St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – V of the following departments under Faculty of Science based on Under Graduate Curriculum Framework - 2023 to be implemented from the Academic Year 2025-26

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

BSc. (Hons.) Chemistry
Category – V

Minor Course-4 Nanotechnology and Nanomaterials (Theory)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Perquisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Nanotechnology and Nanomaterials CHMN552C	2	0	2	10 + 2 from a recognized board in any stream	Basic foundation for studying Nanotechnology in chemistry

LEARNING OBJECTIVES (LO)	
LO-1	Explain the fundamental principles of nanotechnology and their application in various fields.
LO-2	Students will be able to identify and compare different nanofabrication methods and characterization techniques for nanomaterials.
LO-3	Recognize the applications of nanotechnology in various fields including nanomedicine and personal health care.
COURSE OUTCOMES (CO)	
On Completion of this course, the student will be able to	

CO-1	Students will gain basic Knowledge of nanoscience and nanotechnology, including nanoscale phenomena and the unique properties that emerge at the nanoscale.
CO-2	Students will be able to apply their knowledge to characterize nano materials related to nanotechnology.
CO-3	Students will be able to understand fundamental principles, synthesize and characterize nanomaterials, and understand their applications in various fields.
CO-4	Students will be able to design experiments to synthesize and characterize nanomaterials.
CO-5	Students will be able to recognize the applications of nanomaterials and nanotechnology in biological fields

Unit-1 INTRODUCTION AND PREPARATION OF NANOMATERIALS (15L)

Introduction to Nanomaterials, Optical, magnetic and chemical properties of Nanomaterials, Preparation of Nanoparticles: Chemical Approaches: Chemical reduction; Sonochemical synthesis; Sol-Gel Synthesis; Self-assembly. Physical Approaches: Aerosol spray; Gas condensation; Laser vaporization and vapour deposition; Sputtering.

Unit-2 Characterization techniques for Nanomaterials (15L)

Particle size Analyser (Laser scattering), Optical Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunnel Microscopy (STM), X-ray Diffraction (XRD), Auger Emission Spectroscopy, Electron Spectroscopy for Chemical analysis (ESCA)..

Unit-3 APPLICATION OF NANOMATERIALS AND NANOTECHNOLOGY IN BIOLOGICAL SCIENCE (15L)

. Nano medicine, Nano materials for programmable drug delivery, self-assembled nanostructures for biomedical applications, Nanomaterials in cancer treatment, nanotechnology in brain–machine interfaces, Nanomaterials for personalized health care, electronic skins, nanotechnology in tissue engineering, sustainable biomedical technologies, Nanomaterial Delivery Tools for Plants

Suggestive Reading:

1. "Introduction to Nanotechnology: Charles P. Poole, Jr. and Frank J. Owens; Wiley Student Edition, 2008
2. Nanostructures and Nanomaterials: Synthesis, Properties and Applications: G. Cao, ICP, London, 2004.
3. Nanobiotechnology, Concepts, Applications and perspectives: C. M. Niemeyer and C. A.

Mirkin, WILEY-VCH, Verlag GmbH & Co, 2004.
4. Nanotechnology - Molecularly Designed Materials: G. M. Chow and K. E. Gonslaves; (American chemical society)
5. Nanostructures &Nanomaterials: Synthesis, Properties & Applications: G. Cao, Imperial College Press, 2004.
6. “Nano - The essentials: T. Pradeep, Tata McGraw Hill, New Delhi, 2007
7. Nano materials: J. Dutta& H. Hofman.
8. “NANOTECHLOGY-basic science and emerging technologies: Mick Wilson, Kamali Kannagaraet.al., University of new south wales press ltd, 2008.
9. Nanotechnology: Mark Ratner and Daniel Ratner, Pearson Education.
10. Nanomaterials: A.K. Bandyopadhyay; New Age International Publishers
11. Nanomedicine: Kenneth A. Howard, Thomas Vorup-Jensen, Dan Peer (eds.), Springer-Verlag New York, 2016
12. Diverse Applications of Nanotechnology in the Biological Sciences: An Essential Tool in Agri-Business and Health Care Systems; Khalid Rehman Hakeem, Majid Kamli, Jamal S. M. Sabir, Hesham F. Alharby, CRC Press/Apple Academic Press, 2022
13. Nanotechnology in health care: Sanjeeb K Sahoo, Pan Stanford Pub, 2012