THIRD YEAR BACHLOR OF SCIENCE MAJOR PHYSICS REVISED SYLLABUS ACCORDING TO CBCS NEP 2020

COUERSE TITLE: NANOMATERIALS AND APPLICATIONS

SEMESTER: V

W.E.F. 2025-2026

Recommended by the Board of Studies in PHYSICS
And
Approved by the Academic Council

Devrukh Shikshan Prasarak Mandal's
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal.Sangmeshwar, Dist. Ratnagiri-415804, Maharashtra, India

Semester V

Academic Council Item No: 02/2025

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangmeshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Bachelor of Science
Name of the Department	:	Physics
Name of the Class	:	Third Year
Semester	:	Fifth
Paper	:	Elective II
No. of Credits	:	02
Title of the Course	:	Nanomaterial and Applications
Course Code	:	S308PHT
Name of the Vertical in adherence to NEP 2020	:	Elective II
Eligibility for Admission	:	Any student admitted to Third year of B. Sc, degree programme in adherence to Rules and Regulations of the University of Mumbai and Government of Maharashtra
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	5.5
Pattern of Marks Distribution for TE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2025-2026
Ordinances /Regulations (if any)		

Semester – V Paper – II

Syllabus for Third Year of Bachelor of Science in Physics
(With effect from the academic year 2025-2026)

Semester-V **Paper No –Elective II**

Course Title: Nanomaterials and Applications **No. of Credits – 02**

Type of Vertical: Elective **Course Code: S308PHT**

After completing the course, the learner will be able to…

Course Outcome	Course Learning Outcome
CO-01	Understand the fundamental properties and behavior of nanomaterial at the nanoscale.
CO-02	Describe in the fabrication and synthesis of nanostructures using top-down and bottom-up techniques.
CO-03	Understand Application of Characterization Techniques
CO-04	Explain design and Fabrication of Nanomaterial-Based Devices
CO-05	Exploring Nanotechnology in Photonic and Data Storage Applications

Syllabus for Third Year of Bachelor of Science in Physics

(With effect from the academic year 2025-2026)

SEMESTER-V **Paper No.– Elective II**

Course Title: Nanomaterial and Applications **No. of Credits - 02**

Type of Vertical: Elective **COURSE CODE: S308PHT**

COURSE CONTENT			
Module	**Content**	**Credits**	**No. of Lectures**
1	**Nanoscale systems** Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods)**,** Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences. **Synthesis of nanostructure materials** Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis.	**01**	**15**
2	**Characterization of Nanomaterials** X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy. **Applications of Nanomaterials** Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage.	**01**	**15**
	Total	**02**	**30**

References:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.)
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company)
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
5 M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier, 2007).
6 Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

Access to the Course

The course is available for all the students admitted for Bachelor of Science.

Methods of Assessment

The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

Pattern of Evaluation

The Examination/Evaluation pattern shall be framed by the Board of Examination with its final approval from the Academic Council of the College.