

**SARDAR PATEL UNIVERSITY**  
**VALLABH VIDYANAGAR**

**Course: M.Sc. (Materials Science)**

**III Semester**

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

**SARDAR PATEL UNIVERSITY****M. Sc. Programme : Materials Science****Structure with effect from: 2018-19****Semester:-III**

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	PS03CMTS21	Glass, Ceramic and Carbon Materials	T	4	4hrs	3hrs	30/10	70/28	100/40
	PS03CMTS22	Fibers, Plastics and Elastomers	T	4	4hrs	3hrs	30/10	70/28	100/40
	PS03CMTS23	Modern Characterization Techniques	T	4	4hrs	3hrs	30/10	70/28	100/40
Elective courses (Any one)	PS03EMTS21	Composite Materials	T	4	4hrs	3hrs	30/10	70/28	100/40
	PS03EMTS22	Testing Methods for films and rubbers	T	4	4hrs	3hrs	30/10	70/28	100/40
	PS03CMTS24	Practicals I	P	4	12hrs	3hrs	30/10	70/28	100/40
	PS03CMTS25	Practicals II	P	4	12hrs	3hrs	30/10	70/28	100/40
	PS03CMTS26	Comprehensive Viva		1	1hrs	-	-	50/20	50/20

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**SYLLABUS EFFECTIVE FROM: 2018-19**

**Course: M.Sc.**

**Subject: Materials Science**

**Semester : III**

**Subject Code: PS03CMTS21**

**Total Credit: 04**

**Subject Name: GLASS, CERAMIC AND CARBON MATERIALS**

Unit	Unit Title	Weight-age (%)
1	Introduction to ceramics and glass, raw materials: silica , alumina structure, silicate chemistry, properties of fabricated body, phase diagrams.	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	Introduction to carbon, mechanical & thermal properties, hybridization and different crystalline and amorphous carbon, General law material for processing of carbon and graphite materials, properties of carbon and graphite. Activated carbon, raw materials, processing of raw materials, pyrolysis, physical activation, chemical activation, adsorption properties and application of porous carbon, <b>Advanced carbons</b>	25 %

**Reference Books :**

Science of Engineering Materials – Manas Chanda

Ceramic Science for Materials Technologists – I. J. McColm.

An Introduction to carbon science – Herry Marsh

Industrial Ceramic – F. Singer, S. Singer.

Carbon Science- C.L. Mantel

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**Course: M.Sc. Subject: Materials Science**  
**Structure with effect from: 2018-19**

**Semester : III**

**Subject Code: PS03CMTS22**

**Total Credit: 04**

**Subject Name: FIBERS, PLASTICS AND ELASTOMERS**

<b>Unit</b>	<b>Unit Title</b>	<b>Weight-age (%)</b>
<b>1</b>	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 machinery designs theory and quality control.	<b>25%</b>
<b>2</b>	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, assessment of processability & state of cure, hard rubber, latex technology, some major rubber products	<b>25%</b>
<b>3</b>	Commercial fiber forming polymers like poly (ethylene terephthalate), Nylon 6, 66, acrylics, polypropylene, elastomeric fibers, polyvinyl chloride, and aramid fiber.	<b>25%</b>
<b>4</b>	Fiber spinning techniques, melt spinning, wet and dry spinning, spin finishes, and basic post spinning operations, identification, testing and evaluation of polymers and fibers.	<b>25%</b>

**Reference Books :**

- Polymers Science & Tech of plastics & Rubber by P. Ghosh
- Production of Synthetic Fibers by A. 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**

**Subject Code: PS03CMTS23**

**Total Credit: 04**

**Subject Name: Modern Characterization Techniques**

<b>Unit</b>	<b>Unit Title</b>	<b>Weight-age (%)</b>
<b>1</b>	Introduction, electromagnetic radiation, generation of X-rays, continuous X-ray spectrum, characteristic X-ray spectrums, absorption. Phase relationship, diffraction, derivation of diffraction condition, diffraction methods, Laue, powder and rotating crystal method, X-ray diffractometer and spectrometer, grain size estimation and texture.	<b>25%</b>
<b>2</b>	X-ray fluorescence, chemical analysis using X-ray spectrometry, general principle, wavelength dispersive and energy dispersive spectrometers.	<b>25%</b>
<b>3</b>	Introduction, classification of structure, the basic optical microscope, characteristics of the microscope, application.	<b>25%</b>
<b>4</b>	Introduction, electron optical instruments, Analytical Transmission Electron Microscopy, Transmission Electron Microscopy, electron optics, electron beam specimen interaction, signal detectors. Introduction to SEM general uses, samples, example of applications, image contrast, limitations, Atomic Force Microscopy.  <b>Thermal analysis</b>  <b>Thermal analysis techniques like DTA, TGA, DSC of materials, thermal expansion and thermal conductivity of materials</b>	<b>25%</b>

**Reference Books :**

Elements of X-ray diffraction – B.D. Cullity.

Materials characterization – Ruth E. Whan

Volume 10, ASM Handbook

Characterization of Materials, Vol. 2 – Elton N. Kaufmann.

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**Course: M.Sc.      Subject: Materials Science**  
**Structure with effect from: 2018-19**

**Semester : III**

**Subject Code: PS03EMTS21**

**Total Credit: 04**

**Subject Name: COMPOSITE MATERIALS**

<b>Unit</b>	<b>Unit Title</b>	<b>Weight-age (%)</b>
<b>1</b>	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, <b>Hybrid composites system</b>	<b>25%</b>
<b>2</b>	Types of reinforcements – Whiskers, <b>natural fibers and synthetic fibers</b> , preparation, structure and properties of different reinforcing fibers, carbon fibers, glass fibers, polymer fibers and alumina fibers.	<b>25%</b>
<b>3</b>	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.	<b>25%</b>
<b>4</b>	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, <b>specific durability issues, NDT &amp; evaluation.</b>	<b>25%</b>

**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**

**Subject Code: PS03EMTS22**

**Total Credit: 04**

**Subject Name: TESTING METHODS FOR FILMS & RUBBERS**

<b>Unit</b>	<b>Unit Title</b>	<b>Weight-age (%)</b>
<b>1</b>	Plasticity, rotating disk viscometer, plasticity tests and test methods, parallel plate plastometer, extrusion and mixing tests, scorch, vulcanization, vulcanization test, chemical methods, physical test methods, continuous measurement of vulcanization, uses of curemeter, effect of temperature on vulcanization rate.	<b>25%</b>
<b>2</b>	Stress-strain test, tensile tests, hardness, dynamic mechanical tests, free vibration tests, heat Build-up tests, crack tests, time-dependent properties, tear tests, friction test, adhesion properties measurement.	<b>25%</b>
<b>3</b>	Durability of coatings, adhesion, mechanical methods, tape method, scratch method, abrasion method, deceleration method, engineering methods for measuring adhesion. Basic concepts, nucleation rate measurements, island density measurement, critical condensation measurement, comparison between mechanical and nucleation methods, nature of adhesion forces, physisorption, chemisorption.	<b>25%</b>
<b>4</b>	Stress measuring techniques, disk method, bending beam method, X-ray and electron diffraction techniques, other techniques.	<b>25%</b>

**Reference Books:**

1. Hand Book of Polymer Testing : Roger Brown.
2. Rubber Technology : M. Morton.
3. Handbook of Thin Films : Maissel and Glang

**SARDAR PATEL UNIVERSITY**  
**Course: M.Sc. Subject: Materials Science**  
**Structure with effect from: 2018-19**

**Semester : III**

**Subject Code: PS03CMTS24 (Practical –I)**

**Total Credit: 04**

**Subject Name: LIST OF EXPERIMENTS FOR M.Sc. (MATERIALS SCIENCE) THIRD SEMESTER,**

Unit	Unit Title	Weight-age (%)
	Chemical Analysis of Alloys	<b>100%</b>
	Volumetric	
	Gravimetric	
	Phase diagram	
	Porosity of ceramics	
	Conductometric Analysis	
	Cell constant	
	Analysis for strong acid & strong base	
	Analysis for weak acid & strong base	
	Analysis for Mixture of acids	
	Solubility of sparingly soluble salts	
	pH metry	
	Analysis of strong acid & strong base	
	Analysis for weak acid & strong base	
	Analysis for Mixture of acids	
	Spectrophotometric Analysis	
	$\lambda_{\max}$	
	Strength of unknown solution	
	Refractrometry	



	Refractive Index & Molar reflectivity	
	Analysis of unknown mixture	
	Viscometry	
	Relative viscosity	
	Mol. Weight of Polymers	
	Corrosion	
	Zinc and Al in acid & base	
	Anodization of Aluminium and its corrosion studies	
	Flame photometry	
	Estimation of Na <sup>+</sup> ion	
	Estimation of K <sup>+</sup> ion	
	Selective Electrode Analysis	
	Gas chromatography	
	Particle size distribution	
	Specific Gravity of powder sample.	
	FTIR	
	Langmur Adsorption Isotherm	
	Studies on carbon - Ash content	
	Carbon content	
	Surface complex	
	Calorific value by Bomb calorimeter	

**Course: M.Sc.      Subject: Materials Science**  
**Structure with effect from: 2018-19**

**Subject Code: PS03CMTS25 (Practical –II)**

**Subject Name: LIST OF EXPERIMENTS FOR M.Sc. (MATERIALS SCIENCE) THIRD SEMESTER,**

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

**Semester : III**

**Subject Code: PS03CMTS26**

**Total Credit: 01**

**Subject Name: Comprehensive Viva**

<b>Unit</b>	<b>Unit Title</b>	<b>Weight -age (%)</b>
		<b>100 %</b>