Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

IV SEMESTER B.Tech.(BME) DEGREE END SEM EXAMINATIONS APR/MAY 2019

SUBJECT: ELEMENTS OF BIO-INSTRUMENTATION (BME 2201)
(REVISED CREDIT SYSTEM)
Saturday, 4th May 2019: 2 pm to 5 pm

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to Candidates:

1. **Answer all the questions.**
2. **Draw labeled diagrams wherever necessary.**

1.	(a)	Discuss the principle of an unbounded strain gauge transducer and explain how it can be used to measure pressure in a catheter-tip transducer.	3
	(b)	Determine the temperature of a particular medium, when the resistance measured by the thermistor is 2330 Ω. The reference temperature of the thermistor is 1050 Ω at 27^0C. Assume the material constant of the thermistor to be 3140.	3
	(c)	With suitable figures, describe how the pulse of a subject can be measured using photo transducer. Also, mention the limitations of using this transducer.	4
2.	(a)	Define electrode potential. Discuss the factors that can affect the electrode potential.	3
	(b)	With suitable examples, distinguish between accuracy and precision of a measurement. On what factor does precision depend? How can the accuracy be improved upon?	3
	(c)	Calculate the series resistance (in a metal microelectrode model) and determine the frequency response of a KCL filled microelectrode, if the micropipette radius is 0.2 µm and the inner tip radius is 0.15 µm. The value of the dielectric constant (ρ) for KCl is 3.7 Ωcm, and the taper angle is π/180. Given: The dielectric constant of glass is 4, and the electrode is immersed 3 cm deep in the electrolyte.	4
3.	(a)	Compare the potentiometric recorders with galvanometric recorders, and explain a type of galvanometric recorder which has the following characteristics: High frequency response, low driving power and inexpensive.	4
	(b)	The R-wave resulting from a standard lead connection has a peak amplitude V_I = 0.2 mV and V_{II} = 0.8 mV. 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+1

(c) Identify and explain the device that can be used to measure velocity of a blood stream in an exposed blood vessel. 3

4. (a) 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. 2+1

(b) A defibrillator produces a square pulse of 3000 V with a duration of 5 msec. The instrument resistance R_D = 10 Ω, skin-electrode resistance R_E = 30 Ω and the total resistance =100 Ω. Compute the energy delivered to the patient's thorax when the defibrillator is connected. 4

(c) Differentiate 'micro-shock 'from 'macro-shock'. Explain how the 'grounding' technique can be used to prevent electrical accidents. 3

5. (a) (i) Calculate the heart rate (in beats/min), given the pulse period generated by the pacemaker to be 0.859 sec. 2+3
(ii) Interpret the code 'VAT' and explain the pacemaker which is identified by this code.

(b) Draw the energy-level diagram and explain the laser set-up of a He-Ne laser. Give two medical applications of this laser. 5