

- d) A linear potentiometer having a resistance of $50\text{k}\Omega$ is connected to a supply of 12V . The slider is set to $\frac{1}{5}$ range of the arc length.

calculate

- i) the output voltage when the output terminals are left open circuit
- ii) the output voltage when a $20\text{k}\Omega$ load resistor is connected to the slider
- iii) the % loading error (4 marks)

QUESTION TWO

- a) Draw the block diagram of Successive Approximation Analog to Digital convertor and explain its operation (8marks)
- b) Derive the expression for the output voltage in figure 1

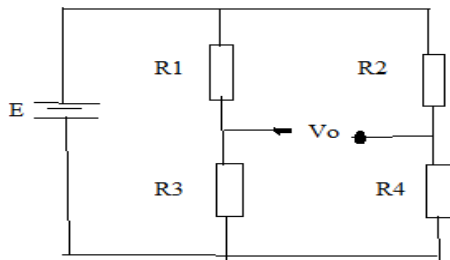


Figure 1

(4marks)

- c) The bridge arrangement of figure2 contains in its fourth arm a resistive strain gauge transducer of value R when unloaded. When loaded, the transducer resistance changes by ΔR depending on the load. If for a particular case $\Delta R=5\Omega$, Determine the reading of the voltmeter (4 marks)

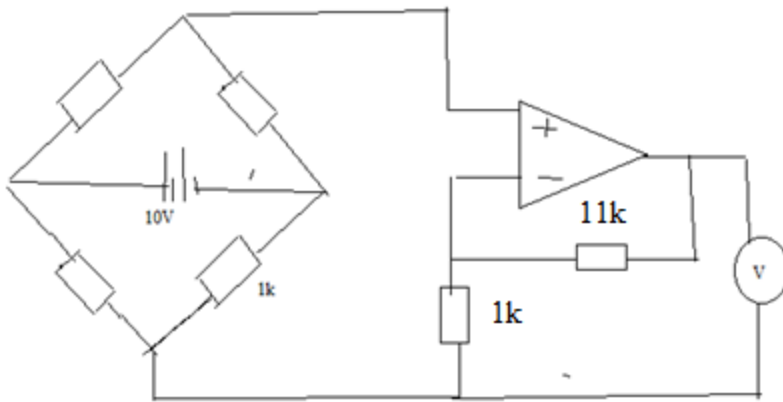


Figure2

- d) A 5 bit binary weighted DAC has a resistance of 160KΩ in the LSB position .The feedback resistor is 10kΩ.The reference voltage is 12V.Determine
- i) the weight of the LSB digit
 - ii) the output voltage corresponding to an input of 11110
 - iii) the digital input equivalent for analog output of 8.25V
 - iv) the resistance of the MSB digit (4 marks)

QUESTION THREE

- a) Define the following terms;
 - I) piezo resistive effect
 - II) piezoelectric effect (2 marks)
- b)
 - i) State any TWO effects of temperature on strain gauges
 - ii) State any TWO advantages of semiconductor strain gauges
 - iii) Describe, with the aid of a diagram the dummy gauge method of overcoming the effect of temperature on strain gauges (8 marks)
- c)
 - i) With the aid of a well labeled diagram, describe the construction and operation of the drag cup tachogenerator
 - ii) A variable reluctance type tachometer has a 60 rotor teeth .The counter records 3600 counts per second .Determine the speed in revolution per minute (10 marks)

(12 marks)

QUESTION FOUR

- a) Explain what is meant by 'loading effect' as applied to instruments and state one method of overcoming loading effect (3 marks)
- b) A pressure transducer has a sensitivity of 1.5mV/bar if correctly energized. The output impedance of the transducer is 200Ω and it is connected to a galvanometer with an internal resistance of 100Ω. If the galvanometer has a sensitivity of 15mm/μA and the galvanometer spots deflects 100mm. Determine the magnitude of the pressure being measured. (5 marks)
- c) A remote temperature monitoring system comprises the components in table 1 with respective sensitivities and impedances. If the thermocouple has a hot junction temperature of 50°C, Determine
- i) the input voltage into the amplifier
 - ii) the output voltage from the amplifier
 - iii) the power developed in the indicator /recorder

(4 marks)

Table 1

component	sensitivity	impedances	
		input	output
Thermocouple	40μV/°C	-	20 Ω
Amplifier	1000V/V	10000 Ω	1000 Ω
Indicator/recorder	-	200 Ω	-
Total Cable		250 Ω	

- d) i) Draw a block diagram of an instrumentation system and Explain the function of each block
- ii) Explain any TWO advantages of electronic instrumentation over mechanical types

(8 marks)

QUESTION FIVE

- a) Distinguish between x-t and x-y recorders and give an example of each (4marks)
- b) With the aid of a diagram and explain the operation of a strip chart recorder (8marks)
- c) Draw the block diagram of a digital storage oscilloscope and explain the function of each block (6 marks)
- d) State any TWO advantages of Light Emitting Diodes (2 marks)