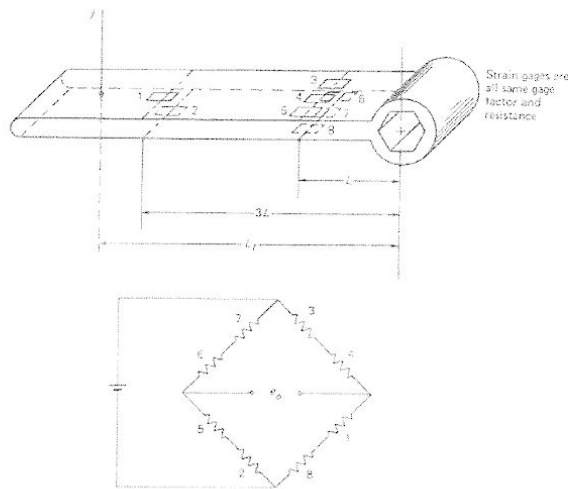


AE 242 Aerospace Measurements Laboratory
Mid Semester Exam 23rd February 2017 14:30-16:30 Marks 52

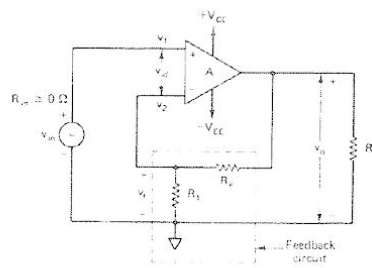
Instructions: 1) Use of mobile phone is strictly prohibited. 2) Sharing of calculators is not allowed

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

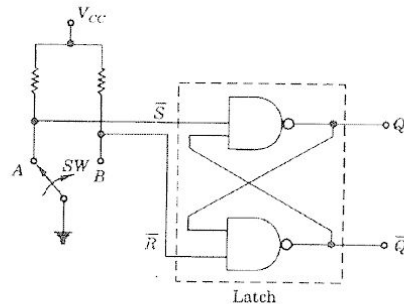
Q2) Force f of 10 N is applied to torque wrench at $L_f = 50$ cm. Assume all the strain gages have 120Ω resistance and gage factor 2. Strain gages are fixed at length L and $3L$ where $L = 10$ cm. Strain produced at the surface $\epsilon_s = 10^{-6} M$, where M is moment in N-m. What will be output e_0 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 (10+5)



Q3) An operation amplifier have openloop gain of 50000. It is used in following circuit. What will be exact gain? And compare it with the gain obtained by using golden rules. Give derivation to support your answer. (5)



Q4) Circuit given below uses NAND circuits for bounce elimination in mechanical circuit breakers. Is it possible to achieve similar functionality using NOR gates? Support your answer with circuit diagram. (5)



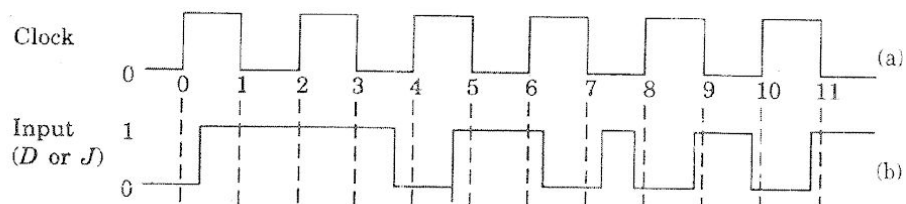
Q5) Explain sampling and quantization error with respect to analog to digital conversion. (3)

Q6) Use 2's complement method to solve $8_{10} - 25_{10}$. Give all the steps used for calculation (2)

Q7) 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)

Q8) What are the functional elements of a measurement system. Explain with an example. (5)

Q9) Input and clock signal to a positive edge triggered D-Type flip-flop is shown below. Show the output of the flip flop. (5)



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