Shri Vaishnav Vidyapeeth Vishwavidyalaya

Shri Vaishnav Institute of Science

Department of Chemistry

Generic Elective Course

Choice Based Credit System (CBCS)

SEMESTER V

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
GUCH501	UG	Nanoworld in Chemistry	3	0	0	3	60	20	20	00	00

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To introduce the fundamental concepts of nanoscience and nanotechnology.
2. To highlight the role of chemistry in nanotechnology.

Course Outcomes:

After successful completion of the course, students will be able to:

1. Understand the basic concepts of nanochemistry, including definitions, size regimes, and quantum effects at the nanoscale.
2. Describe various methods of synthesis and characterization of nanomaterials.
3. Identify the applications of nanomaterials in different fields.
4. Critically analyze advanced concepts of nanomaterials.
5. Understand the interaction of nanomaterials with environment.

Syllabus:

Unit I: Introduction to Nanochemistry

- Definitions,
- Unique properties of nanomaterials,
- Historical development and scope of nanochemistry,
- Classification of nanomaterials,
- Exploring the interdisciplinary nature of nanochemistry.

Unit II: Synthesis and Characterization Techniques of Nanomaterials

- Top-down vs. Bottom-up approaches
- Chemical synthesis methods:

Sol-gel methods, Hydrothermal synthesis, Microemulsion techniques, Chemical reduction methods, Chemical vapor deposition (CVD).

- Basic knowledge of characterization tools:

X-ray diffraction (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Energy-dispersive X-ray spectroscopy (EDS), UV-Vis spectroscopy, Gas chromatography-mass spectrometry (GC-MS), Infrared spectroscopy (IR).

Unit III: Applications for Nanochemistry

- Electronics: nanoscale transistors, energy storage, sensors.
- Medicine: drug delivery, cancer treatment, imaging, biomimetic nanomaterials.
- Energy: solar cells, batteries, fuel cells.
- Environmental science: water purification, air pollution control.
- Materials science: composites, coatings, nanomaterials in industry.

Unit IV: Advance Topics of Nanochemistry

- Nanocatalysis,
- Nanocomposites,
- Nanoceramics,
- Nanopolymers,
- Green synthesis of nanomaterials,
- carbon nanotubes (CNT), fullerenes, and graphene,
- Introduction to quantum dots,
- Intellectual property and business development in nanotechnology,
- Ethical and social implications of nanotechnology.

Unit V: Nanotechnology in Environmental and Health Effects

- Nanomaterial based adsorbents and photocatalysts for water and wastewater treatment,
- Nanomembranes in drinking water purification,
- Environmental impacts of nanomaterials on human health,
- Nano/microplastics,
- Environmental hazards in handling and processing nanomaterials,
- Nano Engineering materials for Pollution Prevention.

- Environmental nano remediation technology

References:

1. Klabunde, K.J. (Ed.), "Nanoscale Materials in Chemistry", John Wiley & Sons Inc. 2001
2. Schmid, G. (Ed.), "Nanoparticles", Wiley-VCH Verlag GmbH & Co. KgaA.2004
3. Rao, C.N.R., Müller, A. and Cheentham, A.K. (Eds.),"Chemistry of Nanomaterials", Wiley – VCH. 2005
4. Mai, Y. A., "Polymer Nano composites", Woodhead publishing, 2006.
5. Ajayan, P. M., Schadler, L. S., Braun, P. V. "Nanocomposites Science and Technology"
6. Sergeev, G.B., "Nanochemistry", Elsevier, B.V. 2010.