			Reg. No.											
MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL A Constituent Institution of Manipal University														
1 <sup>st</sup> SEMESTER M.Tech (BME) DEGREE MAKE-UP EXAMINATIONS, DEC/JAN 2016-17														
SUBJECT: BIO-INSTRUMENTATION (BME 5102) (REVISED CREDIT SYSTEM)														
Thursday, 29 <sup>th</sup> December 2016, 9 AM to 12 NOON														
TIME: 5 HOURS MAX. MARKS: 100														
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1.	(a) Mention the primary signal characteristics and transducers required for acquiring (5) the following physiological parameters: (i) Phonocardiogram,								(5)					
		(ii) Galvanic skin resistance, (iii) Plethysmogram, (iv) Arterial Blood pressure, and (v) Respiratory rate.												
	<b>(b</b> )	(i) List the characteristics of the ideal heart/ lung machine? (3							(3)					
		(ii) Explain a type of passive thermal resistor which has a non-linear response.								(5)				
	(iii) A strain gauge of length l=0.1m is bonded to a surface having an area of $4\text{cm}^2$ . The modulus of elasticity E=200GN/m <sup>2</sup> . The unstrained resistance of the strain gauge is 200 $\Omega$ and the gauge factor is 10. When a load is applied, the resistance changes by 0.01 $\Omega$ . Find the values of the stress and the force applied.									(3)				
	(c)	What are the risks associate	ed with ESU	U? H	ow c	an th	ey b	e pre	vente	d?				(4)
2.	(a)	(i) Calculate the series remicroelectrode if the radiu tip is 0.15 $\mu$ m. The value $\pi/180$ . Dielectric constant the electrolyte.	esistance a us of the pi of ρ for of glass is	ind f ipet i KCL 4. Tł	requ s 0.2 is 3 ne ele	ency 2μm a 3.7Ω- ectroo	resp and t cm de is	onse he ra and t imm	of a dius the ta ersed	a KC of th aper .3cm	CL-fi ne ins anglo n deej	lled side e is p in		(4)

(ii) What are the advantages of using needle electrodes when compared to surface electrodes? Explain any three types of needle electrodes in detail. (3+4)

	(b)	(i) Show that the induced voltage is proportional to the flow rate of blood in an electromagnetic blood flow meter. With a neat figure, also explain the design of the flow head.	(7)
		(ii) A blood vessel has a diameter of 0.8cm and the blood flow rate is 10cm/sec. A magnetic flow probe surrounds the blood vessel when the magnetic field is $1 \times 10^{-5}$ weber/m <sup>2</sup> . Calculate the voltage induced in the probe.	(2)
3.	<b>(a)</b>	What is a plethysmograph? Explain the construction and working of the plethysmograph.	(7)
	( <b>b</b> )	(i) Draw and explain the standard electrode placement in recording the EEG signal.	(8)
		(ii) If the blood pressure of a patient is 150/95, determine his mean arterial pressure (MAP).	(2)
	(c)	Write a note on channels and valves used in endoscopes.	(3)
4.	(a)	(i) For an ideal square wave defibrillator, determine the energy delivered to the patient. The ideal square wave pulse has amplitude of 2000V for 5msec duration. [Skin electrode resistance = $25\Omega$ , internal resistance of the defibrillator= $5\Omega$ and thorax resistance = $30\Omega$ ].	(3)
		(ii) Which type of defibrillator would be ideal to treat the condition of tachycardia? Justify your answer, and explain the type in detail.	(6)
	(b)	(i) What are the basic requirements of an implantable pacemaker?	(3)
		(ii) Differentiate synchronous and asynchronous pacemaker and discuss any one type of synchronous pacemaker in detail	(1+5)
	(c)	Differentiate A-scan from B-scan of ultrasound.	(2)
5.	(a)	Give an example of a solid state pulsed laser and explain the same in detail. Also, draw the energy level diagram depicting the transitions.	(5+5)
	<b>(b</b> )	(i) With a neat block diagram, explain the hemodialysis machine in detail.	(6)
		(ii) Explain the parts of a hearing aid and describe the influence of each of the parts on the final output of the hearing aid.	(4)