Q5) You have conducted temperature measurement experiment using thermistor during laboratory sessions. What was the resistance of thermistor at room temperature? Give qualitative variation of resistance and temperature of the thermistor for the temperature range used by you. Give maximum and minimum value of resistance observed by you. (1+1+1)

Q6) Explain sampling and quantization error with respect to analog to digital conversion (3)

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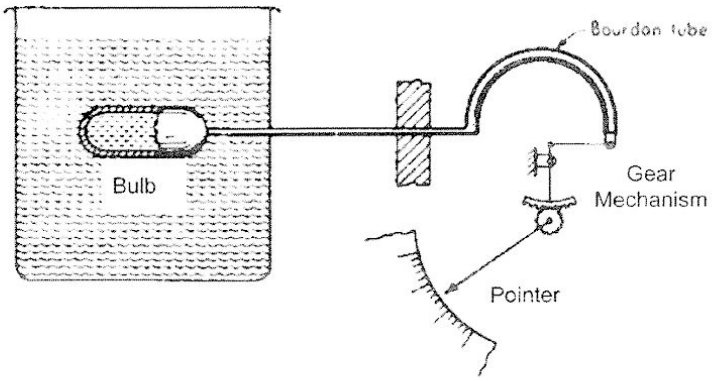
AE 242 Aerospace Measurements Laboratory

Mid Semester Exam 7th March 2018 14:30-16:30 Marks 55

Instructions: 1) Use of mobile phone is strictly prohibited. 2) Sharing of calculators is not allowed

Q1) Explain any two laws of thermocouple behavior. (4)

Q2) Figure given below is for Burdon Gage for temperature measurement. Some liquid is filled in the bulb and capillary, when temperature changes fluid pressure inside the bulb changes and deforms the mechanism, which is a measure of temperature. What are the different functional elements in the given measurement system. Justify your answer (6)

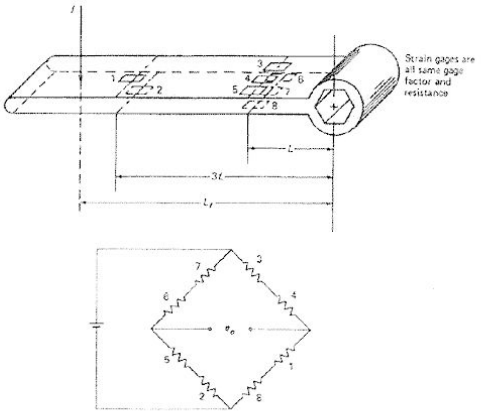


Q3) During laboratory session you have conducted experiment related to temperature measurement using thermocouple and operational amplifier. Draw the circuit diagram with appropriate values of components used during the experiment. (5)

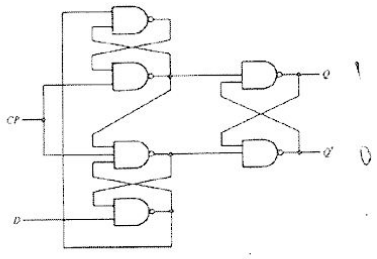
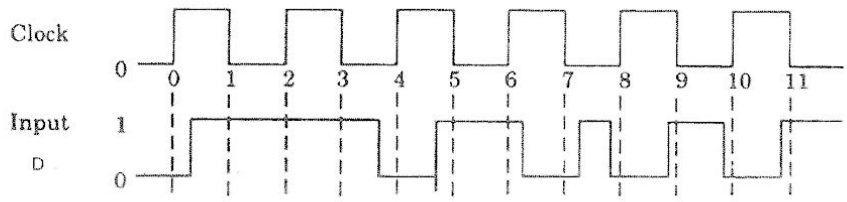
Q4) James is using a temperature sensor for measurement from 10 degree Celsius to 90 degree Celsius and the output of the sensor is 1.25 V to 1.75 V. He wishes to interface this sensor to a 8 bit ADC having input range of 0-5V. Help James in designing a circuit which will map 1.25V-1.75V to 0-5V so that he can achieve good accuracy. What will be the output of sensor and ADC value for 50 degree Celsius temperature. (5+3)

Q5) A parachute carrying a first order thermometer, with a 15 s time constant, falls through the atmosphere at 6m/s. Assume temperature varies with altitude at 0.15 °C/30m. The parachute radios temperature and altitude readings back to ground. At 3000m the parachute says the temperature is 0 °C. What is the true altitude at 0 °C occurs? (5)

Q6) Force f of 10 N is applied to torque wrench at Lf =50 cm. Assume all the strain gages have 120Ω resistance and gage factor 2. Strain gages are fixed at length L and 3L where L= 10 cm. Strain produced at the surface $\varepsilon_s = 10^{-6}$ M, where M is moment in N-m. What will be output e_0 when supply voltage is 10 V. Give complete derivation to support your answer. What will be the error if force f is not applied perpendicular to the bar, support your answer with derivation (5+5)



Q7) Input and clock signal is given to digital circuit shown below. Show the output of the circuit. (5)



Digital circuit