Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.Tech (BME) DEGREE MAKE-UP EXAMINATIONS JUNE 2017

SUBJECT: ELEMENTS OF BIO-INSTRUMENTATION (BME 2201)

(REVISED CREDIT SYSTEM)

Monday, 12th June 2017: 2 PM to 5 PM

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

Instructions to Candidates:

Answer ALL questions

1.	(a)	(i) Determine the total change in the length of a strain indicator wire in a strain gauge, when the gauge factor = 3, original wire resistance = 0.5Ω, final strained wire resistance=0.7Ω and the pre-strained wire length is 50mm.	(3)
		(ii) Using a photoconductive transducer, explain how the pulse of a subject can be detected. Also, write a note on the photoconductive transducers.	(4+4)
	(b)	(i) Explain the performance characteristics of the transducer in detail.	(6)
		(ii) An RTD has $\alpha = 0.004^{o}C$ and R= 300Ω at 30 ^{0}C. Determine the resistance at 0 ^{0}C and 60 ^{0}C.	(3)
2.	(a)	(i) List the problems of using the Standard Hydrogen Electrode.	(2)
		(ii) Explain two methods for manufacturing the Ag/ AgCl electrode.	(5)
		(iii) At frequencies above 20KHz, the impedance of a bio-potential surface electrode in contact with the electrolyte is 500Ω. At frequencies less than 50Hz, the electrode-impedance is 30KΩ. The corner frequency is 100Hz. From the preceding data, determine the circuit model for the electrode.	(4)
	(b)	(i) What are the advantages of using floating electrode over suction cup electrode? Discuss the structure of the floating electrode in detail.	(2+2)
		(ii) Define the following: (a) electrode (b) electrode potential. Also, list the factors that affect the electrode potential.	(2+3)
3.	(a)	(i) Explain the principle of laser action.	(3)
		(ii) Draw and explain the energy level diagram of a molecular gas laser and the laser setup (of the molecular gas laser) in detail. Also, mention a few medical applications of this laser.	(1+5+2)

(b) (i) Differentiate a) Unipolar electrode from a Bipolar electrode b) Needle electrode from a surface electrode. (3)

(ii) A blood vessel has a diameter of 0.8 cm, and the flow rate is 10 cm/sec. A magnetic flow-probe surrounds the blood vessel, which provides a magnetic field of $1X10^{-5}$ weber/m^2. Calculate the voltage induced in the probe. (2)

(iii) List the different types of microphones that can be used to detect the heart sounds. Explain the principle of working of each of them. (1+3)

4. (a) (i) Differentiate synchronous and asynchronous pacemakers and discuss any one type of synchronous pacemaker in detail. (1+5)

(ii) Draw and explain two basic types of cardiac pacemaker electrodes. (4)

(b) (i) Discuss the working of the ink-jet recorders. (6)

(ii) List the parameters based on which the recorders can be selected for a particular recording. (4)

5. (a) (i) What are the key considerations in the defibrillator's electrode design? Also, draw and explain the internal and external type of defibrillator electrodes in detail. (2+3)

(ii) 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)

(b) (i) Define "Let-go" current, Micro-shock and Macro-shock. (3)

(ii) List the precautions to be taken to minimize the electric-shock hazard. (5)

(iii) Discuss how 'Ground Fault circuit interrupter' and 'double insulation' methods can be used to prevent electric accidents. (4)