Optional course

LS 578—Nanobioscience—2 credits

Karunakar Kar

S No	Topics	Contact Hours
Introduction to Nanoscience		
1.	Introduction to Nanoscale, History of nanotechnology, and nanoscience innature,Discussion on CNTs, MWCNT, Quantum dots	2
2.	Molecular based study of condensed matter; low-dimensional materials	2
3.	Properties of nanomaterials: size, surface charge, conductivity, optical propertiesandbiocompatibility. Spectroscopy of nanomaterials (FTIR, UV-Vis, Raman, Fluorescence)	3
Synthesis and characterization of nanomaterials		
4.	Fabrication of nanostructures, Top down and bottom up approaches, their relativemerits, metallic nanoparticles, semi-conductor, and biopolymeric nanostructures, andMagnetic nanoparticles.	2
5.	Methods of characterization: TEM, SEM. EDAX, DLS, XRD	3
6.	Stability of nanoparticle dispersions, Surface functionalization of nanoparticlesbyvarious methods.	2
7.	Rationally engineered Nanostructures and nanomaterials based on proteins,peptides,carbohydrates, and nucleic acids	3
Biological application of Nanotechnology		
8.	Strategies to design biologically active nanostructure-based biomaterials. Interaction ofnanoparticles with biomolecules, determination of binding constants, effects onsecondary structure	3
9.	Cell uptake, cytotoxicity of nanomaterials, size, shape and dose dependence effects.	3
10.	Biomaterials, immobilized enzymes and. Size dependent enzymatic kinetics,drugloading and release kinetics, Drug delivery systems	3
11.	Nanomaterials as Biosensors, Cellular imaging tools, tissue scaffolds, 3D tissue culture	3

Recommended Textbooks, reference books:

(1) Poole, C.P., Owens, F.J. Introduction to Nanotechnology Wiley,2012
(2) Cao, G. Wang, Y. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications WorldScientific,
(3) Bohidar, H.B and Rawat, K: Design of Nanostructures: Self-Assembly of Nanomaterials,Wiley-VCH,2017
(4) Pradeep, T. Nano: The Essentials: Understanding Nanoscience and Nanotechnology: Mc-Graw-HillEducation
(5) Cox, M.M, Nelson, D.L., Lehninger Principles of Biochemistry, W.H. Freeman & Co, 2009.
(6) Voet, D., Voet, J.G., Pratt, C.W., Fundamentals of Biochemistry: Life at the Molecular Level, Wiley,2012
(7) Selected Review Papers/Book Chapters