



DEPARTMENT OF APPLIED PHYSICS

DELHI TECHNOLOGICAL UNIVERSITY

Programme: M.Tech. (Material Science and Technology)

Course Outcomes

Ist Semester:

Subject Code & Course Title: MST 501 Physics and chemistry of nanomaterials	
MSR501-1.1	Understanding of fundamentals of physics and chemistry of low dimensional material
MST501-1.2	Study the properties of material on nano and microscale.
MST501-1.3	Compare the dimensionality of solid material
MST501-1.4	Highlight applications of low dimensional materials.
MST501-1.5	Importance of nanomaterial for society, health and environment

Subject Code & Course Title: MST 503 Mathematical and Computational Methods	
MST503-1.1	To apply the problem solving skill to implement the various numerical algorithms for linear and non-linear equations, data prediction using interpolation and approximation.
MST503-1.2	To develop the ability to analyse the various errors involved in the problem solving process in order to realize the accuracy of complex solutions.
MST503-1.3	To solve the complicated numerical differentiation, integration and differential equations using numerical methods related to multi-disciplinary complex problems.
MST503-1.4	To develop the problem analysing skills and to design the algorithms for the solution of complex problems of applied physics and engineering.
MST503-1.5	To use the gained knowledge of this course for their research project.



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Subject Code & Course Title: MST 505 Material for Energy and Applications

MST505-1.1	Understanding to basics of materials science and engineering.
MST505-1.2	Knowledge of properties of various materials and special coatings and energy applications.
MST505-1.3	To understand the testing of materials behaviour suitable for application in solar energy systems.
MST505-1.4	Environmental impact on solar system materials and corrosion protection
MST505-1.5	To analyse the properties of various energy storage devices.

Subject Code & Course Title: MST 507 Lithography and Device Fabrication

MST507-1.1	Understanding of fabrication processes and cleanroom environments.
MST507-1.2	Knowledge of lithography and wafer processing.
MST507-1.3	Understanding of the effects of contamination.
MST507-1.4	Understanding of principles and practice of doping techniques, such as diffusion and ion implantation
MST507-1.5	Understanding of fabrication processes of FETs, MOSFETs, and BIMOS



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Subject Code & Course Title: MST 509 Modelling and Simulation in Material Engineering

MST509-1.1	An ability to apply knowledge of mathematics, science, and engineering to problems in materials engineering.
MST509-1.2	An ability to identify, formulate, and solve engineering problems, particularly in the context of materials selection and design.
MST509-1.3	Knowledge of modeling methods including electronic structure, molecular dynamics, Monte Carlo, finite differences, finite elements, and microstructure evolution methods
MST509-1.4	An ability to use the techniques and skills for experimental and computational data analysis necessary for materials engineering practice.
MST509-1.5	An ability to exhibit effective oral and written communication skills.

Subject Code & Course Title: MST 511 Introduction to Biomaterial Science and Engineering

MST511-1.1	To understands the basics of biological molecules and biomaterials.
MST511-1.2	Understand the characterization techniques for biological analysis
MST511-1.3	Application of microbial synthesis route for inorganic materials
MST511-1.4	Examine the structure, properties, and applications of biomaterials.
MST511-1.5	Application of biological molecules and biomaterials for society

Subject Code & Course Title: MST 513 Self Study

MST513-1.1	Identification of the topic related to the research problem.
MST513-1.2	Awareness of current trends on specific topic and area of interest.
MST513-1.3	Enhance their leadership and participation abilities.



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MST513-1.4	Report writing and effective presentation.
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Subject Code & Course Title: MST 515 Battery Design and Testing

MST515-1.1	Understanding the basic mechanisms allowing electrochemical energy storage in batteries
MST515-1.2	Understanding the basic kinetics, reactions, e.g. charge transfer at the electrode interfaces; cell resistance; ion diffusion and migration; electron diffusion into the electrode
MST515-1.3	Knowledge of components, processes and characterization tools in batteries: separators, binder, electrolyte, additives, ion insertion/de-insertion, "SEI"; solid electrolyte interphase formation, degradation; cycle life, calendar life, overcharging
MST515-1.4	Analysing the design of commercial Li-ion battery solutions, from business, safety, social economic and environmental perspective
MST515-1.5	Importance of electrode material for society, health and environment

IInd Semester:

Subject Code & Course Title: MST 502 Design and Synthesis of Materials

MST502-1.1	Describe the fundamental principles of top-down and bottom-up approaches for synthesis of material from bulk to the nanoscale.
MST502-1.2	Knowledge of physical, chemical and biological methods for materials synthesis
MST502-1.3	To analyze different synthesis route for the materials keeping in mind limitations and use it to design systems for the benefits of society, environment and contribute towards sustainable development.
MST502-1.4	To apply different characterization techniques and draw valid conclusions from the collected data.
MST502-1.5	Demonstrate professional attitudes, effective communication and behavioural skills that support and enhance individual's performance.



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Subject Code & Course Title: MST 504 Structure and Characterization of materials

MST504-1.1	Create theoretical and analytical skills among students for various structural characterizations technique of materials.
MST504-1.2	Enable students to understand various primary characterization techniques for scientific, engineering and technological aspect of materials.
MST504-1.3	Impart the knowledge of micro to nano level structural and spectroscopic characterizations of materials.
MST504-1.4	Equip the students with knowledge, principle and design of microscopic techniques and their analysis.
MST504-1.5	Design the advanced experimental techniques, based upon the basic physics, to solve the complex problems which are having positive and sustainable impact on our environment and future human life.

Subject Code & Course Title: MST 506 MEMS and NEMS Devices

MST506-1.1	Analyse the fundamental concepts and techniques used in development of micro and nano electromechanical materials and devices.
MST506-1.2	Ability to classify and categorize nanomaterials on the basis of their structural, electrical, optical and mechanical properties.
MST506-1.3	Ability to analyse and design various devices by using the different size materials.
MST506-1.4	To develop methods to purify and functionalize the materials for real time applications which are sustainable.
MST506-1.5	To analyse the device engineering parameters involved in the development of devices fabricated using micro and nanomaterials.

Subject Code & Course Title: MST 508 Thin Film Science and Technology

MST508-1.1	Understanding thin film deposition techniques and process
MST508-1.2	Understanding thin film growth mechanism and parameters
MST508-1.3	Explain the molecular behaviours in different vacuum conditions for gas-phase deposition techniques of thin films



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MST508-1.4	Knowledge of right tools to perform thickness measurement of different thin films and characterize their properties
MST508-1.5	Application of thin films in batteries, glass, and medical devices

MST 510 Nanophotonics

MST510-1.1	Elucidate the fundamentals of photons and electrons, their similarity and difference specially the confinement effects and their application to engineering.
MST510-1.2	Apply engineering and physics concept to develop nanophotonics and nanoelectronics based devices.
MST510-1.3	Identify as well as compare state-of-the-art nanofabrication methods and perform a critical analysis of the research literature.
MST510-1.4	Discuss and evaluate state-of-the-art of fabrication methods for micro and nanoscale devices and their handling methods.
MST510-1.5	Importance of photonic crystal in nature

MST512 Nanosensors and devices

MST512-1.1	Understanding of nanostructures and their thermal, mechanical, electronic and optical properties.
MST512-1.2	Understanding of nanomaterial-based sensors based on optical, mechanical, and chemical properties
MST512-1.3	Analyse different types of sensing devices and their application
MST512-1.4	Acquire the knowledge of actuators and their various applications
MST512-1.5	Application of sensor for society



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MST514 Industrial Training

MST512-1.1	Participate of students in relevant industries during training period
MST512-1.2	Awareness of advanced tools and techniques encountered during industrial training and visit.
MST512-1.3	Interaction with industrial personnel as well as follow-up the standard engineering practices and discipline adopted in industry.
MST512-1.4	Develop work habits and attitudes necessary for job success (technical competence, professional attitude, organization skills etc..)
MST512-1.5	Writing of professional work reports and presentations.

IIIrd Semester:

MST 601 Spectroscopic Techniques for Materials

MST601-1.1	Create theoretical and analytical skills among students for various spectroscopic characterizations technique of materials.
MST601-1.2	Enable students to understand various primary characterization techniques for scientific, engineering and technological aspect of materials.
MST601-1.3	Impart the knowledge of micro to nano level spectroscopic characterizations of materials like Raman, UV-Vis, and IR.
MST601-1.4	Equip the students with knowledge, principle and design of dedicated techniques like absorption and steady state techniques.
MST601-1.5	Design the advanced experimental techniques, based upon the basic physics, to solve the complex problems which are having positive and sustainable impact on our environment and future human life.

MST 603 Advanced Characterization Techniques



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MST603-1.1	Create theoretical and analytical skills among students for various structural characterizations techniques like RHEED, LEED, and SAXS.
MST603-1.2	Enable students to understand various surface characterization techniques like AES, SIMS, SEM and AFM.
MST603-1.3	Impart the knowledge of magnetic characterization techniques
MST603-1.4	Equip the students with knowledge, principle and design of techniques and their analysis.
MST603-1.5	Importance of studied experimental techniques in development of new devices

MST 605 nanocomposites

MST605-1.1	To provide knowledge of the advantages of using different types of nanocomposites
MST605-1.2	Knowledge of mechanical , thermal, electrical, electronic and optical properties of nanocomposites
MST605-1.3	Understand and appreciate the significance of the polymer, nano and natural composites as an important class of material
MST605-1.4	Knowledge use nanocomposites in human life
MST605-1.5	Environment and Sustainability of composites

MST 607 Plasma Technology

MST607-1.1	Knowledge of fundamental parameters and types of plasma
MST607-1.2	Understanding of plasma properties such as the motion of charged particles in a magnetic field, plasma waves, and magneto hydrodynamic and kinetic representation of plasma
MST607-1.3	Characterisation of plasma using Langmuir Probe
MST607-1.4	Application of plasma based techniques for synthesis of carbon materials
MST607-1.5	Environment and Sustainability of Plasma



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MST 609 Spintronics

MST609-1.1	Able to summarize the role played by electron spin in solid state physics, and possible devices.
MST609-1.2	Able to describe and calculate the main characteristics of the spin transport effects.
MST609-1.3	Able to explain the causes of the main spin transport effects and analyses their relevance in relation to technological applications.
MST609-1.4	Able to identify different kinds of spin relaxation, spin dephasing and spin injection mechanisms.
MST609-1.5	Able to construct new transport devices based on spin using the knowledge acquired in the course.

MST 611 Minor Project/ Research Thesis/ Patents

MST611-1.1	Identify scientific and engineering problem.
MST611-1.2	Demonstrate knowledge and principles of the chosen research problem.
MST611-1.3	Record and analyze the scientific data relevant to the topic.
MST611-1.4	Prepare report and documentation to communicate effectively on complex engineering activities.

IV Semester:

MST 602 Major Projects

MST601-1.1	Study research papers for understanding of a new research field and summarize as well as review them.
MST601-1.2	Identify promising new directions of various cutting-edge technologies.
MST601-1.3	Impart skills in preparing detailed report describing the project and results.



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MST601-1.4

Effectively communicate by making an oral presentation before an evaluation.