ANNA UNIVERSITY
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012
CURRICULA AND SYLLABI FOR
I TO VIII SEMESTERS

B.TECH. CERAMIC TECHNOLOGY
(FULL TIME)
# I SEMESTER

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OBJECTIVE
To impart basic communication skills and develop the habit of reading

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

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

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

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

UNIT IV

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

UNIT V

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

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCE BOOKS
1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. Technical English: Writing,


EXTENSIVE READERS


Website Resources
1. www.uefap.com
2. www.eslcafe.com
3. www.listen-to-english.com
4. www.owl.english.purdue.edu
5. www.chompchomp.com

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

OBJECTIVE
To impart the fundamental knowledge about matrices, infinite series, partial derivatives, improper and multiple integrals

OUTCOME
• To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
• To make the student knowledgeable in the area of infinite series and their convergence so that he/she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
• To familiarize the student with functions of several variables. This is needed in many
branches of engineering.

- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES


UNIT II INFINITE SERIES


UNIT III FUNCTIONS OF SEVERAL VARIABLES


UNIT IV IMPROPER INTEGRALS


UNIT V MULTIPLE INTEGRALS

TEXT BOOKS

REFERENCES

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

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

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the basic physic concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER
UNIT II ACOUSTICS AND ULTRASONICS


UNIT III THERMAL PHYSICS


UNIT IV APPLIED OPTICS


UNIT V SOLID STATE PHYSICS

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

TOTAL: 45 PERIODS

TEXT BOOKS
REFERENCES

CY8151 ENGINEERING CHEMISTRY L T P C
(Common to all branches of Engineering and Technology) 3 0 0 3

OBJECTIVE
To introduce the basic chemistry concepts relevant to different branches of Engineering and Technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on thermodynamics, polymers, catalysis, spectroscopy and nanochemistry.

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

UNIT II POLYMER CHEMISTRY
Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS
Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY


UNIT V NANOCHEMISTRY


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVE
To introduce the basic knowledge about computers and fundamentals of C programming.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on computers and C programming.

UNIT I  INTRODUCTION

UNIT II  C PROGRAMMING BASICS

UNIT III  ARRAYS AND STRINGS

UNIT IV  FUNCTIONS AND POINTERS

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

REFERENCES

GE8152 ENGINEERING GRAPHICS

OBJECTIVE
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.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on design of various engineering products and technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.
UNIT I  PLANE CURVES AND FREE HAND SKETCHING  14

Basic Geometrical constructions, Curves used in engineering practices


Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  14

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS  14

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  14

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

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  15

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.
Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

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.
OBJECTIVE

To make the students understand and get hands-on in the basic concepts of practical Physics.

OUTCOME

Familiarizes the basic concept in experiments and provide strong platform to apply hands-on experience gained here for experimenting higher level concepts.

1. Torsional pendulum  Determination of rigidity modulus of wire and moment of inertia of disc
2. Non – uniform bending  Determination of young’s modulus
3. Lee’s disc  Determination of thermal conductivity of a bad conductor
4. Potentiometer  Determination of thermo e.m.f. of thermocouple
5. Air wedge  Determination of thickness of a thin sheet of paper
6. i. Optical fibre  Determination of Numerical Aperture and acceptance angle
   ii. Compact disc  Determination of width of the groove using laser
7. Acoustic grating  Determination of velocity of ultrasonic waves in liquids
8. Post office box  Determination of Band gap of a semiconductor
9. Spectrometer  Determination of wavelength using grating
10. Viscosity of liquids  Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

TOTAL : 30 PERIODS
OBJECTIVE
To provide hands-on experience in using PH meter, potentiometry, titration methods and estimating the strength of given solutions.

OUTCOME
Ability to perform all kinds of titrations and estimate the unknown chemical samples.

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.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

REFERENCE BOOKS
GE8161  COMPUTER PRACTICES LABORATORY  L T P C  0 0 3 2

OBJECTIVE
• To enable the student to learn and use the major components of a computer system
• To make the students write programs and solve problems
• To learn to use office automation tools

OUTCOME
At the end of the lab session student will be able to use MS office and generate data, solve simple problems with C-Programming Language.

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

TOTAL : 45 PERIODS

GE8162  ENGINEERING PRACTICES LABORATORY  L T P C  0 0 3 2

OBJECTIVE
To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

OUTCOME:
• ability to fabricate carpentry components and pipe connections including plumbing works.
• ability to use welding equipments to join the structures.
• ability to fabricate electrical and electronics circuits
GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICE

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

Wood Work
- Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

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

2. ELECTRICAL ENGINEERING PRACTICE

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

GROUP – B (MECHANICAL AND ELECTRONICS)

3. MECHANICAL ENGINEERING PRACTICE

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

4. ELECTRONIC ENGINEERING PRACTICE

• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and testing.
• Study of Telephone, FM radio, low-voltage power supplies.

TOTAL: 45 PERIODS

HS8251 TECHNICAL ENGLISH II L T P C

(For all branches of B.E / B.Tech programmes) 3 1 0 4

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

OUTCOME
On completion of the course the students are expected to acquire various linguistics skills required for academic and workplace situations.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCE BOOKS

Extensive Readers

**Web Resources**

1. www.esl-lab.com
2. www.englishgrammar.org
3. www.englishclub.com
4. www.mindtools.com
5. www.esl.about.com

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**MA8251**

**MATHEMATICS II**

(Common to all branches of B.E. / B.Tech. Programmes in II Semester) 3 1 0 4

**OBJECTIVE**

To impart the fundamental knowledge about differential equations, vector calculus, analytic functions, complex integration and Laplace transforms.

**OUTCOME**

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

**UNIT I  DIFFERENTIAL EQUATIONS**

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

**UNIT II  VECTOR CALCULUS**

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

UNIT III ANALYTIC FUNCTION 9+3

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions -

\[ w = z + c, \quad az, \quad \frac{1}{z}, \quad z^2 \] Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3


UNIT V LAPLACE TRANSFORMS 9+3


TOTAL : 60 PERIODS

TEXT BOOKS


REFERENCES

OBJECTIVE
To introduce the physics of various materials relevant to different branches of technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the various materials and their physical properties.

UNIT I PREPARATION AND PROCESSING OF MATERIALS

UNIT II PROPERTIES OF CONDUCTING AND SUPERCONDUCTING MATERIALS

UNIT III ELECTRONIC MATERIALS
Elemental and compound semiconductors - Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – LED and Solar cells.
UNIT IV  INSULATING AND MAGNETIC MATERIALS


UNIT V  CERAMIC AND NEW MATERIALS


TOTAL : 45 PERIODS

REFERENCES

OBJECTIVE
To introduce the chemistry involved in various technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the chemistry of water, interfaces, oils, fats, chemicals and colorants.

UNIT I   WATER

UNIT II   Chemistry of interfaces

UNIT III   Oils, Fats, Soaps & Lubricants
Chemical constitution, Chemical analysis of oils and fats – acid, saponification and iodine values, Definitions, determinations and significance. Definition, mechanism of lubrication, preparation of petrolubes, desirable characteristics – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Semisolid lubricant – greases, preparation of sodium, lithium, calcium and axle greases and uses, consistency test and drop point test. Solid lubricants – graphite and molybdenum disulphide

UNIT IV   Chemicals AND Auxiliaries

UNIT V   Colorants
Theory of color and constitution: chromophore and auxochrome, classification of dyes based
on application. Chemistry and synthesis of azo dye.

TOTAL: 45 PERIODS

REFERENCES

GE8251 ENGINEERING MECHANICS

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

OUTCOME
On completion of the course the students are expected to study the effect of force and motion in various design functions of engineering.

UNIT I BASICS AND STATICS OF PARTICLES
– Equivalent systems of forces – Principle of transmissibility.

UNIT II   EQUILIBRIUM OF RIGID BODIES 9 + 3
Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III   PROPERTIES OF SURFACES AND SOLIDS 9 + 3

UNIT IV   DYNAMICS OF PARTICLES 9 + 3

UNIT V   FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9 + 3
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
To impart a basic knowledge about ceramics and about various fields in ceramics.

OUTCOME
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

Introduction, properties and applications of – oxides, carbides, nitrides; Advanced ceramic products – ceramic fibers, glass ceramics.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CH8261 UNIX PROGRAMMING LAB

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

CT8211 CERAMIC SCIENCE LAB

OBJECTIVE
To impart basic knowledge about the various testing procedures that can be done on a ceramic sample

OUTCOME
On completion of the course the students are expected to know
- To identify the various ceramic materials
- To prepare ceramic samples using the common fabrication techniques
- To carryout basic tests on a ceramic sample

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

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Equipments Required:
1. Hot Air Oven
2. Hot Plate
3. Electronic Balance
4. Furnace

TOTAL: 30 PERIODS
OBJECTIVE
To impart the fundamental knowledge about various transform techniques and partial differential equations.

OUTCOME
• 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 PDE.

UNIT II   FOURIER SERIES
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
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   FOURIER TRANSFORM
UNIT V  Z – TRANSFORM AND DIFFERENCE EQUATIONS  9+3


TEXT BOOK

REFERENCES

CY8351  INSTRUMENTAL METHODS OF ANALYSIS  L T P C  3 0 0 3

OBJECTIVE
To impart knowledge on the various methods available to analyse the samples

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the various spectroscopic methods available to analyse various materials and their characteristics

UNIT I  INTRODUCTION OF SPECTROMETRY  9
- types of optical instruments – Principle of Fourier Transform optical Measurements.

UNIT II MOLECULAR SPECTROSCOPY


UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY

Theory of NMR – environmental effects on NMR spectra – chemical shift- NMR-spectrometers – applications of $^1$H and $^{13}$C NMR- Molecular mass spectra – ion sources – Mass spectrometer. Applications of molecular mass - Electron paramagnetic resonance- g values – instrumentation.

UNIT IV SEPARATION METHODS


UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode

TOTAL : 45 PERIODS

TEXT BOOK
OBJECTIVE
To enable the students to have a basic knowledge about crystal systems, microstructure and dependence on various properties.

OUTCOME
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  CHARACTERIZATION OF CERAMIC SOLIDS
10

UNIT II  STRUCTURE OF SOLIDS AND IMPERFECTIONS
9

UNIT III  PHASE DIAGRAMS AND PHASE TRANSFORMATIONS
9
UNIT IV  DIFFUSION


UNIT V  PROPERTIES


TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT8302  PROPERTIES OF CERAMICS  L T P C
3 0 0 3

OBJECTIVE
To enable the students to have a thorough knowledge on the different properties of ceramics.
OUTCOME
On completion of the course the students are expected to
- Have a thorough knowledge on the mechanical properties and the mechanical failure modes of ceramics.
- Have studied the thermal properties of ceramics.
- Have an understanding on the optical properties of ceramics.
- Have a better knowledge on electrical properties of ceramics.
- Have a clear understanding on the magnetic properties of ceramics.

UNIT I  MECHANICAL PROPERTIES

UNIT II  THERMAL PROPERTIES
Heat capacity, density and thermal expansion of glasses, crystals, composite bodies. Thermal conduction – phonon conductivity of single phase crystalline ceramics and glasses, photon conductivity, conductivity of multiphase ceramics, thermal stress, temperature gradients, resistance to thermal shock and thermal spalling, thermal tempering and annealing.

UNIT III  OPTICAL PROPERTIES
Introduction, refractive index and dispersion, reflection and refraction, absorption, scattering, polarisability, boundary reflectance and surface gloss, opacity and translucency, absorption and colour, application.

UNIT IV  ELECTRICAL PROPERTIES
Electrical conduction phenomena, ionic conduction in crystals and glasses, electronic conduction in crystals and glasses, non-stoichiometry and solute controlled electronic conduction, valency controlled semiconductors, mixed conduction in poor conductors, poly crystalline ceramics, electrical phenomena, dielectric loss factor for crystals and glasses, dielectric conductivity, polycrystalline and polyphase ceramics, dielectric strength.
UNIT V MAGNETIC PROPERTIES

Magnetic phenomena, origin of interactions in ferromagnetic materials, spinel ferrites, rare earth garnets, ortho ferrites and illmenites, hexagonal ferrites, polycrystalline ferrites, susceptibility, permeability, flux density, types of magnetism and their origin, electronic structure and magnetic moment, exchange interaction and super exchange interaction, hysteresis loop and magnetic domain – domain structure.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
To enable the students to have a better understanding on the principles of unit operations like fluid mechanics, heat transfer and mass transfer.

OUTCOME
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

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
UNIT IV  RADIATIVE HEAT TRANSFER

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


TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

ME8351  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

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

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

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

Engine nomenclature and classification; SI Engine; Cl 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)

CT8311  UNIT OPERATIONS LAB  L T P C
0 3 2

OBJECTIVE
To impart basic knowledge about the operating principles and procedures to determine the properties of ceramic samples

OUTCOME
On completion of the course the students are expected to know

- To know the operating principle behind the various equipments
- To know the methodology to determine the properties of the material
1. Determination of pressure drop in fluid using manometer
2. Determination of 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 powder
6. Heat transfer by combined natural convection and radiation
7. Heat transfer in laminar flow
8. Heat transfer in turbulent flow
9. Determination of wet bulb temperature
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. Brookfield viscometer
4. Dryer

TOTAL: 30 PERIODS

ME8361 MECHANICAL ENGINEERING LABORATORY L T P C 0 0 3 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 visualized.
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

TOTAL : 45 PERIODS

* Minimum 10 experiments shall be offered

MA8356 PROBABILITY AND STATISTICS

OBJECTIVE

To impart the fundamental knowledge about various statistical techniques and basic concepts of probability.

OUTCOME

- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.
UNIT I    RANDOM VARIABLES
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II    TWO-DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III    TESTS OF SIGNIFICANCE

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

UNIT V    STATISTICAL QUALITY CONTROL
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
GE8351  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C 3 0 0 3

OBJECTIVE
To impart the fundamental knowledge about environment and various factors influencing our environment.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the basics of environmental science.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14

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

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.
UNIT II ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

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

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CT8401  CERAMIC RAW MATERIALS  L T P C  3 0 0 3

OBJECTIVE
To enable the students to have a complete knowledge on the basics of geology, mineralogy and different raw materials used commonly in ceramic industries.
OUTCOME
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. Minerals – formation, relation of mineral deposit to igneous activity, chemical and physical properties like composition, colour, streak, luster, fracture, cleavage, hardness, density and tenacity, elements of optical mineralogy.

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 SILICATE MATERIALS
Silica – occurrence, structure, polymorphic transformation, physical and chemical properties. Silicate minerals – quartz, sillimanite, kyanite, andalusite – properties and uses.

UNIT V OTHER RAW MATERIALS
Bauxite, magnesite, dolomite, chromite, limestone, rutile, zircon, beryllia minerals, alumina, slag and ashes, cullet – occurrence, properties and uses.
TEXT BOOKS

REFERENCES

CT8402 PROCESSING OF CERAMIC RAW MATERIALS L T P C 3 0 0 3

OBJECTIVE
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.

OUTCOME
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 of different ceramic powders. Problems in bin storage.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
CT8403 TESTING METHODS OF CERAMICS

OBJECTIVE

To enable the students to have a basic knowledge about the various testing methods of ceramic raw materials and samples and also the basics about quality control.

OUTCOME

On completion of the course the students are expected to

• Have learnt the basics about the testing methods for ceramic raw materials.
• Have learnt the various methods of testing the physical properties.
• Have learnt to test the various properties of glaze.
• Have an immense knowledge about testing of refractories.
• Have a basic knowledge about quality control.

UNIT I TESTING OF RAW MATERIALS

UNIT II TESTING OF PHYSICAL PROPERTIES

Plasticity – Pfefferkorn test, Atterberg test, Casting – Control of casting slips- fluidity, thixotropy, specific gravity, contraction – wet to dry, dry to fired, wet to fired, modulus of rupture –vitrification – density – porosity – water absorption.

UNIT III TESTING FOR GLAZE


UNIT IV TESTING FOR REFRACTORIES


UNIT V QUALITY CONTROL


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
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.

OUTCOME
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 INTRODUCTION

UNIT II BODY FORMULATIONS
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
Manufacturing process & properties – whitewares at home – tableware, kitchenware, flame resistant ware, art ware, containers, construction – floor tile, wall tiles, sanitary ware, electrical – low tension insulators, high tension insulators, high frequency low loss insulators, industrial use – abrasion resistance, chemical resistance, heat resistance.
UNIT IV HEAVY CLAYWARE PRODUCTS

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.

UNIT V PROPERTIES & TESTING


TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES


CT8411 CERAMIC TESTING LAB

OBJECTIVE
To enhance the knowledge about the various testing procedures that can be done on a ceramic sample

OUTCOME
On completion of the course the students are expected to know
To know the principle, theory and working of the various equipments used in ceramic testing

To analyze the given ceramic sample and determine the characteristics of the sample

1. Particle Size Distribution by Screen Analysis
2. Particle Size Distribution by Hydrometer Method
3. Particle Size Distribution by Andreasen Pipette Method
4. IR Moisture Analysis
5. Pfefferkorn Test for Plasticity
6. Thixotropic Behaviour of Slurry by Torsion Viscometer
7. Glaze Testing by Autoclave
8. Cold Crushing Strength of Refractory.
9. Modulus of Rupture of Ceramic Body
10. Determination of Slip Specific Gravity

TOTAL : 45 PERIODS

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

OBJECTIVE

To enable the students to acquire technical skills on the various processing, fabrication and testing methods required for analyzing the ceramic sample.
OUTCOME

On completion of the course the students are expected to know

- To process the raw materials based on the fabrication method
- To test the samples based on the fabrication procedure.
- To prepare ceramic samples using the common fabrication techniques
- To carry out basic tests on a fabricated sample.

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.

Equipments Required:

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

TOTAL: 45 PERIODS
OBJECTIVE
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.

OUTCOME
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

UNIT II PLASTIC FORMING PROCESS

UNIT III DRY FORMING PROCESS
UNIT IV DRYING AND FINISHING

UNIT V FIRING
Action of heat on ceramic bodies – physical changes, chemical changes. Firing equipments, firing schedules – fast firing, firing range. Problems, defects. Liquid phase sintering, vitrification, microstructure control.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT8502 GLASS ENGINEERING – I

OBJECTIVE
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.

OUTCOME
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 OF GLASS 8

UNIT V TESTING AND QUALITY CONTROL

Flat glass defects – origin, characteristics. Container glass defects – origin, remedies. Test procedures for normal glass and coated glass.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CT8503 GLAZE TECHNOLOGY  L T P C 3 0 0 3

OBJECTIVE
To enable the students to have a complete knowledge about the importance of glazing and the processing and application of glazes.

OUTCOME
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


UNIT II RAW MATERIALS AND PROCESSING


UNIT III GLAZING TECHNIQUES AND SPECIAL GLAZES

Glazing techniques – dipping, pouring, spraying, brushing, dusting and other techniques-special glazes – matt glazes, snake skin glazes, crackled glazes, salt glazes and other glazes.

UNIT IV PROPERTIES AND DEFECTS

Glaze body reactions- interface layers- thermal characteristics- mechanical, optical and chemical properties of glazes - glaze defects and remedies- crazing, peeling, crawling, rolling, blisters, pin holes, dunting.

UNIT V DECORATION

Classification of decoration methods- advantages- different decorating techniques- painting, spraying, stenciling, stamping, printing, lithographic transferring, silk screen printing, dusting, engobing, liquid gold decoration and decoration techniques.

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES

CT8504 REFRactories- I  L T P C  3 0 0 3

OBJECTIVE
To enable the students to have a basic knowledge about the various types of refractories used in the industries.

OUTCOME
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.

UNIT I INTRODUCTION
UNIT II  SILICA REFRACTORIES  

UNIT III  ALUMINOSILICATE REFRACTORIES  
$\text{Al}_2\text{O}_3$ – $\text{SiO}_2$ phase diagram, - types of raw materials - different alumino silicate refractories – manufacturing steps – properties & applications.

UNIT IV  BASIC REFRACTORIES  
Manufacturing process - properties and uses of magnesite, forsterite, dolomite and chrome based refractories.

UNIT V  SPECIAL REFRACTORIES  

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
To enable the students to know the method to determine the elements present in the ceramic raw material.

OUTCOME
On completion of the course the students are expected to know
- To identify the various ceramic materials
- To know the experimental procedures to determine the various elements present in the given raw material

1. Alumino Silicate Materials
   - Silica
   - Alumina
   - Iron Oxide
   - Alkali Oxides

2. Alkaline Earth Oxides
   - High Silica Materials
   - Silica
   - Alumina
   - Iron Oxide
   - Alkali Oxides
   - Alkaline Earth Oxides

3. Feldspathic Materials
   - Silica
   - Alumina
   - Iron Oxide
   - Alkali Oxides
   - Alkaline Earth Oxides

TOTAL: 45 PERIODS
OBJECTIVE
To impart basic knowledge about glazing and the various application and testing procedures that can be done on a ceramic sample

OUTCOME
On completion of the course the students are expected to know

- To know the procedure to prepare a glaze slip
- To test procedures to test the suitability of the glaze slip
- To know the various methods of application of the glaze slip on the body

1. Preparation of Glaze Slip.
2. Fusion Studies.
3. Particle Size and Particle Size Distribution of Glaze.
8. Glost Firing.
12. Crazing Analysis.

Equipments Required:
1. Dilatometer
2. Pot Mill
3. Particle Size Analyser
4. Hot Air Oven
5. Furnace

TOTAL: 45 PERIODS

CT8601 GLASS ENGINEERING – II L T P C
3 0 0 3

OBJECTIVE
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.

OUTCOME
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, refractories used. Electric tank furnace – design & operation, electrodes used, electric boosting in tank furnace.

UNIT II OPERATION OF TANK FURNACE
Heating process – temperature distribution, efficiencies, heat balance, thermal insulation & cooling. Measurement and control – temperature, pressure, volume and fuel/air mixture,
glass level. Reversal, heating and cooling of glass furnace, hot repairs.

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

REFERENCES
OBJECTIVE
To enable the students to have a sound knowledge about the various types of refractories used in the various applications.

OUTCOME
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
Refractories used in - coke oven, blast furnace, open hearth furnace, LD converter, THF, EAF, IF, Ladle furnace, slide plate system, nozzle, shroud, continous casting, monolithics – gunning technique, refractory slag and metal interactions.

UNIT II    REFRACTORIES FOR NON FERROUS & NON METALLIC INDUSTRIES 9
Refractories in non ferrous industries – copper, aluminum, lead - Refractories in 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, throat, forehearth and roof of glass tank, regenerator systems, refractories for ceramic industry – kiln design – LTM concept, kiln furniture’s – types, properties, requirements – applications in different ceramic industry.
UNIT IV  REFRACTORIES FOR INSULATION

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

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

FT8651 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT  L T P C 3 0 0 3

OBJECTIVE
To introduce process economics and industrial management principles to chemical engineers.

OUTCOME
• 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.
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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE

• To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
• To help them improve their soft skills, including report writing, necessary for the workplace situations

2. Creating effective PPTs – presenting the visuals effectively
3. Using body language with awareness – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – sociability skills - questioning and clarifying skills – mock GD
8. Writing reports – collecting, analyzing and interpreting data – drafting the report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL 30: PERIODS

Requirements for a class of 30 students

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD’s and DVD’s on relevant topics
5. Individual chairs for conducting group discussions

REFERENCE BOOKS

EXTENSIVE READERS

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

CT8611 CREATIVE AND INNOVATIVE PROJECT

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

This will drive them to learn concepts, models, frameworks, and tools that Ceramic Engineer
need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.

Each student will choose problem related to research or industrial problem that has been difficult for them to “solve.” At the end of the semester, each student or group of students have to submit a report for evaluation.

TOTAL: 30 PERIODS
OBJECTIVE
To enrich the students with the raw materials, processing and testing methods available for glass

OUTCOME
On completion of the course the students are expected to know

- To formulate the glass batch with different composition
- To prepare ceramic samples of different compositions
- To prepare and carry out the various testing procedures on the glass sample.

1. Preparation of Soda Lime Glass
2. Influence of cullet size on melting behavior of soda lime glass.
3. Influence of cullet % 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.

Equipments Required
1. Sieve Shaker
2. Hot Plate
3. Hot Air Oven
4. Furnace

TOTAL : 30 PERIODS
OBJECTIVE
To enable the students to develop refractory compositions and to determine the various properties of refractories.

OUTCOME
On completion of the course the students are expected to know

- To identify the various ceramic materials to formulate refractory compositions
- To prepare and test the samples to determine the various properties of refractories.

1. Preparation of silica refractory of various compositions
2. Preparation of fire clay refractory with different percentage of grog
3. Preparation of high alumina refractories of various compositions.
4. Determination of density, porosity and strength of silica refractory.
5. Comparison of Properties of various compositions of fireclay refractories
6. Comparison of Properties of various compositions of high alumina refractories
7. Influence of shaping methods on physical properties of refractories.
8. Influence of firing temperature on the physical properties of refractories.
9. Preparation of insulating refractory with different pore formers
10. Determination and comparison of properties of different insulating refractories.
11. Comparing the characteristics of a dense and porous refractory.

Equipments Required:
1. Universal Testing Machine
2. Hot Plate
3. Extruder

TOTAL: 45 PERIODS
OBJECTIVE
To impart the fundamentals of ethics for budding scientists and engineers.

OUTCOME
on completion of the course the students are expected to have acquired basic ethical values required for professional conduct.

UNIT I  HUMAN VALUES

UNIT II  Engineering Ethics

UNIT III  Engineering as Social Experimentation
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study

UNIT IV  Safety, Responsibilities and Rights

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

TEXTBOOK

REFERENCES

Web sources
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

CT8701 ADVANCED CERAMIC PROCESSING 3 0 0 3

OBJECTIVE
To enable the students to have a thorough knowledge on the advanced processing techniques in ceramics.
OUTCOME
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

UNIT II FORMING
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
UNIT IV  ADVANCED SINTERING

Pressure assisted sintering – hot pressing and hot iso-static pressing. Reaction bonded sintering, microwave sintering.

UNIT V  MACHINING AND SURFACE FINISHING OF CERAMICS

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


CT8702  ADVANCED STRUCTURAL CERAMIC MATERIALS   L T P C

3 0 0 3

OBJECTIVE

To enable the students to have a thorough knowledge about the various ceramic materials used for structural applications.

OUTCOME

• 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.

UNIT II  CARBIDES

Structural characteristics, properties and applications of silicon carbide, boron carbide, tungsten carbide, titanium carbide.

UNIT III  NITRIDES

Structural characteristics, properties and applications of silicon nitride, boron nitride, titanium nitride, aluminum nitride.

UNIT IV  ADVANCED CERAMICS

Carbon compounds, borides, silicides, Sialon and cermets, high temperature superconducting oxides.

UNIT V  SINGLE CRYSTALS


TOTAL : 45 PERIODS

TEXT BOOKS
1. Mc Colm, Ceramic Science for Materials Technologists, Blackie & Sons Ltd., Glasgow, 1983.

REFERENCES
OBJECTIVE
To impart basic knowledge about the operating principle, theory and working of various advanced equipments available to test ceramic samples

OUTCOME
On completion of the course the students are expected to know
- To know the principle and working of the advanced equipments
- To know the procedure to evaluate the properties of the sample.

2. Thermal Analysis – TGA, DTA, DSC.
3. Determination of Viscosity by Brookfield Viscometer.
5. Microscopy – Optical, SEM.
6. Vicker’s Hardness.
7. Modulus of Rupture.
8. Modulus of Elasticity.
10. Surface Area Measurement – BET.

Equipments Required:
1. Spectrophotometer
2. Atomic absorption Spectrometer
3. Flame Photometer

TOTAL : 45 PERIODS
All the students have to undergo practical industrial training of six week duration in recognized establishments. 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.

OBJECTIVE
To train the students on systematic analysis of a problem and to enable them to bring out a solution it.

OUTCOME
• 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.
OBJECTIVE
To enable the students to have a basic knowledge about the types, manufacturing process, properties and applications of abrasives.

OUTCOME
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 back ups 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

UNIT V  BASICS OF GRINDING AND POLISHING

Grinding wheel – definition, abrasives chosen, grinding chips, chemical reactions, grade selection, wheel wear, chemical grinding aids. Grinding fluids – properties, types and purpose. Types of grinding – cylindrical grinding, centre less grinding, surface grinding, internal grinding. Polishing – definition, types.

TOTAL: 45 PERIODS

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

REFERENCES
OBJECTIVE
To enable the students to have a basic knowledge about the various types of refractories used in the industries.

OUTCOME
On completion of the course the students are expected to
- Have learnt the basics about refractories materials.
- Have a sound knowledge about carbon based refractory materials.
- Have learnt about properties and applications of insulation materials.
- Have learnt about the various Composite refractory materials.

UNIT I  INTRODUCTION
Basic advanced refractory materials – ternary and multiple mixtures, continuous particle size distribution, -Bonding mechanisms – direct bond and chemical bond

UNIT II  FUNDAMENTALS OF ADVANCED REFRACTORY MATERIALS
Study of relevant binary and ternary phase diagrams to understand the effect of impurities, minor additives, firing temperature and atmosphere and process control. Physical and thermomechanical properties of fired or heat treated refractories. Correlation of microstructure – properties of the above refractories

UNIT III  SUPER REFRACTORIES, REFRACTORY FIBERS AND INSULATION REFRACTORIES
UNIT IV COMPOSITE REFRACTORIES

Composite refractories: alumina-carbon, magnesia-carbon, Spinel, magnesia Hercynite-magnesia galaxite refractories - processing, property optimization through microstructural control and quality optimization

UNIT V SLIDE GATE AND BLACK REFRACTORIES

New generation slide gate refractories with improved performance-Alumina carbon alumina-silicon carbide- carbon, zirconia-carbon- Manufacture and use of carbon containing refractories - Black refractories - processing, property optimization through microstructural control and quality optimization

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CT8003 BIOCERAMICS

OBJECTIVE
To enable the students to have a sound knowledge about the applications of ceramic materials in biological field.

OUTCOME
On completion of the course the students are expected to
- Have learnt the various applications of ceramic materials in the medical field.
• Have a complete knowledge about the various calcium phosphate based ceramic materials along with the preparation, properties and applications.
• Have studied about the different bioactive glasses and glass ceramic materials.
• Have studied about the different bioactive composites.
• Have studied about the different bioactive coatings.

UNIT I  MATERIALS IN MEDICINE

UNIT II  CALCIUM PHOSPHATE CERAMICS

UNIT III  BIOACTIVE GLASSES AND GLASS CERAMICS
Surface active glasses, bioactive glass – preparation, mechanical properties, bonding mechanism to living tissue – interfacial bonding. Doped bioactive glasses. High strength bioactive glass ceramics – mechanical and biological properties, bone bonding mechanism, mechanism of surface apatite formation, compositional dependence.

UNIT IV  BIOACTIVE COMPOSITES
Hydroxyapatite composites with zirconia, alumina and titania – preparation and properties. SiC whisker reinforced hydroxyapatite and bioactive glass ceramics, zirconia toughened and bioactive glass ceramics, bioglass-hydroxyapatite composites, carbon composites.

UNIT V  BIOACTIVE COATINGS
Importance of bioactive coatings. Hydroxyapatite coated metal implants – coating methods, characterization and properties. Bioglass and bioactive glass ceramics coating over metals and alloys.
TEXT BOOKS

REFERENCES

CT8004 CALCULATIONS IN CERAMICS

OBJECTIVE
To enable the students to have a basic knowledge about the methods of calculating the various ceramic properties.

OUTCOME
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.

TEXT BOOKS  

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

OUTCOME
On completion of the course the students are expected to

- Have studied the raw materials, manufacturing process and mechanism of hydration of cement.
- Have learnt the tests done on cement and the quality control procedures.
- Have studied the different types of cements and their characteristics.
- Have learnt the types of aggregates and admixtures used for concrete making and the preparation of a concrete mixture.
- Have understood the different properties of concrete and the testing methods of the same.

UNIT I CEMENT

UNIT II TESTING AND QUALITY CONTROL OF CEMENT

UNIT III TYPES OF CEMENT
Types of Portland cement, blast furnace slag cement, trief cement, high alumina cement, white and coloured cement, oil well cement, hydrophobic cement, water proof cement, super sulphate cement, sulphate resisting cement.
UNIT IV CONCRETES


UNIT V PROPERTIES OF CONCRETE

Strength, permeability, creep, thermal expansion, shrinkage, moisture movement, penetration of X-ray, abrasion resistance, fire resistance, freeze-thaw resistance, electrical properties.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
To enable the students to have a sound knowledge about the different types of ceramic fibres, composites, their properties and applications.

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

UNIT III COMPOSITES
UNIT IV  PROPERTIES OF COMPOSITES

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.

UNIT V  WHISKERS

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.

TOTAL : 45 PERIODS

TEXT BOOKS


REFERENCES


CT8007  ELECTRONIC CERAMICS  L T P C

OBJECTIVE
To enable the students to know the basic concepts of ceramic materials used for electronic applications and their applications in various fields.

OUTCOME
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.

UNIT I  CERAMIC INSULATORS


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

CT8008 FUELS AND ENERGY ENGINEERING

OBJECTIVE
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.

OUTCOME
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


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


OBJECTIVE
To enable the students to have a thorough knowledge on the equipments involved in firing of a ceramic article and the temperature measurement methods.

OUTCOME
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   BURNERS AND FLAMES

UNIT II   FURNACES
Introduction, definition, classification – metal heating furnaces, reheating furnace, continuous furnace, sintering furnace, crucible furnaces, electric furnace, unit melters and smelters, muffle furnace, glass tank furnace.

UNIT III   FURNACE DESIGN
Factors for consideration, heating capacity, furnace design, heat economics, furnace atmosphere, draught establishment, chimney calculation, heat transfer, safety aspects.

UNIT IV   KILNS
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**

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**


**CT8010 MATERIALS MANAGEMENT**

**OBJECTIVE**

To enable the students to have a basic knowledge about importance of material management and its applications in various sectors.

**OUTCOME**

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.
• Have studied the importance of management in warehouse and stores.
• Have studied the importance of management in inventory.
• Have studied the concepts of different material procurement procedures.

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

CT8011 MECHANICAL BEHAVIOUR OF CERAMICS

OBJECTIVE
To enable the students to have a detailed understanding about the behaviour of ceramic materials with different mechanical properties.

OUTCOME
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


OBJECTIVE
To enable the students to the basic concepts about processing the ceramic materials in microwave atmosphere.

OUTCOME
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

CT8013  MONOLITHICS AND CASTABLES  L T P C
3 0 0 3

OBJECTIVE
To enable the students to have a sound knowledge about the types, properties and applications of monolithics and castables.

OUTCOME
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


UNIT III  MORTARS, COATINGS AND DRY VIBRATABLES


UNIT IV  MONOLITHIC INSTALLATION

Methods of installations of castables, plastic refractories, ramming mix 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

CT8014 NON DESTRUCTIVE TESTING LTPC 3003

OBJECTIVE
To enable the students to have a basic knowledge about the various non-destructive methods of testing.

OUTCOME
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 SURFACE NDT METHODS
Introduction- Definition of terms, discontinuities and defects/flaws- fracture mechanics concept of design and the role of NDT- life extension and life prediction- penetrant testing and magnetic particle testing - basic principle, limitations & advantages – development and detection of large flux – longitudinal and circular magnetization – demagnetization.
UNIT II  RADIOGRAPHIC TESTING


UNIT III  ULTRASONIC TESTING

Ultrasonic waves- velocity, period, frequency and wavelength- reflection and transmission-near and far field effects and attenuation- generation- piezoelectric and magnetostriction methods- normal and angle probes- methods of Ultrasonic testing- Principle of pulse echo method- Equipment – examples- rail road inspection, wall thickness measurement- range and choice of frequency.

UNIT IV  EDDY CURRENT TESTING

Introduction- principles of eddy current inspection- conductivity of a material- magnetic properties- coil impedance- lift off factor and edge effects- skin effect- inspection frequency- coil arrangements - inspection probes- types of circuit- Reference pieces- phase analysis-display methods-typical application of eddy current techniques.

UNIT V  OTHER METHODS


TOTAL: 45 PERIODS

TEXT BOOKS

OBJECTIVE
To enable the students to have a thorough knowledge about the importance of phase equilibrium and analyzing different systems.

OUTCOME
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 diagram

UNIT I INTRODUCTION

Introduction, phase, component, variable, Gibb’s phase rule, single component system – H₂O, SiO₂, iron, Hume Rothery’s rule; binary phase diagrams – eutectic, incongruent, solid solutions, complex diagrams.

UNIT II THERMODYNAMICS OF PHASE EQUILIBRIA

Introduction, criteria of phase equilibrium, criterion of stability, phase equilibria in single component system and multi component system; binary solutions – constant pressure system, constant temperature system, partially miscible system, immiscible system, liquid-liquid equilibrium diagrams, 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

Techniques for determining phase diagrams – dynamic, static, microscopic methods – optical, electron microscopy, X-ray methods, thermal analysis.

TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES


CT8016 PLANT EQUIPMENT AND FURNACE DESIGN

OBJECTIVE

To enable the students to have a sound knowledge about designing the layout of the plant and designing of furnaces.
OUTCOME
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.
TEXT BOOKS

REFERENCES

CT8017 PROCESS AUTOMATION

OBJECTIVE
To enable the students to have a basic knowledge about the control instruments and its applications in various fields.

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

OUTCOME
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 – OBJECTIVEs, 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
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

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.

CT8019  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
• Have learnt about the wear of refractory linings.
• Have a knowledge about basic principles of thermal design

UNIT I  INTRODUCTION

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

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


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

CT8020 SPECIAL COATING TECHNOLOGY L T P C 3 0 0 3

OBJECTIVE
To enable the students to have a complete knowledge about the advanced ceramic coating technology processes, properties and applications.

OUTCOME
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
Thermal, mechanical. Optical and chemical properties- hardness- wear and erosion resistance-high temperature properties- applications- defects and remedies.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

OBJECTIVE
To enable the students to have a thorough knowledge about the special applications of glasses in various fields.
OUTCOME
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

UNIT II OPTICAL GLASSES

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

UNIT V COATED GLASS
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

CT8022 THERMODYNAMICS FOR CERAMICS L T P C
3 0 0 3

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

OUTCOME
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 9

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


TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES

OBJECTIVE
To impart the fundamentals of nano science

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the basics of nano science.

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

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES
Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS
Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.
UNIT V CHARACTERISATION 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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999

MG8654 TOTAL QUALITY MANAGEMENT

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

OUTCOME
• To understand the various principles, practices of TQM to achieve quality.
• To learn the various statistical approaches for Quality control.
• To understand the TQM tools for continuous process improvement.
• To learn the importance of ISO and Quality systems
UNIT I  INTRODUCTION


UNIT II  TQM PRINCIPLES

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

UNIT III  TQM TOOLS & TECHNIQUES I


UNIT IV  TQM TOOLS & TECHNIQUES II


UNIT V  QUALITY SYSTEMS


TOTAL : 45 PERIODS

TEXT BOOK

REFERENCE BOOKS
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 stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

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

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

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

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to

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

TEXTBOOKS:

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

GE8073 HUMAN RIGHTS L T P C 3 0 0 3

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

UNIT I

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

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

UNIT V

TOTAL : 45 PERIODS

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

REFERENCES: