Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.Tech (BME) DEGREE MAKE-UP EXAMINATIONS DECEMBER 2017
SUBJECT: BIO-INSTRUMENTATION (BME 5102)
(REVISED CREDIT SYSTEM)
Friday, 22nd December 2017: 9 AM to 12 NOON

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates:

Answer ALL questions

1. (a) Mention the primary signal characteristics and transducers required for acquiring the following physiological parameters: (i) Phonocardiogram (ii) Galvanic skin resistance (iii) Plethysmogram (iv) Blood pressure (v) Respiratory rate. (2.5)

   (b) (i) A thermocouple is capable of providing an output of -6.548mV to 54.874mV over a range of -270^0C to 1372^0C. Calculate the sensitivity of the thermocouple assuming a linear response within the range of measurement. (2)

   (ii) What are the risks associated with Electrosurgical Unit? How can it be prevented? (3.5)

   (iii) A strain gauge of length l=0.1m is bonded to a surface having an area of 4cm^2. The modulus of elasticity E=200GN/m^2. The unstrained resistance of the strain gauge is 200Ω and the gauge factor is 10. When load is applied, the resistance changes by 0.01Ω. Find the stress and the force applied. (2)

   (c) (i) Differentiate between bonded and unbonded strain gauge transducers and explain one type of passive transducer that uses active circuit elements. (2+6)

   (ii) An RTD has $\alpha_o = 0.0035/\ ^0$C at $T_0 = 50\ ^0$C and resistance $R(T_0) = 300\Omega$. Determine its resistance at $80\ ^0$C. (2)

2. (a) (i) With a neat connection diagram, explain the bipolar and augmented unipolar limb lead configuration in detail. (5)

   (ii) Explain the technique of measuring the flow velocity of blood using ultrasound. (5)

	(b)	(i)Find the capacitance of a microelectrode if the pipette radius is 0.2μm and the inside tip radius is 0.15μm.	(2)
		(ii) What are the factors to be considered while designing an incubator?	(3)
	(c)	Explain the 10-20 system of electrode placement used in EEG recorders. Also, explain the characteristics of the alpha and beta waves in EEG.	(3+2)
3.	(a)	Explain in detail, a type of pacemaker that can be used to replace the blocked conduction system of the heart.	(7)
		(ii) Write the formula to calculate the lifetime (in years) of a pacemaker battery.	(3)
	(b)	With a neat block diagram, explain the functioning of a synchronized DC defibrillator.	(7)
	(c)	For an ideal square wave defibrillator, determine the energy delivered to the patient. The ideal square wave pulse is 2000V for 5msec duration. [Given: skin electrode resistance =25Ω, internal resistance of the defibrillator=5Ω and thorax resistance =30Ω].	(3)
4.	(a)	(i) Calculate the percentage of sonic beam transmitted in going from the chest wall to the lung. (The value of Z for air and muscle is 0.0004 and 1.7 respectively.)	(2)
		(ii) Explain the A-mode and B-mode scan of ultrasound. Give one medical application of each scanning mode.	(6)
	(b)	With a neat block diagram, explain the hemodialysis machine in detail. Also list the advantages and disadvantages of peritoneal dialysis.	(6+2)
	(c)	Explain the 'Dewall oxygenator' in detail.	(4)
5.	(a)	Explain in detail a type of non-invasive lithotripsy.	(6)
	(b)	Explain the evoked response audiometers in detail.	(8)
	(c)	Define 'Thermography'. Explain any four medical applications of thermography.	(1+5)