U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

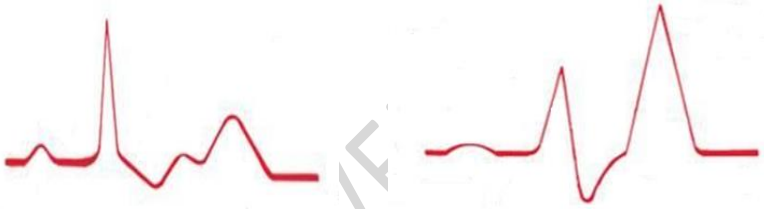
Branch: Institutional elective **Duration: 3 hrs.**

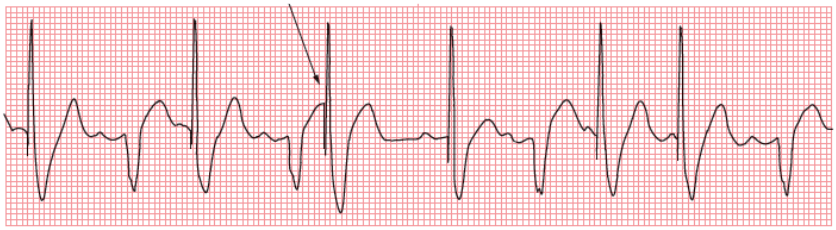
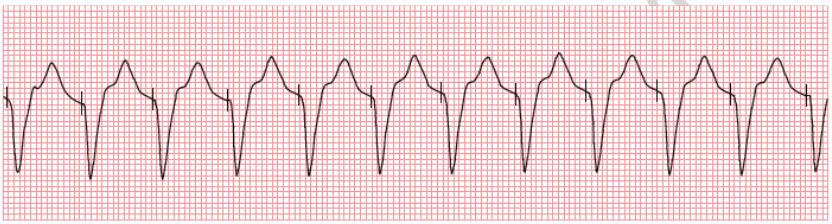
Course Code: 23BT6OEBBI **Max Marks: 100**

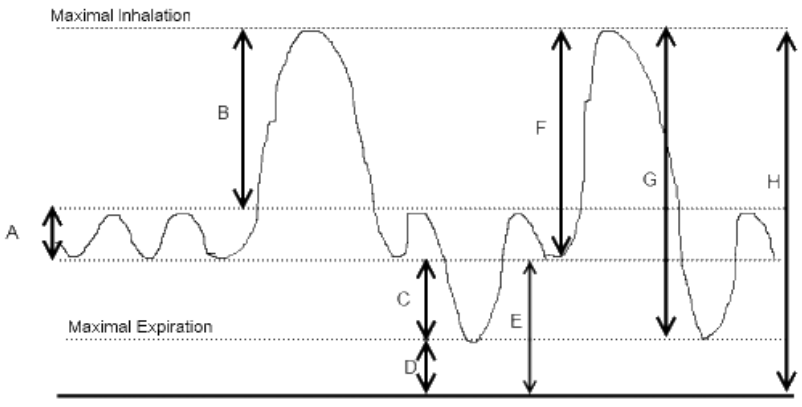
Course: Biosensors And Bioinstrumentation

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	CO	PO	Marks
1	a)	Analyze the following ECG wave patterns to find the abnormality of the heart and write the causes for the same. i. ii. 	CO2	PO 1	10
	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.	CO2	PO1	10
		OR			
2	a)	Demonstrate the conduction of impulses through heart. Substantiate the usage, significance and interpretation of electrical activity of heart using ECG waveform.	CO2	PO1	09
	b)	Demonstrate a biomedical instrumentation system and its components with a general block diagram.	CO1		06
	c)	Deliberate the principle and waveform of EEG.	CO2	PO1	05
		UNIT - II			
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. a. Is there any abnormality? b. If yes, clarify what is the abnormality.	CO3	PO21	10

			i.  ii.  iii.  iv. 			
		b)	Elucidate the principle and working of electromagnetic blood flow meter with a neat sketch.	***CO2***	***PO1***	**05**
		c)	Suggest a suitable method/s to measure pulse rate through change in density.	***CO2***	***PO1***	**05**
			OR			
	4	a)	**Case 1:** 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** **Case 2:** A 46-year-old female is admitted to a nursing unit three hours ago with a severe asthma attack. She has been experiencing increasing shortness of breath since admission. Her ABGs reveal: **pH: 7.22, $PaCO_2$: 55, HCO_3: 25** For the above mentioned case studies, answer the following: i. Is there an imbalance? If yes, explain what is the imbalance? ii. Is compensation occurrng? Explain.	***CO3***	***PO2***	**10**

		b)	The cardiac cycle refers to the sequence of mechanical and electrical events that repeats with every heartbeat. It includes the phase of relaxation and contraction. Substantiate the statement by explaining the different stages and steps in cardiac cycle with neat sketch.	***CO2***	***PO1***	**10**
			UNIT - III			
	5	a)	With a schematic representation, demonstrate the working principle of open circuit Nitrogen wash-out method for measuring FRC.	***CO2***	***PO1***	**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. 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.	***CO3***	***PO2***	**10**
		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.	***CO2***	***PO1***	**05**
			OR			
	6	a)	With a schematic representation, discuss the principle, construction and working of basic type of spirometer.	***CO2***	***PO1***	**10**
		b)	For the following spirometer output of a male person aged 27years, identify and compare the different types of lung volumes and lung capacities in the below diagram. Calculate the values of E, F, G, and H if A=0.5L, B=3.1 L, C=1.2L and D= 1.2L.  	***CO3***	***PO2***	**10**
			UNIT - IV			
	7	a)	Demonstrate the design of DNA biochip through the inkjet and photolithography techniques and elucidate their operating principle.	***CO2***	***PO1***	**08**

		b)	Classify the different classes of biosensor depending upon transducers and bioactive components.	***CO2***	***PO1***	**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.	***CO2***	***PO1***	**06**
			OR			
	8	a)	Demonstrate the steps involved in designing a biochip.	***CO2***	***PO1***	**10**
		b)	Discuss the major tasks in developing a biosensor for a target analyte. Identify the necessary skills involved in it.	***CO2***	***PO1***	**10**
			UNIT - V			
	9	a)	Demonstrate the working principle and applications of nanowire biosensors for detection of biomolecules.	***CO2***	***PO1***	**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.	***CO2***	***PO1***	**10**
		c)	Demonstrate the working principle and applications of luminescence-based biosensors for heavy metal detection in an aquatic ecosystem.	***CO2***	***PO1***	**05**
			OR			
	10	a)	With a schematic representation, discuss the working principle of Blood - Glucose non-invasive biosensor.	***CO2***	***PO1***	**05**
		b)	Demonstrate the working principle and applications of cantilever biosensors for cancer diagnosis.	***CO2***	***PO1***	**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.	***CO2***	***PO1***	**10**

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