PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. To prepare the students to excel in academic and research or to succeed in Ceramic Technology profession through global, rigorous undergraduate education.

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

III. To train the students with good scientific and engineering knowledge so as to comprehend, analyze, design and create novel products and solutions for the real life problems.

IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach and an ability to relate issues to broader social context.

V. To provide students with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life long leaning needed for a successful professional career.

PROGRAMME OUTCOMES (POs)

On successful completion of the programme

I. Graduate will demonstrate knowledge of mathematics, science and engineering.

II. Graduate will demonstrate an ability to identify, formulate and solve engineering problems.

III. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.

IV. Graduate will demonstrate an ability to design a system, component or process as per needs and specifications.

V. Graduate will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.

VI. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.

VII. Graduate will demonstrate knowledge of professional and ethical responsibilities.

VIII. Graduate will be able to communicate effectively in both verbal and written form.

IX. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.

X. Graduate will develop confidence for self education and ability for long life learning.
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# ENGINEERING SCIENCES (ES)

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# PROFESSIONAL CORE (PC)

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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### SUMMARY

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COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

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

CONTENTS

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

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

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

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

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

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.

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

**TOTAL : 60 PERIODS**

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

**TEXTBOOK:**

**REFERENCES:**

**MA7151 MATHEMATICS – I**

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

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

**UNIT I DIFFERENTIAL CALCULUS**
12
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES**
12
Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT III 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 IV MULTIPLE INTEGRALS**
12

**UNIT V DIFFERENTIAL EQUATIONS**
12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

**TOTAL : 60 PERIODS**

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

**TEXT BOOKS**

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

UNIT I  PROPERTIES OF MATTER
9

UNIT II  ACOUSTICS AND ULTRASONICS
9

UNIT III  THERMAL AND MODERN PHYSICS
9

UNIT IV  APPLIED OPTICS
9

UNIT V  CRYSTAL PHYSICS
9
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

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

TEXTBOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

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

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

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY

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

UNIT V NANO CHEMISTRY

TOTAL: 45 PERIODS

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

TEXT BOOKS

REFERENCES

ENGINEERING GRAPHICS

GE7152

L T P C

3 2 0 4

OBJECTIVES
- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.
CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HANDSKETCHING

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES
Orthographic projection- principles- Principal planes- First angle projection- Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to 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.

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

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

TEXT BOOK:
REFERENCES:

Publication of Bureau of Indian Standards:

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

BS7161 BASIC SCIENCES LABORATORY
(Common to all branches of B.E. / B.Tech Programmes) L T P C 0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

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

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

TOTAL: 30 PERIODS

OUTCOME:
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)

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 iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

TEXTBOOKS

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

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

GROUP – A (CIVIL & ELECTRICAL)
CIVIL ENGINEERING PRACTICES

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

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

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

ELECTRICAL ENGINEERING PRACTICES

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

GROUP – B (MECHANICAL AND ELECTRONICS)

MECHANICAL ENGINEERING PRACTICES

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

DEMONSTRATION ON FOUNDRY OPERATIONS.

ELECTRONIC ENGINEERING PRACTICES

- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and Testing.
- Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

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

GE7161  COMPUTER PRACTICES LABORATORY  L T P C
0 0 4 2

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

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

TOTAL: 60 PERIODS

OUTCOMES
At the end of the course, the student should be able to:
• Write and compile programs using C programs.
• Write program with the concept of Structured Programming
• Identify suitable data structure for solving a problem
• Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS
30 Systems with C compiler

HS7251  TECHNICAL ENGLISH  L T P C
4 0 0 4

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

CONTENTS
UNIT I  ANALYTICAL READING
Listening: Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing )-explaining how something works-describing technical functions and
applications; **Reading** – Analytical reading, Deductive and inductive reasoning; **Writing** – vision statement – structuring paragraphs.

**UNIT II  SUMMARISING**
12
Listening: Listening to lectures/ talks on Science & Technology; **Speaking** – Summarizing/ Oral Reporting, **Reading** – Reading Scientific and Technical articles; **Writing** – Extended definition – Lab Reports – Summary writing.

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

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

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

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

**EVALUATION PATTERN:**
Internals – 50%
End Semester – 50%
**TOTAL:** 60 PERIODS

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

**TEXTBOOK:**

**REFERENCES:**
COURSE OBJECTIVES

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

UNIT I MATRICES

12

UNIT II VECTOR CALCULUS

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

UNIT III ANALYTIC FUNCTION

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

UNIT IV COMPLEX INTEGRATION

12

UNIT V LAPLACE TRANSFORMS

12

COURSE OUTCOMES

TOTAL : 60 PERIODS
Upon successful completion of the course, students should be able to:

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

TEXT BOOKS

REFERENCES

PH7257 PHYSICS OF MATERIALS
(Common to Chemical, Ceramic, Food, Leather, Textile, Apparel, Industrial Biotechnology, Pharmaceutical and PET)

OBJECTIVE:
- To make the students to understand the basics of phase diagrams and various materials preparation techniques
- To equip the students to have a knowledge on different types of electron theory, basics of quantum mechanics and about superconductors
- To introduce the physics of semiconducting materials and applications of semiconductors in device fabrication
- To familiarize the students with the theory and applications of magnetic and dielectric materials
- To provide the students a sound platform towards learning about advanced materials and their applications.

UNIT I PREPARATION OF MATERIALS

UNIT II ELECTRICAL AND SUPERCONDUCTING MATERIALS

UNIT III SEMICONDUCTING MATERIALS


UNIT IV DIELECTRIC AND MAGNETIC MATERIALS


UNIT V NEW MATERIALS AND APPLICATIONS


TOTAL: 45 PERIODS

OUTCOME:
On completion of the course, the students will be able to
- acquire knowledge of phase diagram, and thin film and nanomaterial preparation techniques
- familiarize with conducting materials, basic quantum mechanics, and properties and applications of superconductors.
- gain knowledge on semiconductor materials based on energy level diagrams, its types, temperature effect. Also, fabrication methods for semiconductor devices will be understood.
- realize with theories and applications of dielectric and ferromagnetic materials
- familiarize with ceramics, composites, metallic glasses, shape memory alloys, biomaterials and their important applications.

REFERENCES:
OBJECTIVE
- The students should be conversant with boiler feed water requirements, water treatment techniques.
- Applications of oil and its properties, principles of different chemical analysis.
- Different kinds of preparations of important chemicals.

OUTCOME
- Will be familiar with boiler feed water requirements, water treatment techniques.
- Will know the oil and its properties, principles of different chemical analysis.
-Will know the preparations of important chemicals.

UNIT I WATER TECHNOLOGY
9

UNIT II OILS, FATS, SOAPS & LUBRICANTS
9
Chemical constitution, chemical analysis of oils and fats – free acid, saponification and iodine values, definitions, determinations and significance. Soaps and detergents - cleaning action of soap. Lubricants - definition, characteristics, types and properties – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Solid lubricants – graphite and molybdenum disulphide.

UNIT III CHEMICAL ANALYSIS – AN ANALYTICAL INSIGHT
9

UNIT IV DYE CHEMISTRY
9
Witt’s theory and modern theory of colors – synthesis of methyl red, methyl orange, congo red, malachite green, p-rosaniline, phenolphthalein, fluorescence, eosin dyes.

UNIT V CHEMICALS AND AUXILIARIES
9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
GE7153  ENGINEERING MECHANICS  

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

**UNIT I  STATICS OF PARTICLES**  
12

**UNIT II  EQUILIBRIUM OF RIGID BODIES**  
12

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

**UNIT IV  FRICTION**  
8
Rolling Resistance, Ladder friction.

**UNIT V  DYNAMICS OF PARTICLES**  
12
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. 

L – 45 + T – 15 TOTAL: 60 PERIODS

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

**TEXT BOOK**
REFERENCES

ME7251 BASIC MECHANICAL ENGINEERING L T P C 3 0 0 3

OBJECTIVE
To impart knowledge on thermodynamics and thermal engineering power generating units such as engines and theory of machines

OUTCOME
• Students should learn thermodynamics and thermal engineering to understand the principles behind the operation of thermal equipments like IC engines and turbines etc., Students should be able to appreciate the theory behind operation of machinery and be able to design simple mechanisms

UNIT I LAWS OF THERMODYNAMICS 10
Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation-problems- Second law of Thermodynamics – Kelvin - Plank statement and Clausius statement- problems; Limitations; Heat Engine, Refrigerator and Heat Pump, Available energy, Third law of Thermodynamics - Statement.

UNIT II HEATING AND EXPANSION OF GASES 6
Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT III AIR STANDARD CYCLES 6
Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle-Derivations and problems.

UNIT IV I.C. ENGINES, STEAM AND ITS PROPERTIES AND STEAM TURBINES 12
Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption. Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle. Steam turbines – Impulse and Reaction types - Principles of operation.
UNIT V  SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALANCING

Definition of Kinematic Links, Pairs and Kinematic Chains; Flywheel-Turning moment Diagram; Fluctuation of Energy. Belt and rope drives; Velocity ratio; slip; Creep; Ratio of tensions; Length of belt; Power Transmitted; gear trains-types. Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
5. Kothandaraman and Dhomkundwar,”: A course in Thermal Engineering (SI Units)”, Dhanpat Rai and Sons, Delhi (2001)

CH7262  UNIX PROGRAMMING LAB

L T P C 0 0 4 2

OBJECTIVE
To introduce working in UNIX environment.

OUTCOME
• To introduce the basic commands in UNIX.
• To teach UNIX shell programming.
• To introduce programming in C with UNIX system calls.

1. Basic Unix commands
   i) Directory Related Commands
   ii) File Related Commands.
   iii) File Compression Related Commands
   iv) Network Communication Commands
   v) Commands for sending messages between the users
   vi) Miscellaneous Commands

2. Editors for file operations.
   i) Vi Editor
   ii) Gedit
   iii) Kwrite

3. Filters and Pipes
   i) Concatenating Files
   ii) Display beginning and End of Files
   iii) Cut and Paste
   iv) Sorting
v) Translating Characters  
vi) Count Characters, words, Lines  
vii) Comparing Files  

5. Sed Operations – Sed Scripts, Addresses, Commands  
6. Awk  
7. Input Redirection and Out Redirection Commands  
8. Simple shell programming.  
9. Shell programming using complex control structures  
   1. if - fi  
   2. if-else-fi  
   3. if-elif  
   4. case-esac  
   5. while- do- done  
   6. For-do-done  
10. Shell Programming using Arrays & Functions .  
11. C Programs using file system related system calls.  
12. C Programs using process related system calls.  
13. Programs for inter process communication using pipes, FIFOs.  
14. Programs using signals.  
15. Programs using shared memory  

TOTAL : 60 PERIODS  

TEXT BOOK  

REFERENCE  

ME7262 MECHANICAL ENGINEERING LABORATORY  

L T P C  
0 0 4 2  

OBJECTIVE  
To impart practical knowledge in operating IC engines and conduct experiments. To understand test procedures in testing material for engineering applications  

OUTCOME  
• Students will be able to understand Power-generating units such as engines and operate IC engines and conduct tests. They will be able to appreciate the theory behind the functioning of engines. Material properties, their behavior under different kinds of loading and testing can be.
LIST OF EXPERIMENTS
1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I C Engines
4. Load test on 4-stroke petrol engine
5. Performance test on 4-stroke single cylinder diesel engine
6. Performance test on 4-stroke twin cylinder diesel engine
7. Heat balance test on diesel engines
8. Tension test
9. Compression test
10. Deflection test
11. Hardness test (Rockwell and Brinell)
12. Spring test
13. Torsion test
14. Impact test

* Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS

GE7351 ENGINEERING ETHICS AND HUMAN VALUES

OBJECTIVES
• To emphasise into awareness on Engineering Ethics and Human Values.
• To understand social responsibility of an engineer.
• To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime - the challenger case study.

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY

UNIT V GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES
- Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

REFERENCES

MA7358 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

(Branch specific 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 apart from its use in solving boundary value problems;
- 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
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange’s Linear equation – Integral surface passing through a given
curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FORUER 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
Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FORUER TRANSFORM 12

UNIT V Z-TRANSFORM AND DIFFERENCE EQUATIONS 12

TOTAL : 60 PERIODS

OUTCOMES:
The students can able to solve the partial differential equations, find the Fourier series analysis and solve the problems by using Fourier transform and Z transform techniques.

TEXTBOOKS:

REFERENCES:

CT7302 MATERIALS SCIENCE FOR CERAMIC 3 0 0 3

AIM
The course is aimed to enable the students to have a basic knowledge about crystal systems, microstructure and dependence on various properties.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt about the atomic structure and bonding.
- Have studied about the structure of solids and various imperfections.
- Have learnt the basics about phase diagrams and phase transformations.
- Have learnt the basic concepts of diffusion in solids.
- Have studied the general properties of the solids.

UNIT I  BONDING AND STRUCTURE  10

UNIT II  IMPERFECTIONS  9

UNIT III  PHASE DIAGRAMS AND PHASE TRANSFORMATIONS  8

UNIT IV  DIFFUSION  9

UNIT V  PROPERTIES OF CERAMICS  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
The course is aimed to enable the students to have a better understanding on the principles of unit
operations like fluid mechanics, heat transfer and mass transfer.

OBJECTIVES
On completion of the course the students are expected to
• Have a thorough knowledge on the fluid statics and the fluid flow phenomena.
• Have studied the different equations involved in fluid flow and the changes
  that occur in a fluid flowing past immersed solids.
• Have understood the concepts involved in transfer of heat by conduction and
  convection.
• Have a clear idea on principle of heat transfer by radiation and radiative heat
  transfer between different surfaces.
• Have studied the basic mass transfer operations commonly come across in
  ceramic technology, like diffusion, humidification, drying of solids and
  crystallization.

UNIT I  FLUID STATICS AND FLUID FLOW PHENOMENA  8
Fluid statics – hydrostatic equilibrium, applications of fluid statics – manometer, gravity &
centrifugal
decanter. Fluid flow phenomena – laminar flow, rheological properties of fluids, turbulence, boundary
layers.

UNIT II  FLUID FLOW EQUATIONS AND FLOW PAST IMMERSED SOLIDS  9
Fluid flow equation – Mass balance in a flowing fluid, mechanical energy equation for flowing fluid.
Flow past immersed solids – drag and drag coefficient, flow through a bed of solids, motion of
particles through fluids.

UNIT III  CONDUCTIVE AND CONVECTIVE HEAT TRANSFER  10
Conductive heat transfer – basic laws of conduction, steady state conduction, unsteady state
conduction. Convective heat transfer – typical heat transfer equipments, energy balance, heat flux
and heat transfer coefficient, heat transfer by forced convection in laminar flow, turbulent flow and
transition region between laminar and turbulent flow, natural convection.

UNIT IV  RADIATIVE HEAT TRANSFER  8
Emission of radiation, absorption of radiation by opaque bodies, radiation between surface, radiations
to semi transparent materials, combined heat transfer by conduction, convection and radiation.

UNIT V  BASICS OF MASS TRANSFER OPERATIONS  10
Diffusion – definition, prediction of diffusivities. Humidification operation – definition, humidity chart,
wet bulb temperature. Drying of solids – classification of dryers, solids handling in dryer, principles of
drying, cross circulation drying, through circulation drying, freeze drying, drying equipments for solids,
pastes, solutions and slurries. Crystallization – crystal geometry, super saturation, mechanism of
crystallization.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Warren L.McCabe, Julian C.Smith and Peter Harriott, Unit Operations of Chemical Engineering,
2. SalilK.Ghosal, ShyamalK.Sanyal and Siddhartha Datta, Introduction to Chemical Engineering,
3. J F Richardson J. M. Coulson J R Backhurst J H Harker, Chemical Engineering, Volume 1, Sixth
REFERENCES

CT7301 ELEMENTS OF CERAMICS

L T P C 3 0 0 3

(Fundamentals Only – Qualitative Study)

AIM
The course is aimed to impart a basic knowledge about ceramics and about various fields in ceramics.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the process of preparing a white ware article.
- Have understood the importance and types of ceramic coatings, and the process of preparing and applying the same.
- Have an idea on preparation of glass and different glass articles.
- Have knowledge on importance and types of refractories.
- Have an introduction on different advanced ceramics materials and products.

UNIT I WHITEWARE 8

UNIT II CERAMIC COATINGS 9

UNIT III GLASS 8

UNIT IV REFRACTORIES 10
Introduction, classification, Raw materials, preparation, properties and uses of – silica, alumino silicate, alumina, magnesite, forsterite, dolomite, chromite, chrome magnesite, zirconia and carbon.

UNIT V ADVANCED CERAMICS 10
Introduction, properties and applications of – oxides, carbides, nitrides; Advanced ceramic products – ceramic fibers, glass ceramics.

TOTAL : 45 PERIODS

TEXT BOOKS
REFERENCE BOOKS

CT7304 THERMODYNAMICS FOR CERAMICS

AIM
To enable the students to have a basic knowledge about thermodynamics and the applications of thermodynamic laws of various systems.

OBJECTIVE
On completion of the course the students are expected to
- Have an understanding about the basic concepts of thermodynamics and the thermodynamic laws.
- Have an idea about the behavior of gases under conditions of temperature, pressure and volume.
- Have a basic knowledge about concepts of heat capacity.
- Have learnt the various applications of thermodynamics and solve some thermodynamic problems.
- Have a knowledge about solution thermodynamics.

UNIT I BASIC CONCEPTS
Fundamental concepts – system, process, state, properties, force, work, pressure, energy, equilibrium state, phase rule. Thermodynamic laws – zeroth law, internal energy, first law for flow process, non flow process, enthalpy, limitations, second law, entropy, Clausius inequality, third law.

UNIT II PVT BEHAVIOUR
PVT behavior – equation of state – concept of ideal gas – constant volume constant pressure, constant temperature, adiabatic process, isotropic process – equation of state for real gases – compressibility chart – heat effects accompanying a chemical reaction.

UNIT III CONCEPTS OF HEAT CAPACITY

UNIT IV APPLICATIONS OF THERMODYNAMICS

UNIT V SOLUTION THERMODYNAMICS

40
TEXT BOOKS

REFERENCES

CT7312 UNIT OPERATIONS LAB

1. Determination of pressure drop in a fluid using manometer
2. Determination of liquid viscosity
3. Estimation of settling velocity of particles through fluid
4. Separation of solid from suspension by sedimentation
5. Estimation of thermal conductivity of insulating material
6. Effect of $N_R_e$ on Heat Transfer
7. Estimation of LMTD in Co-current Heat Transfer
8. Estimation of LMTD in Counter-current Heat Transfer
9. Calculation of RH, Enthalpy and Specific Volume of Air using Humidity Chart
10. Crystallization of solid from a super saturated solution
11. Drying rate estimation during drying of a solid

EQUIPMENTS REQUIRED:
1. Manometer
2. Orifice
3. Ostwald viscometer
4. Dryer
5. Electronic balance
6. Hot plate
7. Concentric tube heat exchanger
8. Lee’s Disc Apparatus

TOTAL: 60 PERIODS

CT7311 CERAMIC SCIENCE LAB

1. Physical Identification of Ceramic Raw Materials
2. Determination of Moisture Content of Ceramic Powders
3. Determination of Loss on Ignition of Ceramic Powders
4. Preparation of Ceramic Body by Extrusion
5. Preparation of Ceramic Body by Pressing
6. Determination of Shrinkage of Ceramic Body – Dry & Fired, Volume & Linear
7. Determination of Density - True & Bulk
8. Determination of Porosity
9. Determination of Water Absorption
10. Determination of Water of Plasticity of extruded body

EQUIPMENTS REQUIRED:
1. Hot Air Oven
2. Hot Plate

TOTAL: 60 PERIODS
The course is aimed to enable the students to have a complete knowledge on the basics of geology, mineralogy and different raw materials used commonly in ceramic industries.

OBJECTIVES
On completion of the course the students are expected to
- Have studied the basics of rock formation, its types, and mineral formation and its physical and optical properties.
- Have learnt about clay formation, clay minerals and types of clays.
- Have studied the different types of fluxes and their characteristics.
- Have learnt the types of silicate minerals, their properties and uses.
- Have an understanding on other ceramic raw materials, their properties and uses.

UNIT I GENERAL GEOLOGY AND MINEROLOGY
Rocks – formation, characteristics, classification into igneous, sedimentary and metamorphic. Some important rocks – granite, sandstone, marble. Minerals – formation, relation of mineral deposit to igneous activity; chemical and physical properties like composition, color, streak, luster, fracture, cleavage, hardness, density and tenacity; radioactive properties and optical properties.

UNIT II PLASTIC MATERIALS

UNIT III FLUXES
Occurrence, properties and uses of natural fluxes – feldspar group, nepheline syenite, Cornish stone, lithium containing minerals. Bone ash – preparation, properties and uses.

UNIT IV SILICA AND OTHER RAW MATERIALS
Silica – occurrence, structure, polymorphic transformation, physical and chemical properties. Silicate minerals – quartz, sillimanite, kyanite, andalusite – properties and uses. Bauxite, magnesite, dolomite, chromite, limestone, rutile, zircon, beryllia minerals, alumina, slag and ashes, cullet – occurrence, properties and uses.

UNIT V TESTING

TOTAL: 45 PERIODS

TEXT BOOKS
AIM
The course is aimed to enable the students to have a complete knowledge on the steps involved in the processing of ceramic raw materials and the equipments used for those processes.

OBJECTIVES
On completion of the course the students are expected to
- Have a thorough knowledge on the quarrying of different plastic and non-plastic raw materials.
- Have a better understanding on the different equipments used for size reduction of raw materials and the laws involved in size reduction.
- Have a clear understanding on the mechanical separation operations like screening, filtration, sedimentary separation and magnetic separation.
- Have studied the principle and working of various equipments used for mixing, conveying and storage of ceramic raw materials.
- Have a clear knowledge on methods for characterizing the ceramic powder for its shape and size.

UNIT I QUARRYING

UNIT II SIZE REDUCTION

UNIT III MECHANICAL SEPARATION

UNIT IV MIXING
Mixing – mechanism of mixing, types of mixers – batch and continuous mixers – pan mixer, shaft mixer, U mixer, muller mixer and other mixers, liquid mixers – mechanism, blungers, agitators.

UNIT V CONVEYING AND STORAGE OF MATERIALS
Conveying – solid conveying-types of conveyors, criteria for selecting a conveyor; liquid conveying-condition for liquid conveying, different types of pumps. Storage methods for different ceramic powders. Problems in bin storage.
TEXT BOOKS

REFERENCES

CT7402 METALLURGY

AIM
The course is aimed to enable the students to have a basic knowledge about the basics of metallurgy, the various operations in the metallurgical process and in specific about steel making.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the basics about metals, ores and its extraction.
- Have learnt the various metallurgical processes that take place during the high temperature operation.
- Have learnt to measure and estimate the physical properties of metals.
- Have an immense knowledge about steelmaking.
- Have a basic knowledge about powder metallurgy.

UNIT I BASICS OF METALLURGY

UNIT II HIGH TEMPERATURE METALLURGICAL PROCESS

UNIT III MEASUREMENT & ESTIMATION OF PHYSICAL PROPERTIES
Introduction – factors affecting physical properties and their measurements –microstructure, thermal expansion coefficient, electrical resistivity, diffusion coefficient, yield strength, fracture toughness and hardness.

UNIT IV STEEL MAKING

UNIT V  POWDER METALLURGY  8

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7405 TRADITIONAL CERAMICS  L T P C  3 0 0 3

AIM
The course is aimed to enable the students to have a sound knowledge about the whiteware and heavy clayware products and their manufacturing processes, their properties and quality control.

OBJECTIVES
On completion of the course the students are expected to
- Have a basic knowledge about whiteware and heavy clayware, their classification and formulation.
- Be capable of classifying the various whiteware products and know the body formulation and properties.
- Have learnt in detail about the manufacturing process of various whiteware products.
- Have a better understanding about the heavy clayware products and their applications.
- Have learnt about the properties and the various properties methods.

UNIT I  DESIGNING OF BODY COMPOSITION  9

UNIT II  BODY FORMULATIONS  9
Body composition – porcelain, earthenware, bone china, sanitary ware, hotel china, terracotta, majolica, steatite bodies, cordierite bodies, rutile bodies, titanate bodies, zircon bodies, lava bodies.

UNIT III  WHITEWARE PRODUCTS  9
Manufacturing process & properties – whitewares at home – tableware, kitchenware, flame resistant ware, art ware, containers, whitewares in construction – floor tile, wall tiles, sanitary ware, whitewares
in electrical applications — low tension insulators, high tension insulators, high frequency low loss insulators, whitewares in industrial use — abrasion resistance, chemical resistance, heat resistance.

UNIT IV HEAVY CLAYWARE PRODUCTS 9
Introduction — classification—body composition — properties and applications of heavy clayware products — face bricks, paving bricks, hollow bricks, roofing tiles, sewer pipes, stoneware pipes, floor tiles, vitrified tiles, fireclay sanitaryware.

UNIT V PROPERTIES & TESTING 9
Rheological properties of slip— Fluidity, thixotropy, density. Moisture content. Glaze properties—pick up, testing of viscosity of glazes at room temperatures and high temperatures. Tests on unfired strength—bulk density, green MOR, Contraction. Fired properties—strength, density, porosity, moisture expansion, abrasion resistance, chemical durability and electrical properties.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7403 PHASE EQUILIBRIA

AIM
The course is aimed to enable the students to have a thorough knowledge about the importance of phase equilibrium and analyzing different systems.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the basics of phase equilibrium and phase diagrams.
- Have studied the thermodynamics behind phase equilibria.
- Have a better understanding on the different two component and three component phase diagrams.
- Have studied the types and theory behind phase transformations and also about nucleation and growth.
- Have gained knowledge on the different experimental methods to determine phase diagrams.

UNIT I INTRODUCTION 9
Introduction, phase, component, variable, Gibb’s phase rule, single component system — H₂O, SiO₂, iron, Hume Rothey’s rule; binary phase diagrams — solid solutions, eutectic, peritectic, liquid immiscibility, exsolution, invariant reactions, lever rule, ternary diagrams.

UNIT II THERMODYNAMICS OF PHASE EQUILIBRIA 9
Introduction, criteria of phase equilibrium, criterion of stability, phase equilibria in single and multi component system; binary solutions — constant pressure system, constant temperature system, partially miscible and immiscible system, liquid-liquid and ternary equilibrium diagrams.
UNIT III PHASE DIAGRAMS
Al₂O₃ – SiO₂, MgO – Al₂O₃, MgO – SiO₂, Al₂O₃ – ZrO₂, K₂O – Al₂O₃ – SiO₂, MgO – Al₂O₃ – SiO₂, Na₂O – Al₂O₃ – SiO₂. Prediction of alkali corrosion of alumino silicate refractories using phase diagrams.

UNIT IV PHASE TRANSFORMATIONS

UNIT V EXPERIMENTAL METHODS

TEXT BOOKS

REFERENCES

CY7351 INSTRUMENTAL METHODS OF ANALYSIS

OBJECTIVE
- To know the principle and importance of various analytical instruments used for the characterization of various materials

UNIT I INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS
Electromagnetic radiation: various ranges, dual properties, various energy levels, interaction of photons with matter, absorbance & transmittance and their relationship, permitted energy levels for the electrons of an atom and simple molecules, various electronic transitions in organic and inorganic compounds effected by UV, and visible radiations, various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and visible radiations, choice of solvents, cut off wavelengths for solvents

UNIT II QUALITATIVE ANALYSIS BY UV AND VISIBLE SPECTROCOPY
Lamda max and epsilon max rules, Woodward -Fieser rules for the calculation of absorption maxima (Lamda max) for dienes and carbonyl compounds. Effects of auxochromes and effects of conjugation on the absorption maxima, Different shifts of absorption peaks(Bathochromic, hypsochromic, hypochromic), Instrumentation for UV and Visible spectrophotometers (source, optical parts and detectors), Applications of UV and Visible spectroscopy.

UNIT III QUANTITATIVE ANALYSIS BY UV AND VISIBLE SPECTROCOPY
Beer-Lambert's law, limitations, deviations (real, chemical, instrumental), estimation of inorganic ions such as Fe, Ni and estimation of nitrite using Beer-Lambert's law, multicomponent analysis (no overlap, single way overlap and two way overlap), photometric titration (experimental set-up and various types of titrations and their corresponding curves).

UNIT IV  IR SPECTROSCOPY 9
Theory of IR spectroscopy, various stretching and vibration modes for diatomic and triatomic molecules (both linear and nonlinear), various ranges of IR (near, mid, finger print and far) and their usefulness, Instrumentation (only the sources and detectors used in different regions), sample preparation techniques, qualitative analysis of alkanes, alkenes and carbonyl compounds.

UNIT V  CHROMATOGRAPHIC METHODS 9
Classification of chromatographic methods, column, thin layer, paper, gas, High Performance Liquid Chromatographical methods (principle, mode of separation and technique).

TOTAL: 45 PERIODS

OUTCOME
• To have thorough understanding of theory, instrumentation and applications of analytical equipments used in industries for testing quality of raw materials, intermediates and finished products. To know the importance of analytical instrumentation during the purification, compounding and formulating the finished product.

TEXT BOOKS:

REFERENCES

TOTAL: 60 PERIODS
EQUIPMENTS
1. Flame Photometer
2. Hot Plate
3. Hot Air Oven
4. Electronic Balance
5. Furnace

CT7411 CERAMIC TESTING LAB
1. Determination of particle size by Screen Analysis
2. Determination of particle size by Hydrometer Method
3. Determination of particle size by Andreasen Pipette method
4. Determination of moisture content by IR Analyzer
5. Determination of moisture content by Speedy Moisture Balance
6. Determination of moisture content by Oven method.
7. Determination of shrinkage of ceramic products
8. Determination of density, porosity and water absorption for ceramic products by Archimedes principle
9. Determination of plasticity of ceramic materials by Pfefferkorn test
10. Determination of plasticity of ceramic materials by Atterberg test
11. Determination of rheological properties like density, fluidity and thixotropy by torsion viscometer
12. Determination of Modulus of Rupture for ceramic products
13. Determination of Cold Crushing Strength for ceramic products

TOTAL: 60 PERIODS

Equipments Required
1. Sieve Shaker
2. IR Moisture Analyser
3. Universal Testing Machine
4. Atterberg Apparatus
5. Pfefferkorn Apparatus
6. Torsion Viscometer

CT7501 CERAMIC PROCESSING I
AIM
The course is aimed to enable the students to have a thorough knowledge about the different ceramic fabrication process and the other final operations involved after the fabrication of the product.

OBJECTIVES
- On completion of the course the students are expected to
  - Have complete knowledge about the slip casting process.
  - Have a complete knowledge about the various plastic forming process.
  - Have a complete knowledge about the various dry forming process.
  - Have a sound understanding on the mechanism of drying and the construction and working of the various drying equipments.
  - Understand effectively the importance of firing and the mechanism and types of firing equipments.
UNIT I       SLIP FORMING PROCESS  9

UNIT II      PLASTIC FORMING PROCESS  9

UNIT III     DRY FORMING PROCESS  9

UNIT IV      DRYING AND FIRING  9

UNIT V       FIRING AND TESTING  9
Density porosity, water absorption, shrinkage, contraction – wet to dry, dry to fired, wet to fired modulus of rupture – dried and fired, Plasticity – Perferkon test, Atterberg test, Casting – Control of casting slips- fluidity, thixotropy, specific gravity.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7503  GLAZE TECHNOLOGY  L T P C
3 0 0 3

AIM
To enable the students to have a complete knowledge on the importance of glazing, its processing and application techniques.

OBJECTIVE
On completion of the course the students are expected to
• Have learnt the definition of glazes and classification of glazes.
• Have a thorough knowledge about the raw materials and properties of the glaze raw materials.
• Have a thorough knowledge about the various glazing techniques.
• Have learnt the properties and defects produced by glazing.
• Have complete understanding about the various methods of decorating the glazed article.
UNIT I  INTRODUCTION TO GLAZE  9

UNIT II  RAW MATERIALS AND PROCESSING  9
Role of individual raw materials - colouring agents - stains - mixed colours - metallic lustures - unit operations and processes - glaze Additives - special glazes - matt glazes, snake skin glazes, crackled glazes, salt glazes and other glazes.

UNIT III  GLAZING TECHNIQUES AND DEFECTS  9
Glazing techniques - dipping, pouring, spraying, brushing, painting and other techniques - Glaze body reactions- interface layers- glaze defects and remedies- crazing, peeling, crawling, rolling, blisters, pin holes, dunting.

UNIT IV  PROPERTIES AND TESTING  9
Thermal, mechanical, optical and chemical properties of glazes – Testing of glazes - Particle size distribution, Slip density, Viscosity, Fluidity , coherence parameter, glaze pick up, solubility of lead frits, glaze fit, thermal expansion, chemical durability , colour measurement, thermal shock measurement,

UNIT V  DECORATION  9
Classification of decoration methods- advantages- different decorating techniques- painting, spraying, stencilling, stamping, lithographic transferring, printing-silk screen printing, digital printing - dusting, decalcomania- liquid gold decoration and decoration techniques.  

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7504  REFRACTORIES- I  L T P C  3 0 0 3

AIM
The course is aimed to enable the students to have a basic knowledge about the various types of refractories used in the industries.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the basics about refractories and its demand.
- Have a sound knowledge about silica refractories.
- Have learnt about properties and applications of alumino silicate refractories.
- Have learnt about the various basic refractories.
- Have a knowledge about special refractories.
Definition – production - demand & growth of refractories in India - Layout of a refractory plant - classification of refractory - fundamental properties of refractories and their testing - factors for selection and use of refractories.

UNIT II  SILICA REFRACTORIES  9

UNIT III  ALUMINOSILICATE REFRACTORIES  9
Al₂O₃ – SiO₂ phase diagram, - types of raw materials - different alumino silicate refractories – manufacturing steps – properties & applications.

UNIT IV  BASIC REFRACTORIES  9
Raw materials, manufacturing process, properties and applications of magnesite, forsterite, dolomite and chrome based refractories.

UNIT V  SPECIAL REFRACTORIES  9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CT7502  GLASS ENGINEERING – I  L T P C  3 0 0 3

AIM
The course is aimed to enable the students to have a complete knowledge on the principle behind glass formation, raw materials and melting of glass batch, glass properties and quality control in glass.

OBJECTIVE
On completion of the course the students are expected to
- Have understood the principle behind glass formation and structures of different glasses.
- Have studied about the raw materials for glass making and calculation of a glass batch for a given composition.
- Have learnt about the reactions involved in the conversion of solid glass batch into a liquid glass melt.
- Have studied about the thermo-dynamical, thermal, mechanical, electrical and other properties of glass.
- Have learnt the defects found in a flat ware and a hollow ware, and the quality control procedure for a coated glass.
UNIT I  PRINCIPLES OF GLASS FORMATION  10
Definition. Difference between a glass and crystalline material. Glass Formation – atomistic hypothesis of glass formation, kinetic approach to glass formation. Structures of glasses – fundamental laws, elements of structural models for glasses, structural models for silicate glasses. Phase diagrams of glass forming oxide systems – CaO-Al₂O₃-SiO₂, Na₂O-CaO-SiO₂ etc.

UNIT II  RAW MATERIALS AND PREPARATION OF GLASS BATCH  10
Raw materials – Glass formers, intermediates and modifiers, cullet, minor ingredients like oxidizing/reducing agents, refining agents, decolourisers, colouring oxides – description and importance. Selection of glass composition, change in properties in relation to change in composition, Glass batch calculation.

UNIT III  GLASS MELTING PROCESS  10

UNIT IV  PROPERTIES AND TESTING OF GLASS  8

UNIT V  QUALITY CONTROL OF GLASS  7
Flat glass defects – origin, remedies. Container glass defects – origin, remedies. Quality control in special glasses like coated glass, laminated glass, tempered glass.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CT7512  CERAMICS PROCESSING LAB  L T P C  0 0 4 2

LIST OF EXPERIMENTS
1. Preparation of Ceramic Slip in a Pot Mill
2. Determination of Slip Specific Gravity.
3. Determination of Slip Viscosity.
4. Effect of Water on Viscosity of Slip.
5. Effect of Deflocculant on Viscosity of Slip.
8. Determination of Setting Time and Setting Temperature of Plaster of Paris
10. Forming of Drain Slip Cast Article.
12. Glaze Preparation
13. Glaze Application
14. Glost Firing

Equipments Required:
1. Pot Mill
2. Gibbs Viscometer
3. Hot Air Oven
4. Sieves
5. Moulds
6. Furnace

TOTAL : 60 PERIODS

CT7511  CAD LAB FOR CERAMICS  L T P C
0 0 4 2

AIM
To impart CAD modeling and design of ceramic components using FEA software.

OBJECTIVE
The students are trained to create modeling of basic ceramic components and analyze the same using finite element analysis software.
1. Design of Mold for Ceramic Products.
2. Thermal Stress Behavior for mould
3. Stress Analysis of beams with point Load.
4. Stress Analysis of beams with varying Load.
5. 1-D Conduction Problem with Single Wall.
6. 1-D Conduction Problem with Multi wall.
7. Non Linear Problem.
8. Stress Analysis Of An Axis-Symmetric Component
9. Coupled Structural/Thermal Analysis
10. Fatigue Problems.

TOTAL : 60 PERIODS

(All the above Experiments solve Using Design and Analysis soft wares)

Equipment’s: 15 No's of higher end Pentium PC with minimum 64 bit, 4GB RAM and Suitable Finite element analysis software like ANSYS/ABAQUS.

GE7251  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
To the study of nature and the facts about environment.
To find and implement scientific, technological, economic and political solutions to environmental problems.
To study the interrelationship between living organism and environment.
To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
To study the dynamic processes and understand the features of the earth’s interior and surface.
To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

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

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

UNIT III  NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain,

UNIT V HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:

REFERENCES:

CT7601 CERAMIC PROCESSING II L T P C

AIM
The course is aimed to enable the students to have a thorough knowledge on the advanced processing techniques in ceramics.

OBJECTIVES
On completion of the course the students are expected to
- Have a thorough knowledge on the preparation of ceramic powder by mechanical and chemical methods.
- Have studied the additives used in ceramic forming and different ceramic forming processes in dry powder, slurry and plastic consistency.
- Have a better understanding on the mechanisms of solid state and liquid phase sintering, and crystal growth during sintering.
- Have learnt the advanced sintering processes and their mechanisms.
- Have understood the processes involved in machining and surface finishing of ceramic products.

UNIT I  POWDER PROCESSING  9

UNIT II  FORMING  10
Additives in ceramic forming – solvents, dispersant, binder, plasticizer, other additives. Forming of ceramics – dry and semidry pressing - die compaction and isostatic compaction; casting methods - slip casting, pressure casting, gel casting, electrophoretic deposition; plastic forming methods - extrusion, co-extrusion, injection molding, solid freeform fabrication - particle filled polymer methods, powder methods, suspension methods- Porous ceramic forming- foaming, intrusion, organic additives.

UNIT III  SINTERING MECHANISMS  10

UNIT IV  ADVANCED SINTERING  7
Pressure assisted sintering – hot pressing and hot iso-static pressing. Reaction bonded sintering, microwave sintering.

UNIT V  MACHINING AND SURFACE FINISHING OF CERAMICS  9
Mechanism of material removal and its effect on strength, surface grinding and mechanical polishing, non abrasive finishing, ceramic surface coating, joining of ceramics – metal ceramic joints.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
On completion of the course the students are expected to

- Have learnt the basics about refractories used in iron & steel industry.
- Have a sound knowledge about refractories used in non ferrous and non metallic industries.
- Have learnt about refractories used in glass and ceramic industry.
- Have learnt about the refractories used for insulation.
- Have a knowledge about special refractories used in space and atomic/nuclear energy.

UNIT I  REFRACTORIES FOR IRON & STEEL INDUSTRY  9

UNIT II  REFRACTORIES FOR NON-FERROUS&NON-METALLIC INDUSTRIES  9
Refractories for non ferrous industries – copper, aluminum, lead. Refractories for non-metal industries – hydrocarbon industry, fertilizer industry, cement industry.

UNIT III  REFRACTORIES FOR GLASS AND CERAMIC INDUSTRY  9
Refractories for glass industry – refractory practices in sidewall, basin, throat, forehearth and roof of glass tank, regenerator systems. Refractories for ceramic industry – kiln design – LTM concept, fast firing technology, kiln furnitures – types, properties, requirements – applications in different ceramic industry.

UNIT IV  REFRACTORIES FOR INSULATION  9
Purpose of insulation – types of insulating materials and preparation of insulating refractories, ceramic fibre products – design and installation – ceramic coatings.

UNIT V  REFRACTORIES FOR SPACE & NUCLEAR APPLICATIONS  9
Ceramics for space – materials used in space satellite, missiles, rockets nozzles. Ceramics for nuclear reactors – types of reactors, structural ceramic materials, ceramic fuel elements, control rod elements.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CT7602  GLASS ENGINEERING – II  L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a thorough knowledge on furnaces used for glass melting, fabrication of glass and the treatments to the final glass article.

OBJECTIVES
On completion of the course the students are expected to

- Have learnt the different furnaces used for glass melting, their design and operation.
- Have a better understanding on the heating process in tank furnace and the measurement and control of parameters in tank furnace.
Have studied the fabrication methods of glass flat ware and hollow ware.
Have a clear understanding on the purpose and process of annealing of glass products.
Have learnt the different value adding processes done to glass.

UNIT I GLASS MELTING FURNACES
Construction and operation of pot furnace and day tank furnace. Tank furnace – types, design & construction. Electric tank furnace – design & operation, electrodes used, electric boosting in tank furnace. Forehearth & Feeder section in tank furnace.

UNIT II OPERATION OF TANK FURNACE

UNIT III FABRICATION PROCESS

UNIT IV ANNEALING
Introduction, nature of generation & release of strain, temporary & permanent strain, dependence of strain on cooling rate, detection & measurement of strain, annealing equation, problems in annealing, annealing glass plate, optical glass, ideal annealing cycle.

UNIT V VALUE ADDING PROCESSES IN GLASS
Mirror, chemical vapour deposition, physical vapour deposition process, laminated glass, tempered glass, decorated glasses, vycor & micro porous glass, sealing glass, neutral glass, photosensitive glass, glass ceramic, glass fibers.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CT7612 REFRACTORY CERAMICS LAB
[Minimum of 10 experiments]
1. Preparation of silica refractory with different additives
2. Preparation of fire clay refractory with different additives
3. Preparation of high alumina refractory with different additives.
4. Estimation of PLC of and silica, fire clay high alumina refractories.
5. Estimation of TEC of silica, fire clay high alumina refractories
6. Estimation of PCE of silica, fire clay high alumina refractories
7. Estimation of RUL of silica, fire clay high alumina refractories
8. Estimation of chemical attack resistance of silica, fire clay high alumina refractories
9. Comparison of density, porosity and strength of refractory prepared by powder pressing and extrusion.
10. Comparison of density, porosity and strength of silica, fire clay and high alumina refractories.
11. Preparation of porous refractory for insulation with different pore formers and comparison of their characteristics.
12. Comparing the characteristics of a dense and porous refractory.

TOTAL: 60 PERIODS

Equipments Required:
1. Universal Testing Machine
2. Hot Plate
3. Extruder
4. Electronic balance
5. Uniaxial pressing machine
6. Hot air oven
7. Furnace
8. Dilatometer
9. Optical microscope

CT7611                    GLASS LAB                      L T P C
[Minimum of 10 experiments]
1. Preparation of Soda Lime Glass
2. Influence of cullet size on melting behavior of soda lime glass.
3. Influence of cullet percentage on melting behavior of soda lime glass.
4. Influence of refining agent on the melting behavior of soda lime glass.
5. Preparation of Amber Glass
7. Determination of Specific Gravity.
8. Determination of Refractive Index.
10. Determination of Chemical Durability.
11. Identification of defects in glass.

TOTAL: 60 PERIODS

Equipments Required
1. Sieve Shaker
2. Hot Plate
3. Hot Air Oven
4. Furnace
5. Electronic balance
6. Dilatometer
7. Spectrometer
8. Optical microscope
OBJECTIVES:
To introduce process economics and industrial management principles to chemical engineers.

UNIT I  PRINCIPLES OF PRODUCTION MANAGEMENT AND ORGANISATION  15
Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a
process and a structure; types of organizations Method study; work measurement techniques; basic
procedure; motion study; motion economy; principles of time study; elements of production control;
forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and
inventory control.

UNIT II  ENGINEERING ECONOMICS FOR PROCESS ENGINEERS - INTEREST,
INVESTMENT COSTS AND COST ESTIMATION  10
Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs
and working capital, invested capital and profitability.

UNIT III  PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT  8
Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy;
forecasting sales; inflation and its impact.

UNIT IV  ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 4
Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance
and growth.

UNIT V  ECONOMIC BALANCE AND QUALITY AND QUALITY CONTROL  8
Essentials of economic balance – Economic balance approach, economic balance for insulation,
evaporation, heat transfer. Elements of quality control, role of control charts in production and quality
control.

OUTCOMES:
The objective of this course is to teach principles of cost estimation, feasibility analysis, management,
organization and quality control that will enable the students to perform as efficient managers.

TEXT BOOKS:

REFERENCES:

AIM
The course is aimed to enable the students to have a thorough knowledge about the various ceramic
materials used for structural applications.

OBJECTIVES
On completion of the course the students are expected to have studied the structural characteristics and properties of oxide, carbide, nitride, carbon and other ceramic materials used for structural applications.

UNIT I   OXIDE CERAMICS
Structural characteristics, properties and applications of silica, alumina, zirconia, magnesia, titania, thoria, mullite, uranium oxide and plutonium oxide. high temperature superconducting oxides.

UNIT II  NON OXIDE CERAMICS
Structural characteristics, properties and applications of silicon carbide, boron carbide, tungsten carbide, titanium carbide. Structural characteristics properties and applications of silicon nitride, boron nitride, titanium nitride, aluminum nitride

UNIT III CERMETS
Structural characteristics, properties and applications of cermets. Types of cermets, Uses, high temperature cermets, making of cermets.

UNIT IV  ADVANCED STRUCTURAL CERAMICS
Structural characteristics, properties and applications of Carbon compounds, borides, silicides, Sialon,

UNIT V   SINGLE CRYSTALS

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

HS7551     EMPLOYABILITY SKILLS
L T P C
3 0 0 3

COURSE DESCRIPTION
This course aims to help the students acquire the employability skills necessary for the workplace situations. It also attempts to meet the expectations of the employers by giving special attention to language skills, presentation skills, group discussion skills and soft skills. This will be achieved through expert guidance and teaching activities focusing on employability skills.

COURSE OBJECTIVES
• To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills
• To help them improve their reading skills, writing skills, and soft skills necessary for the workplace situations
• To make them employable graduates

CONTENTS
UNIT I   READING AND WRITING SKILLS
Reading: skimming & scanning strategies – note making skills – interpreting visual material (charts & tables) – critical reading – fast reading necessary for reading letters & files - preparing job applications
- writing covering letter and résumé - applying for jobs online - email etiquette – writing official letters (placing an order, letters to consumers, etc.) writing reports – collecting, analyzing and interpreting data

UNIT II SOFT SKILLS

UNIT III PRESENTATION SKILLS
Preparing slides with animation related to the topic – organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice—presenting the visuals effectively – 5 minute presentation

UNIT IV GROUP DISCUSSION SKILLS
Participating in group discussions – understanding group dynamics - brainstorming the topic – questioning and clarifying – GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD - mock GD

UNIT V INTERVIEW SKILLS

LEARNING OUTCOMES
- Students will be able to make presentations and participate in group discussions with high level of self-confidence.
- Students will be able to perform well in the interviews
- They will have adequate reading and writing skills needed for workplace situations

TOTAL : 45 PERIODS

REFERENCES:

EXTENSIVE READING

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

CT7711 ADVANCED INSTRUMENTAL METHODS LAB
[Minimum of 10 experiments]
1. Analysis of Trace Elements using Spectrophotometer, Flame Photometer
2. Thermal Analysis – TGA, DTA, DSC.
3. Determination of Viscosity by Brookfield Viscometer.
5. Microscopy – Optical
6. Vicker’s Hardness.
7. Modulus of Rupture.
8. Cold Crushing Strength
10. Thermal expansion – dilatometer
11. Impedance analyzer-LCR

TOTAL : 60 PERIODS

CT7712
INDUSTRIAL TRAINING
During Summer(4 weeks)  L T P C
0 0 0 2

All the students have to undergo practical industrial training of four week duration in recognized establishments during summer either in the IV Semester or VI Semester. At the end of which they have to submit a report. The internal assessment will be based on the report and presentation and the examination marks be based on viva voce examination.

CT7713
ADVANCED CERAMIC PROCESSING LAB  L T P C
0 0 4 2

[Minimum of 10 Experiments]
1. Powder synthesis by Communion / High Energy Ball milling
2. Powder preparation by Sol - Gel process
3. Powder preparation by Precipitation process
4. Powder preparation by Spray Drying
5. Forming by Gel Casting
6. Forming by Tape Casting
7. Role of additives in compaction by Pressing
8. Porous body making by Foaming
9. Porous body making by Intrusion / Replication
10. Microwave Sintering
11. Hot Pressing
12. Spray Pyrolysis - Coating
13. Surface Grinding and Roughness estimation

TOTAL : 60 PERIODS

Equipments Required:

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5. Uniaxial pressing Machine
6. Hot plate
7. Microwave Furnace
8. Spray Dryer
9. Surface Grinding Machine
10. Magnetic stirrer
11. Surface Roughness Tester Machine
12. Tape casting Equipment

CT7811 PROJECT WORK

AIM
The project work aims to train the students on systematic analysis of a problem and to enable them to bring out a solution.

OBJECTIVE
The objective of the project is to make use of the knowledge gained by the student at various stages of the degree course.

Each student is required to submit a report on the project assigned to him/her by the department. The report should be based on the literature collected from the many sources and the actual analysis done by the student on the given project.

CT7001 ABRASIVE TECHNOLOGY

AIM
The course aimed to enable the students to have a basic knowledge about the types, manufacturing process, properties and applications of abrasives.

OBJECTIVES
On completion of the course the students are expected to
- Have a basic understanding on the abrasives, and different raw materials and their characteristics.
- Have studied the stages involved in the manufacture of a coated abrasive.
- Have learnt about the different types of backups used in a coated abrasive and how they affect the grinding characteristic.
- Have a good knowledge on the manufacturing of bonded abrasive, its types and characteristics.
- Have learnt the fundamentals of grinding operation, grinding aids and about polishing.

UNIT I INTRODUCTION

UNIT II MANUFACTURE OF COATED ABRASIVES
Raw material selection and preliminary treatments, maker coating, abrasive coating – methods and types of coating, sizer coating, drying and humidification, flexing, conversions – slitting, belt making, sheet cutting, disc cutting. Individual disc coating process. Quality control and testing.
UNIT III  BACK UPS
Contact wheels – cloth contact wheels, rubber contact wheels, hardness, face serrations, shape, wheel diameter, speed, belt tension, dressing and protection of contact wheels – their characteristics. Drum, rolls, pads and platens – types, characteristics, choice and uses. Working principle of coated abrasive.

UNIT IV  MANUFACTURE OF BONDED ABRASIVES
Abrasive grain type and characteristics required for bonded abrasives. Types of bonds – vitrified, silicate, resinoid, shellac, rubber and oxychloride. Bonded wheel manufacture with different bonds and their characteristics. Shapes and sizes of wheels. Factors determining grinding action – characteristics of abrasive grain, bond type, structure. Other types of wheels – Diamond wheels, reinforced wheels, mounted wheels. Selection of appropriate abrasive wheels for grinding metals.

UNIT V  BASICS OF GRINDING AND POLISHING

TOTAL: 45 PERIODS

TEXT BOOKS
2. Coated Abrasives – Modern Tool of Industry, Coated Abrasive Manufacturer’s Institute, Cleaveland, Ohio, 1982.

REFERENCES

CT7002  ADVANCED REFRACTORATORY MATERIALS

AIM
The course is aimed to impart basic knowledge about refractory for various industries and conservation.

OBJECTIVE
On completion of the course the students are expected to
- Have a basic understanding about applications of refractories in steel, cement, glass industries.
- Have learnt about various choice of refractory for kiln furniture.
- Have basic knowledge about energy conservation using ceramic fibres.

UNIT I  SELECTION CRITERIA & INSTALLATION
Criteria for refractory selection – thermal criteria and calculations, structural criteria, chemical criteria. Installation – refractory bricks & shapes, castables, plastics, ceramic fibers.
UNIT II  REFRACTORIES FOR FERROUS INDUSTRIES  9
Design, construction and refractories used in coke ovens, blast furnace, steel making furnaces, secondary steel making furnaces, continuous casting, heat treating & forging industries.

UNIT III  REFRACTORIES FOR NON-FERROUS METALLIC INDUSTRIES  9
Design, construction and refractories used in copper, aluminum, lead, zinc extraction and processing industries.

UNIT IV  REFRACTORIES FOR NON-METALLIC INDUSTRIES  9
Refractories used in refining & petrochemical, fertilizer, cement, glass, ceramic industries. Refractories used in combustors, boilers, incinerators etc.

UNIT V  INDUSTRIAL MAINTENANCE & SAFETY  9
Refractory maintenance & repair; Refractory Economics; Safety, health hazards, pollution control & ecology.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7003  BIOCERAMIC MATERIALS  L T P C
3  0  0  3

AIM
The course is aimed to enable the students to have a sound knowledge about the applications of ceramic materials in biological field.

OBJECTIVES
- On completion of the course the students are expected to
  - Have learnt Introduction.
  - Have a complete knowledge about inert ceramics.
  - Have studied about Calcium Phosphate Bioceramic.
  - Have studied about Silica based Ceramics.
  - Have studied about Material Shaping.

UNIT I  INTRODUCTION  9

UNIT II  INERT BIOCERAMICS

UNIT III  CALCIUM PHOSPHATE BIOCERAMICS  9
Preparation, properties and biological performance of hydroxyapatite, Tricalcium Phosphate, Biphasic Calcium phosphate, Calcium phosphate nano particles. In-vivo response of calcium phosphate ceramics and clinical applications of Calcium phosphate ceramics.

UNIT IV  SILICA BASED CERAMICS  9
Glass as Bio materials, increasing bio activity of glasses, Strengthening and adding new capabilities to bioactive glasses. Non silicate glasses, Clinical application of glass. Mesoporous silica - Synthesis and Functionalization.

UNIT V  MATERIAL SHAPING  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CT7018  QUANTITATIVE TECHNIQUES IN CERAMICS  
L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a basic knowledge about the methods of calculating the various ceramic properties.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the basic methods of calculating the properties of ceramic raw materials.
- Have learnt to calculate the properties of ceramic bodies.
- Have learnt to calculate the properties of suspensions.
- Have learnt to formulate glaze batches by varying the parameters.
- Have learnt to formulate glass batches.

UNIT I  ULTIMATE & RATIONAL ANALYSIS
Ultimate analysis, proximate analysis, rational analysis of clay, stone and feldspar - mica convention – substitution of clays in body recipes – triangular plot.

UNIT II DETERMINATION OF PHYSICAL PROPERTIES

UNIT III CALCULATIONS OF BODY & SUSPENSIONS

UNIT IV GLAZE CALCULATIONS
Molecular weights – formula and use of chemical equations – oxides – percentage composition and formula – calculation of a recipe from a simple glaze formula – given the recipe of a glaze calculate the formula – synthesis of a fritted glaze – given the recipe calculate the formula for a fritted glaze – calculation of the percentage composition of the mill batch.

UNIT V GLASS CALCULATIONS
Determination of molecular formula of glass from chemical composition of the glass and from glass batch – determination of batch from molecular formula of glass – determination of batch from the given chemical composition.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
5. R.Charan, Handbook of Glass Technology.

CT7004 CEMENT TECHNOLOGY

AIM
The course is aimed to enable the students to have a complete knowledge on the manufacture, quality control and types of cement, and preparation, properties and different types of concrete.

OBJECTIVES
On completion of the course the students are expected to
- Have studied the raw materials, manufacturing process and mechanism of clinker production.
- Have learnt in detail about clinker
- Have studied the different types of Portland cements and their characteristics.
- Have learnt the types of blended cements and special cements
- Have understood the environmental impact of cement production.

TOTAL: 45 PERIODS
UNIT I PRODUCTION OF CEMENT CLINKER 9

UNIT II CLINKER STUDY 9
Study of Solid state rins, Sintering and Clinkering, Constitution of PC clinker, Study of important system in phase formation, Effect of impurities and role of minor components, QC of clinker- Litre weight test, Characterization of clinker- Chemical analysis, Optical microscopy, electron Microscopy, XRD.

UNIT III PORTLAND CEMENT 9

UNIT IV BLENDED CEMENTS AND SPECIAL CEMENTS 9
Introduction, Type I and related Portland cements, cement with mineral constituents, pozzolanic materials, Blast furnace slag and blast furnace slag cements, problem in specification of blended cements.

UNIT V ENVIRONMENTAL IMPACT 9
Introduction, emission to air, water, environmental aspects of alternative fuels, Environmental monitoring- Greenhouse gas emissions, Carbon footprinting.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7006 FIBRES AND COMPOSITES  L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a sound knowledge about the different types of ceramic fibres, composites, their properties and applications.

OBJECTIVES
On completion of the course the students are expected to
• Have studied the different fibre reinforcements, their manufacturing routes, properties and applications.
• Have studied the different types of matrices, its manufacturing techniques and properties.
• Have a basic knowledge about the types, manufacturing process and properties of composites.
• Have a basic knowledge about the properties of composite materials.
• Have a sound knowledge about the different types of whiskers.

UNIT I  REINFORCEMENTS  9
Fibre definition, fibre flexibility; Glass fibres – types, manufacturing process, properties, glass wool forming process; Alumina fibres, mullite fibres, zirconia fibres, boron fibres, carbon fibres and graphite fibres – manufacturing techniques, properties and applications; Strength of reinforcements.

UNIT II  WHISKERS  9
Background of whisker growth – whisker nucleation and growth – composite processing – whisker purification, whisker / matrix powder mixing, densification, SiC and Si$_3$N$_4$ whiskers, VLC synthesis, properties.

UNIT III  TYPES OF MATRICES  9
Introduction, types – polymer, ceramic, metal, glass, thermosetting and thermoplastic matrices.

UNIT IV  COMPOSITES  9

UNIT V  PROPERTIES OF COMPOSITES  9
Elastic and strength properties – fracture behavior – fibre matrix load transfer – failure of a composite – criteria, damage of composites from physical and mechanisms to modeling, long term behavior of composite materials, high temperature stability – wear and friction.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7005  ELECTRONIC CERAMICS  L T P C
3 0 0 3

AIM
The Course is aimed to enable the students to know the basic concepts of ceramic materials used for electronic applications and their applications in various fields.

OBJECTIVES
On completion of the course the students are expected to
• Have studied the use of ceramic materials as insulators and capacitors and their properties.
• Have learnt the processing, properties and various applications of ceramic materials in ferroelectric applications.
• Have learnt the manufacture, characteristics and properties of magnetic ceramics.
• Have a basic knowledge about superconductivity.
• Have a basic knowledge about the manufacture, characteristics and properties of varistors and fuel cells.

Attested
SALIM
DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025
UNIT I  CERAMIC INSULATORS  
Insulators, insulator materials, triaxial and non-triaxial insulators – composition, properties and uses – dielectric properties - dielectric strength, dielectric breakdown mechanisms, factors affecting dielectric strength, dielectric constant and loss-polarization- different types of polarization – effect of frequency and temperature, thermal properties – thermal conductivity, thermal resistance, thermal coefficient of expansion, mechanical properties, conduction – electronic and ionic

UNIT II  CERAMIC CAPACITORS  

UNIT III  FERROELECTRIC CERAMICS  

UNIT IV  MAGNETIC CERAMICS  

UNIT V  VARISTORS AND FUEL CELLS  
Introduction- ZnO varistors – PN junction diode– electrical characteristics, fabrication of ZnO varistor behavior- microstructure – gas sensors fuel cells – types, principle, working, solid oxide fuel cells – applications- structure and operation principle of oxygen sensors, NOx sensors.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7007 FUELS AND ENERGY ENGINEERING  

AIM
The course is aimed to enable the students to have a thorough knowledge about different types of fuels used in industries and the mechanism involved in converting the fuel into a useful source of energy.

OBJECTIVES
On completion of the course the students are expected to
- Have a complete knowledge idea about the occurrence and characteristics of the different types of solid fuels.
- Have a better knowledge about the different types of liquid fuels and their properties.
Have a complete understanding about the different liquid fuels and their properties.
Have a basic knowledge about the combustion process involved in the fuels.
Have an idea about the ways of heat transfer and the different heat recovery systems.

UNIT I  SOLID FUEL

UNIT II  LIQUID FUEL

UNIT III  GASEOUS FUELS
Composition and calorific value – natural gas, liquefied petroleum gas, oil gas, coal gas, producer gas, water gas, other gaseous fuels. Non conventional fuels – importance, hydrogen fuel. Advantages disadvantages and storage of gaseous fuel

UNIT IV  COMBUSTION PROCESS
Air requirement, combustion processes of solid, liquid, gaseous fuels, control of combustion process, combustion stoichiometry.

UNIT V  HEAT TRANSFER
Heat transfer to charge by conduction, convection and radiation in a kiln, heat loss through kiln wall, opening, cooling etc., heat balance and thermal efficiency, heat recovery – recuperator and regenerator, co-generator – importance.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7009  KILNS, FURNACES AND PYROMETRY  L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a thorough knowledge on the equipments involved in firing of a ceramic article and the temperature measurement methods.

OBJECTIVES
On completion of the course the students are expected to
• Have a thorough knowledge on the different burners used based on the fuel type and the types of flame produced from burners.
• Have studied the different types of furnaces and their operation.
• Have an understanding on the different factors involved in designing a furnace.
• Have a better knowledge on different types of kilns, their construction and working.
• Have a clear understanding on the temperature and heat measurement techniques in kilns and furnaces.

UNIT I  LAY OUT OF FURNACE AND DESIGNING  9

UNIT II  BURNERS AND FLAMES  9

UNIT III  FURNACES  9
classification – metal heating furnaces, reheating furnace, continuous furnace, sintering furnace, crucible furnaces, electric furnace, unit melters and smelters, muffle furnace, glass tank furnace. microwave furnace.

UNIT IV  KILNS  9
Introduction, definition, classification – draught kiln, chamber kiln, tunnel kiln, roller kiln, rotary kiln, continuous kiln, shuttle kiln, top hat kiln, muffle kiln, Hoffman’s kiln – principle, materials used in foundation and construction, working.

UNIT V  PYROMETRY  9
Introduction and thermometry, thermocouples, radiation pyrometers, low temperature measurement, temperature control, heat work recorders – Segar cone, Holdcroft’s bar, Buller rings, Watkin recorders.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7010  MATERIALS MANAGEMENT  L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a basic knowledge about importance of material management and its applications in various sectors.

OBJECTIVES
On completion of the course the students are expected to
• Have learnt the basic concepts about materials management.
• Have studied about the importance of purchasing.
UNIT I  INTRODUCTION
Introduction to material management, importance of integrated materials management, need for integrated materials management, concept, definition, scope and advantage- an overview, A-B-C analysis, codification, variety reduction, standardization.

UNIT II  PURCHASE MANAGEMENT
Material planning and purchase, purchase system, procedures, price forecasting, purchasing of capital equipment, vendor development, account procedure, purchasing decisions, procurement policies.

UNIT III  WARE HOUSING AND STORE MANAGEMENT
Store keeping principles-past and latest techniques, stores-general layout, cost aspect and productivity, problems and development, store system procedures incoming material control, store accounting and stock incoming material control, store accounting and stock verification, value analysis.

UNIT IV  INVENTORY MANAGEMENT
Introduction, basic models, definition of commonly used terms, replenishment model, choice of system etc., inventory work in progress, safety stock, computerization in materials management control, information to materials management case study, spare parts.

UNIT V  MATERIAL PROCUREMENT PROCEDURES
Arbitration act- octroi, central and local sales tax, excise duties- custom tariff, import, control policies, procurement from government agencies and international market- insurance, DGS and D tariff.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7011  MECHANICAL BEHAVIOUR OF CERAMIC MATERIALS  L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a detailed understanding about the behaviour of ceramic materials with different mechanical properties.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt in detail about the elastic property and brittle nature of ceramics.
- Have understood the fracture behaviour of ceramics.
- Have studied the behaviour of the materials in strength and engineering design.
- Have learnt the creep behaviour of ceramic materials.
• Have understood the thermal shock behaviour of the ceramic materials.

UNIT I ELASTIC BEHAVIOUR

UNIT II FRACTURE MECHANICS
Theoretical strength and stress concentrations, linear elastic fracture mechanics, micro structural aspects, fracture testing techniques.

UNIT III STRENGTH AND ENGINEERING DESIGN
Strength testing, statistical treatment to strength, time dependent strength behaviour – subcritical crack growth, stable crack propagation, cyclic fatigue – SPT diagram. Toughening of Ceramics.

UNIT IV CREEP BEHAVIOUR

UNIT V THERMAL BEHAVIOUR
Thermal stress, thermal shock resistance parameters, thermal stresses and cracking, testing technique, applications of thermal stress.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
3. Hasselman D.P.H and Heller R.A (eds.), Thermal Stresses in Severe Environments

CT7012 MICROWAVE PROCESSING OF CERAMICS

AIM
The course is aimed to enable the students to the basic concepts about processing the ceramic materials in microwave atmosphere.

OBJECTIVES
On completion of the course the students are expected to
• Have learnt the introduction about microwave processing.
• Have learnt the concepts of microwave heating circuit.
• Have learnt the applicator types of microwave.
• Have studied the industrial applications of microwave processing.
• Have studied the hazard and safety of microwave processing.

UNIT I INTRODUCTION
Dielectric Behavior of materials- power dissipation- propagation factor and skin depth- heat and mass transfer phenomena- temperature distribution- wall loss.

UNIT II MICROWAVE HEATING CIRCUIT
Power sources- klystron and magnetron- operating characteristics- protection system- high frequency breakdown phenomena- automatic control of the process- automation, tuning and machining.

UNIT III APPLICATION TYPES
Travelling wave applicators- multimode applications- power transfer- uniformity of heating.

UNIT IV INDUSTRIAL APPLICATIONS
Microwave drying- microwave sintering- application to laboratory models and pilot system-comparison with pilot heating.

UNIT V HAZARDS AND SAFETY
Exposure standards- industrial- frequency band- leakage from industrial equipment- batch system-continuous flow system- safety precautions.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7013 MONOLITHICS REFRACTORIES

AIM
The course is aimed to enable the students to have a sound knowledge about the types, properties and applications of monolithics and castables.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the types of castables, its composition and characteristics.
- Have a better understanding on the use of plastic refractories, ramming and gunning mixes as monolithic materials.
- Have studied about the composition and characteristics of mortars, coatings and dry vibratables.
- Have a clear idea on the methods of installing different monolithic materials, the application design and the lining materials used while laying monolithics.
- Have studied the wear mechanisms that cause failure in a monolithic lining and the methods to test a monolithic.

UNIT I CASTABLES

UNIT II PLASTIC REFRACTORIES, RAMMING AND GUNNING MIXES

77
UNIT III MORTARS, COATINGS AND DRY VIBRATABLES

UNIT IV MONOLITHIC INSTALLATION
Methods of installations of castables, plastic refractories, ramming mis and gunning mix. Drying and heating up of installed monolithic lining. Application designs – blast furnace trough design, trough lining, and form design, tundish, steel ladle, electric arc furnace. Linings in installation – anchors, steel fibre reinforcements.

UNIT V WEAR MECHANISMS AND TESTING
Wear mechanisms – introduction, abrasion, penetration, corrosion, spalling. Tests done on monolithics – chemical analysis, density, porosity, strength, high temperature properties, corrosion, erosion.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7014 NON DESTRUCTIVE TESTING AND EVALUATION

AIM
The course is aimed to enable the students to have a basic knowledge about the various non-destructive methods of testing.

OBJECTIVES
On completion of the course the students are expected to
- Have studied the basic concepts of non-destructive testing and surface NDT methods
- Have learnt about small business and preparation of feasibility chart.
- Have a basic knowledge about establishment of a business.
- Have learnt about how to manage a business unit.
- Have some basic concepts about promotion of entrepreneurship and practical knowledge about some case studies.

UNIT I INTRODUCTION
Non destructive Test and Evaluation Technology – an overview, Materials, Manufacturing Process and Non destructive testing methods, Designs and Non Destructive Testing, Industrial applications of non destructive evaluation – railways, nuclear, non nuclear and chemical industries, automotive industries.

UNIT II RADIOGRAPHIC TESTING
Sources of γ-ray and gamma rays and their interaction with matter, equipment, general radiographic procedure, radiographic technique and acceptance standard, special radiographic techniques, safety aspects of industrial radiography.

UNIT III ULTRASONIC TESTING
Principles of wave propagation, Reflection, Refraction, Diffraction, Mode conversion and Attenuation, Sound field, Piezoelectric effect, Ultrasonic transducers and their characteristics, Ultrasonic equipment, A, B, C scan presentation of Test Indications and Interpretations, Ultrasonic Testing, Effective applications and Limitations of Ultrasonic Testing.

UNIT IV EDDY CURRENT TESTING
Introduction- principles of eddy current, Eddy current test system, Applications of Eddy Current Testing, Effectiveness of eddy current testing.

UNIT V OTHER METHODS
Liquid Penetrant Test basic concepts, liquid penetrant system, Test Procedure, effective applications and Limitations, Magnetic Particle Test – Magnetic Materials, Magnetic Particle Test – Principle, Equipment, Procedure, Interpretation and Evaluation, Effective applications and limitations, other methods – thermal infrared testing, acoustic emission.

TOTAL: 45 PERIODS

TEXT BOOKS
3. J Prasad and C G K Nair, Non Destructive Test and Evaluation of Materials,

REFERENCES

CT7015 PLANT EQUIPMENT AND FURNACE DESIGN

AIM
The course is aimed to enable the students to have a sound knowledge about designing the layout of the plant and designing of furnaces.

OBJECTIVES
On completion of the course the students are expected to
- Have learnt the factors for selection of a plant layout.
- Have studied the ways of assembling the various sections in the plant for proper functioning.
- Have studied the principles of designing equipments.
- Have studied the principle and designing of furnaces.
- Have studied the construction of furnaces.

UNIT I PLANT DESIGN
Proper location of the plant- factors to be considered, factory buildings- layouts with necessary details.

UNIT II ASSEMBLING
Assembling of economics, engineering and industrial data, calculations and data necessary for the process route- electrical, piping instruments, motors, compressors etc- flow diagrams- process design and overall technical report.
UNIT III EQUIPMENT DESIGN
Design principles- crushers, filter press, sieves, pugmill and different types of pug moulds- tunnel, chamber and electrical.

UNIT IV FURNACE DESIGN
Design of furnaces- tank furnace, tunnel kiln, chamber kiln, rotary kiln, muffle furnace, blast furnace, open hearth furnace, stack calculations- chimney foundations. Essential operations- firing, charging, melting, preheating- air, gas, fuel, flame systems, furnace high temperature measurements and temperature control instruments.

UNIT V FURNACE CONSTRUCTION
Furnace life and selection of proper refractories, thermal currents and atmosphere, safe firing schedule. Basic knowledge about furnace construction, capacity, fuel and firing efficiencies- design, construction and thermal calculation of one of the furnaces.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7016 PROCESS AUTOMATION
L T P C
3 0 0 3

AIM
The course is aimed to enable the students to have a basic knowledge about the control instruments and its applications in various fields.

OBJECTIVES
On completion of the course the students are expected to
- Have studied the principle and classification of process control equipments.
- Have learnt basic concepts on process control.
- Have learnt the basics about advanced control instruments.
- Have learnt about digital control instruments.
- Have learnt the optimal control instruments.

UNIT I INTRODUCTION
Principles of measurement and classification of process control instruments; temperature, pressure fluid flow, liquid level, velocity, fluid density, viscosity, conductivity etc., instrument scaling; sensors; transmitters and control valves; instrumentation symbols and labels.

UNIT II PROCESS AUTOMATION
Basic Concepts; terminology and techniques for process control; control modes; tuning process controllers.
UNIT III ADVANCED CONTROL
Advanced control techniques, feed forward and ratio control; controller design; adaptive control system; statistical process control; expert system; multivariable control techniques; supervisory control.

UNIT IV DIGITAL CONTROL
Digital control techniques; z transforms; sampling and filtering; response of discrete time systems; sampled data control systems; design of digital controllers.

UNIT V OPTIMAL CONTROL
Optimization and simulation; optimization techniques; single and multivariable constrained optimization; dynamic simulation of distillation columns and reactors.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7017 QUALITY CONTROL IN CERAMIC INDUSTRIES

AIM
To impart knowledge on various quality control aspects and issues followed in ceramic industries.

OBJECTIVES
At the end of the course the students would
• Be aware on the basic concepts of standardization.
• Have a comprehensive insight in the Indian standard specifications.
• Have a basic knowledge on the concepts of quality control in ceramic industries.
• Have learnt the statistical methods of quality control.
• Have a basic knowledge about the reliability and maintainability of quality concept.

UNIT I CONCEPTS OF STANDARDISATION
Historical development of standards – aims, techniques, management, formulation, implementation of company standards- economic benefits of standardization.

UNIT II INDIAN STANDARDS FOR CERAMIC MATERIALS

UNIT III CONCEPTS OF QUALITY
Quality engineering - planning for quality and reliability - quality standards - specification of inspection methods, setting of standard quality levels - introduction to ISO 9000 - design of quality experiments using statistics - analysis of variance.

UNIT IV  STATISTICAL QUALITY CONTROL  9
Introduction to taguchi methods and 6 sigma concepts - objectives of statistical quality control - inspection and its importance - difference between inspection and quality control, basic statistical methods - techniques of quality control - control charts for attributed - control charts for variables.

UNIT V  DECORATION  9
Definition of reliability, factors affecting reliability - MTTF - MTBF - evaluation of reliability, quality management - organizing for quality - economy of quality - techniques of ABC analysis - quality management education - zero defects concept -

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
1. Jerome D West and Ferdinand K Leoy, A Management Guide to PERT/CPM.

CT7019  REFRACTORY ENGINEERING AND MANAGEMENT  L T P C
3 0 0 3

OBJECTIVE
To enable the students to have a basic knowledge about Refractory lining and the structural and mechanical behavior of refractory linings

OUTCOME
On completion of the course the students are expected to
  • Have learnt the basics of structural and mechanical behavior of refractory linings
  • Have a sound knowledge about heat transfer in refractory linings
  6. Have learnt about the wear of refractory linings.
  7. Have a knowledge about basic principles of thermal design

UNIT I  INTRODUCTION  9
Introduction-types of loading-Stress controlled and strain controlled loads -Design philosophy of structures based on load types -Material properties required for structural analysis.

UNIT II  CRITERIA FOR SELECTION OF REFRACTORY MATERIALS  9
ASTM strength tests - Choosing best refractory for thermomechanical application - Verification from field test study - static compressive stress strain data-Creep data -Influence of stress state on the strength of refractories -Thermal expansion data

UNIT III  REFRACTORY LININGS JOINTS  9
analytical study of Hinge joint

UNIT IV  FUNDAMENTALS OF DIFFERENT LINING DESIGNS
Basics of refractory brick arch behavior – Fundamentals of brick lined cylindrical shells – Brick dome behavior – fundamentals of flat brick linings -Cylindrical refractory-lined vessel analysis – Refractory sprung arch – spherical refractory silica brick dome. Dos and Don’ts in Refractory lining design

UNIT V  STRUCTURE –PROPERTY- PERFORMANCE STUDY
Correlation between structure and property-correlation between property and performance of refractories.-Postmortem studies – microstructural studies.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7020  SPECIAL COATING TECHNOLOGY

AIM
The course is aimed to enable the students to have a complete knowledge about the advanced ceramic coating technology processes, properties and applications.

OBJECTIVES
On completion of the course the students are expected to
- Have studied the classification and raw materials used for the special coatings.
- Have learnt in detail about enamel coating.
- Have studied the concept of vapour phase coatings.
- Have studied about the various special coating techniques.
- Have studied the properties and applications of special coatings.

UNIT I  COATINGS – FUNDAMENTALS

UNIT II  VAPOUR PHASE COATINGS
PVD - basic evaporation process - evaporation techniques - sputtering – ion plating- CVD process-CVD reactor- CVD kinetics- product and process route.

UNIT III  SPECIAL COATINGS
Plasma spray- pack coating- slurry coating- sol gel coating- hot dip coating- electrophoresis- electro chemical coating- corrosion resistant coating and other coatings.

UNIT IV  SURFACE ANALYTICAL METHODS
XRD – glancing incidence, x-ray diffraction- electron microscopy techniques- auger electron spectroscopy, secondary ion mass spectroscopy, photoelectron spectroscopy.
UNIT V PROPERTIES AND APPLICATIONS 9
Thermal, mechanical. Optical and chemical properties- hardness- wear and erosion resistance- high temperature properties- applications- defects and remedies.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT7008 FUNCTIONAL GLASSES L T P C 3 0 0 3

AIM
The course is aimed to enable the students to have a thorough knowledge about the special applications of glasses in various fields.

OBJECTIVES
On completion of the course the students are expected to
- Have a clear understanding on the types and properties of heat resistant and safety glasses.
- Have studied the manufacture, types and applications of optical glasses.
- Have studied the composition of glass fibres and optical fibres, and their applications.
- Have learnt the composition, preparation and properties of glass ceramics.
- Have a knowledge on the methods and types of coatings on glass, their applications and quality control.

UNIT I HEAT RESISTANT AND SAFETY GLASSES 9

UNIT II OPTICAL GLASSES 9

UNIT III GLASS FIBRES 9
Composition for fibre glass, glass wool, manufacturing process and applications. Optical fibres – optical properties of fibres, silica based glass fibres – applications in optical communication.

UNIT IV GLASS CERAMICS 9
Glass composition, heat treatment schedule, crystal nucleation in glass, nucleating agent, microstructure and properties, applications, machinable glass ceramics.

UNIT V COATED GLASS 9
Coating methods – physical vapour deposition, chemical vapour deposition. Types of coatings, characteristics of coated glass, applications of coated glasses, quality control of coated glass.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

GE7073 FUNDAMENTALS OF NANOSCIENCE

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO\textsubscript{2}, MgO, ZrO\textsubscript{2}, NiO, nanoalumina, CaO, AgTiO\textsubscript{2}. Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots preparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS

OUTCOMES:
Upon completing this course, the students
• Will familiarize about the science of nanomaterials
• Will demonstrate the preparation of nanomaterials
• Will develop knowledge in characteristic nanomaterial

TOTAL : 45 PERIODS
TEXT BOOKS

REFERENCES

GE7652 TOTAL QUALITY MANAGEMENT

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

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

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

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY MANAGEMENT SYSTEM

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

TEXT BOOK:

REFERENCES:

GE7071 DISASTER MANAGEMENT

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

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

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

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

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

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

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management

TEXTBOOKS:

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

GE7074  HUMAN RIGHTS  L T P C  3 0 0 3

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

UNIT I

UNIT II

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

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

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

REFERENCES:

GE7072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT  9

UNIT II  REQUIREMENTS AND SYSTEM DESIGN  9

UNIT III  DESIGN AND TESTING  9

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  9

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9

TOTAL: 45 PERIODS

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

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