Noorul Islam Centre for Higher Education

(Deemed to be University u/s 3 of the UGC Act 1956)

Kumaracoil, Thuckalay, Kanyakumari District - 629 180

Accredited by NAAC with 'A' Grade

NT22 BTech NANO TECHNOLOGY

Student Performance and Learning Outcomes

NT22 BTech NANO TECHNOLOGY

Programme Outcome (PO)	
PO-A	By the end of the program, the student will have 1) In-depth knowledge in optics, electronics, physical, mechanical and biological techniques.
PO-B	2) the student will have a cross linking or inter disciplinary knowledge and problem solving skills for different research challenges.
PO-C	3) the student will be capable of chemical and green synthesis routes, can handle software and modern instrumentation for characterization.
P0-D	4) can design practical platforms with novel nanomaterials and chip based sensors, implants and MEMS.
PO-E	5) can write projects, publications, patents, proposals and design novel tools and materials for research sectors.
PO-F	6) can work in any sector related to energy, space, environment and health to develop novel technologies towards existing challenges

PROGRAM SPECIFIC OUTCOMES (PSO)	
PSO1	Acquire knowledge on the fundamentals of nanotechnologyenables them to understand the emerging and advanced engineering concepts in engineering sciences and life sciences.
PSO2	Acquire knowledge in domain of nanotechnology enabling their applications in industry and research.
PSO3	Empower the students to acquire technological knowledge by connecting disciplinary and interdisciplinary aspects of nanotechnology.

Sl.No	Subject Code	Subject Name
		SEMESTER II
1.	NT2201	Introduction to Nanoscience and Technology
2.	EG2102	Technical English
3.	MA2102	Engineering Mathematics II
4.	ME2201	Engineering Graphics
5.	ME2272	Manufacturing Process Lab I
6.	PH2201	Physics for Electronics Engineering
7.	BS2103	Environmental Science
8.	NT2271	General Synthesis Method Laboratory
		SEMESTER IV
9.	EC2230	Basic Electronics
10.	NT2204	Impedance and Electrochemistry
11.	NT2206	Chemical Reaction Engineering
12.	MA2206	Random Process
13.	NT2205	Basic Characterization Techniques
14.	NT2274	Basics Characterization Lab I
15.	NT2275	Chemical Engineering Lab
16.	EC2298	Basic Electronics Lab
		SEMESTER VI
17.	NT1219	Nanoceramics
18.	NT1217	Nanoelectronics and Nanophotonics
19.	NT1275	Nanoelectronics and Simulation Laboratory
20.	NT1218	Vacuum Science and Cryogenics
21.	NT1215	Nanolithography and Nanofabrication
22.	NT1216	Nanorobotics
23.	CS1212	Cyber Security
24.	NT1276	Surface characterization lab
		SEMESTER VIII
25.	NT12A6	Applications of Nanotechnology in Industries
26.	NT12A4	Advanced Electronics and Instrumentation
27.	NT12A8	MEMS and NEMS
28.	NT12P5	Major Project Work

NT2201 - Introduction to Nanoscience and Technology	
CO1	Understand the fundamentals of nanotechnology
CO2	Understand the theory of structural nanomaterials
CO3	Understand the thermal optical electronic and chemical properties
CO4	Understanding the analysis of thermal mechanical and magnetic properties
CO5	Understanding the applications of basics nanomaterials.

EG2102-Technical English – II	
CO1	The Students will be able to improve their vocabulary and use articles and prepositions effectively in sentences.
CO2	The students will be able to understand grammatical items like phrases and verbs, derivatives, relative pronouns etc. and thereby enhance their linguistic competence.
CO3	The students will be able to acquire the essentials of writing skills relating to resume writing, E-mail writing and also the essential components of essay writing.
CO4	The students will be able to learn the basics of letter writing and the formalities involved in writing formal and business letters.
CO5	The students will be able to learn English Phonemes such as vowels, Diphthongs, consonants, Stress and Intonation.

MA2102- Engineering Mathematics – II	
CO1	Understand the linear differential equations with constant and variable coefficients. To solve the Cauchy's and Legendre's linear equations and solve the differential equations by variation of parameters.
CO2	Know about a functions of a complex variable, analytic functions, Cauchy's Riemann equations. To prove the properties of analytic functions. To find analytic functions and bilinear transformations.
CO3	Study about Cauchy's integral formula and Cauchy's integral theorem and Laurent expressions. Know about singular point and Cauchy's Residue theorem. To evaluate the integrals by Contour integration.
CO4	Know about Gradient, Divergence, Curl, Directional derivative, Irrotational and solenoidal vector field. To verify the vector integration by Green's theorem, Gauss divergence theorem and Stoke's theorem.
CO5	Obtain the Laplace transform of elementary functions, Transform of derivatives and integrals and periodic functions. To find the inverse Laplace transform using convolution theorem and solve the differential equations.

ME2201-Engineering Graphics	
CO1	Familiarize with the fundamental standards applied in engineering graphics and perform free hand sketching of basic geometrical construction and multiple views of object.
CO2	Project orthographic projection of points, line and plane surfaces.
CO3	Understand and draw the projection of solids and its sections.
CO4	Visualize and project isometric views.

CO5	Understand and draw development t of different solids and project orthographic projection of various machine parts.

ME2272-Manufacturing Processes Laboratory – I	
CO1	Understands the important of casting. Machining
CO2	Develop the knowledge about usage of machining and handling cost
CO3	Enable the students for manufacturing the components
CO4	Increase the imagination into reality as a product
CO5	Increase skill to prepare a project report

PH2201-Physics for Electronics Engineering	
CO1	Apply the theoretical foundations of photonics to an advanced level.
CO2	Develop the knowledge and understanding of the key principles and applications.
CO3	Classify solids on the basis of band theory.
CO4	Describe the properties of different materials and their applications.
CO5	Understands the current technical literature which underpins the topic of study

BS213 – Environmental sciences	
CO1	To remember and understand the environmental nature and various resources
CO2	To understand the eco system and apply various techniques to protect eco system
CO3	Analyse the environmental pollution and evaluate the pollution management rules
CO4	To remember and synthesize the social issues. Apply the role of engineering on it.
CO5	Analysis of human population and evaluate the EVS role in human population

NT2271 General Synthesis Method Laboratory	
CO1	Understanding the concepts of UV vis and FTIR spectroscopy
CO2	Understanding the morphological structure using AFM, SEM
CO3	Understanding the thermal and optical property of nanoparticles using PSA and BET
CO4	Understanding the thermal and optical property of compounds using TG/DTA structure
CO5	Understanding the structure of a nanomaterial using RAMAN and FTIR

EC2230 - Basic Electronics	
CO1	To study theory, operation and characteristics of PN junction and Zener diode
CO2	To understand the theory, structure and operation of PNP, NPN, JFET and MOSFET transistors
CO3	To study the function of CRO ammeter, voltmeter, multimeter, frequency meter, time meter, energy meter, poer meter, watt meter and spectrum analyser.
CO4	To understand the digital logic in number system, k- map minimization of Boolean expression
CO5	To study the basics of combination and sequential circuits

NT2204 - Impedance and Electrochemistry	
CO1	Understand the basic concepts and characteristics of electrochemical reactions
CO2	Understand the various concepts and models of electrochemical reactions
CO3	Understand and learn the various techniques used to study and evaluate the various electrochemical reactions
CO4	Understand the reaction kinetics associated with the electrochemical reactions
CO5	Understand the concepts, techniques and applications of impedance spectroscopy

NT2206 - Chemical Reaction Engineering	
CO1	Determine the reaction rate of different types of reactions
CO2	Understand the effects of velocity and fluid properties on rate of reactions controlled by mass transfer
CO3	Determine the mean residence time and standard deviation using residence time distribution (RTD) data
CO4	Analyze the performance of non-ideal reactors using tanks-in series and parallel model
CO5	Understand the effects of catalyst in various reactor considerations

NT2205 - Basic Characterization Techniques	
CO1	Understanding the principle & procedure of Scanning Probe Microscope to characterize the Nanomaterials. To analysis the particle size and surface area.
CO2	To understand the principle & procedure to characterize the nanomaterials using the various spectrometer. To analyze the various applications of nanomaterials based on specific characteristics.
CO3	Understanding the structural and thermal characterization of nanomaterials using X-ray diffractometer and TG/DTA.
CO4	To identify the specific electrical characterization of nanomaterials to use the nanomaterials for specific applications.
CO5	To identify the specific magnetic characterization of nanomaterials for specific applications.

NT2274-Basics Characterization Lab I	
CO1	Understand the basic principle and working set up of X-ray powder diffractometer
CO2	Understand the centrifuge and dynamic light scattering techniques to analyze the particles.
CO3	Understand the basic principle of UV Vis spectroscope to identify the quantity of sample.
CO4	Understand to analyze the crystal structure using FTIR spectroscope and Raman spectroscope.
CO5	Understand the basic principle and working of TG/DTA, AFM and impedance spectroscopy.

NT2275-Chemical Engineering Lab	
CO1	Understand the methods for reaction rate determination
CO2	Understand the reaction kinetics
CO3	Understand the concepts of RTD
CO4	Understand the types of reactions

CO5	Understand the concepts of distillation

EC2298 - Basic Electronics Lab	
CO1	To study theory, operation and characteristics of PN junction and zener diode
CO2	To understand the theory, structure and operation of PNP, NPN, JFET and MOSFET transistors
CO3	To study the function of CRO ammeter, voltmeter, multimeter, frequency meter, time meter, energy meter, poer meter, watt meter and spectrum analyser.
CO4	To understand the digital logic in number system, k- map minimization of Boolean expression
CO5	To study the basics of combination and sequential circuits

MA2206 - Random Process	
CO1	Know about probability, conditional probability, bays theorem, random variable, distribution functions and moments.
CO2	Compute binomial poission, uniform exponential, Gamma and normal distributions and properties. Appy central limit theorem and solve problem.
CO3	Evaluate joint, Morginal and conditional expectations, covariance, correlations and regressions.
CO4	Find the strictly stationary sense, wide sense, Ergodic process and Markow processes. Also find Binomial sine wave processes and Gaussian processes.
CO5	Obtain auto correlation, cross correlation, spectral density and cross spectral density. To find the relation between power spectrum and cross correlation function, Auto correlation and cross correlation.

NT1219-Nanoceramics	
CO1	To come to know the basics of ferroelectric materials. Understanding the function of ferroelectric materials at various devices.
CO2	To understand the principle of piezoelectric devices. To come to know the various characterization of piezoelectric materials and its applications.
CO3	Understanding the concept of spintronics. To apply the spintronics concept in various devices.
CO4	To analyze the materials for electrical energy storage materials based on its characterization.
CO5	To understanding the Photovoltaic Diodes concept. To apply the concept on PVDs and analyze the suitable materials for PV Devices.

NT1217-Nanoelectronics and Nanophotonics	
CO1	To know the basics of nanoelectronic and band diagram of semiconductor structures
CO2	To study the principle and working of single electron devices
CO3	To know the construction and working of resonant tunnel devices
CO4	To study the basic principle and structure of various short channel transistor
CO5	To know the basics of flexible electronics

NT1275-Nanoelectronics and Simulation Laboratory	
CO1	Understanding the VI characteristics of SET using MATLAB
CO2	Understanding the short channel effects of MOSFET using MATLAB
CO3	understanding the electron density and band structure of semiconductor

CO4	Understanding the band structure of armchair ribbon
CO5	Understanding the transmission spectrum of graphene

NT1218-Vacuum Science and Cryogenics	
CO1	Understand the various properties of gases
CO2	Gain knowledge on the different equipment's used in measuring low temperatures and pressure
CO3	To know about the methods and instruments used for vacuum production
CO4	To have a detailed knowledge of cryo-coolers, gas-liquefaction, refrigeration systems, cryogenic insulations and Vacuum technology
CO5	To analyze the cryogenic systems

NT1215-Nanolithography and Nanofabrication	
CO1	To study the basics of lithography techniques which used to fabricate the nanomaterials-based devices.
CO2	To understand the procedure of various optical lithography techniques which used to fabricate the MEMS devices.
CO3	Understanding the source, experimental set up and applications of various electron beam lithography to fabricate the nanomaterials-based devices.
CO4	Understanding the source, experimental set up and applications of various ion beam lithography to fabricate the nanomaterials-based devices.
CO5	To identify the various techniques based on soft lithography to fabricate the nanomaterials-based devices.

NT1216-Nanorobotics	
CO1	Understanding the concepts nanorobotics types and its prototyping materials
CO2	Understanding Modelling of nanorobots and its mechanosynthesis and its various forces involved
CO3	Understanding the design and control of nanorobots by the manipulation with various microscopy techniques
CO4	Understanding various nano robots found in the nature and their interactions
CO5	Understanding the application of nanorobots and their potential applications in drug delivery

CS1212-Cyber Security	
CO1	Learn and understand the basic computer system, operating system and network connectivity
CO2	Analyse the information security issues and goals, study the global security
CO3	Understand the various threats and evaluate the attacks
CO4	Apply the security policies in internet and cloud computing and data base
CO5	Synthesize of cyber crimes and understand the crime laws, analyze the laws in social networks.

NT1276 – surface characterization lab	
CO1	Understand the various surface morphological structure of a material
CO2	Understand the elemental composition of a material
CO3	Analyse the imaging process of a sample material

CO4	Understanding the morphology, elemental composition and magnetic domain of a nano materials
CO5	Identify the unknown compounds and their phase and structural order

NT12A4 –Advanced electronics and instrumentation	
CO1	To learn the basics of feedback amplifier
CO2	To acquire the knowledge of MOSFET
CO3	To expose the ideas of pumping systems
CO4	To learn the basics of microscope and its real time applications
CO5	To gain the knowledge of quantum system

NT12A8 - MEMS and NEMS	
CO1	Gain to design the various sensors and actuators
CO2	Gain the knowledge of different types of materials used in manufacturing
CO3	Ability to design the micro devices, micro systems using the MEMS fabrication process
CO4	Gain the technical knowledge required for fabrication, micro and nanoscale devices
CO5	Ability to understand the operation of micro devices, micro systems and their applications

NT12A6 -Applications of Nanotechnology Industries	
CO1	Understand the importance of nanoscience and nanomaterials for finding suitable area.
CO2	Apply the nanotechnology concepts for various industries such as agriculture, medicine, textiles, cosmetics, automobile and sports industries to solve unsolved issues.
CO3	To gain knowledge over risk assessment, regulatory approaches and potential for regulatory control.
CO4	To get aware of nanotechnology product and its markets.
CO5	Apply the nanomaterials for diagnosis and treatment

NT12P5- Major Project Work	
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach.
CO4	Conduct an engineering project
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.