

	<b>Program:</b>	<b>M.Sc. - subject</b>	<b>M.Sc-Nanoscience and Technology</b>	
	<b>PO Code</b>	<b>Programme Outcomes:</b>		
	PO1	This program will help to the students to gain the knowledge in basic concepts of Nanoscience and technology and its applications.		
	PO2	The program will help the students build their Skills in Nanostructures synthesis, Nano thin film fabrication and Nano characterization techniques.		
	PO3	Students will be able to plan and execute their own innovative ideas in the form of research projects, product design and development.		
<b>Sem ester</b>	<b>Course Code</b>	<b>Course Name</b>	<b>CO Code</b>	<b>Course Outcomes</b>
I	CC-01	Basic Physics for Nanoscience	CO1	Student will learn the historical aspects of development of quantum mechanics from the failures of classical mechanics
			CO2	Student will be able to understand the idea of wave function and the principles of quantum probability
			CO3	Student will be able to understand the uncertainty relations and solve Schrodinger equation for simple potential
			CO4	Student will be able to apply quantum mechanics to nuclear and solid state physics to understand tunneling and band theory
			CO5	Student will gain knowledge on theoretical description of crystal structure and lattice dynamics
			CO6	Student will be able to understand the basic concepts of dielectric and magnetic materials
			CO7	Student will be able to understand the fundamental behavior of semiconductors
	CC-02	Basic Chemistry for Nanoscience	CO1	Student will be able to appreciate the location and energy of electron which decides its size, shape and magnetism. Understand the various types of bonds and their significance
			CO2	Student will be able to interpret and relate the concepts of electrochemistry to develop a deep understanding of the subject

			CO3	Student will be able to describe the existence of different phases and their significance in explaining various systems
			CO4	Student will be able to analyze and discuss the classifications and properties of surfactants
			CO5	Student will be able to understand the concept of reaction kinetics, theories of catalytic reaction, monolayer/multilayer adsorption and photochemistry
			CO6	Student will be able to understand the concept of mole, Avogadro number, concentration in terms of ppm, normality, molarity and mole fraction
			CO7	Student will be able to understand the concept of titrations and indicators
	CC-03	Materials for Nanoscience	CO1	Students will gain knowledge on different nanomaterials
			CO2	Students will be able to analyze and compare different forms of carbon based nanomaterials.
			CO3	Student will be able to understand the basics of polymer science
			CO4	Student will impart knowledge on theoretical background about nanocomposites
			CO5	Student will gain insight about the importance of polymers nanocomposites in nanotechnology
	CC-04	Basic Electronics for Nanoscience	CO1	Student can identify active and passive electronic components. This course will help to setup simple circuits using diodes, transistors and Op Amp
	AC-01	Basic Mathematics for Nanoscience	CO1	Student will understand the importance of computers and the role of approximations and errors in the implementation and development of numerical methods
			CO2	Student will gain sufficient information to successfully approach a wide variety of problems dealing with roots of equations
			CO3	Student will solve problems involving linear algebraic equations and appreciate the application of these equations in many fields.
			CO4	Student will solve many numerical integration and differentiation problems and appreciate their application for engineering problem solving.

			CO5	Student will solve ordinary differential equations and Eigen value problem
	AC-02	Computational Lab	CO1	Solve an algebraic or transcendental equation using an appropriate numerical method approximate a function using an appropriate numerical method
			CO2	Solve a linear system of equations using an appropriate numerical method
			CO3	Perform an error analysis for a given numerical method
			CO4	Prove results for numerical root finding methods
			CO5	Code a numerical method in a modern computer language
II	CC-05	Nano Fabrication	CO1	Student will acquire knowledge on scientific principles behind thin film technology
			CO2	Student will gain knowledge on basic concepts for thin film coating using physical vapor deposition
			CO3	Student will be able to understand the conditions for the formation of thin films using electrical discharge technique
			CO4	Student will get familiarized with the principles, equipment and limitations of chemical vapor deposition techniques
			CO5	Student will be able to understand the mechanism of Adsorption and Diffusion in Thin Films
	CC-06	Synthesis of nanomaterials	CO1	Student will get adequate knowledge on mechanical milling methods to synthesize the nanomaterials
			CO2	Student will appreciate various chemical methods involved in nano material synthesis and their mechanism of formation
			CO3	Student will get familiarized with the various growth parameters and their influence on the morphology and size control of nanomaterials
			CO4	Student will be able to understand the factors controlling growth of the nanomaterials
			CO5	Student will be able to understand the basic principles behind the synthesis, form bio and green synthesis
			CO6	Student will be able to understand the concept of spontaneous formation and ordering of nanostructures using self-assembly technique

	CC-07	Materials characterization	CO1	Students will be provided with a technological background of the basic condensed matter related knowledge of production of Vacuum
			CO2	Student will understand in detail the concepts, theories and the application of spectroscopy
			CO3	Student will gain the knowledge on material characterization and its importance.
			CO4	Students will understand the surface morphology using different surface scanning instruments
			CO5	Realize the importance of mechanical characterization techniques
	CC-08	Properties of Nanoscale materials	CO1	Student will get a deeper understanding of physical and chemical aspects of nano structures.
			CO2	Student will be able to Understand the principles of optical and mechanical properties of nanomaterials.
			CO3	Student will gain adequate knowledge on principles and underlying phenomena associated with nanomaterials.
			CO4	Acquaint the students with basic concepts and working principles of surface analysis instruments
			CO5	Student will be able to analyze and understand the mechanical behavior of different materials
	AC-03	Research Methodology	CO1	Enable students to identify the overall process of designing a research study from its inception to its report.
			CO2	Students can select and define appropriate research problem, organize and conduct research in a structured manner.
			CO3	Also enables students to prepare a project proposal, to write a research report, articles and thesis in a decipherable manner.
	AC-04	Basics of Biochemistry	CO1	Student will understand the chemical structures, properties and importance of key carbohydrate molecules
			CO2	Contrast the structure of fatty acids and phospholipids and explain its various applications..
			CO3	Student will be understand the chemical structure, reactions, properties, function and use of broad range of various components of nucleic acids.
			CO4	Student will be able to categorize enzymes based on their action and

				understand the kinetic parameters of enzymatic reactions.
			CO5	Student will understand complex biochemical pathways within living cells. Elaborate the importance of ATP
III	EC-01	Nano Electronics	CO1	The student realizes the importance of nano scaling and how it's useful for Nanoelectronics era.
			CO2	Students understand the under laying physical process in Short channel effects.
			CO3	The student will be able to connect the similarities and differences from classical devices to non classical devices through that they understand evolution
			CO4	The student learns the impact of nanotechnology on electronics and the advanced devices operations such as CNT FET, SOI FET, SET etc.,
			CO5	The student understand the importance and necessity of future devices and it's working.
	EC-02	MEMS and Sensors	CO1	The student learn the knowledge and operation of the different MEMS and sensors
			CO2	The student will be able to understand analyze the fabrication process of the lithography
			CO3	The student learns the impact of nanotechnology on sensors and its mechanisms and functioning such as organic sensors
			CO4	To become familiar with the NEMS and advanced devices such as smart dust, DNA sensors etc.,
			CO5	Students will be able to fabricate and analyze of various prototype sensors
	EC-03	Renewable Energy	CO1	The student realizes the importance of energy challenges. To understand the knowledge of the sources of energy and methods of energy conversion technology
			CO2	The student will be able to analyze the functioning basics of solar cell and its different types solar cell operation
			CO3	Students will be able to understand the concept and operation of electro chemistry and its Conversion and Storage Devices
			CO4	The student will be able to analyze the basics and operation of fuel cell and its different types

			CO5	Students apply the acquired knowledge in renewable energy and able to propose alternative solutions
	EC-04	Nano biotechnology	CO1	Students will understand the basics of Nanobiotechnology and their basics and modern biomaterials
			CO2	Students will realize how bimolecular design, structure and molecular imaging were done based nanotechnology
			CO3	Students Acquire the knowledge for Protein based nano structures, Polymer nano containers, DNA based nano structures
			CO4	Students are gains the knowledge of nano particles for bio analytical applications such as X-Ray, MRI and tissue engineering etc.
			CO5	Students will understand nano biotechnological advancements
	AC-05	Computational Mathematics for Nano Science	CO1	Student will understand the role of Mathematics in problems of Nano Science.
			CO2	Demonstrating the use of mathematical tools like FEM and FDM in solving initial and boundary value problems involving differential equations
			CO3	Demonstrating the use of these tools to solve problems through software like Matlab and Mathematical. Also, we intend to show the application aspects of this software
			CO4	Students will be trained to take up problems of physical significance of nano science that involves mathematics as a tool in mathematical modelling.
	OE-01	Nanotechnology and Everyday life	CO1	The student will realizes the background of nanotechnology such as nanotechnology in nature, Scaling and properties at nanoscale
			CO2	The student gains knowledge in preparation of nanomaterials and Dimensionality structure of materials
			CO3	The student will be able to appreciate applications of nanomaterials in all fields.
			CO4	The student realizes the importance Issues and Ethics in Nanotechnology
			CO5	Students gets hands on training on synthesis and fabricate nanostructures
IV	EC-05	Nanotechnology, Society and Ethics	CO1	The student learns the impact of pollution from nanoparticles source, Environment.

			CO2	Students understand of professional and ethical responsibility of nanotechnology
			CO3	The student gains competence about nanotechnology research by taking ethics and public opinion into consideration
			CO4	The student realizes the importance of social impact of nanotechnology
			CO5	Students gains the knowledge of Nanotechnology in medical and health care, food and nutrition
	EC-06	Lithography Techniques and Fabrication	CO1	The student will be able to appreciate the clean rooms and its necessity for nanofabrication techniques such as etching etc.
			CO2	The student realizes the importance of lithographic technique in industrial applications.
			CO3	The student acquire the knowledge of state-of-art nano meteorology tools such as Optical ,electron beam , ion beam , lithography's and nano imprint , soft lithography.
			CO4	The student will be able to connect the similarities and differences between the lithographic techniques and also able to interpreting the various lithography techniques
			CO5	Students able to fabricate and analyze lithography technique for project
	EC-07	Organic Electronics and Nano Magnetism	CO1	The student will be able to appreciate the clean rooms and its necessity for nano fabrication techniques such as etching etc
			CO2	The student realizes the importance of lithographic technique in industrial applications
			CO3	The student acquire the knowledge of state-of-art nano meteorology tools such as Optical ,electron beam , ion beam , lithography's and nano imprint , soft lithography.
			CO4	The student will be able to connect the similarities and differences between the lithographic techniques and also able to interpreting the various lithography techniques
			CO5	Students will be able to fabricate and analyze any of the lithography technique

