Question Paper

Exam Date & Time: 31-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY-JUNE 2023

BIOMEDICAL INSTRUMENTATION - I [BME 2252]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		With a neat figure, illustrate the working principle of a passive transducer which uses active circuit elements. Also, mention the advantages and disadvantages of this transducer.	(5)
	A)		
	B)	A strain gauge having a gauge factor of 2.1 and resistance of 120.2Ω is glued to a structure. As the structure is subject to a stress, the resistance changes to 120.25Ω. Calculate the strain and the stress applied on the structure. (Given: Young's modulus, E = 205GPa).	(3)
	C)	Determine the advantages of the fifth generation CT machines over the previous CT geometries used.	(2)
2)		Contrast direct and indirect flat-panel detectors (FPDs) and explain the working of direct FPD.	(5)
	A)		
	B)	With a neat figure, interpret the equivalent circuit model of a microelectrode.	(3)
	C)	The R-wave resulting from a standard lead connection has a peak amplitude V_I = 0.2mV and V_{II} = 0.8mV. Compute the value corresponding to V_{III} R-wave peak amplitude. Also, with a neat diagrammatic representation, explain the augmented unipolar limb lead configuration.	(2)
3)		Compare 'VVI' and 'VVIR' pacemakers. Explain the 'VVI' pacemaker in detail.	(5)
	A)		
	B)	In the case of an ideal square wave defibrillator, determine the energy delivered to the patient. The ideal square wave pulse discharged by the defibrillator has amplitude of 2000V for 5msec duration. [Skin electrode resistance = 25Ω, internal resistance of the defibrillator=5Ω and thorax resistance =30Ω].	(3)
	C)	Determine the key factors to be considered in the design of a defibrillator electrode.	(2)
4)		Why is Argon laser the most suitable for photocoagulation of biological tissues? With a neat figure, explain the set-up used to control gastric haemorrhage in patients, using argon ion laser photocoagulation.	(5)
	A)		
	B)	Differentiate micro-shock from macro-shock and explain the precautions required to minimize electric-shock hazards.	(3)

C) Determine the capacitance of a microelectrode if the pipette radius is 0.2μm and the inner tip radius is 0.15μm [Assume Ɛ to be the dielectric constant of glass]. How does the value of capacitance and resistance affect the performance of the microelectrode? (2)

5) Differentiate suction cup electrodes from floating electrodes. Also indicate if there is any advantage of using microelectrode for ECG recording as compared to surface electrodes. (5)

A)

B) Determine the type of defibrillator that is ideal to provide effective defibrillation at lower voltage levels, explain the same in detail. (3)

C) A thermocouple measures over a range of -270 ºC to 1372 ºC by providing an output in the range -6.548mV to 54.874mV. Calculate the sensitivity of the thermocouple. (2)

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