

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(BT)/SEM-7/BT-703E/2012-13**  
**2012**  
**BIOSENSORS AND DIAGNOSTICS**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

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

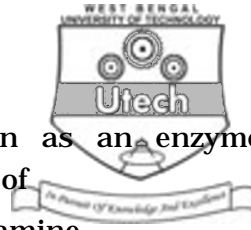
**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

- i) To develop a biosensor, the biological components are immobilized most effectively on the surface of a transducer by
  - a) Adsorption
  - b) Micro-encapsulation
  - c) Physical entrapment
  - d) Covalent bonding.
- ii) The antibody as a bioreceptor is suitable for a biosensor based on
  - a) Electrochemical process
  - b) Thermistor
  - c) Piezoelectric crystal
  - d) CHEMFET.



- iii) Enzyme present in banana used in as an enzyme electrode is suitable for the detection of
  - a) Alcohol
  - b) Dopamine
  - c) Phenol
  - d) Benzene.
- iv) Nernst equation is used for quantitative determination of an analyst in a biosensor of the type
  - a) Voltametric
  - b) Impedimetric
  - c) Potentiometric
  - d) FET based sensor.
- v) Optical sensors are based on the principle of
  - a) Snell's law
  - b) Total internal reflection
  - c) Beer Lambert's law
  - d) Light scattering technique.
- vi) Sensors based on piezoelectric properties of some crystals depend on
  - a) Mass of the crystals
  - b) Frequency of vibration
  - c) Total mass of crystals with the deposit mass
  - d) Surface vibration.
- vii) Sensors using the surface acoustic waves are used for the detection of
  - a) Human IgG
  - b) Organophosphorus
  - c) Formaldehyde
  - d) Sulphurdioxide.
- viii) Response time of an enzyme sensor depends on
  - a) the rate of enzymatic reaction
  - b) diffusion through the membrane
  - c) membrane thickness
  - d) both (b) & (c).



- ix) Insulin can be detected by a sensor of the type
- Conductometric
  - Potentiometric
  - Optical biosensor
  - Piezoelectric biosensor.
- x) Movement of electrons due to redox reactions can be measured by
- Calorimetric biosensors
  - Optical biosensors
  - Piezoelectric biosensors.
- xi) Most extensively studied biosensor is
- Urea Biosensor
  - Thermistor
  - Glucose Biosensor
  - Optical Biosensor.

### GROUP - B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

- How do you classify biological receptors ? How do these receptors respond to specific transducers ?  $2 + 3$
- What is the mechanism of Glucose Biosensor using glucose oxidase ?
- What are the potentiometric biosensors ? How is the electrical signal in the form of potential difference given by Nernst equation ?  $3 + 2$
- Write down the principles of bio-affinity based biosensor.

**GROUP - C****( Long Answer Type Questions )**Answer any *three* of the following.  $3 \times 15 = 45$ 

6. a) What is the third generation of direct enzyme electrode coupling using organic conducting salt electrodes. Illustrate with an example.
- b) What is cyclic voltametry ? Illustrate with glucose, glucose oxidase and ferrocene as a mediator.
7. In amperometric sensor using banana tissue to detect catechol beer, the following data are given in terms of peak current (  $i_p$  ) and concentration of catechol (  $\Delta C$  ).

Catechol Concentration $10^{-5} M (\Delta C)$	0	1.0	1.99	2.98	3.95	4.93
$i_p, \mu A$	1.45	1.8	2.0	2.3	2.7	2.8

 $i_p$  is related to catechol concentration (  $\Delta C$  ) as

$$i_p = mC (ox) + C_o \text{ ( a constant )}$$

- a) Give the mechanism of the system with respect to analyte, enzyme and the transfer of electrons.
- b) Fit the data to the linear model and determine the slope.
8. Write short notes on any two :
- a) Optical biosensors
- b) ENFET
- c) Thermal biosensors
- d) Microbial sensors.
9. Discuss in detail the application of biosensors in the following :
- i) Environmental monitoring
- ii) Defense
- iii) Food industry.