BIOSENSORS
(BIOT 4181)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   Biosensors what measure change in mass are known as
           (a) amperometric biosensors   (b) piezoelectric biosensors
           (c) potentiometric biosensors   (d) optical biosensors.

   (ii)   Which generation of a biosensor needs a mediator for it's operation?
           (a) 1st generation   (b) 2nd generation
           (c) 3rd generation   (d) 4th generation.

   (iii)   Biosensors that measure the light output is known as
           (a) electrochemical biosensors   (b) optical biosensors
           (c) calorimetric biosensors   (d) piezoelectric biosensors.

   (iv)   BIO-FET, where antibodies are immobilized on the GATE surface, is known as
           (a) EN-FET   (b) DNA-FET
           (c) immuno-FET   (d) none of these.

   (v)   Selectivity coefficients for ion selective electrodes more responsive to target ions as compared to the interfering ions is
           (a) < 1   (b) > 1   (c) = 1   (d) = 0.

   (vi)   Most extensively studied biosensor is
           (a) glucose biosensor   (b) urea biosensor
           (c) thermistor   (d) optical biosensor.

   (vii)   For detection of urea, the required electrode is
           (a) ammonia electrode   (b) oxygen electrode
           (c) CO_2 electrode   (d) nitrogen electrode.

(viii) Which of the following is the physico-chemical component of biosensor?
(a) Enzymes   (b) Anti-bodies
(c) Transducer   (d) Cells or tissues.

(ix) Response of an enzyme sensor depends on
(a) rate of enzymatic reaction   (b) membrane thickness
(c) diffusion through membrane   (d) all of the above.

(x) Which of the following biosensors use the movement of electrons produced during redox reactions?
(a) amperometric biosensor   (b) Potentiometric biosensors
(c) Piezo-electric biosensors   (d) Optical biosensors.

Group - B

2. (a) Describe three processes for enzyme immobilisation for biosensor construction.

   (b) How can a biosensor be categorised based on sensor type and transducer type? Provide examples of each catagory.

   6 + 6 = 12

3. (a) Illustrate the variations of the biological /biochemical components of a biosensor.

   (b) Explain, with an example, the use of microbes as a biosensor.

   6 + 6 = 12

Group - C

4. (a) Discuss the characteristics of a non-invasive biosensor.

   (b) Explain the working principle of bananatrode.

   6 + 6 =12

5. (a) Explain how you can detect DNA hybridization with the help of potentiometric biosensor.

   (b) Explain, with two examples, working principle of enzyme-inhibition based biosensor.

   6 + 6 = 12

Group - D

6. (a) Explain the working principle of DNA-FET.

   (b) Discuss the role of carbon nanotubes in biosensors.

   7 + 5 = 12

7. (a) Explain how can you detect bacteria in clinical or food samples with the help of optical biosensors.

   (b) A 10 KΩ NTC thermistor has a B value of 3455 between the temperature range of 25^0C to 100^0C. Calculate its resistive value at 100^0C. Data Given: B=3455, R1=10 KΩ at 25^0C.

   8 + 4 = 12

Group - E

8. (a) Explain the method of pesticide determination using acetyl-cholin-esterase enzyme.

   (b) Describe the method of urea determination in environmental samples using biosensor.

   6 + 6 = 12

9. (a) State the principle of nitrate determination in water using biosensor.

   (b) Describe the method of acrylamide detection in fried foods using biosensor.

   7+ 5=12