Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University)
Manipal – 576 104

FIRST SEMESTER M.TECH. DEGREE END-SEMESTER EXAMINATIONS- DECEMBER 2015

SUBJECT: BIO-INSTRUMENTATION (BME 503)
(REVISED CREDIT SYSTEM)
Thursday, December 3rd , 2015: 2.00 p.m.- 5.00 p.m

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

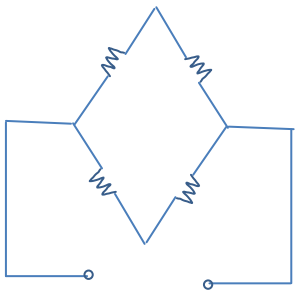
Instruction to Candidates:

Answer any FIVE full 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) Arterial Blood pressure, and (v) Respiratory rate. (5)

(b) (i) In the Figure 1, the resistance R_s is a resistive temperature sensor (thermistor), whose resistance varies with temperature. When the temperature is 70^0C, the resistance has a value of 1KΩ. Determine the value of R_b so that the bridge is balanced at a temperature of 70^0C. When the temperature rises to 71^0C, the resistance R_s drops to 999Ω. Determine the output voltage of the bridge at that temperature. Note: V_{in} = 12V, R_a = 4.7KΩ, R_c = 1KΩ. (4)

Figure 1



(ii) Explain in detail (with neat figures), how a photoresistor can be used to detect the pulse of a subject. (4)

(c) (i) What are the risks associated with Electrosurgical Unit? How can they be prevented? (4)

(ii) 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 a load is applied, the resistance changes by 0.01Ω. Find the values of the stress and the force applied. (3)

2. (a) (i) Ag-AgCl electrode has been found to be of acceptable standard for bio-potential measurements. Give reasons. (2)

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

(b) (i) Draw and explain the equivalent circuit of a microelectrode. (5)

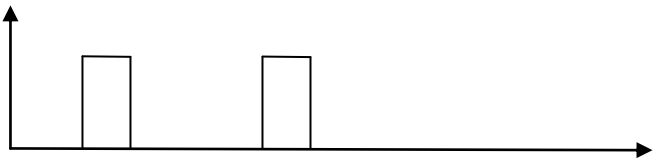
(ii) At frequencies above 20KHz, the impedance of a bio-potential surface electrode in contact with the electrolyte is 500Ω. At frequencies less than 50Hz, the electrode-impedance is 30KΩ. The corner frequency is 100Hz. From these data, determine the circuit model for the electrode. (4)

(c) What are the factors to be considered while designing an incubator? (4)

3. (a) (i) Explain in detail, a type of pacemaker that can be used to replace the blocked conduction system of the heart. (6)

(ii) For the given pulse signal (Figure 2), calculate the energy delivered by each pulse from a pacemaker. Assume R_h=150Ω, I_d=1.3μA (3)

Figure 2



(b) (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 = 25Ω, internal resistance of the defibrillator=5Ω and thorax resistance =30Ω]. (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)

(c) Write a note on the important features of fiber optic endoscopes. (2)

4. (a) With a neat block diagram, explain the hemodialysis machine in detail. Also list the advantages and disadvantages of peritoneal dialysis. (8+2)

(b) Give an example of a solid state pulsed laser and explain the same in detail. Also, draw the energy level diagram depicting the transitions. (6+4)

5. (a) (i) List the characteristics of an ideal heart-lung machine, and explain the 'Dewall oxygenator' in detail. (5+5)

(ii) Define "CPAP". Differentiate 'Thorpe uncompensated' and 'pressure compensated' flow meter. (1+3)

(b) The speed of sound in the human body is 1500m/sec. If a fetus is 6 cms blow the mother's skin, how long will it take for the echo to be received? Further, compare the B-scan and M-scan used in ultrasound. (2+4)

6. (a) What is 'masking' in audiometry? Explain the types of 'masking noise' used in audiometry. Also, name the type of audiometer used to access pathology in the auditory cortex and explain the same in detail. (2+3+8)

(b) Define 'Thermography'. Write a note on the infrared detectors used in thermography. (2+5)

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