AE 242 Aerospace Measurements Laboratory

End Semester Exam 25th April 2017 18:00-20:00 Marks 50

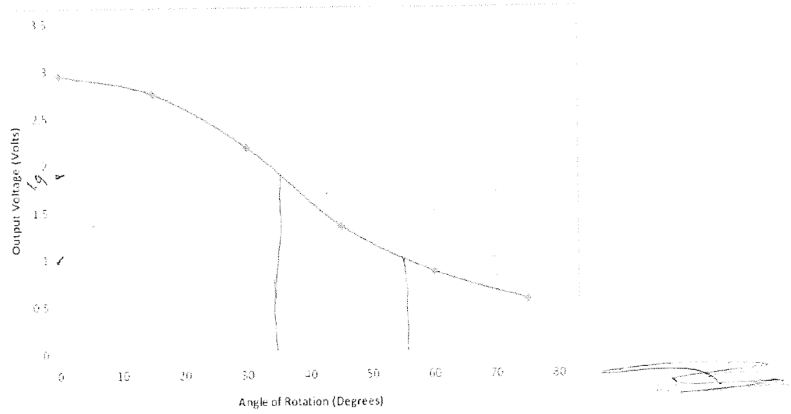
Instructions: 1) Use of mobile phone is strictly prohibited. 2) Sharing of calculators is not allowed

Q1) What is the role of pressure altitude in aircraft flying? Explain what correction is required when aircraft is close to runway. (4)

Q2) Explain working of any one optical gyroscope. (3)

Q3) A four channel analog to digital conversion system can have a) one sample and hold, one four channel multiplexer and one analog to digital converter b) one four channel sample and hold, one four channel multiplexer and one analog to digital converter. Four signals are recorded by above ADCs described in a) and b), what will be the difference in data recording? (8)

Q4) Typical characteristics of a light sensor used during the laboratory session is given below. X-axis zero is when light is perpendicular to sensor surface. Such two sensors are used on two adjacent faces of a cube and it is used for finding the attitude of the cube.



a) Why two sensors are used? b) What was the operating angle chosen for finding rotation of the body? c) What will be the output for an angle of 10 degrees from operating point, when connected in difference mode? Show your calculations. (2+1+2)

Q5) Using block diagram of low pass filter and high pass filter create a) band pass filter b) band reject filter. (3)

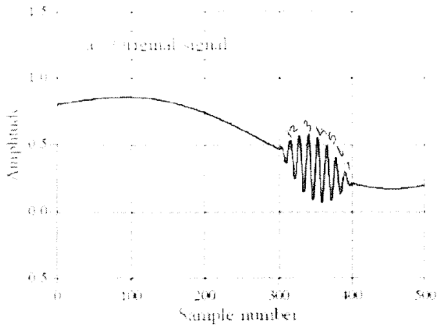
Q6) Explain how a pressure sensor connected by a tube is modeled when pressure variation is fast and fluid is moderately damped. (5)

Q7) What is secondary standard? (2)

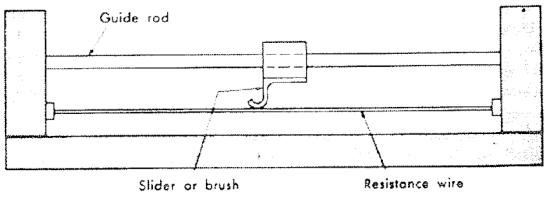
Q8) Give qualitative description of various types of errors in measurement. (6)

Q9) What was latitude and longitude recorded by you during the GPS experiment? (1)

Q10) Show the output when the given signal is passed through a) low pass filter b) high pass filter (1+1)



Q11) Figure below is a setup for measuring linear displacement using linear potentiometer. The length of the wire is 1 m and zero is on the left and 1 m on the right. Resistance/unit length of the wire is 50 ohms/cm. Supply of 5 V is used across the potentiometer. Assume slider is at 0.45m from left. A) What will be the output when the input resistance of measuring device is very high (infinity) B) What will be the error in measurement if the output device is having resistance of 5000 ohms C) If the wire is getting uniformly heated (same temperature) by the current, what is the error in measurement due to heating (assume measuring instrument resistance is infinity). Support all your answers with calculation or derivations.(1+3+3)



Q.12) A balloon is carrying a thermometer whose behavior is like first order system of 5s time constant and it rises through the atmosphere at 6m/s. Assume temperature varies with altitude at 0.15°C/30m. The balloon radios temperature readings back to ground. It is released from ground, which is at 30.0°C. What value of temperature sensor will be transmitted after 300 seconds? Will there be any error in the measurement, if yes what is the magnitude? (3+1)

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$$y(t) = \underbrace{t - \tau + \tau \exp(-t/\tau)}_{x} = T_g - T_a$$

$$\frac{dT}{dt}$$