

Program-Doctor of Philosophy (Chemistry)

Course Name: Advanced Nanochemistry

Course Code: PHDC-06

NO. OF CREDITS: 4

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SESSIONAL	: 25
FINAL EXAM	: 75
TOTAL	: 100

Unit-I

Synthesis Methods: Nanotechnology, Top down and Bottom up techniques, Nanomaterials, Preparation of nanomaterials- solid state reaction method, sol-gel method, hydrothermal, Co-precipitation method, Chemical Vapor Deposition, Ball Milling, Electrodeposition, Green synthesis, Microemulsion synthesis, Quantum Dot synthesis, sonochemical assisted synthesis, core-shell nanostructures, Organic-Inorganic hybrid nanocomposites,

Unit-II

X-ray and Spectroscopic Techniques: X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), X-ray absorption spectroscopy (XAS), X-ray emission spectroscopy, Raman spectroscopy, Beer's Lambert Law, UV-Vis spectroscopic technique, Fourier transform infrared spectroscopy, Fluorescence and Photoluminescence Spectroscopy, Mass spectroscopy, Nuclear magnetic resonance spectroscopy, Electron spin resonance spectroscopy, Thermo Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA).

Unit-III

Microscopy Techniques: Interaction of electrons with solids, Optical microscopes, Electron microscope, Types of electron microscopes, Scanning electron microscope, Transmission electron microscope, Dark and bright field imaging, Analysis of SAED pattern, High resolution Transmission electron microscope, Scanning Tunnelling Microscope, Scanning transmission electron microscope, atomic force microscope.

Unit-IV

Application of Nanotechnology: For remediation of pollutants, waste-water treatment- photocatalysis, electrocatalysis, adsorption, heavy-metal removal, optical and electrochemical sensing of harmful analyte in aqueous media, EMI shielding, nanomaterials in textile and cosmetic, electrical and electronic industries.

REFERENCE BOOKS

1. Poole Jr., C.P., Owens, F.J. "Introduction to Nanotechnology", Wiley (2003).
2. Roco, M.C.; Bainbridge, W.S. (eds.): 2001, Societal implications of nanoscience and nanotechnology, (Proceedings of a workshop organized by the National Science Foundation, September 28-29, 2000), Kluwer, Dordrecht.
3. Zander, C., Enderlein, J. & Keller, R.A. 2002 Single Molecule Detection in Solution. Wiley-VCH Verlag.
4. Ferziger, J. H., Numerical Methods for Engineering Applications, 2nd ed., Wiley-Interscience (1998).

5. Nanomaterials: synthesis, Properties and Applications by Edelstein A S and Cammarata R C, Taylor and Francis, 2012.
6. Nanochemistry: A Chemical Approach to Nanomaterials by G. A. Ozin, A.C. Arsenault, and L. Cademartiri, The Royal Society of Chemistry, Cambridge, 2nd Ed., 2009.
7. Nanostructures & Nanomaterials: Synthesis, Properties, and Applications by Guozhong Cao, Imperial College Press, London, 2004.
8. Nanoscale Science and Technology, edited by R. W. Kelsall, I. W. Hamley, and M. Geoghegan, Wiley, West Sussex, 2005.

Mapping of CO and PO for PHDC-06

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	2	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	2	3	3	3	3	2	3
CO4	3	2	3	3	3	3	3	3	3	2	3	3	3	3	3	3