		Reg. No.				
MANIPAL INSTITUTE OF TECHNOLOGY						
1 st SEMESTER M.Tech (BME) DEGREE END SEM EXAMINATIONS NOV/DEC 2016						
SUBJECT: BIO-INSTRUMENTATION (BME 5102) (REVISED CREDIT SYSTEM) Saturday, 26 th November 2016: 9 AM to 12 NOON TIME: 3 HOURS MAX. MARKS: 100						
		Instructions to Candidates:				
Answer ALL questions						
1.	(a)	(i) What are the general performance parameters of a transducer? Explain.	(5)			
		 (ii) A thermocouple is capable of providing an output of -6.548mV to 54.874mV over a range of -270°C to 1372°C. Calculate the sensitivity of the thermocouple assuming a linear response within the range of measurement. (i) Differentiate between bonded and unbonded strain gauge transducers 	(2)			
	(0)	and explain one type of passive transducer that uses active circuit elements.	(2+3)			
		(ii) An RTD has $\alpha_0 = 0.0035/ {}^{0}C$ at $T_0 = 50 {}^{0}C$ and resistance $R(T_0) = 300\Omega$. Determine its resistance at 80 ${}^{0}C$.	(2)			
	(c)	Write the specifications for the waveforms that are associated with different modes of action in Electrosurgery?	(4)			
2.	(a)	(i) What are the advantages of using floating electrodes over suction cup electrodes? Discuss the structure of the floating electrodes in detail.	(2+2)			
		(ii) "Electrode impedance increases with sweaty skin surfaces". True or False?	(1)			
	(b)	(i) Draw and explain the equivalent circuit of a microelectrode.	(5)			
		(ii) Find the capacitance of a microelectrode if the pipette radius is $0.2\mu m$ and the inside tip radius is $0.15\mu m$.	(2)			
	(c)	(i) What is Doppler effect? Explain how this principle can be used to measure the blood flow.	(1+5)			
		(ii) A 7MHz Doppler probe is set at an inclination of 45° with the skin surface to measure the blood flow in a blood vessel underneath. The Doppler shift in the frequency of the received ultrasonic wave is observed to be 10kHz. Assuming the velocity of sound in flowing blood to be 1500m/s, calculate the blood velocity.	(2)			

3.	(a)	(i) For obtaining good quality ECG, what is the minimum bandwidth the ECG recorder should have?	(1)
		(ii) What are the typical waves observed in an EEG signal? Mention the frequency and characteristics of each of these waves.	(5)
	(b)	(i) What is the drawback of using the unipolar limb lead configuration for the measurement of ECG? How can it be improved?	(3)
		(ii) Write a note on Bionic ear.	(5)
	(c)	(i) List the important features of fiber optic endoscopes.	(2)
		(ii) Mention the specific applications of each of the following endoscopes: Enteroscope, Cystoscope, Rhinoscope & Otoscope.	(4)
4.	(a)	(i) With a neat block diagram, explain the functioning of a synchronized DC defibrillator.	(6)
		(ii) In a certain defibrillator, a constant voltage of 1800V is measured across the electrodes for 5msec, and then the voltage drops to 0V. The delivered energy is 200J. Compute the energy delivered when the constant voltage	(4)
		Case a) Drops to 900V and the duration of the pulse remains 5msec. Case b) Drops to 900V and the duration of the pulse is 10msec.	
	(b)	(i) Differentiate R-wave triggered from an R-wave inhibited pacemaker.	(2)
		(ii) Explain a type of synchronous pacemaker that is used when the conduction system of the heart is blocked.	(6)
	(c)	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)
5.	(a)	With a neat figure, explain how the Argon ion laser can be used to control the gastric hemorrhage. Draw the energy level diagram of the Argon ion laser.	(4+2)
	(b)	(i) List the characteristics of an ideal artificial kidney.	(4)
		(ii) Explain in detail a type of non-invasive lithotripsy.	(4)
	(c)	(i) Differentiate positive pressure ventilators from negative pressure ventilators.	(2)
		(ii) Give a comparison of the natural and artificial lungs.	(4)