BIOSENSOR
(BIOT 4124)

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

(ii) Time required to return the sensor to working state afterinteraction with the sample
(a) Response time   (b) Regeneration time
(c) Specificity   (d) None of (a), (b) & (c).

(iii) Which of the following property is not possessed by biosensors?
(a) The probe used in the biosensor must be tiny and biocompatible
(b) The biosensor should be cheap, small, portable
(c) There should be a market for the biosensor
(d) The specificity of substrate binding is mediated by spatial arrangement of atoms in an enzyme's substrate binding site as well as substrate.

(iv) Biosensors which measures the heat change is known as
(a) Amperometric biosensor   (b) Electrochemical biosensor
(c) Calorimetric biosensor   (d) Piezoelectric biosensor.

(v) The restriction of enzyme mobility in a fixed space is known as _____
(a) enzyme immobilization   (b) enzyme inhibition
(c) enzyme kinetics   (d) enzyme deactivation.

(vi) Which one of the following sensors is also known as mass sensitive biosensor?
(a) Piezoelectric   (b) Calorimetric
(c) Conductometric   (d) All of (a), (b) & (c) .

(vii) Which one of the following devices is used to measure the glucose level in blood or sweat?
(a) Gravimetric biosensor   (b) Pyroelectric biosensor
(c) Glucometer   (d) All of (a), (b) & (c).

(viii) What does the following diagram represent?
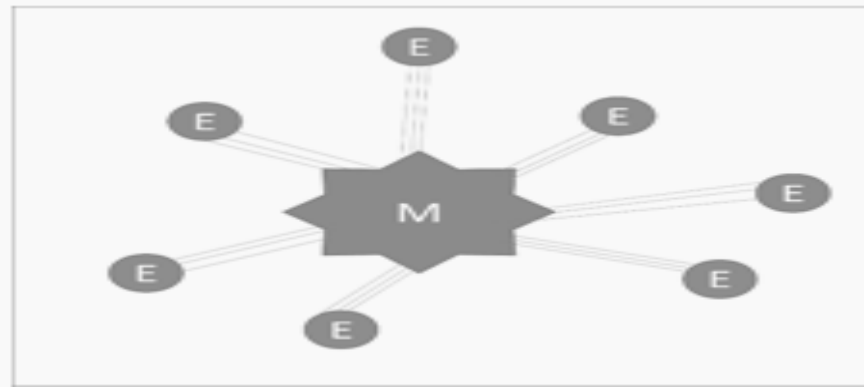
(a) Covalent binding   (b) Adsorption
(c) Entrapment   (d) Membrane confinement.

(ix) The genetic monitoring and disease diagnosis are examples for _____ sensor?
(a) DNA sensors   (b) Cell-based sensors
(c) Point of care sensors   (d) All of (a), (b) & (c)

(x) In agriculture the biosensors are used to detect the _____.
(a) Gases   (b) Carbohydrates
(c) Pesticides   (d) All of (a), (b) & (c)

Group- B

2. (a) List biosensors according to the variation in transducer part.
[(CO2)(Remember/LOCQ)]
   (b) State the advantages of biosensors.   [(CO1)(Understand/LOCQ)]
6 + 6 = 12

3. (a) State the principle of enzyme immobilisation by crosslinking method.
[(CO2)(Understand/IOCQ)]
   (b) Illustrate the process of activating the cellulose support matrix by ethyl chloroformate for enzyme immobilization in constructing a biosensor.
[(CO2)(Remember/LOCQ)]
6 + 6 = 12

Group - C

4. (a) Explore the idea of Salivary Biosensor.   [(CO3)(Explore/IOCQ)]
   (b) Give a comparative analysis between Microbial biosensor and Enzyme biosensor.
[(CO3)(Compare/LOCQ)]
6+ 6 = 12

5. (a) What do you mean by a Non-Invasive Biosensor?   [(CO3)(Understand/LOCQ)]
   (b) Comment on the limitations of a biosensor.   [(CO4)(Comment/LOCQ)]
   (c) Enumerate the characteristics of a Biosensor?   [(CO1)(Enumerate/IOCQ)]
2 + 4 + 6 = 12

Group - D

6. (a) Explain the working principle of DNA-FET.   [(CO4)(Explain/IOCQ)]

(b) Design the process of detecting antigen-antibody with the help of Potentiometric biosensor. [(CO4)(Design/HOCQ)]

6 + 6 = 12

7. (a) Illustrate the characteristics of the carbon nanotubes. [(CO4)(Illustrate/IOCQ)]
   (b) Enumerate the process of measuring Glucose with the help of Amperometric Biosensor? [(CO4)(Enumerate/IOCQ)]

5 + 7 = 12

Group - E

8. (a) How is pesticide measured by enzymatic biosensors using Acetylcholin esterase enzyme. [(CO5)(Critical/HOCQ)]
   (b) Explain in detail the principle of urea determination in fertilised soil using biosensor. [(CO6)(Analyse/IOCQ)]

6 + 6 = 12

9. (a) Describe the process of acrylamide detection in fried food using biosensor. [(CO6) (Illustrate/HOCQ)]
   (b) Briefly explain the principle of determination of benzene in soft drinks. [(CO5) (Explain/HOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31.25	43.75	25

Course Outcome (CO):

At the end of this course students will be able to:
1. State types of bio-recognition elements and describe the fundamental components required to make a viable biosensor.
2. Illustrate types of enzyme immobilization methods used to make a biosensor and immobilize it to a transducer for the construction of biosensor.
3. Describe each types of biosensing element in relation to their uses in biosensors.
4. Understand the classification, construction and working principle of various transducers.
5. Understand the concepts, types, working principles and practical applications of important biosensors. 6. Explain the working principle of different types of inhibition based biosensors.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question