

B.E. ELECTRICAL ENGINEERING EXAMINATION, 2024

(4th Year, 2nd Semester)

INTRODUCTION TO NANO- BIOTECHNOLOGY (HONS.)

Time: Three Hours

Full Marks: 100

(50 marks for each part)

Use a **separate** Answer-script for each Part

PART-I

Answer *any three* questions

Two Marks are reserved for neatness and well organized answer script

1. With suitable examples, illustrate how a nano-bio (i) linear and (ii) rotary motor can be implemented. Provide proper illustrations to support your answer. 8+8
2. How does photo-induced electron transport occur in DNA? Compare it with respect to HOMO-control and LUMO-control. Depict the experimental setup for the same. 2+9+5
3. a) Identify some important topics of research in nano-biotechnology. 6
b) Describe an "artificial red blood cell" and its proposed working principle. 5
c) What is a "bioengineered cell rover"? Explain its function. 5
4. a) Describe the "top-down" and "bottom-up" approaches of nano-bio technology. 4
b) Write short notes on (i) Liposomes (ii) Dendrimers and (iii) Microbivore. 4+4+4
5. a) Provide applications of nano-biotechnology in medical and clinical fields. 8
b) What are the future prospects of nano-biotechnology? 4
c) Discuss the challenges of nano-biotechnology. 4

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PART-II

Answer Any three questions

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1. Briefly explain the following tools used in the fabrication of nanostructures: 16
 - a) Laser Ablation
 - b) Self-Assembly
 - c) Nanosphere Liffoff Lithography
 - d) Molecular beam epitaxy (MBE)
2. a) Explain the electrical, mechanical, and vibrational properties of carbon nanotubes. 10
b) Briefly mention some of the applications of carbon nanotubes. 6
3. In brief, explain the following nano-material characterization tools: 16
 - a) Atomic Force Microscopy
 - b) Fluorescence Microscopy
 - c) Electron Microscopy
4. a) What is Moore's law? What are the factors enabling Moore's law? 2+4
b) Explain the operation of a tunnel diode in the context of nanotechnology. Mention the advantages and disadvantages of tunnel diodes. Also, mention their applications. 10
5. Write short notes on **any two** of the following: 2×8=16
 - a) Different forces that play a vital role in the creation of stable nanostructures
 - b) Different structures of carbon nanotubes
 - c) Quantum Computing