

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION, 2023

(5th Year, 2nd Semester)

INTRODUCTION TO NANO- BIO TECHNOLOGY

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 neat and well organized answer script

1. With a neat sketch, draw the rotary motor of flagella. Label the parts and show the similarity with an electrical induction motor. 16

2. How photo-induced electron transport takes place in DNA? Compare with respect to HOMO-control and LUMO-control. 16

3. a) Identify some important topics of research in nano-bio technology in the coming years. 6
b) Describe a “respirocyte” and its proposed working principle. 5
c) What is “bioengineered cell rover”? Explain its function. 5

4. a) What is nano scale? Give idea of a nano-bio structure that fits in a nano scale. 3
b) Draw a schematic of various types of pharmaceutical nano systems. 5
c) Write short notes on (i) Liposomes and (ii) Dendrimers. 8

5. Briefly explain some of the therapeutic applications of nano-biotechnology. 16

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PART-II

Answer Any three questions

(2 marks for neat and well-organized answers)

1. a) Briefly explain the different forces that play vital role in creation of stable nanostructures. 9
- b) Discuss the different properties of carbon nanotubes. 7
2. a) Describe the different structures of nanotubes. 6
- b) Explain the different fabrication processes of carbon nanotubes. 10
3. a) In brief, explain the following nano-material characterization tools:
 Atomic Force Microscopy, Fluorescence Microscopy and Electron Microscopy. 4+4+4
- b) Mention the different commercial applications of nanotechnology 4
4. a) What is Moore's law? What are the factors enabling Moore's law? 2+4
- b) Explain Moore's Second Law. 6
- c) Briefly explain the development of nanoscale transistors. 4
5. Write short notes on **any two** of the following: 2×8=16
 - a) Quantum Computing
 - b) Different application of carbon nanotubes
 - c) Operation of tunnel diode w.r.t. nanotechnology