

BHARATHIAR UNIVERSITY-COIMBATORE. 641 046**M.Phil./ Ph.D.-NANOBIOTECHNOLOGY**

[From October 2011 batch onwards]

PART-I SYLLABUS**PAPER-I- Research Methodology****Unit 1: Structural Studies:**

X-Ray Diffraction-Introduction- basic principles- characterisation by XRD- examples of XRD characterization-Debye Scherer formula-FTIR- introduction- basic principles- Methodologies and accessories- interferences and artifacts

Unit 2: Microscopic techniques – Optical microscopy of aggregates, Electron Microscopy- Scanning Electron Microscopy (SEM)-Modern advances in SEM- Transmission Electron microscopy (TEM)- Biological sample preparation for TEM- Environmental TEM- Scanning probe microscopy-STEM- Atomic Force Microscopy(AFM)-Confocal Microscopy- Scanning Near Field Microscopy-Nanoindentation.

Unit 3: Spectroscopic and Electrochemical techniques- UV-Vis Spectroscopy- Energy Dispersive X-ray Spectroscopy, Mass Spectroscopy-Types-Nuclear Magnetic Resonance (NMR) Spectroscopy, Differential Scanning Calorimetry (DSC) - Electrochemistry fundamentals, Electro-analytical techniques- Voltametry- Linear Scan voltametry-Cyclic Voltametry- Impedence Spectroscopy- Applications.

Unit 4: Techniques in Biomedical imaging and Nanostructuring

Immuno Fluorescent Biomarker Imaging- Immuno gold labeling- Nanoprobes- Diagnostic Biosensors- Functionalized Metallic Nanoparticles And Their Applications in Colorimetric Sensing- Dip stick Tests- Nanoparticles as Catalysts for Signal Generation and Amplification- Optical nanoparticles sensors for quantitative intracellular imaging. Cancer imaging- Nanophotonics.

Unit 5. Statistical Methods:

Measures of central tendency probability and dispersal; (Binomial, distributions Poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis variance; of X² test; basic introduction to Muetrovariate statistics. etc.

References:

1. N. Yao And Zhong Lin Wang, Handbook Of Microscopy For Nanotechnology Kluwer Academic Publishers, 2005.
2. T.Pradeep, Nano, The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, 2007.
3. J. D. Bronzino, Tissue Engineering and Artificial Organs, Taylor & Francis Group, LLC, 2006.
4. Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology, John Wiley and Sons Inc, 2009.

5. C.A. Mirkin and C.M. Niemeyer, Nanobiotechnology- II, More Concepts and Applications, WILEY-VCH, Verlag Gmb H&Co, 2007.
6. E. David Reisner, Bionanotechnology- Global Prospects, Taylor & Francis Group, LLC, 2009.
7. J. W. M. Bulte, M.M.J. Modo, Nanoparticles in Biomedical Imaging: Emerging Technologies and Applications, Springer Science Business Media, LLC, 2008.
8. Jerrod H.Zar (1999) Biostatistical ananalysis by Prentice hall international Inc Press, London.

BHARATHIAR UNIVERSITY COIMBATORE 641-046**M.Phil/ Ph.D Biotechnology****Part-I Syllabus****Paper-II- Research Trends in Nanobiotechnology****Unit 1: Introduction to Nanotechnology**

Particle size, Size effect, particle shape, various methods of synthesis—chemical, physical-biological, Surface, mechanical, electrical, biostability properties of nanoparticles - Crystal structure.

Unit 2: Biologically Inspired Hybrid Nanodevices- Membrane Proteins and their Native Condition- Protein Tool box- ATPase and Bacteriorhodopsin, Ion Channels and Connexin-Biochips.

Unit 3: Bionanoelectronics- Nanomotors, Biocatalytic Growth of Nanoparticles for Sensors and Circuitry, Photoinduced Electron Transport in DNA: DNA Nanowires- Charge Transport- DNA-Based Nanoelectronics- Electrical Manipulation of DNA on Metal Surfaces, Nanostructured Biocompartments- DNA-Gold nanoconjugates

Unit 4: Bio-interface systems- Lab on chip devices-their potentials for Nanobiotechnology-microfluidic devices- methods- fluidic structures- fabrication and surface modification- spotting and detection mechanism- Microcontact printing of Proteins-Strategies- printing types- Cell nanostructure interactions-networks for neuronal cells.

Unit 5: Nanoscale Applications in Health and Science- Cancer- Current trends in cancer treatment- Nanotechnology in treatment of cancer, Nanotechnology in personalized medicine, Antimicrobial activity of nanoparticles- mode of action, Cell Nanobioscience- Nucleosome core-Protein stability to heat and radiation- and Nanooptics.

References:

1. O. Shoseyov, Ilan Levy, Nanobiotechnology-BioInspired Devices and Materials of the Future, Humana Press Inc, 2008.
2. C.A. Mirkin and C.M. Niemeyer, Nanobiotechnology- II, More Concepts and Applications, WILEY-VCH, Verlag Gmb H&Co, 2007.
3. David E. Reisner Bionanotechnology- Global Prospects, Taylor & Francis Group, LLC, 2009
3. Claudio Nicolini, Nanobiotechnology & Nanobiosciences Pan Stanford Publishing Pte. Ltd, 2009.

BHARATHIAR UNIVERSITY COIMBATORE 641-046**M.Phil/ Ph.D Biotechnology****Part-I Syllabus****Paper-III- Nanobiotechnology**

Unit 1: Functional Principles of Nanobiotechnology- Information-Driven Nanoassembly- Energetic- Chemical Transformation- Regulation- Traffic Across Membranes- Biomolecular Sensing- Self-Replication- Machine-Phase Nanobiotechnology

Unit 2: Self assembling nanostructures- Self-Assembled Artificial Transmembrane Ion Channels-types, Methods, Self-Assembling Nanostructures from Coiled-Coil Peptides, Synthesis and Assembly using Bio-Derived Templates- Self-Assembling for Patterned Molecular Assembly.

Unit 3: Protein and Peptide based Nanostructures- S-layers-Chemistry and structure, Assembly, recrystallisation, diagnosis- Engineered Nanopores- Methods of production-Supported bilayers and membrane arrays- Genetic Approaches- Microbial nanoparticles production- Magnetosomes- Bacteriorhodopsins- Nanoproteomics.

Unit 4: DNA based Nanostructures- DNA-protein nanostructures-Methods- Self assembled DNA nanotubes—Nucleic acid Nanoparticles, DNA as a Biomolecular template-DNA branching-Metallization- Properties.

Unit 5: Pharmaceutically important nanomaterials

Drug Nanoparticles- Structure and Preparation, Liposomes, Cubosomes and Hexosomes, Lipid based Nanoparticles-Liquid nanodispersions- Solid Lipid Nanoparticles (SLP)- Biofunctionalisation of SLP, Characterization- Nanoparticles for crossing biological membranes. Fundamentals- Physicochemical Principles of Nanosized Drug Delivery Systems-Nanotubes, Nanorods, Nanofibers, and Fullerenes for Nanoscale Drug Delivery, Carbon nanotubes biocompatibility and drug delivery

References:

1. Claudio Nicolini, Nanobiotechnology & Nanobiosciences Pan Stanford Publishing Pte. Ltd, 2009.
2. C.M. Niemeyer and C.A. Mirkin, Nanobiotechnology, Concepts, Applications and perspectives, WILEY-VCH, Verlag Gmb H&Co, 2004.
3. S. David Goodsell, Bionanotechnology, Lessons from Nature, Wiley-Liss, Inc, 2004.
4. Melgardt M.deVilliers, Pornanong Aramwit, Glen S.Kwon, Nanotechnology in Drug Delivery, Springer-American Association of Pharmaceutical Scientists Press 2009.
5. Robert A. Freitas Jr. Nanomedicine, Volume I:Basic Capabilities, Landes Bioscience,1999.

BHARATHIAR UNIVERSITY COIMBATORE 641-046**M.Phil/ Ph.D Biotechnology****Part-I Syllabus****Paper-III- Biomaterials**

Unit 1: Properties of Materials- Bulk properties- bondings, Atomic and Micro structures, materials type, Mechanical properties- Elastic behavior, Stress and Strain, Tension and Compression, Shear, Isotropy-Fatigue- Toughness- Effect of Fabrication on Strength.

Unit 2: Biomaterial types- metals, polymers, hydrogels, bioresorbable and bioerodible materials, ceramics, natural materials, composites- biologically functional materials.

Unit 3: Tissue derived biomaterials- Collagen-Structure and properties, biotechnology of collagen- Isolation, Purification and matrix Fabrication Technology-Design of Resorbable collagen based medical implants- tissue Engineering for tissue and organ- Cell-Biomaterials Interactions at micro and nanoscale.

Unit 4: Cell adhesion and Migration on biomaterials-Adhesion Receptors in Tissue Structures- Cell Adhesion to Biomaterials-Measurement of Cell Adhesion to Biomaterials-Effect of Biomaterial on Physiological Behavior-Mammalian Cell Migration-Characteristics-Regulation of Cell Movement-Cell Migration Assays.

Unit 5: Host Reactions to Biomaterials and their Evaluation- Inflammation, Foreign Body Response- Hypersensitivity- Toxicity- Blood Material Interactions- Tumorigenesis and Biomaterials-Infections-Other immunological reactions.

References:

1. O. Shoseyov, Ilan Levy, Nanobiotechnology-BioInspired Devices and Materials of the Future, Humana Press Inc, 2008.
2. J.Y.Wong and J.D.Bronzino, Biomaterials, CRC press, 2007.
3. B.D.Ratner, A.S.Hoffman, F.J.Schoen, J.E.Lemons, Biomaterials Science: An introduction to materials in Medicine, Elsevier, 1996.
4. C.M. Niemeyer and C.A. Mirkin, Nanobiotechnology, Concepts, Applications and perspectives, WILEY-VCH, Verlag Gmb H&Co, 2004.
5. B.K.Parthasarathy, Nanotechnology in Life Science, Isha Books, 2007.
6. C. Nicolini, Nanobiotechnology & Nanobiosciences Pan Stanford Publishing Pte. Ltd, 2009.
7. R.Ian Freshney, Culture of Animal Cells: A manual of basic Techniques, Wiley publications
8. Joseph D. Bronzino, Tissue Engineering and Artificial Organs, Taylor & Francis Group, LLC, 2006.