

CERTIFICATE COURSE ON NANO-BIOLOGY

(Non-Semester)

(With effect from the academic year 2013-14)

Eligibility for the Course

Candidates for admission to Certificate course on Nano-Biology could possess a Higher Secondary school Education in Science subjects with Biology

Duration of the Course

One year Certificate course Nano-Biology course non-semester for One Year duration

Examination

All the theory papers are of 3 hours duration each for a maximum of 100 marks with passing minimum of 35 marks. Practical examinations are also for 3 hours duration for a maximum of 100 marks and passing minimum of 35 marks.

Question Paper Pattern

Maximum marks: 100

Time: 3 hours

Part A (5 x 3 = 15)

Five short answer questions (One question from each unit)

Part B (5 x 8 = 40)

Paragraph questions (Total questions 8, out of which answers are to be given for any five questions;

Part C (3 x 15 = 45)

Total questions 5, out of which answers are to be given for any Three questions;

S.No	Theory & Practicals	Maximum Marks	Minimum Marks
1.	Biological Nano-Objects	100	35
2.	Bio-nanomaterials and their uses	100	35

Paper 1: Biological nano-objects

Unit: 1

Biopolymers: DNA: structure, geometry, topology and modification- introduction to cells- Proteins: enzymes and structural proteins; lipids: fatty acids, phospholipids, glycolipids, protein-lipid assembly and biomimetic nanostructures- lipid nanoparticles, micelle; polysaccharides: starch, cellulose, agar, agarose, pectin, xanthan etc.

Unit: 2

Biological nanomachines and genetic material : DNA polymerases: DNA pol I , DNA pol II and DNA pol III, helicases- ligases- topoisomerases, recombinase- transposase - mitotic spindle and chromosome separation; RNA polymerases, RNA pol I , RNA pol II and RNA pol III .

Unit: 3

Nanomachines in protein metabolism: ribosome structure: 30S, 50S, 40S and 60S sub units – tRNA & mRNA; structure, 5' UTRs, 3'UTRs, polyA tail, protein synthesis; structure of protein: primary, secondary, tertiary and quaternary structures- peptides-proteasome- structure and function, antibody structure; monoclonal antibodies, single chain antibodies, phage display of peptides.

Unit: 4

Nanomotors : rotary motors: bacterial flagella, ATP synthase; Linear molecular motors : actomyosin responsible for muscle contraction; dynein-microtubule system; Kinesin-microtubule system: transport of vesicles.

Unit: 5

Receptors and signal transduction pathways; peptide ligands: insulin, calcitonin, epidermal growth factor, glycoproteins: thyroid stimulating hormone (TSH), adrenocorticotrophic hormone (ACTH), Lipid hormones: cortisol, vitamin; prostaglandins.

Paper 2: Bio-nanomaterials and their uses

Unit 1:

Types of nanomaterials: nano rods, nanowires, nanoparticles, nanocapsules, nano membranes, nano meshe, nano fibres, nano catalysts, carbon nano tubes. Methods of preparation of nanomaterial: top down and bottom up approaches-emulsifiers, homogenizers, MOCVD etc. Nanomaterial characterization: AFM, HR-TEM, Particle size analyzer, Zetasizer.

Unit 2:

Nanomedicine: nano carriers for drug delivery, nanoparticle mediated delivery of siRNA, nanotechnology in drug discovery, nano-formulation of herbal medicine, dermal delivery ; nano-scaffolds and their use in cell culture, organ culture and tissue engineering, nano-cosmetics. Regulatory aspects in the approval of nano medicine, Toxicological considerations in Nano medicine and nano-delivery systems.

Unit 3:

Nano biotechnology: Bioelectronics systems based on photosystem - Devices based on bacteriorhodopsin, bio polymers. Food industry applications: lipid and starch nano carriers; flavors, nanosalt, Oil in water emulsions, breathing bags, nanosensors, taste, color.

Unit 4

Devices used: Micro & Nano fluidics – Micro-fabricated Devices for cell biological applications-micro-fabricated devices to study directed cell migration – Q dots and imaging applications – single molecular analysis, biosensors - Lab-on-a-chip.

Unit 5:

Environmental applications: Nano clays, nano adsorbents, zeolites, release of nutrients and pesticides, biosensors - green technologies - molecular biomimetic - nano remediation: Identification and characterization of Hazardous waste, nano pollution, air - water - soil contaminants, identification and Characterization of Organic and inorganics, Treatment of industrial waste waters using nano-particles.

Book:

Nanoscience : Nanobiotechnology and Nanobiology (2009) P. Boisseau, P. Houdy and M.Lahmani, (Eds.)Springer, Heidelberg.

References:

1. Nanotechnologies for Solubilization and Delivery in Food, Cosmetics and Pharmaceutics (2011). NissimGarti and Idit Amar-yuli. DEStech publications.
2. Nanotechnology in Biology and Medicine: Methods, Devices and Application, 2007,Tuan Vo-Dinh . CRC press.
3. Environanotechnology ,2010, Mao Hong fan, Chin-pao Huang, Alan E Bland, Z Honglin Wang, Rachid Sliman, Ian Wright. Elsevier.
4. Nanotechnlogy: Health and Environmental risk, 2008, Jo Anne Shatkin. CRC press.