4. (a) Explain the concept of targeting in nanocarrier-based drug delivery. Differentiate between active and passive targeting. (7)

   (b) Describe how nanocarriers improve pharmacokinetics, biodistribution and bioavailability of drugs. (8)

5. (a) Explain the role of lipid nanoparticles and viral nanoparticles in modern vaccine systems. (7)

   (b) Discuss in vivo nanoparticle-based imaging for detection of tumours and genetic defects. (8)

6. (a) Describe nanotoxicity with reference to the effect of size, shape, surface properties and composition of nanoparticles on cells. (8)

   (b) Explain genotoxicity, carcinogenicity and the methods used for evaluation of nanoparticle toxicity. (7)

7. Write short notes on any **three** of the following : (3×5=15)

   (a) Ball milling

   (b) Intranasal drug delivery

   (c) DNA-based biosensors

   (d) Environmental nanoremediation technology

   (e) Risk assessment of nanoparticle exposure

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 266 **L**

Unique Paper Code : 2233010014

Name of the Paper : Nanobiotechnology (DSE)

Name of the Course : **B.Sc. (H) Zoology**

Semester : VI (NEP-UGCF)

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all, including Question No. **1**, which is compulsory.
3. Draw well-labelled diagrams wherever necessary.

1. Attempt **all** parts. (**30** Marks)

   (a) Define the following : (5×2=10)

      (i) Nanoscale assembly

      (ii) Lipid nanoparticle vaccine

      (iii) Bioavailability

      (iv) Nano-immunosensor

      (v) Cytotoxicity

(b) Differentiate between the following : (4×2=8)

(i) Bulk materials and nanomaterials

(ii) Chemical synthesis and green synthesis of nanoparticles

(iii) Oral drug delivery and controlled drug release

(iv) Enzyme-based biosensor and nano-immunosensor

(c) State whether the following statements are True or False : (4×1=4)

(i) Quantum dots exhibit size-dependent optical properties.

(ii) Active targeting does not require any ligand on the nanoparticle surface.

(iii) Nanofiltration is useful for removal of organics, inorganics and pathogens from wastewater.

(iv) Smaller nanoparticles may show greater cellular uptake than larger particles of the same material.

(d) Fill in the blanks : (4×1=4)

(i) Liposomes are composed of a _____ bilayer.

(ii) Ball milling is an example of a _____ approach.

(iii) Iron oxide nanoparticles are commonly used in _____ imaging.

(iv) The harmful effect of nanoparticles on cells is called _____.

(e) Match the following : (4×1=4)

Column A	Column B
(i) Quantum dots	(a) Passive tumour accumulation
(ii) Carbon nanotubes	(b) Fluorescent imaging probe
(iii) Nanofiltration membrane	(c) Removal of pollutants/ pathogens from wastewater
(iv) EPR effect	(d) One-dimensional carbon nanostructure

2. (a) Explain biomaterials and synthetic materials used in nanobiotechnology. (7)

(b) Describe various types of nanocarriers, including liposomes, polymeric micelles, quantum dots, iron nanoparticles and carbon nanotubes, with their applications. (8)

3. (a) Discuss top-down and bottom-up approaches used in the nanofabrication of nanobiomaterials. (7)

(b) Explain chemical synthesis of metal oxide nanoparticles and co-precipitation methods with suitable examples. (8)

P.T.O.