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University Examinations 2023/2024

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN MEDICAL MICROBIOLOGY

HMM 3222: BIOSENSOR TECHNOLOGY

DATE: APRIL 2024

TIME: 2 HOURS

INSTRUCTIONS:

- (i) The paper consists of **Three** Sections
 - (ii) Section A: Multiple Choice Questions
 - (iii) Section B: Short Answer Questions
 - (iv) Section C: Long Answer Questions
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SECTION A (20 MARKS)

1. The HIV and hepatitis are examples for _____ sensor?
 - a) DNA sensors
 - b) Cell-based sensors
 - c) Point of care sensors
 - d) Immunosensors
 2. Which of the following is not a characteristic of the immobilized enzymes?
 - a) They cannot be re-used
 - b) It produces reproducible results
 - c) Stability exists
 - d) Same catalytic activity is present for number of analysis
 3. Which of these biosensors use the principle of heat released or absorbed by a reaction?
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- a) Potentiometric biosensor
 - b) Optical biosensors
 - c) Piezo-electric biosensors
 - d) Calorimetric biosensors
4. 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
5. Given below is the diagram of biosensor. Identify the unmarked component.



- a) Microprocessor
 - b) Filter
 - c) Transducer
 - d) A/D converter
6. Which of the following statements is not true for biosensors?
- a) Biosensors convert a biological signal into an electrical signal
 - b) Biosensors are used to determine the concentration of substances and other parameters of biological interest even where they do not utilize a biological system directly
 - c) Biosensors utilize the different biological systems such as enzymes, whole cell metabolism, ligand binding and the antibody-antigen reaction
 - d) Biosensor consists of a vessel, or series of vessels, used to perform a desired conversion by enzymic means
7. Distribution of charges: Potentiometric biosensor:: Mass of reactants or products:_____
- a) Optical biosensor
 - b) Calorimetric biosensor
 - c) Piezo-electric biosensor

- d) Amperometric biosensor
8. Point of care technology refers to:
- a) Medical information that can be retrieved with the point and click of a computer mouse
 - b) The utilization of technology to provide accurate and up-to-date information to patients
 - c) Technology that the patient can point to in order to receive care from a nurse
 - d) Medical testing that can be done where the patient is
9. Glucose level as low as 0.15 mmol can be detected by using _____enzyme.
- a) Penicillinase
 - b) putrescine oxidase
 - c) glucose oxidase
 - d) alcohol oxidase
10. Which of the following features is not possessed by biosensor?
- a) The biocatalyst used in the biosensor must be highly specific for the purpose of the analyses
 - b) The reaction occurring in the biosensor should be as independent of such physical parameters
 - c) Active site is mainly constituted by non-polar amino acids for catalysis to take place
 - d) The response from the biosensors should be accurate, precise, reproducible and linear
11. Abbreviation of ELISA is _____
- a) Ion Selective Field Effect Transistors
 - b) Enzyme Linked Field Effect Transistors
 - c) Adenosine triphosphate
 - d) Enzyme Linked Immunosorbent Assay
12. ELISA techniques have been combined with biosensors to form _____
- a) calorimetric biosensor
 - b) piezo-electric biosensor
 - c) immunosensor

d) potentiometric biosensor

13. What type of biometrics does a gait analysis wearable measure:?

- a) Facial parameters
- b) Fingerprints
- c) Footfall patterns
- d) Retinal scans

14. Recording electrical activities associated with heart is known as _____

- a) EEG
- b) EOG
- c) EMG
- d) ECG

15. In optical detection biosensor _____ is measured as output

- a) Light
- b) Heat
- c) ions
- d) Waves

16. What property of enzyme doesn't make it an excellent analytical reagent?

- a) Specificity
- b) Selectivity
- c) Piezo-electric biosensor
- d) Location of the enzyme

17. Which of the following biosensors function by the production of a current when a potential is applied between two electrodes?

- a) Calorimetric biosensor
- b) Potentiometric biosensor
- c) Optical biosensor
- d) Amperometric biosensor

18. Which of the following biosensor determines glucose concentrations by the use of an immobilized glucose oxidase membrane?

- a) Optical biosensor
- b) Amperometric biosensor

- c) Calorimetric biosensor
 - d) Potentiometric biosensor
19. Which one of the following is a detection device or transducer?
- a) Antibodies
 - b) Amperometric electrodes
 - c) Cells
 - d) Both a and b
20. Advantages of point-of-care testing (POCT) include all of the following except:
- a) Faster turnaround time of test results.
 - b) Providing faster patient treatment.
 - c) Limiting the amount of blood needed for testing.
 - d) Providing a wider variety of laboratory tests

SECTION TWO: 40 MARKS

- 1) Outline the criteria that paper based assays must meet in order to be competitive (6 marks)
- 2) Outline any disadvantages of an intra-arterial blood pressure monitoring system (6 marks)
- 3) Explain the principle of cell counting by a coulter counter (6 marks)
- 4) Describe briefly the merits and demerits of using biomolecules in biosensors (4 marks)
- 5) Write short notes on aptamer based sensors (6 marks)
- 6) Explain the following terms as used in biosensor technology (6 marks)
 - a) Sensitivity
 - b) Linearity
- 7) Describe the qualities of cellulose membrane that make it suitable for biosensor construction (5 marks)

SECTION C: (40 MARKS) ANSWER ANY TWO QUESTIONS

1. Discuss a classical biosensor with all its parts and functions (20 marks)
2. Discuss briefly the future prospects of biosensors (20 marks)
3. Write detailed notes on bioreceptors used in construction of biosensors (20 marks)