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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 19BT5DE2BBI **Max Marks: 100**
Course: Biosensors and Bioinstrumentation **Date: 19.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

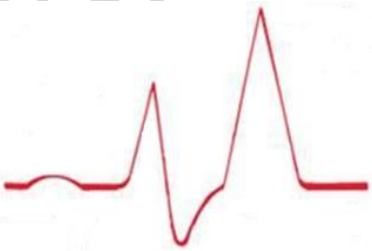
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Analyze the following ECG wave patterns to find the abnormality of the heart and write the causes for the same. **10**

i.

ii.



b) With the help of a schematic diagram discuss the construction and working of a transducer that makes use of the principle of induction and displacement. **10**

UNIT - II

2 a) Demonstrate the conduction of impulses through heart. Substantiate the usage, significance and interpretation of electrical activity of heart using ECG waveform. **09**

b) Demonstrate a biomedical instrumentation system and its components with a general block diagram. **06**

c) Deliberate the principle and waveform of EEG. **05**

OR

3 a) Analyze the following ECG wave patterns which are captured from the patients while using pacemaker unit and answer the following questions in each case. **05**

a. Is there any abnormality?
b. If yes, clarify what is the abnormality.

i.

ii. 

b) A patient is admitted to hospital. He is a kidney dialysis patient who missed his last two appointments at the dialysis center. Here are his arterial blood gas results. **pH :7.32, $PaCO_2$:32, HCO_3 :18** **05**

For the above mentioned two cases studies, answer the following:

i) Is there an imbalance? If yes, explain what is the imbalance?

ii) Is compensation occurring? Explain.

c) Elucidate the principle and working of electromagnetic blood flow meter with a neat sketch. **05**

d) Suggest a suitable method/s to measure pulse rate through change in density. **05**

UNIT - III

4 a) With a schematic representation, demonstrate the working principle of open circuit Nitrogen wash-out method for measuring FRC. **05**

b) A 56-year-old women suffering from shortness of breath is recommended for spirometry test by a medical practitioner. The spirometry used to conduct pulmonary function tests has provided results in the form of volume as a function of time. **10**

i. Which spirometry method is referred to in the case study?

ii. With a schematic representation, demonstrate the working principle of the referred spirometer device.

iii. The tests could not give a measure of TLC. State the reason.

c) Suggest a suitable technique to measure the gas distribution through the principle of variable-pressure and with a schematic representation, discuss the principle and procedure of conduction. **05**

UNIT - IV

5 a) Demonstrate the design of DNA biochip through the inkjet and photolithography techniques and elucidate their operating principle. **08**

b) Classify the different classes of biosensor depending upon transducers and bioactive components. **06**

c) Propose a suitable technique for monitoring biomolecular interaction in real time, using a non-invasive optical detection principle based on surface plasmon resonance. **06**

UNIT - V

6 a) Demonstrate the working principle and applications of nanowire biosensors for detection of biomolecules. **05**

b) Classify and explicate the mechanisms applied in glucose biosensors. Also differentiate first, second and third generation biosensors with respect to glucose estimation with suitable diagrams. **10**

c) Demonstrate the working principle and applications of luminescence-based biosensors for heavy metal detection in an aquatic ecosystem. **05**

OR

7	a)	With a schematic representation, discuss the working principle of Blood - Glucose non-invasive biosensor.	**05**
	b)	Demonstrate the working principle and applications of cantilever biosensors for cancer diagnosis.	**05**
	c)	"Biosensors are used in manufacturing industry for environmental monitoring, process/product control and safety monitoring." Substantiate the statement by giving any five applications of biosensors for environmental monitoring and control of pollution.	**10**

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