# SARDAR PATEL UNIVERSITY
## VALLABH VIDYANAGAR

## Course: M.Sc. ( Nano Sci. & Nano Tech)

## III Semester

**Structure with effect from: 2018-19**

**SARDAR PATEL UNIVERSITY**

**M. Sc. Programme : Nano Science. & Nano Technology**

**Structure with effect from: 2018-19**

**Semester:-III[rd]**

| Course Type | Course Code (10 Digit) | Name of Course | Theory (T) / Practical (P) | Credit | Contact Hrs/week | Exam Duration in hrs | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Internal | External | Total |
| | | | | | | | Total/Passing | Total/Passing | Total/Passing |
| Core Courses | PS03CNST21 | GLASS CERAMICS AND NANOSTRUCTURED MATERIALS | T | 4 | 4hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| | PS03CNST22 | Special Purpose Polymers | T | 4 | 4hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| | PS03CNST23 | Modern Characterisation Techniques | T | 4 | 4hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| Elective Courses (Any One) | PS03ENST21 | Nanomaterials and Environment | T | 4 | 4hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| | PS03ENST22 | Composite Materials | T | 4 | 4hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| Core Courses | PS03CNST24 | Practicals I | P | 4 | 12hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| | PS03CNST25 | Practicals II | P | 4 | 12hrs | 3hrs | 30/10 | 70/28 | 100/40 |
| | PS03CNST26 | Comprehensive Viva | T/P | 1 | 1hrs | - | - | 50/20 | 50/20 |

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**SYLLABUS EFFECTIVE FROM: 2018-19**

**Syllabus for M.Sc. (Nano Science & Nano Technology)**

**Semester : III**

**Subject Code: PS03CNST21** **Total Credit: 04**

**Subject Name: GLASS CERAMICS AND NANOSTRUCTURED MATERIALS**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| 1 | Polycrystalline ceramics, various types of ceramics, phase diagrams, raw materials, fabrications science of ceramics, principles of main fabrication techniques, drying, firing, sintering, reaction sintering, control of nanostructures in Ceramics. Crystalline structures, properties of fabricated bodies density, porosity, permeability, strength, thermal properties thermal shock theory. | 25% |
| 2 | **Types of ceramics and types of glass ceramics , processing , steatite, Mullite, Advanced Ceramics oxides and non-oxides silicon carbide, silicon nitride, borides carbides etc.** | 25% |
| 3 | **Properties and Application of ceramics and glass, refractories ,thermal properties , density , porosity, permeability, mechanical properties, optical properties,** | 25% |
| 4 | Carbon nanostructures, Fullerene, carbon clusters, carbon nanotubes – development, structures, properties Porous structure, ordered mesoporous, Random mesoporous structure, crystalline microporous materials. | 25% |

**Reference Books :**


1. Science of Engineering Materials – Manas Chanda
2. Ceramic Science for Materials Technologysts – I. J. McColm.
3. An Introduction to carbon science – Herry Marsh
4. Industrial Ceramic – F. Singer, S. Singer.
5. Carbon Science- C. L. Mantel

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**Course: M.Sc. Subject: Nano Science & Nano Technology**

**Structure with effect from: 2018-19**

**Semester : III[rd]**

**Subject Code: PS03CNST22** **Total Credit: 04**

**Subject Name: SPECIAL PURPOSE POLYMERS**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| 1 | Synthesis, properties and application of selected thermoplastic and thermosetting resins such as polyolefins, Vinyl resins, Polystyrene, Polyesters, epoxy, phenolic, amino and silicon resins. Additives for plastics. Processing technologies like, extrusion, injection molding, thermoforming, blow molding, calendering, rotational molding, machining of plastic, selected plastic mechinary designs theory and quality control. | 25% |
| 2 | Elastomeric materials, natural rubber, selected synthetic rubbers, thermoplastic elastomer and reclaimed rubber. Processing technologies of rubbers, additives for elastomers, rubber compounding and processing technology, sulfur vulcanisation, theory of sulfur vulcanization & accelerator action, non-sulphur vulcanization, accessment of processability & state of cure, hard rubber, latex technology, some major rubber products. | 25% |
| 3 | Commercial fiber forming polymers like poly (ethylene terephthalate), Nylon 6, 66, acrylics, polypropylene, elastomeric fibers, polyvinyl chloride, and aramid fiber. | 25% |
| 4 | Fiber spinning techniques, melt spinning, wet and dry spinning, spin finishes, and basic post spinning operations, identification, testing and evaluation of polymers and fibers. | 25% |

**Reference Books :**


- Polymers Science & Tech of plastics & Rubber by P. Ghosh
- Production of Synthetic Fibers byA. A. Vaidya
- Elastomers and Rubber Compounding Material by I. Franta
- Plastic Materials and Processing – A Brent Strong.
- Plastic Materials by J.A. Brydson.

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**Structure with effect from: 2018-19**

**Semester : III[rd]**

**Subject Code: PS03CNST23** **Total Credit: 04**

**Subject Name: MODERN CHARACTERIZATION TECHNIQUES**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| 1 | Production and detection of X-rays, Bragg law, x-ray diffraction techniques, Methods of sample preparation and x-ray diffraction, low angle scattering, Applications of XRD for evaluation of structure of polycrystalline aggregates, grain size, particle size, crystal quality, crystal orientation, texture. X-ray spectroscopy, absorption and fluorescence, chemical analysis by x-ray spectrometry, spectrometers. | 25% |
| 2 | Optical properties of nanomaterials | 25% |
| 3 | Principle, Operation and Applications of SEM, TEM, HRTEM | 25% |
| 4 | Principle, Operation and Applications of STM and AFM<br>DTA, TGA, DSC of materials, thermal expansion and thermal conductivity of nanomaterials | 25% |

**Reference Books :-**


1. Elements of X-ray diffraction – B.D. Cullity.
2. Materials Characterization – Volume 10, ASM Handbook –Ruth E. Whan
3. Handbook of nanostructured Materials and Nanotechnology- H.S.Nalwa (Ed.) Academic Press.
4. Modern physical techniques in materials technology – T. Mulvey and R.K. Webster.
5. Characterization and Chemical Analysis by Sibilia John.

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**Structure with effect from: 2018-19**

**Semester : III[rd]**

**Subject Code: PS03ENST21** **Total Credit: 04**

**Subject Name: (Elective 01) : NANOMATERIALS AND ENVIRONMENT**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| 1 | Introduction to Environmental pollution, atmosphere pollution, source of air pollution, water pollution, pollution due to sewage and sludge, solid waste problem, metal pollutants, Environmentals carcinogens, symbiotic relationship of Environment & Materials. Ending chemical pollution, cutting resource consumption, making it easier to be clean, cleaning of twentieth century mess, cleaning soil and water, cleansing the atmosphere, orbital wastes, nuclear waste, wealth of garbage. | 25% |
| 2 | Packing, Insect proof packaging, Rodent proof packing, Air conditioning , constant damp heat and cyclic damp heat, humidity and cycles of humidity, Isolation from environmental radiation. Chemical corrosion, Electrochemical corrosion, concepts of reaction at an electrodes, Nernst equation, Tafel equation and polarisation, corrosion kinetic. Protection against corrosion. | 25% |
| 3 | Green wealth, Environmental Restoration, Imported Ecosystem protectors, mending the land & current topics on Hazard of Nanomaterials, Home safety. Extra ordinary accident., Responsible action. Molecular.level Manufacturing techniques. | 25% |
| 4 | Ethics view, policies and prospects of nanotechnology | 25% |

**Reference Books :**


1. Handbook of Nanostructured Materials and Nanotechnology-H.S.Nalwa (Ed.)
2. Encyclopedia of Nanoscience and nanotechnology – H.S. Nalwa
3. The Nanoscope – P. Diwan and A. Bhardawaj

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**Semester : III[rd]**

**Subject Code: PS03ENST22** **Total Credit: 04**

**Subject Name: (Elective 02) : COMPOSITE MATERIALS**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| 1 | Types of composite materials – Dispersion strengthened composites, particulate composites, concretes, laminar composites and introduction to fiber reinforced composites. Fiber reinforced composites with different matrix systems, polymer matrix (thermoset and thermoplastic) matrix composites, metal matrix composites and ceramic matrix composites, **Hybrid composites system** | 25% |
| 2 | Types of reinforcements – Whiskers and **natural fibers and synthetic fibers**, preparation, structure and properties of different reinforcing fibers, carbon fibers, glass fibers, polymer fibers and alumina fibers | 25% |
| 3 | Interfaces in composites and micromechanics of composites molding processes for reinforced composites – contact molding, vacuum bag molding, pressure bag molding, vacuum impregnation and injection molding, transfer molding, pultrusion, filament winding, Fabrication of Metal and Ceramic matrix composition. | 25% |
| 4 | Test procedures for mechanical testing, physical properties, void content for fiber reinforced composites. Mechanical Properties of composite, Effect of fiber volume content, orientation of fibers & void contents on mechanical properties of composite, fracture behaviour of composites, Thermal properties of composites. Applications of composites in different field, **specific durability issues, NDT & evaluation.** | 25% |

**Reference Books :**

Science and Engineering of Materials --- D. R. Askeland

Science of engineering materials – Manas Chandra

Hand Book of composites – G. Lubin

Composites Materials by K. K. Chawla.

An introduction to composites materials – D. Hull

The international handbook of FRP composites in civil engineering by Manoochehr Zoghi

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**Structure with effect from: 2018-19**

**Semester : III[rd]**

**Subject Code: PS03CNST24** **Total Credit: 04**

**Subject Name: LIST OF EXPERIMENTS Practicals I**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| | 1. Synthesis of Nanoarticles by Chemical and Ball Milling Methods<br>- Metal particles - Cu<br>- Ag<br>- Ceramics - SiO2<br>- Semiconductor ZnO2<br>- Carbon Nanotubes<br>2. Characterisation<br>- UV-Vis Spectophotometry<br>- SEM<br>3. Corrosion<br>a. Zinc and Al in acid and base<br>b. Anodization of Aluminium and its corrosion studies<br>4. Flame photometry<br>* Estimation of Na+ ion<br>* Estimation of K+ ion<br>5. Gas chromatography<br>6. Particle size distribution<br>7. Specific Gravity of Powder sample<br>8. FTIR | **100%** |

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**Structure with effect from: 2018-19**

**Semester : III[rd]**

**Subject Code: PS03CNST25** **Total Credit: 04**

**Subject Name: Practicals II**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| | . Mechanical Properties of Materials<br>* Tensile strength<br>* Compressive strength<br>* Impact strength<br>* Hardness<br><br>2. Thermal Properties of Material<br>a. Thermal Gravimetric Analysis<br>b. Differential Scanning Calorimetry<br>c. Thermo mechanical Analysis<br><br>3. Optical Properties<br>a. Polishing of sample<br>b. Microstructure<br>c. Photography & Printing<br><br>4. Non Destructive Testing | **100%** |

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**Structure with effect from: 2018-19**

**Semester : III**

**Subject Code: PS03CNST26** **Total Credit: 01**

**Subject Name: Comprehensive Viva**

| Unit | Unit Title | Weight-age (%) |
|---|---|---|
| | | **100%** |