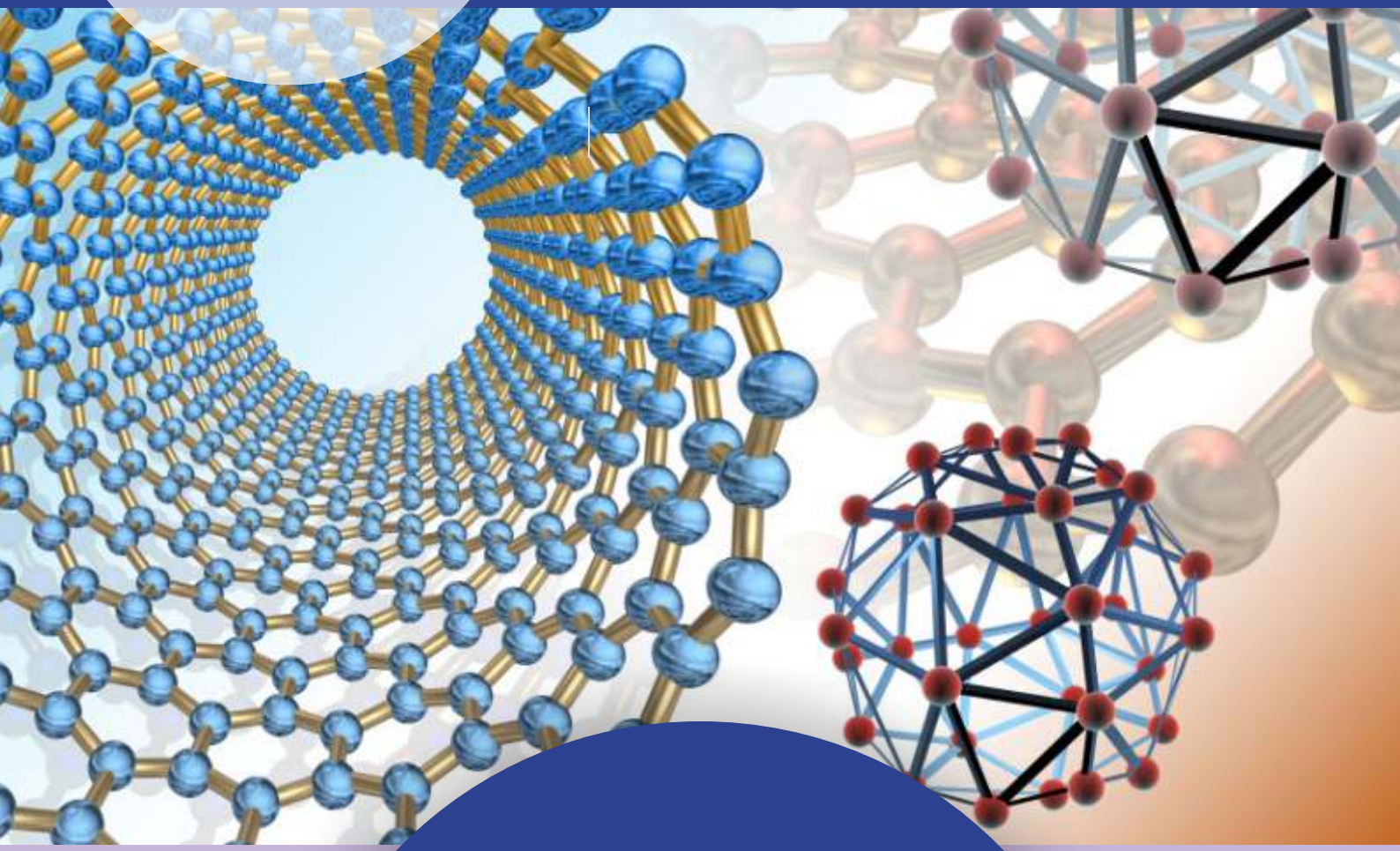
SHARDA UNIVERSITY
Beyond Boundaries

NAAC A+ ACCREDITED

SHARDA SCHOOL OF ENGINEERING & SCIENCE

Department of Electrical Electronics and Communication Engineering



COURSE

Principles of Nanomaterials and it's Characterizations

(NV36001)

VALUE ADDED COURSE BROCHURE-30 HRS

2025-26

ABOUT THE UNIVERSITY

Sharda University envisions to serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship. It has 13,000+ students from 95+ countries, 29 states, and Union Territories, providing cultural diversity and global exposure to students. It has 26000+ alumni who are today leaders in their realms. Sharda University is **NAAC A+** University with Overall **NIRF Rank of 86**. Teaching Learning Center at Sharda University is to equip the faculty members with the expertise, skills and knowledge they need for capacity building of students. Teaching as a profession requires highly specialized skills and knowledge to impact significantly on student learning and therefore teachers must refine their conceptual and pedagogical skills.

ABOUT THE DEPARTMENT

Department of Electrical Electronics and Communication Engineering is one of the premier departments od School of Engineering and Sciences, Sharda University. The department offers B.Tech, M.Tech and Ph.D programmes. The department has people of eminence from academia as well as industry, who have exposure to future cutting – edge research programs in the field of Power system, Power electronics, control engineering, smart grid communication Engineering, Internet of Things, LTE, Embedded systems, Microwave Engineering, Wireless Sensor Networks and VLSI, Robotics.

VALUE ADDED COURSE (VAC)

The Value added Education Courses aim to provide additional learner centric graded skill oriented training, with the primary objective of improving the employability skills of students.

PURPOSE OF VALUE ADDED COURSE

VACs are relevant academic method in order to fill the gaps in students knowledge and add competitive edge to their job prospects. A well-defined of offspring VACs in the courses makes them extremely useful for improving employability quotient of students by building a range of competencies.

It helps students to build a creative foundation for their passion in an area (literary, visual and performing arts, etc) in additional to their professional courses creating dimensions which can help in converting their passion into profession.

VAC can also serve as top-up courses to make students industry-ready by exposing them to the current technology and practices than those covered in their formal degree courses.

RESOURCE PERSON

Dr. Sabyasachi Mukhopadhyay did his Ph.D, in Electronics and Communication Engineering, from Sharda University, Greater Noida , India, in the year of 2023. He received his M.E degree, in Electronics and Communication Engineering, from Panjab University, Chandigarh, India, in the year of 2013. He completed his B.E degree, in Electronics and Communication Engineering, from Burdwan University, WB, India, in the year of 2004. Published 05 research papers. He has travelled Europe to deliver oral presentation on one of his research works. He has been awarded with "Young Investigator Award Certificate", by IRNET, India, for his research contribution on November 4, 2012.Has also been awarded with "Best Teacher Award" by Mewar University in 2005. Till dates he is having 19 years of teaching experiences in various engineering colleges across India. Sabyasachi Mukhopadhyay a young and dynamic academic who associated himself with Sharda University, India, in 2006 and is currently associated with the Sharda School of Engineering & Technology as an Assistant Professor in the Department Electrical Electronics & Communication Engineering. His main research interests are synthesis and characterizations of multiferroic nanoparticles for industrial applications.

SCHEDULE

S. No	Topic	Week
1	Introduction to Materials. Classification of Engineering Materials.	1
2	Industrial applications.	2
3	The fundamentals of nanomaterials and nanotechnology. Structure, properties and processing of nanomaterials. Quantum structure and confinement	3
4	Introduction to physical and chemical approaches of nanomaterial synthesis.	4
5	Crystalline and Amorphous materials, space lattice, motif/basis, unit cell, Crystal system, Bravais lattices	5
6	Crystal directions and planes, Miller indices	6
7	Introduction, structure of nanomaterials. The Bragg Law of X-ray Diffraction	7
8	Hull Debye Scherrer method, Determination of grain size using Scherrer's formula.	8
9	Optical properties, diffraction, interference, resolution, Electromagnetic spectra, Introduction to spectroscopy. UV-Vis. Spectroscopy, Beer Lambert law, Tauc and Davis-Mott relation.	9
10	Raman Spectroscopy, Raman scattering, Rayleigh scattering.	10
11	Scanning Electron Microscope (SEM), Energy Dispersive X-ray Analysis (EDX)	11
12	Transmission Electron Microscope (TEM)	12

School: SSET **Program:** B.Tech **Branch:**	**Batch:** **Current Academic Year:** **Semester:**

1. Course Code	NV36001 / Paper ID:18193
2. Course Title	**Principles of nanomaterials and it's characterizations**
3. Credits	0
4. Contact Hours (L-T-P)	30 Hours
Course Type	Value added course
5. Course Objective	• The course will focus on the structure-property correlations and how these could be unravelled by the use of simple characterization methods such as optical and scanning electron microscopy, x-ray diffraction and Raman spectroscopy. • To understand the characterization methods used for state-of-the-art materials. • To appreciate the results from characterization methods and their reliability. • To appreciate the multiscale and multidisciplinary nature of materials
6. Course Outcomes	After the completion of this course students will be able to: **CO 1:** Explain the basics of nanomaterials and their industrial applications. **CO 2:** Explain the crystal geometry of any crystal structure. **CO 3:** Understand and determine the grain size of nanomaterials using XRD technique. **CO 4:** Demonstrate the spectroscopy techniques and determine the band gap energy. **CO 5:** Explain the electron microscopy characterization for surface morphology. **CO 6:** Apply materials characterization methods based on XRD, spectroscopy, microscopy techniques to various research problems.
7. Course Description	Determination of the structural character and chemical composition of a material is an essential activity of material science. After completion of the course the student should have obtained knowledge of characterization of materials by introducing the basic principles and performing experiences of a large range of techniques used to characterize different types of materials.

8. Outline syllabus		CO Mapping
Unit 1	**GETTING STARTED WITH NANOMATERIALS**	
A	Introduction to Materials. Classification of Engineering Materials. Industrial applications.	CO1
B	The fundamentals of nanomaterials and nanotechnology. Structure, properties and processing of nanomaterials.	CO1
C	Quantum structure and confinement.	CO1
Unit 2	**CRYSTAL GEOMETRY**	
A	Introduction to physical and chemical approaches of nanomaterial synthesis.	CO2
B	Crystalline and Amorphous materials, space lattice, motif/basis, unit cell, Crystal system, Bravais lattices	CO2
C	Crystal directions and planes, Miller indices	CO2
Unit 3	**X-RAY CRYSTALLOGRAPHY**	
A	Introduction, structure of nanomaterials.	CO3
B	The Bragg Law of X-ray Diffraction	CO3
C	Hull Debye Scherrer method, Determination of grain size using Scherrer's formula.	CO3
Unit 4	**SPECTROSCOPY TECHNIQUES**	
A	Optical properties, diffraction, interference, resolution, Electromagnetic spectra, Introduction to spectroscopy	CO4
B	UV-Vis. Spectroscopy, Beer Lambert law, Tauc and Davis-Mott relation.	CO4
C	Raman Spectroscopy, Raman scattering, Rayleigh scattering.	CO5
Unit 4	**SPECTROSCOPY TECHNIQUES**	
A	Optical properties, diffraction, interference, resolution, Electromagnetic spectra, Introduction to spectroscopy	CO5
B	UV-Vis. Spectroscopy, Beer Lambert law, Tauc and Davis-Mott relation.	CO5
C	Raman Spectroscopy, Raman scattering, Rayleigh scattering.	CO6

Mode of examination	Theory
Weightage Distribution	CA MTE ETE 25% 75%
Text book/s*	1. Characterization of materials (Vol. 1 and 2) by E.N. Kaufmann, John Wiley and Sons. 2. Introduction to Nanotechnology - Charles P. Poole Jr. and Franks. J. Qwens (Wiley Inter-science, 2003)
Other References	1.Processing & properties of structural nano materials by Leon L. Shaw (Warrendale, 2003) 2. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao (Taylor & Francis 2008)