



SARDAR PATEL UNIVERSITY

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

Vallabh Vidyanagar

Gujarat

Academic Programme Structure

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Curriculum

(Aligned with NEP-2020)

Master of Science (Materials Science)

NHEQF Level: 6.5

Entry NHEQF Level	:	5.5
Duration	:	Two Years (Four Semesters)
Total Courses	:	24
Total Learning Hours	:	2640
Total Credits	:	88
Total Marks	:	2200



Graduate Attributes (GAs)

Upon successful completion of the programme, graduates are expected to attain the following Graduate Attributes:

GA1. Advanced Disciplinary and Multidisciplinary Knowledge

Demonstrate comprehensive knowledge of materials science to analyze structure-property relationships across interdisciplinary and multidisciplinary contexts.

GA2. Experimental and Analytical Skills

Apply experimental and characterization techniques to investigate materials processes and performance by ensuring scientific accuracy, reliability and integrity.

GA3. Computational and Modelling of Materials

Apply computational, analytical and scientific methods to model, simulate, optimize and interpret materials behaviour, integrating theoretical and experimental data.

GA4. Design and Innovation of Materials and Processes

Focus on designing novel materials, processes and technologies for advanced applications.

GA5. Data Analysis, Interpretation and Validation

Develop competence in analyzing, interpreting and validating experimental and theoretical data for scientific advancement.

GA6. Problem-Solving in Materials Science

Develop the ability to analyze and resolve complex materials-related challenges in practical and real-world scenarios including concepts of the Indian Knowledge System, along with critical thinking and innovative approaches.

GA7. Evidence-Based Decision Making

Select, assess and justify appropriate methods and solutions using independent, informed and data-driven approaches, ensuring the effectiveness.

GA8. Research and Inquiry Competence

Identify research gaps, analyse literature and conduct investigations to derive valid conclusions.

GA9. Sustainable Materials and Innovation-Driven Entrepreneurship

Develop sustainable materials and processes by integrating knowledge from ancient Indian materials science with modern innovations, fostering entrepreneurial orientation to address societal needs.



GA10. Ethics, Values and Environmental Responsibility

Demonstrate ethical practices and a commitment to sustainability in materials science applications.

GA11. Communication and Scholarly Expression

Communicate scientific and interdisciplinary ideas effectively through written, oral and visual forms.

GA12. Collaboration and Leadership

Work effectively in multidisciplinary teams, demonstrating leadership, accountability and the ability to manage collaborative scientific projects.

GA13. Lifelong Learning and Professional Development

Engage in continuous learning, adapt to emerging developments in materials science and enhance professional skills throughout the career.

Programme Educational Objectives (PEOs):

Within 2-3 years of completing the programme, graduates will be able to:

PEO1. Apply advanced materials science knowledge and analytical skills to solve complex problems in professional contexts.

PEO2. Demonstrate research competence through critical inquiry, experimentation and contribution to knowledge.

PEO3. Execute modern characterization and computational approach to address technological challenges.

PEO4. Apply ethical principles, environmental responsibility and professional integrity in materials science application for societal benefits.

PEO5. Communicate effectively and collaborate in multidisciplinary teams while demonstrating leadership in academic, research and industrial sectors.

PEO6. Engage into lifelong education and skill enhancement to emerging technologies, advance career opportunities and encourage innovation with entrepreneurial initiatives.

Programme Learning Outcomes (PLOs):

Upon successful completion of the programme, learners will be able to:

- PLO1:** Apply advanced knowledge of material structures and properties to analyse, design engineering materials.
 - PLO2:** Evaluate the structural properties of polymers, glass, ceramic, carbon, metals, semiconductors and composites.
 - PLO3:** Analyse the effect of phase transformation and heat treatment on ceramic and metallic systems for high performance applications.
 - PLO4:** Synthesize, process and tailor the properties of engineering polymers for advanced functional performance such as flame retardancy, thermal stability, mechanical strength and chemical resistance in biomedical, packaging, energy, coating and related applications.
 - PLO5:** Apply crystal growth and thin film deposition methods for synthesizing materials suitable to various technological applications.
 - PLO6:** Utilize modern characterization techniques for structural and compositional analysis of materials.
 - PLO7:** Demonstrate proficiency in design, processing and fabrication of industrial ceramics and advanced composite materials, enabling the development of high-strength, application-specific components for aerospace, automotive, construction industries and aligned fields.
 - PLO8:** Apply knowledge of nanomaterials, biomaterials, and functional materials to design and develop efficient technologies for batteries, supercapacitors, fuel cells, photovoltaic cells and sensing systems.
 - PLO9:** Assess materials with respect to sustainability, environmental impact, and renewable applications while considering ethical values and insights from the Indian Knowledge System.
 - PLO10:** Analyze and solve real-world materials problems using case studies and concept-based approaches.
 - PLO11:** Design experiments and conduct research to develop innovative solutions in materials science.
 - PLO12:** Demonstrate laboratory skills and work effectively in teams of academic and industrial sectors.
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NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

M.Sc. (Materials Science)

Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme		Credits	Assessment Scheme & Marks				
			L-P-T	Total Notional Hours		Internal Assessment			External Assessment	Total Marks
						FA	SA	Total		
DSC	P2S01NCMTS01	Basic Concepts and Interfacial Aspects of Materials Science	4-0-1	120	4	25	25	50	50	100
DSC	P2S01NCMTS02	Crystal Growth and Thin Film Materials	4-0-0	120	4	25	25	50	50	100
DSC	P2S01NCMTS03	Polymer Science	4-0-0	120	4	25	25	50	50	100
DSC	P2S01NCMTS04	Practical-I	0-8-0	120	4	25	25	50	50	100
DSC	P2S01NCMTS05	Practical-II	0-8-0	120	4	25	25	50	50	100
DSC	P2S01NCMTS06	Materials Testing and Analysis-I	2-0-1	60	2	10	15	25	25	50
				660	22	135	140	275	275	550

DSC: Discipline Specific Core **DSE:** Discipline Specific Elective **L:** Lecture **P:** Practical **T:** Tutorial

FA: Formative Assessment **SA:** Summative Assessment



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Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme		Credits	Assessment Scheme & Marks				
			L-P-T	Total Notional Hours		Internal Assessment			External Assessment	Total Marks
						FA	SA	Total		
DSC	P2S02NCMTS01	Microstructure Control and Metallic Processing	4-0-1	120	4	25	25	50	50	100
DSC	P2S02NCMTS02	Glass, Ceramic and Carbon Materials	4-0-0	120	4	25	25	50	50	100
DSC	P2S02NCMTS03	Fundamentals of Material Properties: Optical, Thermal, Electrical and Magnetic	4-0-0	120	4	25	25	50	50	100
DSC	P2S02NCMTS04	Practical-I	0-8-0	120	4	25	25	50	50	100
DSC	P2S02NCMTS05	Practical-II	0-8-0	120	4	25	25	50	50	100
DSC	P2S02NCMTS06	Materials Testing and Analysis-II	2-0-1	60	2	10	15	25	25	50
				660	22	135	140	275	275	550

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