THE VISION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

We, at the Department of Mechanical Engineering, Anna University shall strive hard to impart knowledge and state-of-the-art training to our students and expose them to broad areas of Mechanical Engineering, namely Design, Manufacturing, Energy, Thermal Sciences and currently related interdisciplinary areas, so that they can later practice their profession at home or abroad keeping in mind the needs and concern of the society they represent, safeguarding values, ethics and be instrumental in bringing about an overall technological development.

THE MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

1. To deliver knowledge in Mechanical Engineering and Materials Science and Engineering with high educational standards so that the outgoing students are employable and globally competitive.
2. To produce graduate and post graduate engineers with core competency as well as relevant software skills and social responsibility.
3. To be dynamic in imparting knowledge to students depending upon the changing national and International needs.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of Materials Science and Engineering curriculum is designed
1. To prepare students to excel in research and to succeed in the areas of materials science and metallurgical engineering.
2. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve materials science and metallurgical engineering problems
3. To train students to have sound knowledge on the production, processing, characterization, structural properties correlation and application of all different engineering materials.
4. To inculcate students with professional and ethical attitude, effective communication skills, teamwork skills and multidisciplinary approach.
5. To develop student with an academic excellence, leadership qualities, leading to life-long learning for a successful professional career
PROGRAMME OUTCOMES (POs):

On successful completion of the Materials Science and Engineering Degree programme, the Graduates shall exhibit the following:

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<tr>
<th>PO</th>
<th>Graduate Attribute</th>
<th>Programme Outcome</th>
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<tr>
<td>1</td>
<td>Engineering knowledge</td>
<td>Apply knowledge of mathematics, basic science and engineering science.</td>
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<td>2</td>
<td>Problem analysis</td>
<td>Identify, formulate and solve engineering problems.</td>
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<td>3</td>
<td>Design/development of solutions</td>
<td>Design a system or process to improve its performance, satisfying its constraints.</td>
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<td>4</td>
<td>Conduct investigations of complex problems</td>
<td>Conduct experiments &amp; collect, analyze and interpret the data.</td>
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<td>5</td>
<td>Modern tool usage</td>
<td>Apply various tools and techniques to improve the efficiency of the system.</td>
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<td>6</td>
<td>The Engineer and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
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<td>7</td>
<td>Environment and sustainability</td>
<td>Design the system with environment consciousness and sustainable development.</td>
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<td>8</td>
<td>Ethics</td>
<td>Interacting industry, business and society in a professional and ethical manner.</td>
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<td>9</td>
<td>Individual and team work</td>
<td>Function in a multidisciplinary team.</td>
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<td>Communication</td>
<td>Proficiency in oral and written Communication.</td>
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<td>11</td>
<td>Project management and finance</td>
<td>Implement cost effective and improved system.</td>
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<td>12</td>
<td>Life-long learning</td>
<td>Continue professional development and learning as a life-long activity.</td>
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PROGRAM SPECIFIC OUTCOMES (PSOs):

On successful completion of the Materials Science and Engineering Degree programme, the Graduates shall exhibit the following:
1. Graduates will have an ability to identify, analyse and provide solution to the problems related to Materials and metallurgical engineering.
2. Graduates will have the ability to implement/use appropriate characterisation techniques, analytical skills, and latest/recent development in materials technology to solve engineering problems related to materials selection and design.
3. Graduates will be able to design and develop materials and processing techniques to meet the industry needs within the realistic constraints economic, environmental, social, ethical, health and safety, manufacturability and sustainability.

PEO / PO Mapping:

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<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
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### MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME

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### UNIVERSITY DEPARTMENTS
### B.E. MATERIALS SCIENCE AND ENGINEERING
### REGULATIONS - 2019
### CHOICE BASED CREDIT SYSTEM
### CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS
### (Applicable to students admitted from the Academic Year 2022 – 2023 onwards)

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*Skill Based Course

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§ Skill Based Course

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* the students will undergo industrial training / Internship during previous vacation

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#### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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OBJECTIVES
- To build lexical competency and accuracy that will help learners to use language effectively.
- To learn various reading strategies that will enable learners to comprehend the different modes of reading materials of varied levels of complexity.
- To comprehend the linguistic aspects of various rhetorical structures and functions of Technical English and use them effectively in writing.

UNIT I INTRODUCING ONESELF 9
Theory:
Reading: Descriptive passages (From Newspapers / Magazines) – Writing: Writing a coherent paragraph (Native Place, School Life) – Grammar: Simple present tense, Present continuous tense – Vocabulary development: One word substitution.

UNIT II DIALOGUE WRITING 9
Theory:
Reading: Reading a print interview (Comprehension and inference questions) - Writing: Writing a checklist - Dialogue writing – Grammar: Simple past tense – Question formation (Wh-Questions, ‘Yes’ or ‘No’ Questions, Tag Questions) – Vocabulary Development: Lexical items relevant to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 9
Theory:

UNIT IV WRITING LETTERS OF COMPLAINT 9
Theory:

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 9
Theory:

TOTAL : 45 PERIODS

LEARNING OUTCOMES:
On completion of the course, the students will be able to:
- Use appropriate language structures and lexical items in authentic contexts.
- Read both general and technical texts and comprehend their denotative and connotative meanings.
- Write different kinds of formal documents with grammatical and lexical appropriacy.
Assessment Pattern
- Two written internal assessments to test learner’s progress in grammar, vocabulary, reading and writing skills.
- End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills for two hours.

MA5158 ENGINEERING MATHEMATICS – I  
(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

L T P C 3 1 0 4

COURSE OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 12

UNIT II DIFFERENTIAL CALCULUS 12

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

UNIT IV INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V MULTIPLE INTEGRALS 12

TOTAL :60 PERIODS
COURSE OUTCOMES:
At the end of the course the students will be able to
- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:

REFERENCES:

PH5151 ENGINEERING PHYSICS
(Common to all branches of B.E / B.Tech programmes)
L T P C 3 0 0 3

COURSE OBJECTIVES:
- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS
UNIT II ELECTROMAGNETIC WAVES
Gauss’s law – Faraday’s law - Ampere’s law - The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS

UNIT IV BASIC QUANTUM MECHANICS
Photons and light waves - Electrons and matter waves - The Schrödinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS
The resonant diode - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students should able to
- Understanding the importance of mechanics.
- Express the knowledge of electromagnetic waves.
- Know the basics of oscillations, optics and lasers.
- Understanding the importance of quantum physics.
- Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES:
- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY
9

UNIT II NANO CHEMISTRY 9

UNIT III PHOTO CHEMISTRY AND SPECTROSCOPY 9

UNIT IV ENERGY CONVERSIONS AND STORAGE 9
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H2-O2 and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY 9
phosphate, calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

REFERENCES:

GE5151 ENGINEERING GRAPHICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.
UNIT I  PLANE CURVES AND FREE HANDSKETCHING  
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  
Orthographic projection- principles-Principle 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 both the principal planes by rotating object method and auxiliary plane method.

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

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  
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 (L: 15 + P: 60)=75 PERIODS

COURSE OUTCOMES:  
Upon completion of this course, the students will be able to:
1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:  
REFERENCES:

Publication of Bureau of Indian Standards:

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

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GE5154 தமிழ் மரம்

L T P C 1 0 0 1
அலகு II: பாடல் -பலகை கதிர்வங்கள் முதல் நூற்றாண்டுகள் காட்சிகள் -தலைவர் கலை -சிற்பக் கறல் - நடுகல் முதல் நூற்றாண்டுகள் வமர் -அர்தத் தொட்டுப்புறத் ததொல்கொப்பியம் -மகொவில்களின் பங்கு.  

அலகு III: மாணவர் கலாச்சாரவாய்ந்த விளக்கங்கள்: 3

அலகு IV: கலிநாரியகரின் விளக்கங்கள் கலப்பாடை: 3

அலகு V: தொக்கம் வரலோறு காலம் மற்றும் பலகை பொம்பாட்டுப்புறம்: 3

TEXT-CUM-REFERENCE BOOKS
1. மதீசு மறைவு - மக்கள் பண்பாடு - தொட பொறிக்கல் (தமிழில்: மதீசு மறைவு - மக்கள் பண்பாடு - தொட பொறிக்கல்).
2. மதீசு மறைவு - மக்கள் பண்பாடு - தொட பொறிக்கல் (தமிழில்).
3. மதீசு மறைவு - மக்கள் பண்பாடு - தொட பொறிக்கல் (தமிழில்).
4. மதீசு மறைவு - மக்கள் பண்பாடு (தமிழில் மறைவு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi -‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

TOTAL : 15 PERIODS
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
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BS5161 BASIC SCIENCES LABORATORY (Common to all branches of B.E. / B.Tech Programmes) 0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

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

LIST OF EXPERIMENTS:
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of Young’s modulus
3. Uniform bending – Determination of Young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
13. Photoelectric effect
14. Michelson Interferometer.
16. Melde’s string experiment

TOTAL: 30 PERIODS
COURSE OUTCOMES:
Upon completion of the course, the students will be able
- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids

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

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:
1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by lodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Phase change in a solid.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To determine the molecular weight of polymers by viscometric method.
- To quantitatively analyse the impurities in solution by electroanalytical techniques
- To design and analyse the kinetics of reactions and corrosion of metals

TEXT BOOKS:
COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:
- a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- b) Preparing plumbing line sketches.
- c) Laying pipe connection to the suction side of a pump
- d) Laying pipe connection to the delivery side of a pump.
- e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
- a) Sawing,
- b) Planing and
- c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
- a) Studying joints in door panels and wooden furniture
- b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES

WIRING WORK:
- a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
- b) Wiring Stair case light.
- d) Preparing wiring diagrams for a given situation.

Wiring Study:
GROUP – B (MECHANICAL AND ELECTRONICS)

PART III  MECHANICAL ENGINEERING PRACTICES

WELDING WORK:
  a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
  b) Practicing gas welding.

BASIC MACHINING WORK:
  a) (simple)Turning.
  b) (simple)Drilling.
  c) (simple)Tapping.

ASSEMBLY WORK:
  a) Assembling a centrifugal pump.
  b) Assembling a household mixer.
  c) Assembling an air conditioner.

SHEET METAL WORK:
  a) Making of a square tray

FOUNDRY WORK:
  a) Demonstrating basic foundry operations.

PART IV  ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:
  a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
  a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
  a) Studying a FM radio.
  b) Studying an electronic telephone.

TOTAL = 60 PERIODS

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

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

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GE5163 ENGLISH LABORATORY

OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-
UNIT V  EXPRESSION  6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking – making predictions – talking about a given topic-giving opinions–understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN
- One online / app based assessment to test listening /speaking
- End Semester ONLY listening and speaking will be conducted online.
  Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

HM5201  ELECTRICAL AND ELECTRONIC PROPERTIES OF MATERIALS  L  T  P  C
3  0  0  3

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

UNIT – I  ELECTRICAL PROPERTIES OF MATERIALS  9

UNIT – II  SEMICONDUCTOR PHYSICS  9

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

UNIT – IV  MAGNETISM AND SUPERCONDUCTIVITY 9

UNIT – V  OPTICAL PROPERTIES OF MATERIALS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain the theories of electrical and thermal conduction is solids, basic quantum mechanics, and energy bands.
2. Recognize semiconducting materials based on energy level diagrams, its types, temperature effect.
3. Interpret the mechanisms of various types of polarization and about classification and properties of ferroelectric crystals.
4. Discuss the classification of magnetic materials, theory and applications of ferromagnetic materials and superconductors.
5. Describe the optical properties of materials and their applications.

TEXT BOOKS:

REFERENCES:
MA5252  ENGINEERING MATHEMATICS – II  
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)  

L  T  P  C  
3  1  0  4

COURSE OBJECTIVES:  
- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.  
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.  
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.  
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.  
- To make the students 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  
VECTOR CALCULUS  

UNIT II  
ANALYTIC FUNCTION  
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation \( w = c + z, \quad az, \quad 1/z, \quad z^2 \).  

UNIT III  
COMPLEX INTEGRATION  

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


TOTAL : 60 PERIODS

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

- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:

REFERENCES:

GE5153  PROBLEM SOLVING AND PYTHON PROGRAMMING  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I  INTRODUCTION TO COMPUTING AND PROBLEM SOLVING
SUGGESTED ACTIVITIES:
- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:
- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II  CONDITIONALS AND FUNCTIONS

SUGGESTED ACTIVITIES:
- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III  SIMPLE DATA STRUCTURES IN PYTHON

SUGGESTED ACTIVITIES:
- Implementing python program using lists, tuples, sets for the following scenario:
  - Simple sorting techniques
  - Student Examination Report
  - Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Group Discussion on external learning component.
UNIT IV STRINGS, DICTIONARIES, MODULES


SUGGESTED ACTIVITIES:
- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student’s choice) and importing into the application.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

SUGGESTED ACTIVITIES:
- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
- CO1: Develop algorithmic solutions to simple computational problems.
- CO2: Develop and execute simple Python programs.
- CO3: Write simple Python programs for solving problems.
- CO4: Decompose a Python program into functions.
- CO5: Represent compound data using Python lists, tuples, dictionaries etc.
- CO6: Read and write data from/to files in Python programs.

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TEXT BOOKS:
REFERENCES:

EE5251  BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING          L T P C
                                                  3 0 0 3

COURSE OBJECTIVES:
• To understand the basic concepts of electric circuits, magnetic circuits and wiring.
• To understand the operation of AC and DC machines.
• To understand the working principle of electronic devices and circuits.

UNIT I   BASIC CIRCUITS AND DOMESTIC WIRING  9

UNIT II  THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS  9

UNIT III ELECTRICAL MACHINES  9

UNIT IV BASICS OF ELECTRONICS  9
Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES  9
Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1  To be able to understand the concepts related with electrical circuits and wiring.
CO2  To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3 Capable of understanding the operating principle of AC and DC machines.
CO4 To be able to understand the working principle of electronic devices such as diode and zener diode.
CO5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

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TEXT BOOKS:

REFERENCES:

ML5201 PHYSICAL METALLURGY
L   T   P   C
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COURSE OBJECTIVES:
1. To acquire a sound background in predicting the behavior of a metallic material to a certain application.
2. To inculcate the knowledge of the fundamental principles of Physical Metallurgy
3. To impart knowledge on the interpretation of phase diagrams.
4. To impart knowledge on the thermodynamics aspect of physical metallurgy
5. To impart knowledge on the use of physical metallurgy concepts in different alloys

UNIT I STRUCTURE OF SOLIDS & SOLIDIFICATION OF PURE METALS
9
Atomic Bonding & Crystal Structure: Metallic bond, unit cell, atomic packing, interstitial sites, Miller indices, crystal orientation, stereographic projection.
Phase rule, Concept of Free Energy, Entropy, Surface Energy (grain boundary) & under cooling, Nucleation & Growth, homogeneous & heterogeneous nucleation, directional solidification. Mechanisms (slip & twin), critical resolved shear stress, single crystal tensile test (FCC), theoretical strength of ideal crystal.
UNIT II CRYSTAL IMPERFECTIONS AND DIFFUSION 9
Vacancy, interstitial, substitutional, free energy of mixing, dislocation (elementary concepts only), edge / screw dislocation, partial dislocation, stacking fault, dislocation lock, dislocation pile up, Hall Petch relation, grain boundary structure.
Elementary concepts of phenomenological & atomistic approaches in Diffusion

UNIT III SOLIDIFICATION OF BINARY ALLOYS 9
Limits of solubility, isomorphous system, lever rule, constitutional super cooling, effect of non-equilibrium cooling, eutectic, peritectic, eutectoid & peritectoid system, complex phase diagram, ternary diagram, structure of cast metal, segregation & porosity, iron-carbon diagram, steel & cast iron.
Phase Diagrams of common commercial alloys: Cu-Ni, Ni-Cr, Al-Si, Al-Zn, Cu-Zn, Cu-Al, Ti-Al, Ti-V, interpretation of microstructure & properties.

UNIT IV COLD WORKING, ANNEALING AND PRECIPITATION 9
Need for Heat treatments. Introduction to various Heat treatment processes.

UNIT V APPLICATIONS OF PHYSICAL METALLURGY 9
Strengthening mechanism, strength vs. toughness (ductility), thermo mechanical processing, micro alloyed steel, ultra high strength steel, superalloy, control of texture.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
The student will be able to
1. To recognize basic nomenclature, basic microstructure, and associate terms with the appropriate structure / phenomena and be able to differentiate between related structure / phenomena.
2. To perform simple calculations to qualify materials properties and microstructural characteristics.
3. To interpret the effect of composition and microstructure on material properties.
4. To perform phase equilibrium calculation and construct phase diagram.
5. To select suitable ferrous and non-ferrous materials for engineering application.

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES:
1. To discuss and explain the basics of solid state chemistry.
2. To understand and apply the basic principles of chemical reaction kinetics and dynamics.
3. To explain the theoretical models of molecular collisions, reaction dynamics and microscopic kinetics.
4. To theoretically derive rate law equations and solve simple numerical problems.
5. To describe the experimental methods of preparation of materials in various forms.

UNIT – I SOLID STATE CHEMISTRY

UNIT – II REACTION KINETICS IN SOLUTIONS
Chemical kinetics – rate equation, order of reaction and rate law determination: 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
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, Atomic theory of diffusion- self diffusion mechanism.

UNIT – V SYNTHETIC METHODS
Thin film - Electrochemical methods, PVD and CVD; Crystal growth- Thermal methods –
Bridgman, Stockbarger and Zone refining, 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 - Flame and plasma fusion, Solution methods, Intercalated compounds.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. To remember and explain the basic concepts of solid state chemistry.
2. To understand and apply the basic principles of chemical reaction kinetics and
dynamics.
3. To analyse the theoretical models of molecular collisions, reaction dynamics and
microscopic kinetics.
4. To derive and evaluate rate law equations and solve simple numerical problems.
5. To develop suitable experimental methods for material preparations.

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TOTAL: 45 PERIODS
அக்டு I கருத்துப் பாடல் தமிழ்மலைக் கல்வியியல்: 3
சாத்து கருத்துப் பாடல் தமிழியல் - பாடல் தமிழியல்நுட்பம் - கட்டுமொனங்கள் - பாடல் தமிழ்மலைக் கல்வியியல்.

அக்டு II ஒப்பொருள் மலைக் கட்ட தமிழ் கல்வியியல்: 3
சாத்து கருத்துப் பாடல் மலைச்சொல்லது உருவொக்கண்டாமல் & சாத்து கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது - கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது - கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது - கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது - கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது - கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது - கருத்துப் பாடல் மலைச்சொல்லது அவசரமானது.

அக்டு III குடா கல்வியியல்: 3
பொட்டட போட்டு கோடு - எிருக்கும் தமிழ்மலைக் கல்வியியல் - தமிழ்மலை குண்டக்கால், சாத்து - பாடல் தமிழ்மலைக் கல்வியியல் எலும் மலைச்சொல்லை மணிகள் - பாடல் தமிழ்மலைக் கல்வியியல் எலும் மலைச்சொல்லை மணிகள் - பாடல் தமிழ்மலைக் கல்வியியல் எலும் மலைச்சொல்லை மணிகள்.

அக்டு IV தொன்மறுமை பாடல் நூல் பொன்றைத் தமிழ் கல்வி: 3
அக்டு, பொதி, கதாக்கால், மகுதி - தொன்மறுமை பாடல் நூல் தமிழ் கல்வி மணிகளின் - காலார்தர் பாரப்படுத்து - காலார்தர் பாரப்படுத்து மணிகளின் குண்டக்கால் - தொன்மறுமை பாடல் நூல் தமிழ் கல்வி எலும் மலைச்சொல்லை மணிகள் - காலார்தர் எலும் - மன்னர் மலைச்சொல்லை மணிகளின் - பாடல் தமிழ் கல்வி எலும் - எலும் மலைச்சொல்லை மணிகள்.

அக்டு V பொன்றைத் தமிழ் கல்வி கல்வியியல்: 3
பொன்றைத் தமிழ் கல்வி - கல்வியியல் எலும் - தமிழ் கல்வியியல் எலும் - தமிழ் பாடல் பொன்றைத் தமிழ் - தமிழ் பாடல் பொன்றைத் தமிழ் - தமிழ் பாடல் பொன்றைத் தமிழ் - தமிழ் பாடல் பொன்றைத் தமிழ்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழ் பாடல் - மணிகள் பாடல்பொடும் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடல் - தமிழ் பாடalah.
GE5252 TAMIls AND TECHNOLOGY L T P C

UNIT I WEAVING AND CERAMIC TECHNOLOGY 1 0 0 1

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakkar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.
UNIT V  SCIENTIFIC TAMIL & TAMIL COMPUTING


TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
2. கணினித் தமிழ் – முமனவர் இலசுந்தரம் (விகடன் பிரசுரம்).
3. சீருமுக – தமிழ் குலிகங்களில் வசதிகள் தடவு தசாரிகம் (தகாண்டியம் தன்மை தொலிகம்).
4. மலராயத் – அங்கங்காரர் தசாரிகம் (தகாண்டியம் தன்மை தொலிகம்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES
1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators

LIST OF EXPERIMENTS
1. Verification of Kirchhoff’s Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode
9. Characteristics of Zener diode
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

COURSE OUTCOMES:
1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines
3. Ability to use logic gates and Flip flops

GE5161  PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY  L  T  P  C  0 0 4 2

COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.
OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I
Speaking
- Role Play Exercises Based on Workplace Contexts,
- talking about competition
- discussing progress toward goals
talking about experiences
- talking about events in life
- discussing past events

Writing:
- writing emails (formal & semi-formal).

UNIT II
Speaking:
- discussing news stories
- talking about frequency
- talking about travel problems
- making arrangements
- discussing plans and decisions
- discussing purposes and reasons
- understanding common technology terms

Writing:
- writing different types of emails.

UNIT III
Speaking:
- discussing predictions
- describing the climate
- discussing forecasts and scenarios
- talking about purchasing
- discussing advantages and disadvantages
- making comparisons
- discussing likes and dislikes
- discussing feelings about experiences
- discussing imaginary scenarios

Writing:
- short essays and reports (formal/semi-formal letters).

UNIT IV
Speaking:
- discussing the natural environment
- describing systems
- describing position and movement
- explaining rules
- discussing rental arrangements
- understanding technical instructions

Writing:
- writing instructions
- writing a short article.

UNIT V
Speaking:
- describing things relatively
- describing clothing
- discussing safety issues
- making recommendations
- talking about electrical devices
- describing controlling actions

Writing:
- job application
- writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern

- One online/app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.
COURSE OBJECTIVES:
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  12
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange’s Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II  FOURIER SERIES  12
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic Analysis.

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION  12

UNIT IV  FOURIER TRANSFORM  12

UNIT V  Z – TRANSFORM AND DIFFERENCE EQUATIONS  12

TOTAL : 60 PERIODS

COURSE OUTCOMES :
At the end of the course, students will be able to
- Solve partial differential equations which arise in application problems.
- Analyze the functions as an infinite series involving sine and cosine functions.
- Obtain the solutions of the partial differential equations using Fourier series.
- Obtain Fourier transforms for the functions which are needed for solving application problems.
- Manipulate discrete data sequences using Z transform techniques.

TEXT BOOKS:
REFERENCES:

ML5301 POLYMER SCIENCE AND ENGINEERING   L  T  P  C
3  0  0  3

COURSE OBJECTIVES:
1. To understand the basics of polymers, its formation and polymerization types.
2. To understand the significance and determine the molecular weights of polymers.
3. To characterize polymers for their thermal behaviour and solution properties.
4. To explain the thermodynamics of polymer dissolution and the factors influencing.
5. To identify suitable polymer processing methods for polymer products.

UNIT – I POLYMERS AND POLYMERIZATION

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

UNIT – III TRANSITIONS IN POLYMERS

UNIT – IV SOLUTION PROPERTIES OF POLYMERS

UNIT – V POLYMER PROCESSING

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. To understand the basics concepts and fundamental principles of polymers and polymerization.
2. To evaluate and determine the molecular weights of polymers.
3. To characterize and evaluate the thermal and solution properties of polymers.
4. To understand and analyze the thermodynamics of polymer dissolution.
5. To produce tailor-made polymers to suit the demanding applications.

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ML5302  METALLURGICAL THERMODYNAMICS  L T P C
4 0 0 4

COURSE OBJECTIVES:
1. To give an overview of fundamental concepts in metallurgical thermodynamics
2. To impart knowledge about the state functions such as internal energy, entropy and criteria of equilibrium.
3. To give insight to the auxiliary functions, heat capacities and thermodynamic potentials.
4. To provide essentials of thermodynamic behavior of solutions.
5. To render exposure to thermodynamics of electrochemical cells, surfaces and defects.

UNIT – I  FUNDAMENTAL CONCEPTS  9+3
Definition of thermodynamic terms; concept of states, systems and surroundings, Types of systems, equilibrium. Equation of states, extensive and intensive properties, homogeneous and heterogeneous, micro-macro systems. Phase diagrams and its classification, Internal energy, heat capacity, enthalpy, isothermal, and adiabatic processes.
UNIT – II INTERNAL ENERGY AND ENTROPY 9+3

UNIT – III AUXILLARY FUNCTIONS AND THERMODYNAMIC POTENTIALS 9+3

UNIT – IV THERMODYNAMICS OF SOLUTIONS 9+3

UNIT – V THERMODYNAMICS OF REACTIONS 9+3

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Recognize the nature of the system and properties.
2. Explain the concept of internal energy, entropy and criteria for equilibrium.
3. Realize the importance of auxiliary functions and thermodynamic potentials.
4. Apply the concepts of thermodynamics in the behavior of solutions.
5. Outline the thermodynamic approaches towards electrochemical cells, surfaces and defects.

TOTAL: 60 PERIODS

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ML5352 MECHANICS OF MATERIALS L T P C 3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare students for:
1. Applying the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyzing the transverse loading on beams and stresses in beam for various engineering applications.
3. Analyzing the torsion principles on shafts and springs for various engineering applications.
4. Analyzing the deflection of beams for various engineering applications.
5. Analyzing the thin and thick shells and principal stresses in beam for various engineering applications

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

UNIT III TORSION 9
Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9
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 THICK & THIN SHELLS & PRINCIPAL STRESSES 9
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 – Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyze the transverse loading on beams and stresses in beam for various engineering applications.
3. Analyze the torsion principles on shafts and springs for various engineering applications.
4. Analyze the deflection of beams for various engineering applications.
5. Analyze the thin and thick shells and principal stresses in beam for various engineering applications.

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ML5311 MICROSTRUCTURAL ANALYSIS LABORATORY L T P C
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COURSE OBJECTIVE:
To provide a hands on experience to understand the effect of heat treatments on the microstructural behavior of some common types of metals and alloys.

LIST OF EXPERIMENTS
1. Mounting and preparation of metallurgical samples.
2. Study of metallurgical microscope and sample preparation.
3. Quantitative Metallography & image analysis.
4. Macro etching - cast, forged and welded components.
5. Electrolytic Etching and Polishing
6. Microscopic examination of cast irons - Gray, White, Malleable and Nodular types
7. Microscopic examination of Plain carbon steels (low carbon, medium carbon, high carbon steels).
8. Microscopic examination of Austenitic Stainless steels and High Speed Steels.
10. Microscopic examination of Copper alloys

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Students will be able:
- To prepare the samples for microscopic examination
- To recognize the microstructures of various ferrous and non-ferrous materials
- To differentiate the different types of cast irons based on their morphology and analyse the effect of the processing on the microstructure.
- To interpret the microstructures of various materials and also understand the effect of the various phase constituents on the properties of the materials
- To perform a quantitative analysis on any given microstructure.

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ML5312 MATERIALS TESTING LABORATORY

COURSE OBJECTIVES:
1. To make the student familiarize with various mechanical testing.
2. To offer hands-on training in the evaluation of mechanical properties and the standards.
3. To know the importance of testing standards.
4. To demonstrate the importance of stress-strain curves and resistance to indentation in materials selection.
5. To expose the different methods of evaluating the soundness of weldment.

LIST OF EXPERIMENTS
1. To perform tensile test and draw stress-strain plot, determination of yield/proof stress, Ultimate tensile strength, breaking stress and % elongation.
2. Comparison of the stress-strain curves of aluminium alloys, steels, polymers and composites.
3. To perform hardness test and determine hardness value using Rockwell Hardness/Brinell Tester.
4. To determine hardness distribution using Micro vicker's hardness.
5. Determination of hardness by LEEB’s Hardness tester.
7. To perform compression test and compare the compressive behaviour of steels/aluminium alloys.
8. To perform the torsion test.
9. To perform longitudinal and transverse welds test.
10. To perform guide and root bend tests in welded specimen.
11. To perform Scratch hardness tests are to determine the hardness of a material to scratches and abrasion in Mohrs scale.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, the students will be able to:
1. Select a suitable mechanical test method to evaluate the properties of material.
2. Identify appropriate test method while performing failure analysis.
3. Use the stress-strain plot in materials selection.
4. Evaluate the soundness of the weldments.
5. Discriminate hardness and hardenability.

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GE5361 PROFESSIONAL DEVELOPMENT L T P C

OBJECTIVES:
- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours
- Create and format a document
- Working with tables
- Working with Bullets and Lists
- Working with styles, shapes, smart art, charts
- Inserting objects, charts and importing objects from other office tools
- Creating and Using document templates
- Inserting equations, symbols and special characters
- Working with Table of contents and References, citations
- Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

**MS EXCEL:**

10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

**MS POWERPOINT:**

10 Hours

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

**OUTCOMES:**

On successful completion the students will be able to

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
COURSE OBJECTIVES:
1. To understand the fundamentals of spectroscopic methods.
2. To understand and describe the principles behind UV-visible, IR, Raman and Atomic spectroscopy.
3. To characterize materials using thermal and surface analytical methods.
4. To estimate samples using separation techniques.
5. To understand the theory, instrumentation of analytical and spectroscopic equipments and their applications in material analysis.

UNIT – I  INTRODUCTION TO SPECTROSCOPY  9

UNIT – II  UV VISIBLE SPECTROSCOPY  9

UNIT – III  IR, RAMAN AND ATOMIC SPECTROSCOPY  9

UNIT – IV  SEPARATION TECHNIQUES  9
Solvent extraction and ion exchange techniques – principles and applications; Chromatographic techniques – adsorption chromatography – Paper, TLC and Columnn- GC and HPLC.

UNIT – V  THERMAL AND SURFACE ANALYSIS METHODS  9
Thermal analysis – TGA, DTA, DSC and DMA – principles, instrumentation and applications. Surface analysis – TEM, SEM and AFM – Principle, instrumentation and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. To understand the fundamentals of spectroscopic methods.
2. To apply the principles of UV-visible, IR, Raman and Atomic spectroscopic techniques for material characterization.
3. To evaluate the thermal and surface properties of materials using analytical techniques.
4. To qualitatively and quantitatively estimate samples using separation techniques.
5. To interpret the results of spectroscopic and analytical methods of specimen analysis.

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ML5402  IRON AND STEEL MAKING  L T P C
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COURSE OBJECTIVES:
1. To provide a basic knowledge on the need for the beneficiation of iron ores and the different preliminary treatments given to the iron ores.
2. To inculcate the knowledge on the various parts of blast furnace and the reactions that take place in the various zones of blast furnace.
3. To make the students to understand the principles and kinetics of pig iron production as well as steel making.
4. To import knowledge on various primary and secondary processes employed for making of steel.
5. To import knowledge on ladle metallurgy to produce different types of steel.

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 9

UNIT IV  STEEL MAKING PROCESSES 9

UNIT V  LADLE METALLURGY 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able:
1. To identify the suitable preliminary treatments to be given to the iron ore for the beneficiation of ores.
2. To explain the construction of Blast furnace, its operation and the various reactions that takes place in the various zones of blast furnace.
3. To interpret the slag theories and slag functions in the steel making processes.
4. To compare the various steel making processes and analyse the advantages and limitations of the different processes.
5. To identify suitable secondary refining processes for producing a good quality steel.

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES:
1. To give an overview of elastic and plastic behaviour of materials
2. To enlighten the different strengthening mechanisms.
3. To give insight into the types of fracture and mechanics of fracture.
4. To provide acumen towards fatigue behavior of materials.
5. To render exposure to high temperature behavior of materials.

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, 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, Fracture toughness and Determination of KIC.

UNIT – IV FATIGUE BEHAVIOUR AND TESTING

UNIT – V CREEP BEHAVIOUR AND TESTING
Creep curve, Stages in creep curve and explanation, Structural changes during creep, Creep mechanisms, Metallurgical factors affecting creep, High temperature alloys, Stress rupture testing, Creep testing machines, creep life prediction-Omega (Damage rate) method, Larson-Miller (parametric) method. Deformation Mechanism Maps according to Frost/Ashby, Superplasticity.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify the role of dislocations and the mechanisms of plastic deformation.
2. Explain the strengthening mechanisms of polycrystalline and composite materials.
3. Analyze the nature of fracture and its underlying mechanism.
4. Appraise the micro-mechanics, factors and life predictions of components under fatigue loading.
5. Assess the behavior of materials under high temperature, metallurgical factors and life prediction of high temperature materials.

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ML5404 HEAT TREATMENT OF METALS AND ALLOYS L T P C
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COURSE OBJECTIVES:
1. To impart necessary background to design/select the necessary heat treatment for attaining the appropriate microstructure for the desired properties.
2. To provide a comprehensive understanding of the various transformation reactions associated with the changes in microstructures and properties that occur due to controlled heat treatment.
3. To import knowledge on different case hardening techniques used in industries
4. To expose the students to various Heat treatment furnaces, Quenching media and the heat treatment of some special alloys.
5. To import knowledge on heat treatments employed for special alloys
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, polymer quenching, Various Heat Treatment furnaces- Roller and Mesh type continuous furnaces- fluidised bed furnaces, cryo-chamber, cryo-treatment of steels, sealed quench furnace, Vacuum furnace, Plasma equipment-Elements of Process control systems- PLC ,PID controllers and continuous monitoring systems.

UNIT V  HEAT TREATMENT OF SPECIFIC ALLOYS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able:
1. To have a comprehensive understanding of the various transformation reactions associated with the changes in microstructures and properties that occur due to controlled heat treatment.
2. To explain the various heat treatment processes that can be applied for different ferrous and non-ferrous alloys.
3. To classify the various case hardening treatments and analyse the effect of various case hardening treatments on the metals and alloys.
4. To compare the advantages and limitations various heat treatment furnaces, quenching media and furnace atmospheres.
5. To interpret the results of heat treatments on the various other non-ferrous materials, alloy steels and cast irons.
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ML5405  POWDER METALLURGY  3 0 0 3

COURSE OBJECTIVES:
1. To provide a thorough knowledge on powder preparation, characterization, compaction and sintering.
2. To make the students well versed with the various methods for manufacturing powders.
3. To expose the students to various testing methods available for metal powders.
4. To enable the students to identify suitable powder production methods, compaction process and sintering method for a given application.
5. To impart knowledge on the various areas of applications of powder metallurgy components.

UNIT I  POWDER MANUFACTURE AND CONDITIONING  9
Mechanical methods: Machine milling, ball milling, shotting- Chemical methods, condensation, thermal decomposition, Reduction, electrodeposition, 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- blending and mixing, equipments, Self-propagating high-temperature synthesis (SHS), sol-gel synthesis- Nanopowder production methods.
UNIT II CHARACTERISTICS AND TESTING OF METAL POWDERS

Sampling, chemical composition, Particle Size and its measurement- Sieve analysis- Principle and procedure, sedimentation, elutriation & permeability, Particle size Topography, Surface area, True, Apparent and Tap Density, Flow rate, Compressibility, Green Strength, Pyrophoricity and Toxicity, particle shape, classifications

UNIT III POWDER COMPACTION

Pressureless compaction: Loose Shaping, slip casting and slurry casting. Pressure compaction-Die compaction, Role of lubrication, single ended and double ended compaction, isostatic pressing, powder rolling, Vibratory Compaction, Centrifugal compaction, explosive forming.

UNIT IV SINTERING


UNIT V APPLICATIONS of P/M COMPONENTS


TOTAL: 45 PERIODS

COURSE OUTCOMES:
The Students will be able:
1. To classify the various powder production methods and the Powder conditioning treatments.
2. To interpret the various characteristics of metal powders.
3. To compare the different compaction processes and identify a suitable compaction methodology for a component meant for specific application
4. To explain the sintering mechanisms and the various types of Sintering processes as well as the finishing processes.
5. To get acquainted with the applications of various powder metallurgy components.

TEXT BOOKS

REFERENCES
OBJECTIVE:
To impart practical knowledge on powder metallurgy steps such as: powder synthesis, compaction and sintering and testing powder compacts and sinters.

LIST OF EXPERIMENTS
1. Powder Production by a chemical method
2. Powder size reduction by Ball Milling
3. Particle size distribution by Sieve analysis
4. Measurement of Apparent and Tap Density of Powders
5. Measurement of Flow Rate of Powders
6. Production of green compacts.
7. Density determination of sintered product.
8. Effect of Sintering temperature on the density
10. Preparation of porous ceramic product.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
The students will be able:
- To produce metal powders of desired size and shape by selecting the suitable powder production method.
- To interpret the distribution of powders and the effect of distribution on the final properties of the component.
- To characterize the powders in terms of tap density, apparent density, flow rate and so on.
- To produce a compact of desired size and shape and also have the hands on experience to eject the compact from the die smoothly.
- To compare the properties of the sintered compact with that of the green compact.
OBJECTIVE:
To provide a practical knowledge on the various heat treatment processes applicable to Ferrous as well as Non-Ferrous materials and also to get acquainted with the microstructural changes and hardness evaluation under various heat treatment conditions.

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Students will be able:
• To perform various heat treatment processes on plain carbon steels and analyse the effect of the processes on steels.
• To execute the case hardening effect on a low carbon steel and to analyse the case depth measurements.
• To interpret the effect of quenching media and the carbon percentage on the hardening of steel.
• To exemplify the effect of Jominy end quench test on the hardenability of steel.
• To do heat treatment on the various non-ferrous materials and analyse the effect of heat treatment on these materials.
COURSE OBJECTIVES:
- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi’s Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

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

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

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

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi’s Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.
TEXT BOOK:

REFERENCES:

ML5501 THEORY AND APPLICATIONS OF METAL FORMING  L T P C
3 0 0 3

COURSE OBJECTIVES
1. To import knowledge on stress-strain relations and stress tensor approach applied in metal forming
2. To import knowledge on fundamentals of metal forming processes
3. To import knowledge on principle of metal working, load calculation and the applications of metal working.
4. To import knowledge on extrusion and drawing processes
5. To import knowledge on sheet metal forming processes.

UNIT-I STRESS - STRAIN TENSOR 9
State of stress, components of stress, symmetry of stress tensor, principle stresses, stress deviator, Von Mises, Tresca Yield criteria, comparison of yield criteria, Octahedral shear stress and shear strain, Slip, twinning, Forming load calculations, Strain Rate Tensor

UNIT-II FUNDAMENTALS OF METAL FORMING 9
UNIT-III FORGING AND ROLLING
Forging-Hot, Cold and Warm Forging – types of presses and hammers. Classification, Open die forging and Closed die forging, die design, forging in plane strain, calculation of forging loads, use of software for analysis - forging defects – causes and remedies, residual stresses in forging. Rolling: Classification of rolling processes, types of rolling mills, hot and cold rolling, rolling of bars and shapes, forces and geometrical relationship in rolling, analysis of rolling load, torque and power, rolling mill control, rolling defects- causes and remedies.

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

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

TOTAL :45 PERIODS

COURSE OUTCOMES:
On Completion of the course the student will be able to
1. Ability to learn stress-strain concepts of materials during plastic deformation.
2. Apply the theory of plasticity and its application for analysing various metal forming Processes.
3. Understand the principle of metal working, load calculation and the applications of metal working.
4. Ability to calculate the forming loads for extrusion and drawing processes.
5. Understand the various sheet metal forming methods.

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COURSE OBJECTIVES:
1. To educate students on various techniques of structural characterisation of materials.
2. To enable student to interpret microstructure, crystal structure and surface structure of materials.
3. To import knowledge on X-Ray diffraction techniques and analysis
4. To import knowledge on different electron microscopy techniques used for characterisation
5. To import knowledge on different electron microscopy techniques used for characterisation
6. To import knowledge on techniques of elemental chemical composition and structure of surface.

UNIT I METALLOGRAPHIC TECHNIQUES
Macroexamination - applications, metallurgical microscope - construction and principle of working, specimen preparation, light material interaction – Rayleigh Scattering, Abbes theory; magnification, numerical aperture, resolving power, depth of focus, depth of field, different light sources; lenses aberrations and their remedial measures, Principles of microscopy - bright field, dark field, phase-contrast, polarization, differential interference contrast, high temperature microscopy; Quantitative metallography – Image analysis for grain size distribution and grain/precipitate shape.

UNIT II X-RAY DIFFRACTION TECHNIQUES
Reciprocal lattice, Stereographic projection, X-ray generation, absorption edges, characteristic and continuous spectrum, Bragg’s law, Ewald’s Sphere, Diffraction methods – Laue, rotating crystal and powder methods. Intensity of diffracted beams – structure factor calculations and other factors. Diffractometer – General features and optics, Counters - Proportional, Scintillating, Geiger counters and semiconductor based.

UNIT III ANALYSIS OF X-RAY DIFFRACTION
Line broadening - crystallite size, residual stress; Texture Analysis; Crystal structure determination-indexing -Phase identification- ASTM catalogue of Materials identification, quantitative phase estimation, Phase diagram determination, Precise lattice parameter calculation, Determination of residual stress – double angle diffraction.

UNIT IV ELECTRON MICROSCOPY
Electron specimen interaction; Construction and operation of Transmission electron microscope (TEM) – specimen preparation techniques- Diffraction mode and image mode, Sources of contrast- Selected Area Electron Diffraction, Zone axis, indexing; Construction, modes of operation and sources of contrast of Scanning electron microscope(SEM), Electron probe microanalysis, Basics of Field ion microscopy (FIB), Scanning Tunneling Microscope (STM) and Atomic Force Microscope(AFM).

UNIT V SURFACE ANALYSIS

TOTAL: 45 PERIODS
COURSE OUTCOMES:
1. Understanding of the techniques of the metallography and analysis the microstructure of materials.
2. Understanding of the techniques of XRD.
3. Ability to interpret and analysis the XRD materials.
4. Understanding of the techniques of electron microscopy and their application.
5. Understanding on techniques of elemental chemical composition and structure of surface.

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ML5503 CASTING METALLURGY

COURSE OBJECTIVES:
1. To impart knowledge about patterns, moulding materials and furnaces used in foundries.
2. To impart knowledge on the various moulding processes.
3. To impart knowledge on the gating system design for castings.
4. To impart knowledge on the ferrous casting metallurgy
5. To impart knowledge on the non-ferrous casting metallurgy

UNIT I PATTERN, MOULDING MATERIALS, FURNACES
Introduction to foundry process- Pattern, types- allowances- selection of pattern materials, - Sand-Core for foundry applications – types, properties of prepared sand.-Moulding and Cores additives- preparations-Types of furnaces –Crucible, Cupola, Oil fired furnaces, Electric furnaces , Arc and Induction types.
UNIT II  MOULDING PROCESSES

UNIT III  DESIGN OF GATING SYSTEM

UNIT IV  FERROUS CAST ALLOYS

UNIT V  NON FERROUS CAST ALLOYS

COURSE OUTCOMES:
1. Should be able to select a proper material for making a pattern, design patterns, and decide on the composition of sand and core and know about the different furnaces for available for melting metals.
2. Will be able to understand the various casting processes available for casting a component.
3. Will be able to design suitable gating system for casting a component.
4. Will be able to cast ferrous castings which are metallurgically sound.
5. Will be able to cast nonferrous castings which are metallurgically sound.

TEXT BOOKS
1. A.K.Chakrabarthi ‘Casting Technology and Cast Alloys’,Prentice Hall of India

REFERENCES
ML5511  METAL FORMING LABORATORY  L T P C
0 0 4 2

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

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:
1. Ability to analyse the formability behaviour of the metal forming process.
2. Ability to carry out various metal forming experiments.
3. Ability to evaluate the defects in the deformed components.
4. Ability to use software tools for analysing the metal forming process.
5. Ability to demonstrate the formability of different materials

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COURSE OBJECTIVES:
1. To train on the various sand testing methods.
2. To understand the effect of welding parameters on the weld bead by GTAW and GMAW processes.
3. To train on the Microstructural analysis of Carbon Steel, Stainless Steel, Aluminium Alloy and Titanium Alloy welded specimens.

LIST OF EXPERIMENTS
1. Determination of Average Sand grain Fineness.
2. Determination of Permeability of Green sand.
3. Estimation of Active clay content in Sand
4. Loss of Ignition Test for Green sand Mould
5. Determination of Green compression and Shear Strength.
6. Determination of Dry compression Strength
7. Determination of Scratch hardness.
8. Determination of Compactability.
9. Metal casting by Green and sand and full mould process.
10. Arc striking practice.
11. Bead-on-plate welding
   Effect of welding parameters on weld bead by
   (i) GTA welding
   (ii) GMA Welding
   (iii) Submerged Arc Welding
12. Microstructural Observation of Weldment
   (i) Carbon Steel
   (ii) Stainless Steel
   (iii) Aluminium Alloy
   (iv) Titanium Alloy

TOTAL: 60 PERIODS:

COURSE OUTCOMES:
(i) After the completion of the course the student will be able to estimate the properties of the system sand.
(ii) After the completion of the course the student will be to understand the effect of welding parameters on the weld bead by GTAW and GMAW processes.
(iii) After the completion of the course the student will be able to carry out the microstructural analysis of Carbon Steel, Stainless Steel, Aluminium Alloy and Titanium Alloy welded specimens.
COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14

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 – bio geographical 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  8

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  10

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 47 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  SOCIA L ISSUES AN D THE ENVIRONMENT


UNIT V  HUMAN POPULATION AN D THE ENVIRONMENT


TOTAL: 45 PERIODS

COURSE OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES
1. To impart knowledge about different matrix and reinforcement materials and selection of them for composite making.
2. To impart knowledge on various manufacturing methods for making polymer matrix composites.
3. To impart knowledge on various manufacturing techniques interface design and developing different in-situ reactions for making metal matrix composites.
4. To impart knowledge to fabricate different ceramic matrix composites and carbon-carbon composites.
5. To impart knowledge to develop constitutive equations for different laminates.

UNIT I  INTRODUCTION TO COMPOSITES

UNIT II  POLYMER MATRIX COMPOSITES

UNIT III  METAL MATRIX COMPOSITES

UNIT IV  CERAMIC MATRIX COMPOSITES AND SPECIAL COMPOSITES

UNIT V  MECHANICS OF COMPOSITES

TOTAL : 45 PERIODS

COURSE OUTCOMES
On completion of this course, the students can able to
1. Design and fabricate composite structures.
2. Identify suitable process for different composite components.
3. Design new composites materials for specific requirement.
4. Test and characterize the composites and qualify for the engineering acceptance.
5. Develop and use the constitutive equation for the composite components design

TEXT BOOKS

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ML5602 MATERIALS ELECTION AND DESIGN
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COURSE OBJECTIVES:
1. To give an overview of criteria, use of property chart and economics of materials selection.
2. To impart knowledge about the manufacturing system, process selection and DFM.
3. To give insight to the manufacturing considerations in design.
4. To provide understanding about the influence of the nature of load and material properties in design
5. To impart the framework in materials design for various kinds of failures.
UNIT – I  MATERIAL SELECTION IN DESIGN  9
Introduction, relation of materials selection to design, general criteria for selection, performance characteristics of materials, materials selection process, design process and materials selection, Types of design, material property chart, material performance indices, materials selection procedure, Structural index, economics of materials, recycling and materials selection

UNIT – II  MATERIALS PROCESSING AND DESIGN  9
Role of Processing in Designing, classification of manufacturing processes, types of manufacturing systems, influence of material on process selection. Design for manufacturability, DFM guidelines, Design for assembly, DFA guidelines, computer methods for DFMA, Design for machining, casting, forging, welding and heat treatment and its DFM guidelines

UNIT – III  MANUFACTURING CONSIDERATIONS IN DESIGN  9
Surface finish, texture, Standardization, Interchangeable manufacturing, Selective assembly, selection of materials based on mechanical properties -- Preferred numbers, Limits, fits and tolerances, Types of fits and tolerances. Geometric tolerance, types of form and position tolerances, tolerance and manufacturing methods, selection of fits.

UNIT – IV  MATERIALS PROPERTIES AND DESIGN  9
Stress - Strain diagram, design for strength, rigidity, design under static loading, stress due to torsion and bending, variable loading, stress concentration, fluctuating stress, eccentric loading – stress concentration. Design examples with shaft design and spring design.

UNIT – V  MATERIALS IN DESIGN  9
Design for brittle fracture, plane strain fracture toughness, fatigue failure, Design criteria, fatigue parameters, infinite, safe life and damage tolerance design, fatigue life prediction, corrosion resistance, forms of corrosion, corrosion prevention, Design against wear, types of wear, wear prevention, Designing with plastics, design for stiffness, Time dependent part performance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify criteria and apply the Ashby charts during materials selection.
2. Recognize the different manufacturing process and diagnose their role in design.
3. Elucidate the manufacturing considerations in design.
4. Analyse the influence of material properties and the nature of loading on design.
5. Develop a design procedure for various types of failures.

TEXT BOOKS:

REFERENCES:
ML5611 MATERIAL CHARACTERIZATION LABORATORY

COURSE OBJECTIVES:
1. To gain practical experience of handling sophisticated instruments.
2. To obtain hands-on-practice for sample preparation.
3. To experience the procedure involved in the instrumentation methods.
4. To calibrate and standardize the sensitive instruments.
5. To use the spectrometers, electron microscopes and thermal analyzers for analyzing the specimens.

LIST OF EXPERIMENTS:
1. Verification of Beer Lambert’s law using Absorption Spectrophotometer.
2. Determination of concentration of metal ions using UV Visible spectrophotometer.
3. Determination of thermal coefficient using dilatometer.
4. Determination of conductivity using conductivity meter.
5. Identification of organic compounds using IR spectroscopy.
6. Quantitative analysis using column chromatography.
7. Qualitative identification of species using TLC.
8. Thermal degradation analysis using TGA.
9. Thermal transition analysis using DSC.
10. Surface analysis of materials using electron microscopy.

COURSE OUTCOMES:
1. To apply the theoretical principles and concepts and verify them practically.
2. To analyze and interpret the results obtained from the instrumental methods.
3. To handle the samples for analysis.
4. To understand and evaluate the data suitably.
5. To derive useful information from the outputs.

TOTAL: 60 PERIODS
COURSE OBJECTIVES
1. To train the students to fabricate and test the polymer matrix composites
2. To train the students to fabricate and test the metal matrix composites
3. To train the students to develop in-situ reactions for particle reinforced metal matrix composites
4. To train the students to test to predict the interface bonding strength of metal –reinforcement
5. To train the student to understand the various standards and testing procedures

LIST OF EXPERIMENTS:
1. Preparation of Continuous Fiber reinforced Polymer Composites
2. Study of Tensile strength and young’s modulus of FRP composites
3. Study of Flexural strength of FRP composites
4. Study of fracture toughness of the PMC by drop weight impact testing
5. Preparation of Al-TiB2 composite by in-situ reaction
6. Study of Microstructure, hardness and density of Al-TiB2 composites
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. Study of interface bonding strength of glass fiber reinforced polymer composite
11. Environmental Testing (Humidity and temperature)

TOTAL: 60 PERIODS

COURSE OUTCOMES:
The student can able to
1. Fabricate the PMC
2. Test the composite and predict different mechanical properties required for the design
3. Predict the interface properties
4. Develop newer in-situ composites
5. Predict the changes in composites when exposed to humidity and temperature.

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COURSE OBJECTIVES
1. To educate Important of Surface Engineering in Industries
2. To provide knowledge on Thermal Spray For Coating
3. To import knowledge on the Process and Mechanism Of Different Diffusion Coating Process
4. To provide knowledge on the Methods Of Non Metallic Coating
5. To import knowledge on the Testing Procedure For Quality Assurance.

UNIT-I   INTRODUCTION

UNIT-II   KINETICS OF CORROSION
Exchange Current Density, Polarization – Concentration, Activation And Resistance, Tafel Equation; Passivity, Electrochemical Behaviour Of Active/Passive Metals, Flade Potential, Theories Of Passivity, Effect Of Oxidizing 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.- Wear Of Industrial Components

UNIT-IV   TESTING

UNIT-V   PROTECTION METHODS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
1. Explain The Important Of Surface Engineering To Industries
2. Use Of Thermal Spray For Coating
3. Explain The Process And Mechanism Of Different Diffusion Coating Process
4. Explain The Methods Of Non Metallic Coating
5. Explain The Testing Procedure For Quality Assurance.

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ML5702 NONFERROUS METALLURGY

COURSE OBJECTIVES:
- To make the students to understand the structure, property relations of nonferrous alloys with special emphasis on engineering applications.
- To expose the students to important alloys used for critical applications.
- To provide knowledge on the phase diagrams of industrially relevant portions of some important alloys.
- To inculcate knowledge on the selection of suitable non-ferrous alloy for a given application.
- To make the students well versed with the properties and applications of precious metals.

UNIT I  COPPER AND COPPER ALLOYS

UNIT II  ALUMINIUM AND ITS ALLOYS

UNIT III  MAGNESIUM AND TITANIUM ALLOYS
Methods of Production of Magnesium- properties and uses. Magnesium alloys and designation, Applications. Methods of Production of Titanium- unique characteristics of Ti 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  
Methods of Production of Nickel-Properties and uses of nickel. Nickel alloys and designation—
their properties and uses. Nickel aluminides. Methods of Production of Zinc-Use of zinc in
corrosion protection of ferrous materials. Zinc alloys – properties and uses. Typical
microstructure of nickel and zinc alloys, Applications.

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able:
• To correlate the structure - property relations of various copper alloys with special
  emphasis on engineering applications.
• To compare the differences between various aluminium alloys with respect to their
  composition, properties and applications.
• To identify suitable magnesium and titanium alloys for applications which involves
  magnesium and titanium alloys.
• To classify the different types of Nickel and Zinc alloys and understand the implications
  of these compositions on the properties and applications of the various alloys.
• To explain the importance of precious metals, their properties and applications as well
  as the properties and applications of Lead and Tin alloys.

TEXT BOOKS

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   Delhi, 1987.

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COURSE OBJECTIVES:
- To make the students to understand the importance of NDT in quality assurance.
- To imbibe the students the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- To equip the students with proper competencies to locate a flaw in various materials, products.
- To make the students to be ready to use NDT techniques for in-situ applications too.
- To inculcate the knowledge of selection of the right NDT technique for a given application

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

UNIT II LIQUID PENETRANT TESTING & MAGNETIC PARTICLE TESTING
LPT - Principle, types, Procedures, Penetrants and their characteristics, Emulsifiers, Solvent Cleaners / Removers, Developers- properties and their forms, Equipments, Advantages and limitations, Inspection and Interpretation, Applications and case study.

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

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

UNIT V RADIOGRAPHY
Introduction, Principle, X-ray Production, Gamma ray sources, tubing materials, X-ray tubing characteristics, Interaction of X-ray with matter, Imaging, Film techniques, Filmless techniques, Types and uses of filters and screens, Real time radiography, geometric factors, inverse square law, characteristics of film, graininess, density, speed, contrast, characteristic curves,

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able
- To compare the differences between the various visual inspection techniques and apply the same to the components to be inspected.
- To recognise the importance of Penetrant testing in NDT with the understanding of the procedures involved in the Penetration methods
- To interpret the images and the results obtained from the Thermographic technique and the Eddy current testing
- To evaluate and interpret the results obtained in the Ultrasonic inspection and Acoustic Emission technique
- To explain the techniques involved in the Radiographic testing and the various advancements in Radiography.

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COURSE OBJECTIVES
1. To import knowledge on different coating techniques employed in industries
2. To demonstrate corrosion test and evaluate the corrosion resistance of different alloys
3. To provide hand on training on wear testing of materials

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

COURSE OUTCOMES:
1. Able to demonstrate electroplating
2. Able to demonstrate Electroless Ni coating
3. Able to perform corrosion test and evaluate the corrosion resistance of different alloys
4. Able to perform wear testing of materials
5. Able to interpretation of results of corrosion and wear test

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TOTAL: 60 PERIODS
COURSE OBJECTIVES:
- To study different concepts in selecting bio and smart materials
- To import knowledge on different electro-rheological and piezoelectric materials
- To import knowledge on different shape memory materials and their applications of materials in biomedical engineering and special materials for actuators, sensors, etc.
- To import knowledge on Materials for oral and maxillofacial surgery
- To import knowledge on materials for cardiovascular ophthalmology and skin regeneration

UNIT I INTRODUCTION

UNIT II ELECTRO-RHEOLOGICAL AND PIEZOELECTRIC MATERIALS

UNIT III SHAPE MEMORY MATERIALS

UNIT IV ORTHOPAEDIC AND DENTAL MATERIALS

UNIT V APPLICATIONS OF BIO MATERIALS FOR CARDIOVASCULAR OPTHALMOLOGY AND SKIN REGENERATION
COURSE OUTCOMES
1. Use of Bio materials for cardiovascular Ophthalmology and Skin Regeneration
2. Use of Bio materials for Dental & Bone application
3. Use of shape memory alloys in engineering application
4. Explain the characteristics of Bio and smart materials
5. Use of smart materials as sensors, actuators

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COURSE OBJECTIVES:
1. To provide the framework of plastic deformation, its mechanism and the role of dislocations.
2. To cognize the mechanism, metallurgical variables and methods of life prediction of materials under creep.
3. To give insight to the nature of stress, factors and life prediction under fatigue.
4. To discern the micro-mechanics and micro structural aspects involved in fatigue.
5. To render an exposure to perform failure analysis.

UNIT – I INTRODUCTION
Mechanisms of plastic deformation- Slip and Twinning, Critically resolved stress, Strength of perfect crystal, Lattice resistance to dislocation movement, Elastic properties of dislocation, Dislocation interactions, Partial dislocation, Dislocation multiplication, Dislocation pile up, effect of stacking fault and strain hardening exponent on dislocation.

UNIT – II HIGH – TEMPERATURE DEFORMATION RESPONSE

UNIT – III CYCLIC STRESS AND STRAIN FATIGUE

UNIT – IV FATIGUE CRACK INITIATION PROPAGATION

UNIT – V ANALYSIS OF ENGINEERING FAILURES
Typical defects, Microscopic surface examination, metallographic and fractographic examination, Fracture surface preservation – Cleaning and replication techniques and image interpretation, failure data retrieval, Component failure analysis: procedural steps for investigation of a failure for failure analysis, Preparation of failure analysis report.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify the mechanism role of dislocation and stacking fault on plastic deformation.
2. Assess the behavior of materials under high temperature, metallurgical factors and life prediction of high temperature materials.
3. Distinguish the characteristics, factors and method of life prediction in the stress and strain controlled fatigue.
4. Appraise the micro-mechanics and micro-structural aspects of fatigue.
5. Design and develop a procedure to perform failure analysis and generate a report.

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ML5003 NANOSTRUCTURED MATERIALS

COURSE OBJECTIVES:
1. 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
2. To import knowledge on processing zero dimensional nanomaterials and use them in engineering applications
3. To import knowledge on processing one dimensional nanomaterials and use them in engineering applications
4. To import knowledge on processing two dimensional nanomaterials and use them in engineering applications
5. To render an exposure to characterisation techniques used for nanomaterials.

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

UNIT III  ONE DIMENSIONAL NANOMATERIALS


UNIT IV  SUPER HARD COATINGS AND BULK NANOSTRUCTURED MATERIALS
Superhard coating – types – characteristics – thermal stability – case studies (nc-TiN/a-Si3N4 coating) – Applications.

Buck nanostructure formation – Equal Channel angular pressing(ECAP) – High pressure torsion(HPT), Accumulative roll bending – Reciprocating extrusion - compression, cyclic close die forging – Repetitive corrugation and straightening – Grain refinement mechanisms.

UNIT V  CHARACTERIZATION OF NANOMATERIALS

TOTAL: 45 PERIODS

OUTCOMES
1. Ability to evaluate nanomaterials and employ different processing methods, properties of nanomaterials for the future engineering applications
2. Ability to process zero dimensional nanomaterials and use them in engineering applications
3. Ability to process one dimensional nanomaterials and use them in engineering applications
4. Ability to process two dimensional nanomaterials and use them in engineering applications
5. Ability to use characterisation techniques to characterize different nanostructures.

TEXT BOOKS:

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### ML5004  FUELS, FURNACES AND REFRACTORIES

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### COURSE OBJECTIVES:
1. To provide the knowledge about different modes of heat transfer.
2. To import knowledge on different types of fuels.
3. To give insight to the different furnaces.
4. To import knowledge about the different refractories.

### UNIT I  FUNDAMENTALS


### UNIT II  FUELS


### UNIT III  FURNACES

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

### UNIT IV  REFRACTORIES

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

Energy and Environment, Environmental optimization, recycling of thermal energy. Emissions control.

### COURSE OUTCOMES:
1. Understand fundamental on different modes of heat transfer
2. Use of different fuels for energy generation system
3. Use of different furnaces and temperature control
4. Use of Refractories in furnace
5. Ability to discuss the issues in environmental.
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ML5005  CRYOGENIC TREATMENT OF MATERIALS  L T P C
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COURSE OBJECTIVES:
1. Students are to study and become familiar with this very specialized form of material treatment at low temperature.
2. To import knowledge on cryocooler and effects of materials
3. To import knowledge on cryogenic treatment
4. To import knowledge on characteristics of cryo treated materials
5. To inculcate the knowledge of applications of cryoprocessing of materials

UNIT I  INTRODUCTION

UNIT II  CRYOCOOLER

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
1. Ability to perform cryogenic treatment of materials
2. Ability to specify cryocooler requirements and performance
3. Ability to select materials for cryogenic treatment
4. Ability to characterise the cryo treated materials
5. Ability to Discuss the properties and application after cryogenic treatment of materials

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ML5006 ELECTRON MICROSCOPY AND DIFFRACTION ANALYSIS OF MATERIALS

COURSE OBJECTIVE:
1. To educate the crystal structure, symmetry elements and diffraction theory for electron microscopy technique.
2. To analyse sub-micron to nano-structured materials using electron microscopy and their diffraction.

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

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

UNIT IV  DIFFRACTION ANALYSIS  

UNIT V  SCANNING ELECTRON MICROSCOPES  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
1. The student will able to understand symmetry, crystal structure, orientation and Texture of crystalline materials.
2. Understand the theory of diffraction and microscopic image formation.
3. Understanding on various types of TEM and their capabilities.
4. Ability for interpret the diffraction pattern for determination of crystal structure, defects and orientations.
5. Knowledge on image formation in SEM, chemical analysis of material by X-ray and electron loss spectroscopy.

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES:

- To provide opportunity to learn about the diffusion mechanisms and the various phase transformations that happen due to diffusion.
- To make the students understand the significance and importance of phase transformations and its influence on the mechanical behaviour.
- To inculcate knowledge on the diffusion less transformations that occurs in ferrous and non-ferrous materials.
- To make the students to understand the concepts involved in the precipitation processes.
- To make the students understand the concepts of recovery, grain growth and recrystallisation in detail.

UNIT I  DIFFUSION MECHANISMS  9

UNIT II  DIFFUSION CONTROLLED PHASE TRANSFORMATIONS  9

UNIT III  DIFFUSIONLESS PHASE TRANSFORMATIONS  9

UNIT IV  PRECIPITATION REACTIONS  9
UNIT V  RECOVERY, RECRYSTALLISATION AND GRAIN GROWTH

Cold working and hot working, recovery – polygonisation and dislocation movements in polygonisation, recrystallisation – effect of time, temperature, strain and other variables – Mechanism of nucleation and growth, grain growth – grain growth law, geometrical collisions, preferred orientation, secondary recrystallisation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to:
1. To explain the various diffusion mechanisms and the thermodynamic and kinetic principles.
2. To classify the various diffusion controlled transformations and infer the effect of various parameters on the kinetics and growth of nucleation.
3. To compare the differences between the diffusion controlled and diffusionless transformations and explain the diffusionless transformations in steels and non-ferrous alloys.
4. To interpret the thermal cycle on the alloys and the effect of time, temperature and composition during precipitation hardening.
5. To recall the concept of recovery, recrystallization and grain growth in cold worked and hot worked steels.

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COURSE OBJECTIVES:

- To provide a comprehensive knowledge on various aspects of Stainless steel making, metallurgy, Properties and its applications.
- To impart knowledge on the classification of stainless steels and their properties.
- To impart the importance of use of stainless steels in various fields of technology.
- To make the student to understand how the characteristics of stainless steels varies with respect to composition and heat treatments as well as the corrosion behaviour of stainless steels.
- To instil thorough knowledge on the numerous applications and importance of stainless steels.

UNIT I  HISTORY AND EVOLUTION OF STAINLESS STEEL  9

UNIT II  CLASSIFICATION OF STAINLESS STEELS  9

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

COURSE OUTCOMES:

Students will be able:
1. To recall the essential elements responsible for the unique properties of stainless steels and basic metallurgical principles involved.
2. To classify the various types of stainless steels based on the microstructure and the effect of microstructure on the properties of stainless steels.
3. To explain the production methodology of stainless steel making and the influence of the process on the quality of the stainless steel.
4. To interpret the results of corrosion testing and PREN index and understand the influence of the various environmental factors on the corrosion of stainless steels.
5. To identify the suitable stainless steel material for a given application.
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ME5751 FINITE ELEMENT ANALYSIS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Developing mathematical models for Boundary Value Problems and their numerical solution.
2. Applying concepts of Finite Element Analysis to solve one dimensional problem.
3. Determining field variables for two dimensional scalar variable problems.
4. Determining field variables for two dimensional vector variable problems.
5. Applying the need for Isoparametric transformation and the use of numerical integration.

UNIT I INTRODUCTION

UNIT II ONE-DIMENSIONAL PROBLEMS
UNIT III  TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS
Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –
Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions
and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion
of Non circular shafts.

UNIT IV  TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive
matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and
shell elements.

UNIT V  ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS
Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric
elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix
solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis
Software- Introduction to Non Linearity.

TOTAL  = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Develop mathematical models for Boundary Value Problems and their numerical solution
2. Apply concepts of Finite Element Analysis to solve one dimensional problems
3. Determine field variables for two dimensional scalar variable problems
4. Determine field variables for two dimensional vector variable problems
5. Apply the need for Isoparametric transformation and the use of numerical integration

TEXT BOOKS:

REFERENCES:
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and
5. Tirupathi R. Chandrupatla and Ashok D. Belegundu, “Introduction to Finite Elements in

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COURSE OBJECTIVES:

- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications.
- To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM.
- To be acquainted with vat polymerization and material extrusion processes.
- To be familiar with powder bed fusion and direct energy deposition.
- To gain knowledge on applications of binder jetting, material jetting and laminated object manufacturing processes.

UNIT I INTRODUCTION


UNIT II DESIGN FOR ADDITIVE MANUFACTURING (DFAM)


UNIT III VAT POLYMERIZATION AND MATERIAL EXTRUSION


UNIT IV POWDER BED FUSION AND DIRECT ENERGY DEPOSITION


UNIT V OTHER ADDITIVE MANUFACTURING PROCESSES


COURSE OUTCOMES:

At the end of this course students shall be able to:
- CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
- CO2: Acquire knowledge on process of transforming a concept into the final product in AM technology.
- CO3: Elaborate the vat polymerization and material extrusion processes and its applications.

TOTAL: 45 PERIODS
• CO4: Acquire knowledge on process and applications of powder bed fusion and direct energy deposition.
• CO5: Evaluate the advantages, limitations, applications of binder jetting, material jetting and laminated object manufacturing processes.

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ME5084 SURFACE ENGINEERING TRIBOLOGY

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UNIT I SURFACES AND FRICTION

UNIT II WEAR
Laws of Wear - Types of Wear mechanism – wear debris analysis - Theoretical wear models - Wear of metals and nonmetals – International standards in friction and wear measurements

UNIT III CORROSION

UNIT IV SURFACE TREATMENTS

UNIT V ENGINEERING MATERIALS

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Describe the fundamentals of surface features and different types of friction associated with metals and non metals
2. Analyze the different types of wear mechanism and its standard measurement.
3. Analyze the different types of corrosion and its preventive measures
4. Analyze the different types of surface properties and surface modification techniques
5. Analyze the various types of materials used in the friction and wear applications.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
1. To impart knowledge about the materials used in MEMS.
2. To provide insight about the microfabrication technologies.
3. To give a comprehensive knowledge on micromanufacturing methods.
4. To make the students familiarize with microdevices.
5. To develop the skills to utilize MEMS devices in the real-time applications.

UNIT – I MATERIAL ASPECTS OF MEMS AND NEMS

UNIT – II MICRO AND NANO FABRICATION PROCESSES
Hot Processing and Ion implantation - Diffusion, Thermal Oxidation, Ion implantation, Rapid Thermal Processing. Pattern Transfer- Photolithography, Extreme UV lithography, X-ray Lithography, Electron Beam lithography Focused ion beam Lithography, nanoimprint.

UNIT – III MICROMANUFACTURING PROCESSES

UNIT – IV MEMS DEVICES

UNIT – V MEMS AND NEMS APPLICATIONS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify suitable materials for MEMS applications.
2. Discuss the micro and nanofabrication techniques.
3. Explain the method of etching, surface and bulk micromanufacturing methods.
4. Describe the MEMS components and Devices.
5. Select and Implement MEMS devices for the required application.
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ML5010   COMPUTATIONAL METHODS FOR MATERIALS ENGINEERING

COURSE OBJECTIVES:
1. To give an insight to the numerical methods for fitting and interpolation of experimental data in materials science.
2. To impart knowledge about the use partial differential equations in diffusion and mass transport of materials.
3. To acumen the application of Monte Carlo simulation for nucleation and grain growth problems.
4. To bestow the adoption of matrix algebra to study the anisotropy in materials.
5. To employ computational methods for modeling and property prediction.

UNIT – I   SOLUTIONS OF EQUATIONS AND INTERPOLATION

UNIT – II  PARTIAL DIFFERENTIAL EQUATIONS

UNIT – III  MONTE CARLO METHODS AND SIMULATION

UNIT – IV  MATRIX ALGEBRA

UNIT – V  SELECTED APPLICATIONS IN MATERIALS SCIENCE
Modeling and property Prediction-Ability to use computational techniques the Materials Engineering - Use of mathematical equation to predict the properties of materials

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify suitable methods for fitting and interpolation of experimental data.
2. Explain the art of using partial differential equations for predicting the diffusion and mass transport in the materials.
3. Realize the utilization of Monte Carlo simulation for nucleation and grain growth problems.
4. Recognize the appositeness of matrix algebra in the investigation of anisotropic materials.
5. Adjudicate the apt the computational techniques for modeling and property prediction.

TEXT BOOKS:

REFERENCES:
ML5011 INTRODUCTION TO TRANSPORT PHENOMENA L T P C
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COURSE OBJECTIVES:
1. To import knowledge on fluid mechanics specific to materials processing
2. To import knowledge on different flow in pipes
3. To train the students to use heat transfer equations in solving casting related problems
4. To import knowledge on different modes and heat transfer and use of them in materials processing

UNIT I FLUID MECHANICS
9
Properties of fluids such as density, viscosity and specific weight. Fluid statics - Pressure at a point - Pressure variations in horizontal and vertical directions - Concept of gauge and absolute pressure. Use of manometer for pressure measurements. Introduction to Hydrostatic Forces.

Energy Balance in Fluid Flow: Types of flow - continuity equation - Application to one dimensional problems. Derivation of Bernoulli’s equation and Euler’s equation - Examples illustrating the use of energy equation in metallurgical processes.

UNIT II INTERNAL AND EXTERNAL FLOW
9
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
9
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
9
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.
Introduction to convective mass transfer-Introduction to computational fluid dynamics- software.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
This course enables the students apply the knowledge of
1. fluid mechanics, mass transport with respect to temperature and pressure as specific to
   mineral processing, liquid metal – solidification, etc. of materials technology
2. flow behaviour in pipes and use of this knowledge in casting
3. use of conductive heat principles in materials processing
4. use of convective heat transfer in materials processing
5. use of mass transfer principle in materials processing

TEXT BOOKS
   International Publishers, Chennai 1998
   International Publishers, New Delhi, 1996.

REFERENCES
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ML5012  MODELING AND SIMULATION IN MATERIALS ENGINEERING
L T P C
3 0 0 3

COURSE OBJECTIVES:
1. To introduce different mathematical concepts related to modeling of materials
2. To train the students to solve one dimensional problems related to heat transfer
3. To train the students to solve two dimensional problems related to heat transfer
4. To introduce different software packages and their capabilities in solving material
   processing problems
5. To train the student to understand the computer applications in physical metallurgy
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  ONE DIMENSIONAL PROBLEMS  
Classical Techniques in FEM – Weighted residual method – Galarkin and Ritz method – Coordinates and shape functions – Potential energy approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to elastic deformation of bar, plane trusses and beam – steady state heat transfer

UNIT III  TWO DIMENSIONAL AND AXISYMMETRIC CONTINUUM  

UNIT IV  SOFTWARE PACKAGES  
Introduction to standard software packages – General purpose FEA packages– Special purpose packages for simulation of rolling, forging and casting simulations. - 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, Expert system for alloy design and selection of materials – computer applications in crystallography

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

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES:
1. To give an overview of principle and types of laser
2. To impart knowledge about the fundamentals of heat and fluid flow during laser processing.
3. To give insight to the metallurgical aspects involved during laser processing.
4. To inculcate the methodology, parameters and imperfections laser welding and surface modification.
5. To render exposure to laser instrumentation, parameters and material considerations in laser cutting and drilling process.

UNIT – I PRINCIPLES OF INDUSTRIAL LASERS

UNIT – II THERMAL PROCESS- HEAT AND FLUID FLOW
Heat flow in the work piece, Temperature distribution: thick plate with point heat source, thin plate with line heat source, peak temperature ,cooling rates and Gaussian heat source. Fluid flow in molten pool: continuity equation, Navier-Stokes equation and surface tension effects.

UNIT – III LASER METALLURGY
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

UNIT – V LASER MACHINING

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify suitable laser source required during laser processing.
2. Explain the heat and fluid flow during laser processing.
3. Analyse the microstructure and discontinuities in the materials subjected to laser processing.
4. Appraise the appropriate methodology, parameters and remedy for imperfections during laser surface modifications.
5. Devise the instrumentation for laser cutting and drilling based on the nature of material.

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the core values toward the ethical behavior of an engineer.
2. Applying the ethical and moral principles in engineering experimentation.
3. Applying the ethical and moral principles in engineering for safety.
4. Applying standard codes of moral conduct toward the ethical behavior of an engineer.
5. Applying ethical and moral principles for engineers as managers, consultants, expert witness. Resolving global issues of ethics concerning weapon development and multinational companies.

UNIT I  ENGINEERING ETHICS  9

UNIT II  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics-Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III  ENGINEERING FOR SAFETY  9

UNIT IV  ENGINEER’S RESPONSIBILITIES AND RIGHTS  9

UNIT V  GLOBAL ISSUES  9

TOTAL  = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the core values toward the ethical behavior of an engineer.
2. Apply the ethical and moral principles in engineering experimentation.
3. Apply the ethical and moral principles in engineering for safety.
4. Apply standard codes of moral conduct toward the ethical behavior of an engineer.
5. Apply ethical and moral principles for engineers as managers, consultants, expert witness. Resolve global issues of ethics concerning weapon development and multinational companies.

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ME5080 PRECISION MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining the need, significance and progress of precision manufacturing and the different levels of manufacturing.
2. Explaining the principle and working of different methods of precision machining.
3. Explaining the special construction requirements of precision machine tools.
4. Explaining the errors involved in precision machine tools and calculate the error budgets for a given situation.
5. Selecting a suitable measurement solution to measure and characterize precision machined features.

UNIT I PRECISION ENGINEERING 9
Introduction to Precision Engineering, Need for precision manufacturing, Taniguchi diagram, Four Classes of Achievable Machining Accuracy – Normal, Precision, High-precision, Ultra-precision Processes and Nanotechnology.

UNIT II PRECISION MACHINING 9
UNIT III  MACHINE DESIGN FOR PRECISION MANUFACTURING

UNIT IV  MECHANICAL AND THERMAL ERRORS
Sources of error, Principles of measurement, Errors due to machine elements, bearings, spindles, Kinematic design, Structural compliance. Vibration, Thermal errors – background, thermal effects, Environmental control of precision machinery. Error mapping and error budgets.

UNIT V  MEASUREMENT AND CHARACTERISATION
Surface metrology - 3D surface topography - Need, Measurement – Chromatic confocal Microscopy, Interferometry, Non-optical Scanning Microscopy – Scanning electron Microscopes, Scanning probe microscopes, Parameters for characterizing 3D surface topography.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the need, significance and progress of precision manufacturing and the different levels of manufacturing.
2. Explain the principle and working of different methods of precision machining.
3. Explain the special construction requirements of precision machine tools.
4. Explain the errors involved in precision machine tools and calculate the error budgets for a given situation.
5. Select a suitable measurement solution to measure and characterize precision machined features.

TEXT BOOKS:
1. Jain, V.K., Introduction to micromachining, Narosa publishers, 2018

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COURSE OBJECTIVES:
1. To give an overview of material properties, use of materials selection chart and considerations for material selection
2. To impart knowledge about the basis of materials selection
3. To give insight about the factors that influence materials selection for engines and transmission system
4. To instill the knowledge required for the selection of materials for automotive structures
5. To render the basis of material selection for electronics devices in the automobile.

UNIT – I ENGINEERING MATERIALS AND THEIR PROPERTIES 9
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 9

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, Damping fluid, 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, temperature sensors for climate control, anti-collision, Anti-fog, Head lamps.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify the criteria and forces that cause the changes in materials selection.
2. Investigate the influence of structural index, manufacturing process, design and functional requirements on selection strategies.
3. Recognize the temperature regime, nature of load and property requirements of materials for engines and transmission system.
4. Analyse the various stresses acting on the structural members of automobile under dynamic loading and select suitable material.
5. Adjudicate the apt material for electronic devices used in automobiles.

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**ML5015**  
**METALLURGY OF TOOL MATERIALS**  
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**COURSE OBJECTIVES:**
- To make the students to gain knowledge on the various types of tool materials and their characteristics and applications.
- To expose the students to various methods of testing tool steels.
- To make the students understand thoroughly the various existing manufacturing processes, heat treatment and properties of advanced tool materials.
- To impart the various heat treatments that can be given to tool steels and its effect on the mechanical properties.
- To make the students to understand the need for coating the tool materials and its implications.
UNIT I  CLASSIFICATION AND MANUFACTURE OF TOOL STEELS  9
Classification – AISI system, selection of tool steels from the point of view of mechanical properties, Effect of alloying elements such as W, Mo, Ni, V, Ti etc., in Tool steels, Production techniques – problems in melting – powder metallurgy route, Refining methods like VAR, ESR – forming of tool steels.

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

UNIT III  PROPERTIES, TESTING AND FAILURE OF TOOL STEELS  9

UNIT IV  ADVANCED TOOL MATERIALS  9

UNIT V  SURFACE TREATMENTS AND COATINGS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able:

- To classify the various tool materials that are used for engineering applications and understand the influence of various alloying elements on the properties of tool materials
- To select suitable heat treatment for the different tool materials inorder to improve the performance of tools.
- To test the tool materials for various properties and analyse on the various possible failures that occur in tools.
- To explain the need for advanced tool materials and the advantages of various special tool materials over conventional tool materials.
- To infer the effect of coating on the tool materials and are exposed to the various possible coating techniques that are available for tool materials.
COURSE OBJECTIVES:
- To enable the students to have a comprehensive knowledge on the basics involved in thin films and development of thin films.
- To expose the students to various methods of preparation of thin films.
- To make the students understand the methods of deposition monitoring and control and its importance.
- 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.
- To educate the students the applications of thin films in various fields.

UNIT I BASICS OF THIN FILMS

UNIT II PREPARATION OF THIN FILMS
UNIT III \ DEPOSITION MONITORING AND CONTROL \ 9
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 \ 9
Thin film Solar Cells CuInSe2 solar cell.

UNIT V \ APPLICATION OF THIN FILMS \ 9
Thin film resistors: Materials and Design of thin film resistors (Choice of resistor and shape and area) - Trimming of thin film resistors - sheet resistance control - Individual resistor trimming.
Thin film field effect transistors: Fabrication and characteristics - Thin film diodes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able:
- To explain the fundamental principles of Thin film technology.
- To compare the various techniques of preparation of thin films with respect to the processes, advantages, limitations and applications.
- To interpret the results obtained from Microbalance, Crystal oscillator thickness monitor, optical monitor, Resistance Monitor and Thickness measurements.
- To interpret the effect of size of thin films and ageing and annealing on the optical and conductive properties of thin films.
- To identify suitable surface modification technologies of deposition of thin film for different application like optical emission, abrasion resistance, dielectric, electronic applications, energy conversion, etc.

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COURSE OBJECTIVES:
1. To explain the basic characteristics of a battery.
2. To understand the fuel cell technology.
3. To justify the importance of green energy.
4. To know the merits and demerits of hydrogen as energy carrier.
5. To understand the future prospects of renewable energy systems.

UNIT – I  BATTERY CHARACTERISTICS
Voltage, current, capacity, electricity storage density, power, discharge rate, cycle life, energy efficiency, shelf life. Primary batteries: Mechanism, 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
Fabrication, mechanism and performance aspects of 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.

UNIT – III  FUEL CELLS

UNIT – IV  TYPES OF FUEL CELLS
Description, working principle, components, applications of 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
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. To remember and understand the basic characteristics of a battery.
2. To understand and appreciate the fuel cell technology.
3. To understand the need for green energy and sustainable technology developments.
4. To analyse the cost effectiveness and eco-friendliness of hydrogen technology.
5. To develop models of renewable energy systems.

TEXT BOOKS

REFERENCES:
5. Pletcher D and Walsh C,“Industrial Electrochemistry”, Blackie Academic and Professional, 1993

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ML5018 FRAC TURE MECHANICS AND FAILURE ANALYSIS

COURSE OBJECTIVES:
1. To import knowledge on basic concepts of fracture mechanics
2. To import knowledge on strain energy principle and use of it for developing theories
3. To train the students to understand and analyse the fatigue failure
4. To import knowledge and train the students to do failure analysis on the components failing by creep, corrosion and wear failure
5. To provide knowledge on corrosion and wear failure of materials.
UNIT I BASIC CONCEPTS IN FRACTURE MECHANICS
Introduction to fracture - elastic deformation, plastic and elasto-plastic deformation, Brittle fracture: Griffiths theory, Ductile fracture, Inglis solution-LEFM-EPFM- Different modes of fracture - photo elastic fringes- characteristics-crack emanating from inner and outer boundaries of cylinder-

UNIT II MECHANICS OF FRACTURE- STATIC LOADING

UNIT III FAILURE ANALYSIS OF FATIGUE FRACTURE

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

UNIT V FAILURE ANALYSIS OF CORROSION AND WEAR

COURSE OUTCOMES:
1. Ability to design structure to prevent failure from the internal defect that unit within the structure
2. Ability to derive the stress field solutions for fracture problems
3. Ability to design structure to prevent fatigue and creep
4. Ability to define different deformation and related theories
5. Ability to analyse the corrosion and wear failure and system methods to prevent corrosion and wear

TEXT BOOKS

REFERENCES
ML5019 MATERIALS SCIENCE AND ENGINEERING OF GREEN ENERGY  L T P C  3 0 0 3

COURSE OBJECTIVES:
1. To provide knowledge on green energy technology.
2. To import knowledge on different sources of renewable energies.
3. To introduce nanotechnology in green energy.
4. To import knowledge on different green energy materials.
5. To give overview about the green management concept and its applications.
6.

UNIT I GREEN ENERGY AND SUSTAINABLE DEVELOPMENT  9
Global warming; greenhouse gas emissions, impacts, mitigation and adaptation; future energy systems - clean/green energy technologies. Criteria for choosing appropriate green energy technologies, life cycle cost; the emerging trends – process/product innovation-, technological/environmental aspects.

UNIT II RENEWABLE ENERGY RESOURCES  9

UNIT III GREEN NANOTECHNOLOGY  9
Nanoparticles preparation techniques, Greener Nanosynthesis: Greener Synthetic Methods for Functionalized Metal Nanoparticles, Greener Preparations of Semiconductor and Inorganic Oxide Nanoparticles, green synthesis of Metal nanoparticles, Nanomaterials for Alternative Energy; Nanomaterials for Fuel Cells and Hydrogen Generation and storage, Nanostructures for efficient solar hydrogen production, Metal Nanoclusters in Hydrogen Storage Applications, Metal Nanoparticles as Electrocatalysts in Fuel Cells, Nanowires as Hydrogen Sensors, Nanomaterials in Energy Storage Devices: MWNT for Li Ion Batteries, Nanomaterials in Electrodes, Hybrid Nanotubes: Anode Material, Supercapacitor, Battery Electrodes

UNIT IV PROCESSING OF GREEN ENERGY MATERIALS  9
Silicon processing methods - Fabrication methods: physical and chemical vapour deposition techniques, photolithography, electroless and electrochemical deposition, etching, mask plating. Newer Energy Materials: Carbon nano-tubes (CNTs) and multiwall carbon nanotubes (MWCNTs) - methods of production, properties and its utility in energy devices.
UNIT V  GREEN MANAGEMENT
Concept of green management; evolution; nature, scope, importance and types; developing a theory; green management in India; relevance in twenty first century.

COURSE OUTCOMES:
- To obtain an enriched knowledge of green energy technology.
- To know the different sources of renewable energies.
- To understand the technological and economical aspects of conversion of renewable energies into useful forms.
- To obtain a basic understanding of energy sciences, its importance, utility.
- To understand the green management concept and its applications.

REFERENCES:
UNIT – II  DESIGN FOR CREEP RESISTANCE  
Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

UNIT – III  FRACTURE  
Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture due to micro void coalescence – diffusion controlled void growth: fracture maps for different alloys and oxides.

UNIT – IV  OXIDATION AND HOT CORROSION  
Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation – defect structure and control of Oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.

UNIT – V  SUPER ALLOYS AND OTHER MATERIALS  
Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify principle and factors influencing the creep.
2. Explain the factors to be considered while designing for high temperature applications.
3. Explicit appropriate mechanism of fracture in the materials subjected to high temperature.
4. Realize the fundamentals, mechanisms and methods of combating oxidation and hot corrosion.
5. Select suitable materials for high temperature applications.

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GE5552  ENGINEERING MANAGEMENT  L T P C

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Explaining basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Applying various functions of management in professional organization.
3. Applying organizational theory in professional organization.
4. Applying the principles of productivity and operations management in professional organization.
5. Applying modern concepts and marketing in management in professional organization.

UNIT I  INTRODUCTION TO MANAGEMENT
Definition and functions of Management - Approaches to the study of Management – Mintzberg’s Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Corporate Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Pros and cons.

UNIT II  FUNCTIONS OF MANAGEMENT
Planning: Characteristics; Nature; Importance; Steps; Limitation – Organizing: Features; Process; Principles; Types – Departmentalization: Functional – Divisional (Product; Customer; Geographic) – Staffing: Systems Approach; Recruiting and Selection Process – Directing (Leading): Traits; Style; Managerial Grid (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barrier – Controlling: Types; Audit (External, Internal, Merits) – Decision Making: Elements; Characteristics; Process; Classification – Controlling techniques.

UNIT III  ORGANIZATION THEORY
Human Resource Development (HRD): Goals – Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Need and Motivation Theories: Maslow’s Hierarchy of Needs Theory; Herzberg’s Motivation-Hygiene Theory; McClelland’s Needs Theory of Motivation – Change Management: Concept of Change; Lewin’s Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT IV  PRODUCTIVITY AND OPERATIONS MANAGEMENT
Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Operations Management Tools: (Simple problems in) Transportation Model (Balanced); Assignment Model (Hungarian); Network Model (Shortest path); Critical Path Method; Decision Trees.
UNIT V  MODERN CONCEPTS AND MARKETING MANAGEMENT

Concept, features, merits and demerits of: SWOT Analysis; Business Process Re-engineering (BPR); Supply Chain Management (SCM) – Marketing: Concept; Functions; Importance; Segmentation; Mix; Problems of Marketing in Small Enterprise; Competitive Analysis and Advantage – E-marketing.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Apply various functions of management in professional organization.
3. Apply organizational theory in professional organization.
4. Apply the principles of productivity and operations management in professional organization.
5. Apply modern concepts and marketing in management in professional organization.

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COURSE OBJECTIVES:
- To classify non-traditional machining processes and describe mechanical energy based non-traditional machining processes.
- To differentiate chemical and electro chemical energy based processes.
- To describe thermo-electric energy based processes.
- To explain nano finishing processes.
- To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes.

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9
Introduction - Need for non-traditional machining processes - Classification of non-traditional machining processes - Applications, advantages and limitations of non-traditional machining processes - Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining their principles, equipment, effect of process parameters, applications, advantages and limitations.

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

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9
Principles, equipments, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

UNIT IV NANO FINISHING PROCESSES 9
Principles, equipments, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magnetorheological finishing, Magneto rheological abrasive flow finishing.

UNIT V HYBRID NON-TRADITIONAL MACHINING PROCESSES 9
Introduction - Various hybrid non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non-traditional machining processes.

COURSE OUTCOMES:
At the end of this course the students shall be able to:
- CO1: Formulate different types of non-traditional machining processes and evaluate mechanical energy based non-traditional machining processes.
- CO2: Illustrate chemical and electro chemical energy based processes.
- CO3: Evaluate thermo-electric energy based processes.
- CO4: Interpret nano finishing processes.
- CO5: Analyse hybrid non-traditional machining processes and differentiate non-traditional machining processes.
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**ML5021 PRINCIPLES OF METAL CUTTING**

**COURSE OBJECTIVES:**
1. To give overview about the tool nomenclature and different nomenclatures used.
2. To provide knowledge on chip formation mechanism and forces during machining
3. To import knowledge on tool wear and tool life and how it is affected by temperature
4. To provide knowledge on different cutting tool materials used
5. To provide knowledge on modelling of metal cutting process

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

**UNIT II CHIP FORMATION MECHANISM AND FORCES IN MACHINING**
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

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

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

OUTCOMES
The course will enable a student to gain Theory and practical knowledge on the metal cutting operations and design of cutting tool.
1. Understand and compare the different metal cutting tool nomenclature
2. Learn the basic concepts of metal cutting mechanism and forces in machining
3. acquire fundamental knowledge and understanding of thermal aspects in machining, tool wear and life
4. Recommend appropriate Cutting tools for part manufacturing processes
5. learn the modelling concepts in metal cutting process

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the 7 QC tools in problem solving for continuous improvement.
2. Designing online sampling plan for quality control using control charts and perform process capability studies.
3. Applying the strategies of acceptance sampling plan to perform quality audit in the customer site.
4. Evaluating the different reliability measurements applying the reliability concepts.
5. Selecting the suitable method of improving the reliability and integrate reliability concepts in new product design and development.

UNIT I  INTRODUCTION AND STATISTICAL PROCESS CONTROL  9
Introduction:- definitions of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance Customer-Orientation: Internal & External Customer Concept, Life cycle approach to quality costs- Prevention; Appraisal and Failure costs. Seven SPC tools - Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart.

UNIT II  ONLINE QUALITY CONTROL  9
Control chart for attributes – control chart for non conforming – p chart and np chart – control chart for nonconformities– C and U charts, Control chart for variables – X chart, R chart and σ chart - State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT III  OFFLINE QUALITY CONTROL  9
Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producers Risk and consumers Risk. AQL, LTPD, AOQL concepts standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV  RELIABILITY CONCEPTS  9
Reliability engineering - fundamentals – failure data analysis, Mean failure rate, Mortality curves concept of burn – in period, useful life and wear out phase of a system, mean time to failure, meantime between failure, hazard rate – failure density and conditional reliability-Maintainability and availability – simple problems.

UNIT V  RELIABILITY ESTIMATION  9

TOTAL  = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the 7 QC tools in problem solving for continuous improvement.
2. Design online sampling plan for quality control using control charts and perform process capability studies.
3. Apply the strategies of acceptance sampling plan to perform quality audit in the customer site.
4. Evaluate the different reliability measurements applying the reliability concepts.
5. Select the suitable method of improving the reliability and integrate reliability concepts in new product design and development.

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ML5022  WELDING METALLURGY  

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**COURSE OBJECTIVES:**
1. To impart knowledge on the various Metal Joining Processes.
2. To train on the analytical methods available to assess the effect of heat transfer in welding.
3. To impart knowledge on the ferrous welding metallurgy.
4. To impart knowledge on the non ferrous welding metallurgy.
5. To impart knowledge on the causes and remedies of various welding defects, weldability, testing of weldments, welding standards and codes.

**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.

COURSE OUTCOMES:
1. Will be able to understand the various welding processes available for welding a component.
2. Will be able to analytically analyse the heat transfer associated with the welding process.
3. Will be able to weld ferrous alloys which are metallurgically sound.
4. Will be able to weld non-ferrous alloys which are metallurgically sound.
5. Will be able find out the remedy for a welding defect becomes familiar with the various welding standards and codes.

TEXT BOOKS
2. R.S. Parmar ‘Welding Engineering and Technology’ Khanna Publishers 2010

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COURSE OBJECTIVES:
- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES

UNIT III ORGANS OF GOVERNANCE
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS

UNIT V LOCAL ADMINISTRATION
District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayat raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

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TEXTBOOKS:
4. The Constitution of India (Bare Act), Government Publication, 1950

AD5092 VALUE EDUCATION

COURSE OBJECTIVES:
- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION
Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION
Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

COURSE OUTCOMES:
CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

TOTAL: 45 PERIODS
COURSE OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY:

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

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REFERENCES:

AD5094 STRESS MANAGEMENT BY YOGA

COURSE OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do’s and Don’ts in life through Yam
- Categorize Do’s and Don’ts in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA
Definitions of Eight parts of yog. (Ashtanga)

UNIT II YAM
Do’s and Don’t’s in life.
Shaucha, santosh, tapa, swadhyay, ishwarpanidhan
UNIT III  
NIYAM  
Do’s and Don’t’s in life. 
Ahinsa, satya, astheya, bramhacharya and aparigraha  

UNIT IV  
ASAN  
Various yog poses and their benefits for mind & body  

UNIT V  
PRANAYAM  
Regularization of breathing techniques and its effects-Types of pranayam  

TOTAL: 45 PERIODS  

COURSE OUTCOMES:
CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency 
CO2 – Learn Do’s and Don’t’s in life through Yam 
CO3 – Learn Do’s and Don’t’s in life through Niyam 
CO4 – Develop a healthy mind and body through Yog Asans 
CO5 – Learn breathing techniques through Pranayam  

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1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata  
2. ‘Yogic Asanas for Group Training-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur  

AD5095  
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS  
L T P C  
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COURSE OBJECTIVES:
- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I  
NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I  
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)
UNIT II  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II  9
Verses- 52,53,59 (don'ts) - Verses- 71,73,75,78 (do's)

UNIT III  APPROACH TO DAY TO DAY WORK AND DUTIES  9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV  STATEMENTS OF BASIC KNOWLEDGE – I  9
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V  PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA  9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

COURSE OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari’s ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016

AD5097  ESSENCE OF INDIAN KNOWLEDGE TRADITION  L T P C
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COURSE OBJECTIVES
The course will introduce the students to
• get a knowledge about Indian Culture
• Know Indian Languages and Literature religion and philosophy and the fine arts in India
• Explore the Science and Scientists of Ancient, Medieval and Modern India
• Understand education systems in India
UNIT I   INTRODUCTION TO CULTURE  
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.  

UNIT II   INDIAN LANGUAGES AND LITERATURE  
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature  

UNIT III   RELIGION AND PHILOSOPHY  
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)  

UNIT IV   FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING)  
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India  

UNIT V   EDUCATION SYSTEM IN INDIA  
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India  

TOTAL: 45 PERIODS  

COURSE OUTCOMES  
After successful completion of the course the students will be able to  
- Understand philosophy of Indian culture.  
- Distinguish the Indian languages and literature.  
- Learn the philosophy of ancient, medieval and modern India.  
- Acquire the information about the fine arts in India.  
- Know the contribution of scientists of different eras.  
- Understand education systems in India  

REFERENCES:  
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989  

AD5098   SANGA TAMIL LITERATURE APPRECIATION   L T P C  
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COURSE OBJECTIVES:  
The main learning objective of this course is to make the students an appreciation for:  
1. Introduction to Sanga Tamil Literature.  
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.  
3. ‘Attruppadai’ in Sanga Tamil Literature.  
4. ‘Puranaanuru’ in Sanga Tamil Literature.  
5. ‘Pathitrupaththu’ in Sanga Tamil Literature.
UNIT I  SANGA TAMIL LITERATURE AN INTRODUCTION 9
Introduction to Tamil Sangam – History of Tamil Three Sangams – Introduction to Tamil Sangam Literature – Special Branches in Tamil Sangam Literature - Tamil Sangam Literature’s Grammar - Tamil Sangam Literature’s parables.

UNIT II  ‘AGATHINAI’ AND ‘PURATHINAI’ 9

UNIT III  ‘ATTRUPPADAI’. 9

UNIT IV  ‘PURANAANURU’ 9
Puranaanuru on Good Administration, Ruler and Subjects – Emotion & its Effect in Puranaanuru.

UNIT V  ‘PATHITRUPPATHTHU’ 9
Pathitruppaththu in ‘Ettuthogai’ – Pathitruppaththu’s Parables – Tamil dynasty: Valor, Administration, Charity in Pathitruppaththu - Message to Society from Pathitruppaththu.

TOTAL (L: 45) = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitruppaththu’ in their personal and societal life.

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HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION L T P C 3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives
- To familiarize students with the concept of communication using linguistic and non linguistic resources.
- To help students ask critical questions regarding facts and opinions.
- To provide students with the material to discuss issues such as language and power structures.
- To help students think critically about false propaganda and fake news.

Learning Outcomes
- Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- Students will be able to analyse communication in terms of facts and opinions.
- Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9
a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9
a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9
a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9
a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas
UNIT V  PERSUASIVE COMMUNICATION AND MISCOMMUNICATION:  9
a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

HU5172  VALUES AND ETHICS  L T P C
3 0 0 3

OBJECTIVES:
- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I  DEFINITION AND CLASSIFICATION OF VALUES  9
Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II  CONCEPTS RELATED TO VALUES  9
Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III  IDEOLOGY OF SARVODAYA  9
Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV  SUSTENANCE OF LIFE  9
The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V  VIEWS ON HIERARCHY OF VALUES  9
The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS
OUTCOMES:
CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

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TEXT BOOKS:
2. Little, William: An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)

HU5173 HUMAN RELATIONS AT WORK L T P C
3 0 0 3

OBJECTIVES:
- Illustrate human relations at work and its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9
Human Relations and You: Self Esteem and Self-Confidence; Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9
Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9
Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9
Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

TOTAL: 45 PERIODS
OUTCOMES:
Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

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TEXT BOOK:

REFERENCES:

HU5174 PSYCHOLOGICAL PROCESSES L T P C 3 0 0 3

COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people’s psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT I INTRODUCTION
UNIT II SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation - Sensory bombardment; ESP - Social Perception.

UNIT III COGNITION & AFFECT

UNIT IV THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT V PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

REFERENCES
COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:
The course aims
- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES
By the end of the course, learners will be able to
- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

UNIT III TECHNOLOGICAL ADVANCEMENTS
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL: 45 PERIODS

TEACHING METHODS
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.
EVALUATION
As this course is not a content-based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end-semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY

OBJECTIVES
- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Foster critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.

UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD
Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual

UNIT IV KNOWLEDGE AS POWER/OPPRESSION

UNIT V SELF KNOWLEDGE/BRAHMAN

TOTAL : 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE

UNIT I INTRODUCTION
Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS
Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH
Abnormality, symptoms and causes psychological disorders
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary, drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

OBJECTIVES
✓ To familiarize students with the concepts of sex and gender through literary and media texts.
✓ To help students ask critical questions regarding gender roles in society.
✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
✓ To help students think critically about gender based problems and solutions.

LEARNING OUTCOMES
➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
• Students will be able to analyse current social events in the light of gender perspectives.
• Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I INTRODUCTION TO GENDER
- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II GENDER ROLES AND RELATIONS
- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)

UNIT III GENDER DEVELOPMENT ISSUES
- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV GENDER-BASED VIOLENCE
- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V GENDER AND CULTURE
- Gender and Film
- Gender, Media and Advertisement
Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE

OBJECTIVES:
- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

TOTAL:45 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273   LAW AND ENGINEERING   L T P C
UNIT I   THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE  9
Enacted law-Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.
UNIT II   LAWS   9
Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.
UNIT III   BUSINESS ORGANISATIONS   9
Sole traders (Business has no separate identity from you, all business property belongs to you). Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors- Their Powers and Responsibilities/Liabilities.
UNIT IV   LAW AND SOCIETY   9
Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.
UNIT V   CASE STUDIES   9
Important legal disputes and judicial litigations

TOTAL: 45 PERIODS
COURSE DESCRIPTION
This is an intensive course designed to promote comprehensive understanding and insights into
the nature of cinema and other related forms and practices. Movies, though at times are used
more as escapism, they are also a true art form and expressive tool used by writers, directors
and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling
and various other elements of a film. It will also explore the impact of movies in our society and
in our lives. It also encourages students to use films as a medium to analyse visual texts and
read underlying messages.

OBJECTIVES:
- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I
THE COMPONENTS OF FILMS
Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of
A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II
EVOLUTION OF FILM
History of Films – Early Cinema – Silent Movies – Talkies – Film Language, Form, Movement –
Film Theories – Realist, Auteurists, Feminist, Psychanalytic, Ideological Theories.

UNIT III
FILMS ACROSS THE WORLD
Culture – All Time Great Movies.

UNIT IV
INDIAN FILMS
The Early Era – History Of Indian Cinema – Movies for Social Change – Hindi Movies that
Created Impact – Regional Movies – Documentaries – Cultural Identity.

UNIT V
INTERPRETING FILMS
Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies –
Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to:
- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other
  elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods
- Each unit consists of reading materials, learning activities videos, websites. Students are
  expected to watch movies sometimes in class and at times at home and discuss in
class.

Evaluation
- As this is course is critical appreciation course on films, there is no written end semester
  examination. The course is more on learning how to critically analyse a movie and
appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

**Internal (100 % weightage)**
- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment 2: Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion: Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

**REFERENCES**
1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983

**HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C**

**OBJECTIVES**
- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

**CONTENTS:**

**UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW**

**UNIT II MORPHOLOGY - WORDS OF LANGUAGE**

**UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE**
UNIT IV  PHONETICS – THE SOUNDS OF LANGUAGE  9

UNIT V  APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE  9
Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods:
Lectures, discussion.

Evaluation Internal and External:
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE  L T P C  3 0 0 3

OBJECTIVES
- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I  INTRODUCTION
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral - Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II  READING CULTURE
Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel’s ‘ The night of the Scorpion’. ‘Nothing’s Changed’- Tatamkhulu Afrika-Apartheid. Ruskin Bond- ‘Night train at Deoli’- How real life is different from movies.

UNIT III  IDENTIFYING MEANING
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.

UNIT IV  POST MODERNISM
‘If on a winter’s night a traveler’- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.
UNIT V
RETURNING TO PICTURES

READING LIST
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: ‘The Night of the Scorpion’
3. Afrika, Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: Mythologies
5. Shankaracharya: Viveka Chudamani
6. Camus, Albert- The Myth of Sisyphus
7. Calvino, Italo: If on a winter’s night a traveler

OUTCOMES
• Can identify the connections among language, literature and culture.
• Is able to relate between seemingly different aspects of life.
• Understands the fractions in modern life and can assimilate meanings.