

**Program Educational Objectives (PEO's):**

- ❖ To produce masters who would have developed a strong background in Nanoscience, Nanomaterials, Thin films and ability to use these tools in their chosen fields of specialization.
- ❖ To produce masters who have the ability to serve country in the R&D domain on solving the problems in existing engineering aspects using the cutting edge technology tool called nanotechnology.
- ❖ To produce masters `who would attain professional competence through life-long learning such as advanced degrees, professional registration, and other professional activities.
- ❖ To produce masters who function effectively in a multi-disciplinary environment and individually, within a global, societal, and environmental context.
- ❖ To produce masters who would be able to take individual responsibility and to work as a part of a team towards the fulfilment of both individual and organizational goals.

**Programme Outcomes (PO's) :**

- ❖ An ability to independently carry out research/investigation development work to solve practical problems.
- ❖ An ability to write and present a substantial technical report/document.
- ❖ Students will demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
- ❖ Recognize the need for multi-disciplinary technologies, exposure to modern tools, environmental sustainability and ability to attain lifelong learning in the broader context of Nano Technology challenges.

## **Course outcomes**

### **M.Tech Sem-I (NanoTechnology)**

#### **Programe core-I**

##### **1NT01 Synthesis/Processing and Properties of Nanostructures**

###### **Course Outcomes:**

1. To develop knowledge about the electronic properties of semiconductor devices.
2. To construct the magnetic properties of bulk Nano structured materials.
3. To visualize the effect of optical properties of various materials
4. Students can able to acquire knowledge based on the thermal properties of nanomaterials
5. To understand advanced mechanical properties of nanostructured materials.

#### **Programe core-II**

##### **1NT02 MATERIALS CHARACTERIZATION TECHNIQUES**

###### **Course Outcomes:**

1. To evaluate the spectroscopic characterization techniques of nano materials.
2. To compare various compositional and structural characterization techniques.
3. To infer the importance of advanced characterization techniques.
4. Student can able to develop knowledge about various electrical and magnetic characterization technique.
5. Gain overall knowledge of various thermal and magnetic characterization techniques.

#### **Programe Elective-I**

##### **1NTPE01: STRUCTURE, BONDING AND QUANTUM MECHANICS**

###### **Course Outcomes :**

1. Student can able to theorize the importance of crystal structure for property evaluation.
2. Student can asses different types of chemical bonding in materials.
3. To evaluate nano structured in quantum mechanical approaches.
4. Students can able to distinguish between classical electromagnetic theory and quantum mechanics.
5. To predict the free electron gas theory of metals and in Hydrogenatom.

#### **Programe Elective-I**

##### **1NTPE01 PHYSICS AND CHEMISTRY OF MATERIALS**

###### **Course Outcomes:**

1. To obtain knowledge on physical properties of materials.
2. Students can able to acquire knowledge on chemistry involved in solid surfaces.
3. To know the importance of chemistry aspects within the material.
4. To understand the mechanism within nanostructures.
5. To demonstrate and understand various growth factors in nanosystems.

### **Program Elective-I**

#### **1NTPE01 PHOTONICS (QUANTUM CONFINED MATERIALS)**

##### **Course Outcomes :**

1. Students can be able to acquire knowledge on luminescence materials.
2. To understand and address the importance of plasmonic properties.
3. To obtain knowledge on new approaches in nanophotonics.
4. To provide sound understanding of various concepts of Biophotonics.
5. To visualize the concept of photonic crystals.

### **Program Elective-I**

#### **1NTPE01 STATISTICAL THERMODYNAMICS FOR NANOSYSTEMS**

##### **Course Outcomes:**

1. To obtain knowledge on thermodynamics systems.
2. Students can be able to acquire knowledge on Nanothermodynamics.
3. To understand the importance of Nonequilibrium thermodynamics.
4. To demonstrate and understand concepts of Nonequilibrium systems.
5. To provide sound understanding of thermodynamics of biological systems.

### **Program Elective-II**

#### **1NTPE02 NANO-BIOMEDICAL APPLIATIONS**

##### **Course Outcomes:**

1. To familiarize students with biological systems, materials and building blocks.
2. To understand the concepts of Biological Nanostructures
3. To familiarize about Biomedical Applications
4. To prioritize the role of nano structured materials in diagnosis
5. To gain the improvements in drug delivery system using nanotechnology.

### **Program Elective-II**

#### **1NTPE02 NANO BIO-TECHNOLOGY**

##### **Course Outcomes:**

1. Students can able to develop deep understanding of Biomedical Application.
2. Student can able to compile all the Drug Delivery Systems.
3. To know the importance of Cell Behavior Toward Nanostructured Surfaces.
4. To prioritize the role of Orthopedic Interface.
5. To gain the improvements in Tissue Engineering/Regenerative Medicine.

## Program Elective-II

### 1NTPE02 BIONANOSTRUCTURES

#### Course Outcomes:

1. Students can able to develop deep understanding of bio nanotechnology, Nanomotors and proteins.
2. To familiarize with various applications of Biosensors.
3. To understand the importance of Biomimicry.
4. To demonstrate and understand applications of nanomaterials in cancer diagnosis.
5. Students can able to acquire knowledge on Nano Artificial Cells

### 1A01 RESEARCH METHODOLOGY & IPR

#### Course Outcomes:

1. Analyze research related information
2. Follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

### 1NT03 SYNTHESIS, FABRICATION AND CHARACTERIZATION LAB

#### Course outcomes:

1. Gain knowledge on the synthesis techniques involved in experiments.
2. Students can acquire knowledge on equipment handling like XRD, PSA, UV etc.
3. To construct a theoretical knowledge on the experiment.
4. The ability to write and present the laboratory reports.
5. To maximize knowledge regarding synthesis and characterization of nanomaterials.

### 1NT04 SIMULATION LAB-I

#### Course Outcomes:

1. To gain knowledge on design and construction of carbon molecules.
2. Student can develop math work and gain knowledge on Mat-Lab.
3. To construct a theoretical knowledge on the experiment.
4. The ability to write and present the laboratory reports.
5. To maximize knowledge regarding simulation components.

## **Course outcomes**

### **M.Tech Sem- II (NanoTechnology)**

#### **Program Core-III**

#### **2NT05 NANO SENSORS AND DEVICES**

##### **Course Outcomes :**

- 1.To develop knowledge about Sensors, Characteristics, design and its Applications.
- 2.To persuade about the Physical Effects of Sensor.
- 3.To visualize the concept of Mass Sensitivity and Conductive Sensors.
- 4.To understand the importance of Electro Chemical Sensors and its measurement types.
- 5.Student can able attain knowledge on Thermometric & Optical sensors.

#### **Program Core-IV**

#### **2NT06: INDUSTRIAL TRENDS AND APPLICATIONS OF NANOTECHNOLOGY**

##### **Course Outcomes:**

1. To elucidate on advantages of nanotechnology-based applications in industries.
2. To provide instances of contemporary industrial applications of nanotechnology.
3. To provide an overview of future technological advancements and increasing role of nanotechnology in Industries.
4. To understand the importance of Nanotechnology in textiles and cosmetics.
5. To visualize the concept of Nanotechnology

### **Program Elective-III**

#### **2NTPE03 NANO TECHNOLOGY FOR ENERGY SYSTEMS**

##### **Course Outcomes:**

1. Study the basic Energy need and role of Battery materials
2. To grade up knowledge of Super Capacitors, and its Applications.
3. Study the role of nano structured material to meet Energy Challenges.
4. Learn about the concept of Hydrogen Storage Technology.
5. Gain knowledge on role of Fuel Cell Technology.

### **Program Elective-III**

#### **2NTPE03 NANO ELECTRONICS AND NANO PHOTONICS**

##### **Course Outcomes:**

1. To assess knowledge on Single Electron and few Electron phenomenon.
2. To determine theory behind Scanning Tunneling Microscope by Applications of Tunneling.
3. Study the basics of coulomb blockade in Quantum mechanics.
4. To persuade Single Electron Transistor and Carbon Nano tube Transistor.
5. To extend the knowledge on Spintronics and Nano photonics.

### **Program Elective-III**

#### **2NTPE03 NANO COMPOSITES DESIGN AND SYNTHESIS**

##### **Course Outcomes:**

1. Student can able to discuss the basic concepts of Nano Composites.
2. Student can able to prioritize the role of Ceramic Metal Composites in Nano Technology.
3. To understand the role of Synthesis Methods for various Nano Composite materials.
4. Learn about the concepts of Indentations and types of Indentations.
5. Correlate the applications of Polymer Nano Composites and Impregnation Techniques.

### **Program Elective-IV**

#### **2NTPE04 SCIENCE AND TECHNOLOGY OF THIN FILMS**

##### **Course Outcomes:**

1. To develop deep understanding on Vacuum Technology.
2. To compile all the Conditions for formation of thinfilms
3. To know the importance of Physical Vapor Deposition techniques.
4. To prioritize the role of Electrical discharges used in Thin Film Deposition
5. To improve the understanding of deposition using CVD.

## **Program Elective-IV**

### **2NTPE04 LITHOGRAPHIC TECHNIQUES**

#### **Course Outcomes :**

1. To discuss about Lithography and Optical Lithography
2. To formulate the role of Electron Lithography
3. To construct the idea of X-ray Lithography
4. To improve our knowledge in Ion Lithography
5. To understand the importance of Lithography based on Surface Instabilities

## **Program Elective-IV**

### **2NTPE04 MEMS/NEMS DESIGN AND APPLICATIONS**

#### **Course Outcomes :**

1. To improve the understanding of MEMS/NEMS.
2. To provide silicon micro fabrication techniques etc.
3. To understand the importance of MEMS Sensors, Design and Processing
4. To bring out scaling and packaging issues of physical system.
5. To provide understanding of MEMS/NEMS applications.

### **2NT07 NANOSTRUCTURED MATERIAL APPLICATION LAB**

#### **Course Outcomes:**

1. To gain overall knowledge on synthesis, characterization and application of nanomaterials.
2. Students can acquire knowledge on equipment handling like Cyclic voltammetry, Anti bacterial applications, gas sensor etc.
3. To construct a theoretical knowledge on the experiment.
4. The ability to write and present the laboratory reports.
5. To maximize knowledge regarding synthesis, characterization and applications of nanomaterials.

### **2NT08 SIMULATION (NANO HUB+QUANTUM WISE) LAB-II**

#### **Course Outcomes:**

1. To familiarize students about applying various material design and data analysis.
2. To help in understanding the theoretical modeling of semiconductor devices quantum structures using online in- browser simulation tools.
3. To construct a theoretical knowledge on the experiment.
4. The ability to write and present the laboratory reports.
5. To maximize knowledge regarding simulation tools.

**AUDIT COURSE: 1A01/2A03 ENGLISH FOR RESEARCH PAPER WRITING**

**Course Outcomes :**

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first- time submission

**AUDIT COURSE: 1A01/2A03 Disaster Management**

**Course Outcomes:** -Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical Relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in..

**AUDIT COURSE: 1A01/2A03 SANSKRIT FOR TECHNICAL KNOWLEDGE**

**Course outcomes:-**

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. Enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. Huge knowledge from ancient literature

**AUDIT COURSE: 1A01/2A03 VALUE EDUCATION**

**Course Outcomes:**

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

**AUDIT COURSE: 1A01/2A03 CONSTITUTION OF INDIA**

**Course Outcomes:**

**Students will be able to:**

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.



**AUDIT COURSE: 1A01/2A03 PEDAGOGY STUDIES**

**Course Outcomes:**

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, And with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and Guidance materials best support effective pedagogy?

**AUDIT COURSE: 1A01/2A03 STRESS MANAGEMENT BY YOGA**

**Course Outcomes:**

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

**AUDIT COURSE: 1A01/2A03 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**

**Course Outcomes**

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students

## Course outcomes

### M.Tech Sem- III (NanoTechnology)

#### Program Elective-V

#### 3NTPE05: PROGRAM ELECTIVE -V: NANOTOXICOLOGY

##### Course Outcomes:

- 1.To provide knowledge on social impact of nano industry.
- 2.To design and conduct experiments, as well as to analyze the results.
- 3.To enhance the various analytical techniques and to identify and solve problems.
- 4.To understand the socio-ethical responsibility.
- 5.To know the importance of Dosimetry, Epidemiology and Toxicology of Nanoparticles.

#### Program Elective-V

#### 3NTPE05: SOCIETAL IMPACTS OF NANOTECHNOLOGY

##### Course Outcomes:

- 1.To provide awareness to the engineering students about socio economic impact of nanotechnology and to handle the techniques effectively.
- 2.Understand the various social impacts of nanotechnology trend and research.
- 3.To enhance the nanotechnology research by taking ethics and public opinion into consideration.
- 4.To understand of professional and ethical responsibility.
- 5.To get awareness on Public Perceptions & Education

#### Program Elective-V

#### 3NTPE05: PROGRAM ELECTIVE –V SEMICONDUCTOR DEVICE PHYSICS AND TECHNOLOGY

##### Course Outcomes:

Students will be able to

1. Gain in-depth knowledge in semiconductor physics
2. Acquire knowledge of mathematical model of various device fabrication processes
3. Gain in-depth knowledge of formation and properties of PN junctions
4. Obtain the fundamentals of metal-semiconductor junctions
5. Gain the physics of optoelectronic devices
6. Understand the fabrication and characteristics of nanoscale MOSFETs
7. Apply the concepts and techniques to solve bandgap model equations and design various semiconductor devices.

#### 3NTOE OPEN ELECTIVE

#### APPLICATIONS OF NANOTECHNOLOGY

##### Course outcomes:

1. To discuss the basic concepts of nano technology.
2. To understand the importance of nano biotechnology
3. To study the influence of nanotechnology in the field of environment and toxicology.
4. To evaluate the concepts of nano electronics.
5. To classify the applications of nano materials.