different tool nomenclatures - Nomenclature
of drills, milling cutters and broaches

UNIT II  CHIP FORMATION MECHANISM AND FORCES IN MACHINING  10
Orthogonal and oblique cutting - Mechanisms of formation of chips-types of chips -Merchant’s
circle diagram-Force and Velocity relationship, shear plane angle, Energy considerations
in matching-Ernst Merchant’s theory of shear angle relationship - Forces in turning, drilling,
milling and grinding- specific cutting pressure-specific horse power- construction and principle
of operation of tool dynamometers for turning, drilling and milling.

UNIT III  THERMAL ASPECTS IN MACHINING, TOOL WEAR AND LIFE  10
Sources of heat generation in machining heat in PSDZ and SDZ – heat flow in cutting tools
temperature measurement techniques in machining, Functions of cutting fluid - characteristics
of cutting fluid-types - application of cutting fluids - Tool wear, type of tool failure - mechanisms,
tool life equation- tool life analysis - machinability - chatter in machining.

UNIT IV  CUTTING TOOL MATERIALS  8
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  8
Introduction to modeling – empirical models – mechanistic models – FEA based models
– artificial intelligence based models for turning, milling and drilling

TOTAL: 45 PERIODS

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

TEXTBOOKS:
1. Kuppuswamy, G., “Principals of Metal Cutting”, Universities Press Limited,
   Hyderabad, 1996.
2. Bhattacharya, “Metal Cutting Theory and Practice “, Central Book Publishers, Calcutta,
   1984.

REFERENCES:
   2000.
OBJECTIVE:
The course is designed to impart the students the knowledge of surface modification technologies of deposition of thin film for different application like optical emission, abrasion resistance, dielectric, electronic applications, energy conversion, etc.

UNIT I BASICS OF THIN FILMS

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.

TEXTBOOKS:

REFERENCES:

OBJECTIVES:
• 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  9
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, chassis & 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

TEXTBOOKS:

REFERENCES:

GE8751  ENGINEERING ETHICS AND HUMAN VALUES  L T P C  3 0 0 3

OBJECTIVES:
To understand the ethical concepts that help engineers resolve moral issues in engineering and management areas and to provide an understanding of the interface between social, technological and natural environments.
UNIT I ENGINEERING ETHICS

UNIT II ENGINEERING AS SOCIAL ExPERIMENTATION
Engineering as Experimentation – Engineering as responsible Experimenters – Research Ethics – Codes of Ethics – industrial Standards – A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEERING RESPONSIBILITY FOR SAFETY

UNIT IV RESPONSIBILITIES AND RIGHTS

UNIT V HUMAN VALUES & GLOBAL ISSUES

OUTCOMES:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXT BOOKS:

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

OBJECTIVES
- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY SYSTEMS

OUTCOMES:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCE BOOKS:
OBJECTIVES:
- To impart knowledge to design experiments to a problem situation using traditional experimental designs as well as Taguchi Methods.
- To develop skill to conduct experiments and analyze the data to determine the optimal process parameters that optimize the process.

UNIT I  FUNDAMENTALS OF EXPERIMENTAL DESIGNS  9
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  9
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  9
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- 2K Design with
two and three factors- Yate’s Algorithm- fitting regression model- Randomized Block Factorial
Design- practical applications

UNIT IV  SPECIAL EXPERIMENTAL DESIGNS  9
Blocking and Confounding in 2K Designs- blocking in replicated design- 2K Factorial Design
in two blocks- Complete and partial confounding- Confounding 2K Design in four
blocks- Two level Fractional Factorial Designs- one-half fraction of 2K Design, design
resolution, Construction of one-half fraction with highest design resolution, one-quarter
fraction of 2K Design- introduction to response surface methods, central composite design.

UNIT V  TAGUCHI METHODS  9
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:
- Able to apply experimental techniques to practical problems to improve quality of processes / products by optimizing the process / product parameters.

TEXT BOOKS:

REFERENCES:

ME8010 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
Types of nozzles, Flow of steam through nozzles, Shapes of nozzles, Effect of friction, Critical pressure ratio, Metastable flow. Types of boilers, Thermal calculations, Heat balance, Mountings and Accessories,

UNIT IV GAS TURBINES AND STEAM TURBINES
Open and closed Gas turbine cycle analysis - methods of cycle improvement. Regenerative, intercooled, reheated cycles and their combinations.
Types, Impulse and reaction principles, Compoundings, Velocity diagrams for impulse and reaction blades, Work done on turbine blades and efficiency of components, Cogeneration Principles, Cycle Analysis.
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.

TEXT BOOKS:


REFERENCES:


ME8071 AUTOMOBILE ENGINEERING

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

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

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 BREAKING SYSTEMS  10
Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and prelimineries of suspension systems

UNIT IV  OTHER AUXILIARY SYSTEMS  10

UNIT V  TESTS, SERVICE AND MAINTENANCE  5
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 automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOK:

REFERENCES:

ME8076  ENTREPRENEURSHIP DEVELOPMENT  L T P C  3 0 0 3

OBJECTIVE:
Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I  ENTREPRENEURSHIP  9

UNIT II  MOTIVATION  9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.
UNIT III  BUSINESS

UNIT IV  FINANCING AND ACCOUNTING

UNIT V  SUPPORT TO ENTREPRENEURS

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

TEXT BOOKS:

REFERENCES:

ME8077  MARKETING MANAGEMENT  L T P C
3 0 0 3
OBJECTIVE:
- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

UNIT I  MARKETING PROCESS
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts,
environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV PLANNING AND STRATEGY FORMULATION 9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9
Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS

OUTCOME
- The course will enable students the management philosophy pertaining to marketing, advertising, pricing and selling.

TEXT BOOKS:

REFERENCES:
7. Graeme Drummond and John Enson, Introduction to marketing concepts, Elsevier, Indian Reprint, 2002
OBJECTIVES:
- To understand material removal by using various forms of energy and machining new materials and complex parts with high accuracy by using non-traditional machining.

UNIT I  INTRODUCTION  7
Need of Non-Traditional Machining Processes – Classification Based on Energy, Mechanism, source of energy, transfer media and process - Process selection-Based on Physical Parameters, shapes to be machined, process capability and economics – Overview of all processes.

UNIT II  MECHANICAL PROCESS  10

UNIT III  ELECTRICAL DISCHARGE MACHINING  10

UNIT IV  CHEMICAL AND ELECTRO CHEMICAL MACHINING  10

UNIT V  HIGH ENERGY MACHINING PROCESS  8

TOTAL: 45 PERIODS

OUTCOMES:
- Describe the modern manufacturing process with respect to productivity economic
- Explain the trends in development of manufacturing process selection of suitable
process for metal cutting and non-traditional manufacturing.

TEXT BOOKS:

REFERENCES:

ME8081 RELIABILITY CONCEPTS IN ENGINEERING
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:

ME8752 FINITE ELEMENT ANALYSIS

OBJECTIVES:
• To introduce the concepts of Mathematical Modeling of Engineering Problems.
• To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION

UNIT II ONE-DIMENSIONAL PROBLEMS

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS

TOTAL: 45 PERIODS
OUTCOMES:
- Given a Structural engineering problem, ability to conduct structural analysis using FEA
- Use of mathematical techniques to solve Engineering problem using FEA.

TEXT BOOK:

REFERENCE BOOKS:

GE8072 DISASTER MANAGEMENT

OBJECTIVES:
- 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 stakeholders- 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  9
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  9
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  9
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

OUTCOMES:
The students will be able to
- 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.

TEXTBOOK:

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