Syllabus of

UNDERGRADUATE DEGREE COURSE

B.Tech. V Semester

Ceramic Engineering

Rajasthan Technical University, Kota

Effective from session: 2019 – 2020

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- V Semester: B. Tech. (Ceramic Engineering)

5CR3-01: Polymer Science & Engineering

Credit 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Chemistry of high polymers:** Degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness, Polymerization methods: addition, condensation and other newer techniques, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, azeotropic copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension, emulsion.	6
3	**Polymer Characterization:** Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights. polymercrystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.	5
4	**Synthesis and properties:** Thermoplastics polymers: PE, PP, PS, PVC, Polyesters, Acrylic, PU polymers, Engineering Plastics: Nylon, PC, PBT, PSU, PPO, ABS, Fluor polymers, Engineering Plastics: Nylon, PC, PBT, PSU, PPO, ABS, Fluor polymers, Thermosetting polymers: PF, MF, UF, epoxy, unsaturated polyester, alkyds, natural and synthetic rubbers: recovery of NR hydrocarbon from latex, SBR, nitrile, CR, CSM, EPDM, IIR, BR, silicone, TPE.	5
5	**Polymer Technology and Rheology:** Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, cross-linking and vulcanization. Newtonian and non-Newtonian fluids, flow equations, dependence of shear modulus on temperature, molecular/segmental deformations, Measurements of rheological parameters. Visco-elasticity-creep and stress relaxations, control of rheological characteristics, rubber curing in parallel plate viscometer, ODR and MDR.	4
6	**Polymer processing and testing:** Different types of molding, thermoforming, rubber processing in two-roll mill, internal mixer, Mechanical & electrical testing of polymers, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.	5
	Total	26

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- V Semester: B. Tech. (Ceramic Engineering)

5CR4-02: Properties of Ceramic Materials-I

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Thermal Properties:** Introduction, heat capacity, density and thermal expansion of crystal, thermal expansion, density and thermal expansion of glasses. Effect of heat treatment, thermal expansion of composite bodies, effect of polymorphic transformation.	5
3	**Thermal & Compositional Stresses:** Thermal expansion & thermal stresses, temperature gradient & thermal stresses, micro-stresses, glaze stresses. Thermal shock, resistance to thermal shock & thermal spalling, thermally tempered glass, annealing, and chemical strengthening.	5
4	**Thermal Conduction Processes in Phonon :** Phonon conductivity of single phase crystalline, temperature dependence, influence of structure and composition of pure materials, boundary effect, impurities and solid solutions, effect of boundaries, conductivity of multiphase ceramics. Phonon conductivity of single-phase glasses, temperature dependence of glass conductivity, effect of compositions, photon conductivity, photon mean free path, temperature dependence.	7
5	**Viscous Flow,Plastic Deformation, and Creep:** Introduction, plastic deformation, creep deformation, viscous deformation. Plastic deformation: of rock salt, fluorite crystal and Al2O3, creep ofsingle crystal and polycrystalline ceramics.	4
6	**Elasticity, Anelasticity and Strength:** Fracture process, elastic deformation & elasticity, elastic moduli, anelasticity behavior, brittle fracture & crack propagation. Theoretical strength: Griffith-Orwan criteria, statistical nature of strength, strength & fracture surface, static fatigue, creep fracture, effect of microstructure.	6
	Total	28

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- V Semester: B. Tech. (Ceramic Engineering)

5CR4-03: Material Science & Engineering

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Nano-Science:** Meaning of nano-particle, metal nano-clusters: magic numbers, theoretical modeling of nano-particles, geometric structure, electronic structure, reactivity, fluctuations, and magnetic clusters. Carbon, Diamond, Graphite, Fullerenes Carbon Nano tubes- methods of synthesis: R F plasma, chemical methods, thermolysis, pulsed laser methods.	8
3	**Polymer Structure:** Hydrocarbon Molecules, Polymer Molecules, Chemistry of Polymer molecules, Molecular weight, shape, Structure & Configuration. Polymer 2: Thermoplastic & Thermosetting Polymers, Co- Polymers, Polymer Crystallinity, Polymer Crystals, Defects in Polymers, Diffusion in Polymeric materials.	8
4	**Polymer's Characteristics, Applications, & Processing:** Stress – Strain behavior, Macroscopic Deformation, Viscoelastic Deformation, Viscoelastic Relaxation Modulus, Viscoelastic Creep, Fracture of Polymers, Characteristics polymers Viz Impact Strength, Fatigue, Tear Strength, Hardness. Mechanism of Deformation strengthening, Crystallization, Melting & Glass Transition Phenomena in Polymers Polymer types, Polymer synthesis & Processing, Polymer's applications.	9
5	**Composites:** Introduction, Particle reinforced composites: Large Particle composites, Dispersion strengthened Composites. Fiber Reinforced Composites: Influence of Fiber length, Fiber orientation, Applications. The fiber phase, The matrix phase, polymer matrix, metal matrix, ceramic matrix, carbon– carbon, hybrid composites, processing of fiber reinforced composites, structural composites.	8
6	**Corrosion & Degradation Of Materials:** Corrosion of Metals: Electro Chemical Consideration, Electrode Potential, Corrosion Rates, Passivity, Environmental effects, Forms of Quotation, Corrosion environments, Corrosion prevention: Corrosion prevention, Oxidation, Corrosion of Ceramic materials & Degradation of Polymers.	8
	Total	42

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- V Semester: B. Tech. (Ceramic Engineering)

5CR4-04: Electro Ceramics

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Ceramic Capacitors:** Historical Background, Ferro Electricity in Capacitors Technology, Dielectric Properties of Multi-Phase systems, Basic Dielectric Materials, Varieties of Ceramic capacitor, Capacitor performance Parameters, Packaging of Ceramic Capacitors, Typical Ceramic Dielectric Compositions	6
3	**Piezo-electric and Electro-optic Ceramics:** Piezoelectric Ceramic, Ferroelectric ceramic, Electro optic Ceramic, Composition, Processing & Properties, Applications of Piezoelectric &Electro optic ceramic	5
4	**Magnetic Ceramics:** Spinal ferrites, Hexagonal ferrites, Rare earth Garnet, Processing & application in various fields	5
5	**Ceramic Sensors:** Theory & Transducer classification, Transition from theory to Practice, Future Prospects,Thermo-physical Properties : Thermo-physical Properties	5
6	**ZnOVaristors:** Varistors electrical characteristics, Varistor's Microstructure & Fabrication,Varistors equivalent circuit, Mechanics of Varistors behavior, Varistors applications.	5
7	**Ionically conducting ceramics:** Kroger Vink Notation used for atomic defects, formulation of reaction equations, defect equilibria and Kroger-Vink diagrams for different systems,Diffusion: Diffusion in stoichiometric and nonstoichiometric oxides.	6
8	**Superconductivity:** Superconductors, Meissner effect, types of superconductors, BCS theory for superconductivity, Synthesis, characteristics and applications of High Tc superconductors.	5
9	**Thick Film Technology:** Initial materials, processing, conductors, dielectrics, resisters, hybrids.	4
	Total	42

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- V Semester: B. Tech. (Ceramic Engineering)

5CR4-05: Refractory-I

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Definition of refractory, properties of refractories, classification of Refractory, Ingredient of refractory, manufacturing process and unit operation.	6
3	**Manufacture, properties, and application:** silica, high alumina, dolomite, Magnesite, zircon, zirconia refractory, fusion cast refractory, ceramic fiber and heat insulating refractory.	7
4	**Composite Refractories:** Alumina-carbon, magnesia-carbon, spinel, alumina-silicon carbide- carbon, zirconia-carbon.	6
5	**Properties and Measurement:** Chemical analysis, mineralogical analysis by X-ray diffraction, microscopic examination, bulk density and apparent Porosity, true density and true porosity, fusion point, permeability, cold crushing strength (CCS), refractory under load (RUL), hot modulus of rupture (H-MOR), pyrometric cone equivalent (P.C.E.), creep behavior, abrasion resistance, thermal shock resistance, thermal conductivity, thermal expansion and spalling, slag resistance.	8
6	**Refractory Applications:** Blast furnace refractories, refractories for steel making, ladle refractories, refractories for aluminum, copper industries, refractories for the refineries and circulating fluid beds, Refractories in cement industries, refractories in glass industries, petrochemical Industries.	8
7	**Reaction of Refractory:** slag, glasses, carbon monoxide, acids, alkalis, flue gases, corrosion of regenerator's refractory by flue gases.	4
	Total	40

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- V Semester: B. Tech. (Ceramic Engineering)

5CR4-06: Pottery & Heavy Clayware Ceramics

Credit 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Red Clay (Terracotta) Technology-** Pre-historic back ground, raw-materials & their types, physical & chemical properties. Clay processing & body mixes, fabrication techniques for different red clay products. Drying & firing, kilns & Kiln construction. Classification of red clay (Terracotta) products and their qualities, common building bricks, roofing tiles. Value up-gradation of red clay products. Glazes & Glazing. Firing & Decoration techniques for red clay products.	8
3	**Plastic & Non Plastic Raw materials-**Clays geology & mineralogy, Ries classification, properties of clays- adsorption, cation exchange, flow properties, thixotropy, plasticity, permeability, green shrinkage & strength, fired shrinkage &strength;talc& steatite, pyrophyllite, silicon atom & its building silica, feldspar, nephelinesyenite, sillimanite, bone ash, wollastonite other fluxes-Li, Na, K, Mg, Ca, Ba &B compounds. Water, deflocculates, flocculants, organic binders, lubricants and sticking agents, drying aids, plaster of paris (POP).	9
4	**Winning & Purification of Clays:** Mining & winning of clays; china clay, sedimentary clays, machinery used in clay mining, treatment of clays.	5
5	**Action of Heat on Ceramic Raw-Materials:** changes, non-altering chemical composition, changes altering chemical composition, incomplete & complete reaction, melting, crystallization& glass formation, structure of glasses & glazes, phase diagram in ceramic bodies.	6
6	**Ceramic Bodies:** Composition of ceramic bodies, brick wares, stoneware, fine stoneware, white stoneware, electrical stoneware, earthenware, vitreous china, soft porcelain, bone china, hard porcelain, chemical porcelain, electrical porcelain.	7
7	**Methods of Fabrication:** Throwing, jiggering and jollying, soft plastic methods, extrusion methods, stiff-plastic methods.	4
	Total	40

5CR4-21: Electro Ceramics Lab

Credit 1.5 **Max. Marks: 75(IA:45, ETE:30)**
0L+0T+3P **End Term Exam: 3 Hours**

1. Preparation of barium titanate based ceramic compositions by solid state method.
2. Preparation of spinel ferrite by ceramic method.
3. Measurement of permeability on ferrite toroid.
4. Study and operation of hydraulic press and determination of green density.
5. Measurement of ionic conductivity of a ceramic solid electrolyte.
6. Determination of Curie temperature for a ferroelectric material.
7. Measurement of electric conductivity of ceramic samples by two probe and four probe method.
8. Study of PTC and NTC behaviour.

5CR4-22: Refractory Lab-I

Credit 1.5 **Max. Marks: 75(IA:45, ETE:30)**
0L+0T+3P **End Term Exam: 3 Hours**

1. Determination of size of refractory brick,
2. Determination of apparent porosity and true porosity of given refractory.
3. Determination of bulk density.
4. Determination of true density of given refractory.
5. Determination of Hot Modulus of Rupture (H-MOR) of refractories.
6. Determination of spalling resistance,
7. Determination of cold crushing strength.
8. Determine RUL of given refractory.
9. Determination of Modulus of Rupture (MOR)of refractories.
10. Determination of thermal expansion behavior of refractory sample.

5CR4-23: Pottery & Heavy Clayware Lab

Credit 1 **Max. Marks: 50(IA:30, ETE:20)**

0L+0T+2P **End Term Exam: 2 Hours**

1. Quantitative chemical analysis of tri-axial porcelain body.
2. Making of ceramic body mixes and determination of plasticity.
3. Study and operation of De-airing Pug Mill and preparation of extruded body.
4. Determination of dry linear shrinkage and fired shrinkage of ceramic body mixes.
5. Determination of tensile strength of Insulator.
6. Determination of porosity of heavy clay ware.
7. Shaping of articles by throwing.
8. Shaping of articles by jigger and jollying.
9. Shaping of articles by slip casting.
10. Shaping of articles by pressing.

Syllabus of

UNDERGRADUATE DEGREE COURSE

B.Tech. VI Semester

Ceramic Engineering

Rajasthan Technical University, Kota

Effective from session: 2019 – 2020

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- VI Semester: B. Tech. (Ceramic Engineering)

6CR3-01: Data Base Management System

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Introduction, need, purpose and goals of DBMS.DBMS architecture, concept of keys, generalisation and specialization. Introduction to relational data model, ER Modeling, relational algebra.	6
3	Conceptual data base design, theory of normalization. Primitive and composite data types, concept of physical and logical databases. Data abstraction and data independence,. Relational calculus	5
4	DDL and DML. Constraints assertions, views, data base security. Application Development using SQL: Host language interface, embedded SQL programming. GL's, Forms management and report writers. Stored procedures and triggers.	5
5	Physical data organization in sequential, indexed, random and hashed files. Inverted and multilist structures.	4
6	Transaction processing, concurrency control. Transaction model properties and state serializability. Lock base protocols, two phase locking, Log based recovery Management.	5
	Total	26

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- VI Semester: B. Tech. (Ceramic Engineering)

6CR4-02: Glass & Glass Ceramics

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Glass:** Definition of glass, model of glass structure, types and composition of glass, Glass constituents and batch ingredients, decolourisers and refining agents, batch calculation, batch preparation.	6
3	**Glass melting:** Fundamental of glass formation, factors that influence glass formation, Zachariasen's rules, kinetic & thermodynamic criteria for glass formation, nucleation and crystal growth, TTT diagram, structural models of silicate and non-silicate glasses, bridging and non-bridging oxygen, tank furnaces, feeding of glass batches, melting process, refining of glass, batch redox number, electric heating, cold top furnace, pot melting.	7
4	**Quality control of glasses:** control of compositions, measurement of density, thermal expansion, viscosity, liquid immiscibility and phase separation in glasses structural theories of liquid immiscibility, thermodynamics of liquid immiscibility, mechanism of phase separation, chemical durability of glass. Fabrication: pressed and blown wares, flat glass, tubing and bulbs, fiber glass.	8
5	**Defect:** Defect in glass, stones, seeds, cords and blisters, gas inclusion, entrapped gas in batch, decomposition of batch materials, bubbles from refractory, nucleation and growth of bubbles from a supersaturated, detection of gases contained in bubble, detection of vitreous inclusions, removal of vitreous inclusion, crystalline inclusion, batch stones, refractory inclusion.	7
6	**Glass–Ceramics:** Definition, production of glass-ceramics, description & application of various glass ceramics, types of glass ceramic; photosensitive lithium aluminum silicate, magnesium aluminum silicate, machinable glass ceramics, bio-active glass ceramics, sintered glass ceramics.	6
7	**Special Glasses:** Technology of making radiation shielding glasses, heat absorbing glasses, solder glasses. Optical properties of glass, optical glass, photosensitive glasses, coating of glass, colored glass including photochromic and electrochromic glass.	5
	Total	40

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- VI Semester: B. Tech. (Ceramic Engineering)

6CR4-03: Ceramic Coating-Enamel & Glazes

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Enameling:** Brief description of raw materials used in enamel. Batch calculations of frit making, milling and slip preparation, preparation of metal parts, and applications of slip. Firing process, colored enamels, properties and defects of enamel coating.	7
3	**General information on Glaze:** Nature, origin and importance of ceramic glazes, ceramic glazes as a glassy state. Properties of glass, composing and optimization of glazes.	8
4	**Raw Materials:** Raw materials for acidic oxides, basic oxides, for simultaneously introducing basic oxides & acidic oxides, for amphoteric oxides. Auxiliary materials for opacifiers, binders, fixingagents, water as a glaze component, toxicity of raw materials, adhesive agents & stabilizers, selection of raw materials.	8
5	**Technology of Glaze:** Seger formula, glaze calculation based on pure raw materials and based on fritted glaze and mill additives, application of glazes, firing of glazes, cooling & tensions inglaze layer, coloring of glazes, molecular, colloidal and glaze staining, decolorization of glazes, matting of glazes, pacification of glazes.	8
6	**Classification of Glazes:** Classification, The nature of glazes, general properties of glazes based on body to be glazed, based on glaze composition.	8
	Total	40

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- VI Semester: B. Tech. (Ceramic Engineering)

6CR4-04: Properties of Ceramic Materials-II

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Electrical Conductivity 1:** Electrical conduction phenomena, ionic conduction in crystal, Nernst- Einstein equation for diffusion and conductivity in ionic solids, applications of ionic conductors, electronic conduction in crystals, ionic conductance in glasses, absorption current, electrode polarization.	8
3	**Electrical Conductivity 2:** Temperature dependence, effect of composition, mix alkali effects, electronic conduction in glasses, non-stoichiometric, solute-controlled electronic conduction, band structure of zinc & copper oxide, valency controlled semiconductors, mixed conductors in poor conductors, polycrystalline ceramics.	8
4	**Dielectric Properties:** Electrical phenomena, dielectric constant of crystal & glasses, dielectricloss factor for crystal & glasses. Dielectric conductivity, poly crystalline & poly face ceramics, dielectric strength, ferro-electric ceramics.	8
5	**Magnetics Properties Phenomena:** Origin of interaction in ferrimagnetic materials, direct exchange interaction and super exchange interactions, double exchange Interaction. Ferrites; spinal ferrite, rare earth garnet and hexagonal ferrites, polycrystalline ferrites, effects of composition & grain size & porosity on the magnetic behavior.	8
6	**Optical Properties:** Electromagnetic waves in ceramics, refractive index & dispersion, reflection & refraction, scattering, refractive Index & dispersion in dielectric materials, boundary reflectance & surface gloss. Opacity & translucency, absorption & color, bands, color, Ligand-Field chemistry, colorants, ceramic stains, color specifications, lasers, phosphors, fiber optics.	8
	Total	41

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- VI Semester: B. Tech. (Ceramic Engineering)

6CR4-05: Refractory-II

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam:3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Introduction to monolithic refractories, advantages and disadvantages; classifications based on application techniques.	7
3	**Bonding Systems and Additives:** Various bonding systems, CaO-Al2O3 system, hydration of calcium aluminates, bonding mechanism of different binders, various additive systems; refractory castables and details of Conventional Castables	8
4	**Castables:** Low Cement Castables, Ultra Low Cement Castables, No Cement Castables, Self-Flow Castables, other monolithics like mortar, gunning mass, spraying mass, ramming mass, dry-vibratables, pumpable castables.	8
5	**Manufacturing:** Machinery and equipment for making unshaped refractories, chemical constituents and purity; raw materials and their selection, particles size distribution, discrete and continuous particle size distribution, Furnas, Andreassen-Andersen and Dinger-Funk model; batch preparation, mixing, processing and manufacturing.	8
6	**Properties & Application:** Installation techniques, application, properties and specialties of different castables systems, like alumina, alumina - magnesia, alumina spinel, magnesia, magnesia carbon, etc	8
	Total	40

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year- VI Semester: B. Tech. (Ceramic Engineering)

6CR4-06: Engineering Ceramic & Abrasives

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Advanced ceramics for engineering application**-reliability consideration, toughening of Si-based ceramics by fiber reinforcement, laminated composite structure with enhanced fracture resistance. Carbide and nitride, ceramic bearing.	8
3	**Sialon** and other ceramics engineering applications, power generation, aerospace application, nuclear reactor. Ceramics for tribological application, ceramic cutting tools, porous ceramics and ceramic fibers.	9
4	**Ceramic materials** for energy system, extruded cordierite honeycomb ceramics for environmental application, ceramic matrix composite, intelligent ceramics, and decorative ceramics.	6
5	**Abrasive:** Abrasive operations, natural abrasives, abrasives like aluminum oxides, silicon carbide, diamond and boron nitride. Miscellaneous synthetic abrasives.	8
6	**Raw materials for abrasives,** their proportioning, processing, manufacture of abrasives, grinding wheels, their drying, firing and testing. The use of abrasives and grinding wheels in grinding, evaluation of abrasives products, loose abrasives operations, chemistry of grinding.	8
	Total	40

6CR4-21: Glass & Glass Ceramic Lab

Credit: 2 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+4P **End Term Exam: 3 Hours**

1. Batch calculation and preparation of soda-lime-silicate glass.
2. To prepare iron and cobalt doped colored glass.
3. Preparation of glass fiber and determine the softening point of given glass fiber.
4. To determine the coefficient of viscosity of the given glass sample.
5. To measure the chemical durability of glass by BIS method.
6. To determine the hardness by Rockwell method.
7. To determine the dielectric constant of given glass sample.
8. Chemical analysis of ordinary soda-lime-silicate glass.
9. Measurements of density of given glass sample by Archimedes Principle.
10. To determine thermal expansions of given glass sample.
11. Preparation of any one glass ceramic sample.

6CR4-22: Ceramic Properties Lab

Credit: 2 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+4P **End Term Exam: 3 Hours**

1. Dimensional analysis of ceramic products.
2. Determination of whiteness of ceramic materials.
3. Testing the ceramic sample for crazing test as per BIS standard.
4. The reflectance test of various tiles.
5. Determine the tensile strength of a given ceramic product.
6. Determine the compressive strength of a given ceramic product.
7. Study the dielectric properties for ceramic capacitor using LCR meter.
8. Determination of Impact strength of given ceramic sample.
9. Determination of bending strength by three point bending methods of a given ceramic specimen.

6CR4-23: Ceramic Coating Lab

Credit: 2 **Max. Marks: 100(IA: 60, ETE:40)**

0L+0T+4P **End Term Exam: 3 Hours**

1. Preparation of enamel batches, melting, fritting.
2. Preparation of iron sheet for enameling.
3. Preparation & application of enamel on iron sheet.
4. Testing of the enamel led plate for acid resistance as per BIS Standards.
5. Preparation & application of stoneware glaze.
6. Preparation & application of insulator glaze.
7. Preparation & application of bone china glaze.
8. Preparation & application of terracotta glaze.
9. Study & description of defects in glazes.
10. Determination of chemical analysis of glaze frit.