Exam Date & Time: 02-May-2019 (02:00 PM - 05:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES (MAHE, Manipal) IV SEMESTER B.Sc.(Applied Sciences) DEGREE EXAMINATION - APRIL/ MAY 2019 (BRANCH: Biomedical Engineering)

BIOMEDICAL INSTRUMENTATION [IBM 242]

Marks: 100

Duration: 180 mins.

Answer 5 out of 8 questions.

Missing data, if any, may be suitably assumed

1)	A)	(i) List the characteristics and medical applications of Laser.(ii) Explain in detail the principle of operation of Laser.	(8)
	В)	What are Korotkoff sounds? Explain how these sounds help in the measurement of systolic & diastolic BP.	(4)
	C)	(i) With a neat block diagram, explain the Cardioverter. (ii) What is the difference between Defibrillation and Cardio-version?	(8)
2)	A)	(i) Differentiate Synchronous and Asynchronous pacemakers.(ii) With a neat block diagram, explain the Demand type of Synchronous pacemaker.	(7)
	B)	Differentiate 'Micro-shock' and 'Macro-shock'.	(6)
	C)	Explain a type of inductive transducer which uses differential output, and mention its application.	(7)
3)		Differentiate 'Sensitivity' and 'Accuracy'.	(4)
	A) B)	 (i) With a neat schematic, illustrate the utility of a photoconductor involved in the instrumentation for the detection of pulse. (ii) The four wires of an unbonded strain gauge form a four arm active bridge. In the null condition, each wire has a resistance of 200Ω. When a force is applied, resistance of each wire changes by 10Ω. Find the output voltage if a 10V excitation potential is applied to the bridge. 	(8)
	C)	What are the characteristics of an instrumentation amplifier? With a neat circuit diagram, discuss the design of an instrumentation amplifier.	(8)
4)	Δ)	What is a microelectrode? What is its tip-diameter? With neat figures, explain the two forms of "supported metal microelectrodes".	(6)
	B)	List the different writing mechanisms commonly used with the PMMC recorders. Discuss the working of an ink-jet recorder.	(8)

	C)	List the different types of microphones that can be used in a phonocardiograph. Discuss the principle of working of each of them.	(6)
5)	A) B)	A piece of zinc metal is immersed in a solution of zinc sulphate; explain how a double layer is formed at the interface between the metal and the solution.	(4)
		(i) A blood pressure transducer is constructed of 4 strain gauges connected in Wheatstone bridge. The sensitivity of the pressure transducer is nominally rated 60μ V/V/mmHg. Find the output voltage if the bridge excitation is 10V dc when a blood pressure of 120mmHg is being measured. If the GF of the strain gauges used is 2.2, calculate the strain on the gauges. (ii) Differentiate 'RTD' and 'Thermistor'.	(8)
	C)	 (i) What is Doppler effect? Explain how this effect can be used to measure the blood flow. (ii) Calculate the velocity of the blood in a blood vessel using the following data: The velocity of ultrasonic waves in blood is 1500m/s. The angle between direction of the blood flow and the direction of incident ultrasonic beam is about 30°. The Doppler shift in frequency is about 231Hz when the incident ultrasonic frequency is 2MHz. 	(8)
6)		Illustrate the correlation between ECG & PCG. Discuss its significance.	(6)
	A) B)	Illustrate the 10-20 system of electrode placement used for the measurement of electroencephalogram.	(8)
	C)	Discuss the origin of the normal heart sounds. What are the causes for abnormal heart sounds? How can the abnormal heart sounds be differentiated from the normal heart sounds?	(6)
7)	٨	What is a bio-potential electrode? With suitable figures, explain 'disposable' and 'floating' surface electrodes in detail.	(8)
	B)	(i) The resolution of transducer A, transducer B and transducer C is $0.1V^{0}F$, $0.2V^{0}F$ and $0.01V^{0}F$ respectively. Which transducer is considered the best under normal conditions? (ii) Explain the principle behind the blood pressure measurement using the bonded strain gauge and semiconductor strain gauge. What are the advantages of using semiconductor strain gauges over metallic strain gauges?	(6)
	C)	Illustrate with an example, the importance of 'grounding' in a hospital environment.	(6)
8)	A)	(i) Illustrate the unipolar limb lead configuration used to measure the ECG.(ii) On an ECG monitor, lead II & lead III display poor quality waveforms.Which electrode and/or lead, is suspected to be bad?	(6)
	B)	(i) What is the calibration signal used in the ECG machine?(ii) Mention the characteristic waves observed in an EEG signal. Also, mention the frequency and characteristics of each of these waves.	(6)

^{C)} With a neat schematic, explain the working principle behind the Balancing ⁽⁸⁾ Null type recorder.

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