

Detail Syllabus of 2nd Year Even Semester B.Sc. Engineering

GCE2405 (Process Ceramics- I)

Lecture: 3 hrs/week, No. of Credit: 3.00

Particle Mechanics and Rheology:

Particle packing characteristics: Models of one, two of spherical balls, Gap grading, continuous grading.

Rheological behavior of slurries and pastes: Newtonian fluid, plastic flow, Dilatant liquid, Thixotropy, Deflocculation, Zeta potential, Effect of electrolytes on Zeta potentials, Applications in ceramic processings.

Beneficiation Process:

Comminution: Equipments, Milling, Particle size distribution.

Batching and mixing: Mixing mechanism and Mixing equipments, Particle separation, concentration and washing processes -Particle sizing, Filtration, Washing, Particle concentration processes.

Granulation: Direct granulation, Spray granulation.

Forming Processes:

Dry pressing: Powder flow and Die filling, Compaction behavior, Ejection and Transfer, Die wall effects, Control of compaction defects, Cold isostatic pressing.

Plastic forming: Extrusion, Jiggering, Jolleying.

Casting process: Slip casting, Tape casting, Gel casting.

Drying: Drying processes, Mechanisms in drying, Defects, Shaping, Surface finishing.

Glazing: Basic concept of glazing.

Firing: Firing system, Pre sintering processes, Sintering, Vitrification and Cooling.

GCE2407 (Principles of Materials Characterization)

Lecture: 3 hrs/week. No. of Credit: 3.00

Spectroscopic techniques: UV-visible, Infra-red, Atomic emission, Atomic absorption spectroscopy.

X-ray techniques: X-rays and their generation, Origin and characteristics of x-rays, Optical grating and diffraction of light, Crystals and diffraction of x-rays, Laue equations, Bragg's law, X-ray diffraction experiment, Powder methods, Single crystal method, Structure of sodium chloride crystal from X-ray studies. Avogadro's number from crystal dimension, Radius ratio, effect of ion size on crystal geometry, X-ray fluorescence.

Microscopic methods: Sample preparation, Principle and Method of Optical microscopy, SEM, TEM, AFM, STM etc.

Microstructure analysis: Sample preparation, Characterization, Quantitative Analysis.

Thermal techniques: Sample preparation, Principle and Method of TGA, DTA, DSC.

Non-destructive testing: Radiography, Ultrasonic, Eddy current, Magnetic particles, and Dye penetration.

Mechanical Testing: Tensile strength, Hardness test, Impact strength.

GCE2409 (Solid State Chemistry)

Lecture: 3 hrs/week, No. of Credit: 3.00

Diffusion: Fick's law, solution of Fick's law for a few boundary conditions, Variation of diffusivity with composition, Choice of reference frame for diffusion, Limitations of Fick's law in binary systems, Diffusion in multicomponent systems.

Solid Solution: Ordered and disordered solid solutions, Substitutional solid solutions, Interstitial

solid solutions, Requirements for solid solution formation, More complex solid solution mechanisms, Experimental methods for studying solid solutions.

Solid State Reaction: General principles, Experimental procedure, Coprecipitation as a precursor to solid state reaction, Other precursor methods, Kinetics of solid state reaction.

Preparative Methods of Materials: Crystallization of solutions, Melts, Glasses and Gels, Vapor phase transport methods, Modification of structures by ion exchange, Electrochemical reduction methods, High pressure and Hydrothermal methods.

Growth of Single Crystals: Czochralski method; Bridgman and Stockbarger methods, Flux methods, Epitaxial growth, Verneuil flame fusion method, Vapor phase transport.

Ionic Conductivity and Solid Electrolytes: Typical ionic crystals, Solid electrolytes, Conductivity measurements, Other experimental techniques, Application of solid electrolytes.

Electronic Properties and Band Theory: Electronic structures of solids-band theory, Refinements to simple band theory-k space and Brillouin zones, Band structures of metals, Insulators, semiconductors, Inorganic solids, Color in inorganic solids.

ME2417 (Thermodynamics, Heat and Mass Transfer)

Lecture: 3 hrs/week, No. of Credit: 3.00

Fundamental Concepts of Thermodynamics: Basic concepts and definitions, Thermodynamic systems, Property and state, Cycle - thermodynamic processes Thermal equilibrium and Zeroth law.

First Law of Thermodynamics: Corollaries, Internal energy and Enthalpy.

Pure Substance: Properties of water & steam, Control volume energy analysis: conservation of mass & energy.

Mixtures of Gases & Vapors: Psychometrics, Real gases.

Study of Steam Generating Units: Introduction, Accessories and mountings, Performance study of steam generator, Steam engines.

Heat Transfer: Thermal properties of materials, Modes of heat transfer. By Conduction: Fourier's law, Compound resistance in series, Steady and unsteady state heat conduction.

By Convection: Natural and Forced convection, Counter current and parallel current flows, Heat transfer by forced convection in turbulent flow, Analogy between transfer of heat and momentum.

Mass Transfer: Introduction, Co-efficient of mass transfer, Fick's law of diffusion in solid, liquid and gases, Equimodal diffusion Mass diffusivity, Mass transfer in non-stationary media.

Material Balance: Process classification, Types of balances, Principles, procedure and Calculation of materials balance.

Energy Balance: Forms of energy, Energy balance on closed and open systems at steady state, Calculation of differential energy balance.

Math2413 (Engineering Math-III)

Lecture: 3 hrs/week, No. of Credit: 3.00

Fourier's Series: Fourier's Series associated with a function, Convergence of Fourier's Series, Dirichlet's conditions, Fourier's Series for odd & even functions, Half range Fourier series.

Fourier Transform and its properties, Fourier sine and cosine transform, Inversion formulas, Convolution Theorem.

Numerical Methods: Solution of algebraic equation: Bisection method, Regula-Falsi method, Newton- Raphson method. Solution of a system of linear equations: Gauss Jacobi, Gauss Seidal Iterative methods, Solutions of ordinary differential equations: Taylor series method, Euler method, Runge Kurta method, Predictor-corrector method.

Elements of Probability and Statistics: Random Experiments, Events (simple and compound), Sample sources, Axioms of probability and Associated results of classical definition, Conditional

probability, Independent events, Baye's formula. Random variable (discrete and continuous), Probability mass function, Probability distribution function, Distribution function, Special distribution: Binomial, Poisson, Normal.

Statistics: Population, Sample, Statistics, Parameters, Estimation (point and interval estimate).

Hypothesis: Null hypothesis, Alternative hypothesis, Critical regions, Testing of hypothesis, Type-1 error, Power of a test. Hypothesis testing for mean and standard deviation (sample drawn from $N(\mu)$, population).

Power Series Method: Bessel's equation, Bessel function, Legendre's equation, and Legendre polynomial, Application of Bessel function especially in heat transfer & mechanics.

GCE2406 (Process Ceramics- I Sessional)

Sessional: 3hrs/week, No. of Credit: 1.50

Sessional based on **GCE2405**

GCE2402 (Chemical Analysis of Glass and Ceramic Materials Sessional)

Sessional: 3hrs/week, No. of Credit: 1.50

Estimation of SiO_2 , Fe_2O_3 , Al_2O_3 , CaO and MgO in Dolomite; Estimation of SiO_2 , Fe_2O_3 , Al_2O_3 , CaO and MgO in Limestone; Quantitative analysis of Bauxite; Analysis of Sea Water Magnesia; Analysis of Fireclay; Analysis of Firebrick; Analysis of Kyanite; Quantitative analysis of Talc; Analysis of Soda-lime-silicaglass; Analysis of Water Glass; Determination of insoluble portion in Portland cement; Determination of Free Lime content in Portland Cement; Complete analysis of Portland Cement; Determination of $\text{Na}_2\text{O}:\text{B}_2\text{O}_3$ in Borax; Rapid estimation of silica in glass sand and glass.

ME2418 (Thermodynamics, Heat and Mass Transfer Sessional)

Sessional: 1.5 hrs/week, No. of Credit: 0.75

Sessional based on **ME2417**

GCE2400 (CAD-CAM)

Sessional: 3 hrs/week, No. of Credit: 1.50

Computer Aided Drawing: Use of interactive menu-driven software for preparation of line drawings, Graphic coordinate system. Commands for draw, Erase, Move, Rotate mirror, Hatch etc, Blocks and Layers, Dimensional drawing files, Saving, Editing and Plotting.

Production Drawing: Machine drawing, Study of part drawing, Study of assembly drawing, Preparing complete working drawing (detail and assembly) from exploded pictorial and actual machines, Dimensioning with tolerances, Notes etc. Representation of Conventional features (threads, fasteners, gear, spring, their specification) & drawing, Basic concept of Adobe illustrator and Solid work.