

**BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING EXAMINATION, 2018**

(4th 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. Explain the concept of a (i) rotary and a (ii) linear motion molecular bio-motor with detailed sketches. 8+8
  
2. Explore the possibility of photoinduced electron transport in DNA. Emphasize on the comparison of HOMO-control and LUMO-control in DNA. 16
  
3. Explain the structure and photocycle of bacteriorhodopsin. Highlight the important amino acids that contribute to the light-driven photocycle. Show the key intermediates, along with each absorption maximum, of the primary (bR, K, L, M, N, and O) and branched (P and Q) photocycle. 16
  
4. Give the schematic representation of a electrical measurement setup adopted to investigate electrical transport in DNA molecules. Show cAFM on “laying” molecules and cAFM and scanning tunnelling microscopy on “standing” molecules. How “Bridging” molecules are trapped? 16
  
5. Illustrate surface functionalization using thiols bound to Au for binding DNA to metal surface. Show the immobilization kinetics of thiolated single-stranded DNA and double-stranded DNA, measured by SPR techniques. Give the detailed sketch of the measurement geometry used for DNA desorption measurements by fluorescent techniques. 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) Explain the operation of tunnel diode in the light of nanotechnology. 7
2. a) What are the properties of nanotubes? Describe different structures of nanotubes. 7  
 b) Explain the different fabrication processes of carbon nanotubes. 9
3. State in brief the following material characterization tools 5+5+6  
 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+3  
 b) Explain Moore's Second Law. 8  
 c) Briefly explain the development of nanoscale transistors 3
5. Write short notes on the following: 2×8=16  
 a) Quantum Computing b) Different application of carbon nanotubes