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Printed Page:-3 **Subject Code:- BBT0603**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: VI - THEORY EXAMINATION (2025 - 2026)
Subject: Nanobiotechnology

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

(1.1) Which is NOT a nanobiotechnological application? (CO1, K1) 1

(a) Biosensors
(b) Nanoimaging
(c) Gene delivery
(d) Large-scale farming

(1.2) The process of removing material to create patterns is known as: (CO1, K1) 1

(a) Deposition
(b) Etching
(c) Layering
(d) Crystallization

(1.3) What is the crystal structure of ZnO nanomaterials? (CO2, K1) 1

(a) FCC
(b) BCC
(c) Hexagonal wurtzite
(d) Amorphous

(1.4) TiO_2 nanoparticles are widely used in: (CO2, K1) 1

(a) Lubricants
(b) Sunscreens
(c) Adhesives
(d) Conductors

(1.5) In DLS, a higher scattering intensity indicates: (CO3, K1) 1

(a) Smaller particles
(b) Non-spherical particles
(c) Aggregation
(d) Lower zeta potential

(1.6) Which spectroscopy is best for detecting functional groups? (CO3, K1) 1

(a) UV-Vis
(b) FTIR
(c) DLS
(d) XRD

(1.7) What affects drug release from polymer matrices? (CO4, K1) 1

(a) pH, polymer type, and loading
(b) Only size of drug
(c) Temperature only
(d) Protein content

(1.8) Bioglass is mainly used in: (CO4, K1) 1

(a) Liver regeneration
(b) Soft tissues
(c) Bone regeneration
(d) Corneal repair

(1.9) Carbon dots are derived from: (CO5, K1) 1

(a) Pure gold
(b) Silica gel
(c) Carbon-rich organic compounds
(d) Iron oxide

(1.10) Quantum dot surface modifications improve: (CO5, K1) 1

(a) Toxicity
(b) Light scattering
(c) Biocompatibility and targeting
(d) DNA melting point

2. Attempt all parts:-

(2.1) State two applications of nanotechnology in medicine. (CO1, K1) 2

(2.2) What is inorganic nanocarrier? (CO2, K1) 2

(2.3) What does Atomic Force Microscopy (AFM) measure? (CO3, K1) 2

(2.4) Define the term biocompatibility. (CO4, K1) 2

(2.5) Name two types of nanoparticles used in targeted drug delivery. (CO5, K1) 2

SECTION-B 30

Answer any one of the following:-

(3.1) Compare between top-down and bottom-up approaches in nanofabrication, giving two examples of each. (CO1, K2) 6

(3.2) Explain the fundamental concepts of nanobiotechnology and discuss how it 6

integrates principles from both biology and nanotechnology. (CO1, K2)

Answer any one of the following:-

(3.3) Explain how carbon nanofibers are synthesized and their advantages. (CO2, K2) 6

(3.4) Explain the thermal and optical properties of inorganic nanoparticles. (CO2, K2) 6

Answer any one of the following:-

(3.5) Differentiate between STM and AFM in terms of working principles. (CO3, K2) 6

(3.6) Explain the basic working principle of Surface Plasmon Resonance. (CO3, K2) 6

Answer any one of the following:-

(3.7) List and explain different types of polymers used as biomaterials with examples. (CO4, K2) 6

(3.8) Define biomaterials and classify them based on origin and application. (CO4, K2) 6

Answer any one of the following:-

(3.9) Explain the working principle of a typical nano-biosensor. (CO5, K2) 6

(3.10) Explain micro and nano biosensors with examples. (CO5, K2) 6

SECTION-C 50

4. Answer any one of the following:-

(4.1) How is nanobiotechnology transforming drug delivery systems? Discuss targeted and controlled delivery mechanisms. (CO1, K3) 10

(4.2) Assess the ethical, environmental, and safety concerns related to nanobiotechnology and its commercialization. (CO1, K3) 10

5. Answer any one of the following:-

(5.1) Explain the size-dependent optical properties of quantum dots and gold nanoparticles. (CO2, K4) 10

(5.2) Discuss structure-property relationship in carbon-based vs inorganic nanomaterials. (CO2, K4) 10

6. Answer any one of the following:-

(6.1) What is Zeta Potential? Explain how it is measured and its importance in evaluating the stability of nanoparticle suspensions. (CO3, K4) 10

(6.2) Explain the working principle of Surface Plasmon Resonance (SPR). Discuss its applications in biosensing and molecular interaction studies. (CO3, K4) 10

7. Answer any one of the following:-

(7.1) Describe the synthesis methods and key characterization techniques used for natural and synthetic biomaterials. Illustrate with examples. (CO4, K4) 10

(7.2) Explain the working principle and use of bioresorbable polymers in surgical implants. (CO4, K4) 10

8. Answer any one of the following:-

(8.1) Analyze the toxicity concerns and biocompatibility of quantum dots in clinical use. (CO5, K4) 10

(8.2) Compare MRI, PET, and fluorescence-based nano-imaging agents in terms of resolution and sensitivity. (CO5, K4) 10