

M. TECH – MATERIALS SCIENCE AND ENGINEERING

Center for Excellence in Advanced Materials and Green Technologies

The M.Tech. Materials Science and Engineering program is offered at Amrita Vishwa Vidyapeetham by the Center of Excellence in Advanced Materials and Green Technologies established in May 2013, based on a grant awarded by the Ministry of Human Resource Development (MHRD). The Center has numerous ongoing research projects covering materials for fuels/energy, electricity, construction, and water.

The program is designed to produce graduates that can apply fundamental knowledge of mathematics, physics & chemistry of materials, and statistics, to model and solve problems related to design, synthesis, performance enhancement, and optimization of materials. Recognizing the multidisciplinary nature of the field, the teaching and project guidance will be accordingly delivered by highly qualified, world-class faculty from various departments including, chemical engineering, chemistry, physics, & aerospace engineering.

With a view towards developing both science and engineering skills, the program curriculum has been framed so as to incorporate and deliver on experimental, analytical, statistical, and computational tools & educational components of globally accepted standards in the materials discipline. The core courses include: Engineering Materials, Advanced Materials, Electronic Materials Science, Materials Thermodynamics, Physical Metallurgy, Materials Processing, Statistical Design of Experiments, Materials Characterization Techniques, and Materials Design. While the labs cover important aspects of synthesis, testing, and characterization, the electives are structured in such a way as to offer opportunities for acquisition of specialized and advanced knowledge in sub-disciplines such as electronic materials, biomaterials, and materials for energy systems. Students have the opportunity to pursue their projects either in-house (research in the departments of Chemical Engineering, Sciences, Aerospace Engineering, Civil Engineering, and the Center for Excellence in Advanced Materials & Green Technologies), or outside in reputed industrial or R&D institutions.

With a strong focus on developing research skills among the students, in frontier areas, the program includes educational components that would make the graduates suited to, and employable in, industrial, government R&D, and academic settings, spanning diverse areas such as electronics & communications, energy, chemicals, medicine, and transportation.

Program Educational Objectives (PEOs)

The broad educational objectives of the MTech (Materials Science and Engineering) program are:

1. To develop knowledgeable, skilled and trained human resources in the broad domain of materials science and engineering who can effectively contribute towards design, development, processing, and optimization of materials for innovative applications in new products and processes
2. To equip the graduates with knowledge and skills to gain employment in industries and

consultancies or pursue higher studies in research and academic institutions

3. To equip the graduates with good technical communication skills, and promote communication of their ideas and knowledge via scholarly articles, patents, delivery of effective presentations, and/or training of co-workers and associates

4. To inculcate professional values for ethical and responsible individual and teamwork, leadership, management, self-development and lifelong learning, applied for nation building and global sustainable development.

Program Outcomes (POs):

On completion of the MTech (Materials Science and Engineering) program, the graduate will:

PO1. Engineering Knowledge. Understand thoroughly the different engineering materials/devices/products, their structure, properties, processes of manufacturing and modification, characterizations, design, performance analysis and optimization, and the application of mathematical and experimental techniques for the same

PO2. Problem Analysis. Identify, formulate, study, analyse engineering problems related to materials, their synthesis-structure-property-performance relationships, using fundamental principles, mathematical and experimental tools

PO3. Design and Development of Solutions. Design and develop desired material performances, properties, structures and manufacturing/synthesis processes, for diverse applications, from both theoretical and experimental perspectives

PO4. Conduct Investigations of Complex Problems. Develop research-based methodologies to synthesize, modify, characterize and optimize materials, devices and products by applying the engineering knowledge gained, analysing the outcomes, evaluate methodologies, & synthesise the information to valid conclusions.

PO5. Modern Tools Usage. Understand and utilize modern tools such as advanced materials synthesis, modification and characterization techniques, modelling and simulation tools, & statistical analysis tools, and gain hands-on experience in them.

PO6. Engineer and Society. Gain contextual knowledge of societal, health, safety, legal, cultural, economic and ecological issues and the consequent responsibilities in the professional practice of materials science and engineering.

PO7. Environment and Sustainability. Understand the impact of materials technologies in the context of sustainability, demonstrate the knowledge of sustainable development, & contribute sustainable materials engineering solutions.

PO8. Ethics. Apply ethical principles and commit to professional ethics, responsibilities and norms of engineering practice.

PO9. Individual and Teamwork. Gain skills to function effectively as an individual as well as a

member or leader in diverse teams, and especially in multidisciplinary settings

PO10. Communication. Develop effective communication skills to engage the engineering community and the society at large on complex engineering activities, specifically on understanding & writing effective reports and design documentation, making effective presentations, & give and receive clear instructions.

PO11. Project Management and Finance. Understand engineering, project and financial management principles and apply them in materials engineering practice, as a member and leader in teams, to manage projects in multidisciplinary environments.

PO12. Lifelong Learning. Understand the need for & develop the ability to engage in independent and lifelong learning in materials engineering and in the broadest context of evolution

Proposed New Curriculum and New Courses

for

MTech Materials Science & Engineering

Amrita Vishwa Vidyapeetham, Coimbatore

CURRICULUM

I Semester

Course Code	Type	Subject	L T P	Credits
19MA617	FC	Mathematical Foundations for Materials Science	2-1-0	3
19MS601	FC	Engineering Materials	3-0-0	3
19MS602	FC	Materials Thermodynamics	3-1-0	4
19MS603	FC	Electronic Materials Science	4-0-0	4
19MS611	SC	Materials Characterization Techniques	4-0-0	4
19MS615	SC	Materials Synthesis and Characterization Lab I	0-0-2	1
19HU601	HU	Amrita Values Program*		P/F

Credits

19

II Semester

Course Code	Type	Subject	L T P	Credits
19MS604	FC	Statistical Design of Experiments	2-1-0	3
19MS605	FC	Materials Processing	4-0-0	4
19MS612	SC	Physical & Mechanical Metallurgy	4-0-0	4
19MS613	SC	Advanced Materials	4-0-0	4
19MS614	SC	Materials Design	3-0-0	3
19MS616	SC	Materials Synthesis and Characterization Lab II	0-0-2	1
19EN600	HU	Technical Writing*		P/F

Credits**19****III Semester**

Course Code	Type	Subject	L T P	Credits
	E	Elective I	3-0-0	3
	E	Elective II	3-0-0	3
19MS617	SC	Materials Performance Analysis Lab	0-0-2	1
19MS799	P	Dissertation		8

Credits**15****IV Semester**

Course Code	Type	Subject	L T P	Credits
19MS799	P	Dissertation		14

Credits**14****Total Credits****67****List of Courses****Foundation Core**

Course Code	Subject	L T P	Credits
19MA615	Mathematical Foundations for Materials Science	2-1-0	3
19MS601	Engineering Materials	3-0-0	3
19MS602	Materials Thermodynamics	3-1-0	4
19MS603	Electronic Materials Science	4-0-0	4
19MS604	Statistical Design of Experiments	2-1-0	3
19MS605	Materials Processing	4-0-0	4

Subject Core

Course Code	Subject	L T P	Credits
19MS611	Materials Characterization Techniques	4-0-0	4
19MS612	Physical & Mechanical Metallurgy	4-0-0	4
19MS613	Advanced Materials	4-0-0	4
19MS614	Materials Design	3-0-0	3
19MS615	Materials Synthesis and Characterization Lab I	0-0-2	1
19MS616	Materials Synthesis and Characterization Lab II	0-0-2	1
19MS617	Materials Performance Analysis Lab	0-0-2	1

Electives

Course Code	Subject	L T P	Credits
19MS701	Polymer Processing	3-0-0	3
19MS702	Electrochemistry and Corrosion	3-0-0	3
19MS703	Catalytic Chemistry	3-0-0	3
19MS704	Carbon Nanomaterials	3-0-0	3
19MS705	Interfacial Science and Engineering	3-0-0	3
19MS706	Waste to Energy	3-0-0	3
19MS707	Solar Energy	3-0-0	3
19MS708	Energy Storage Technologies	3-0-0	3
19MS709	Molecular Simulation	3-0-0	3
19MS710	Design for Sustainable Development	3-0-0	3