

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2019

Programme Name: B.Tech/Mechatronics

Semester : VII

Course Name : Biomedical Mechatronics

Time : 03 hrs

Course Code : MEEL 471

Max. Marks : 100

Instructions:

S. No.		Marks	CO
Q 1	List the four main factors involved in the movement of ions across the cell membrane in the steady state condition.	5	CO1
Q 2	An excitable cell is impaled by a micropipette, and a second extracellular electrode is placed close by at the outer -membrane surface. Brief pulses of current are then passed between these electrodes, which may cause it to conduct an action potential. Explain the transition of the polarity of the stimulating pair influences the membrane potential, and subsequently the activity, of the excitable cell.	5	CO2
Q 3	Describe the construction and working of the metal plate electrodes.	5	CO3
Q 4	List and sketch the different type of microelectrodes.	5	CO3
SECTION B			
Q 5	An electrode consisting of a piece of Zn with an attached wire and another electrode consisting of a piece of Ag coated with a layer of AgCl and an attached wire are place in a 1 M ZnCl ₂ solution to form an electrochemical cell that is maintained at a temperature of 25°C (a) What chemical reaction might you expect to see at these electrodes (b) If a very high input impedance voltmeter were connected between these electrodes, what would it read.	10	CO2
Q 6	Describe the functional block diagram of electrocardiograph.	10	CO3
Q 7	Design a portable system for indirectly measuring blood pressure every 5 minute on ambulatory subjects.	10	CO3

Q 8	<p>A patient who has been vomiting for several days is dehydrated. Liquid is infused through a venous catheter at the rate of 250ml/hr. Sketch the resulting central venous pressure versus time.</p> <p style="text-align: center;">OR</p> <p>Sketch the construction of multiple element arterial tonometer.</p>	10	CO4
SECTION-C			
Q 9	<p>For cardiac catheterization, describe the characteristics of the dye used to improve visualization. Describe the characteristics of the dye used for measuring cardiac output.</p>	20	CO4
Q 10	<p>In order to determine the frequency response of an electromagnetic flowmeter, the clinical can transiently short circuit the magnet current by using a microswitch . For steady flow, sketch the resulting output of the flowmeter. Describe the mathematical step could implement on a computer in order to convert the resulting transient wave to the flowmeter's frequency response.</p> <p style="text-align: center;">OR</p> <p>A physician is using the rapid-injection thermodilution method of finding a patient's cardiac output. Calculate the cardiac output (in milliliters per second and in liters per minute) from the following data:</p> $V_i = 10 \text{ ml}, \Delta T_i = -30K$ $\rho_i = 1005 \text{ kg/m}^3, c_i = 4170 \text{ J/(Kg.K)}$ $\rho_b = 1060 \text{ kg/m}^3, c_b = 3640 \text{ J/(Kg.K)}$ $\int_0^{t_i} \Delta T_b dt = -5 \text{ second.K}$	20	CO4