

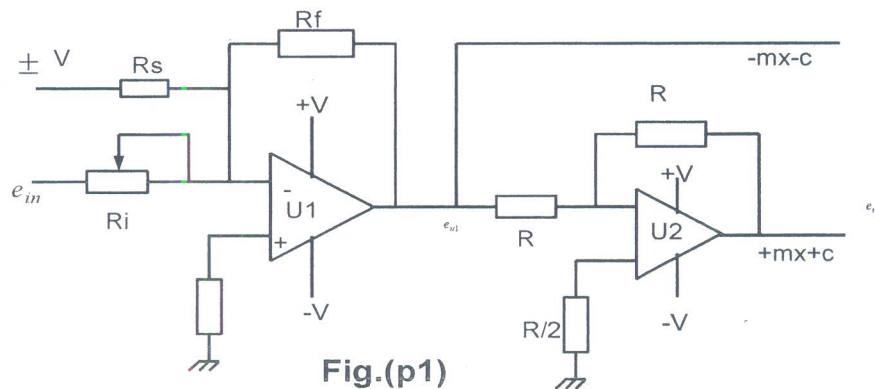
University	: Menoufia	Date	: 5 Jan 2020
Faculty	: Electronic Engineering	Time	: 3 Hour
Department	: Industrial Electronics and Control Engineering	No. of pages	: 2
Academic level	: 3 <sup>rd</sup> Year	No. of Questions	: 6
Course Name	: Electronic Measurements	Full Mark	: 70 Marks
Course Code	: ACE 311	Exam	: <u>Final Exam</u>
Academic Year	: 2019/2020	Examiner	: Prof. Mohamed Mabrouk Sharaf Dr. Hossam Khalil



**Answer all the following questions :**

**Question No 1 :**

The signal from a controller is 0 V for full OFF and 10 V for full ON. The actuator requires an input of 3 V for full OFF and 1 V for full ON. Design a zero and span converter that will convert the 0 to 10 V signal from the controller into the 3 to 1 V signal needed by the actuator, fig.(p1). Draw the transfer characteristic.



**Question No 2:**

(a) Bourdon tubes are used to measure the pressure:

- i- What kind of pressure, (i.e. absolute, differential or gage) ?
- ii- Explain how to transform the mechanical displacement resulted due to the pressure into an electrical signal can be fed to controller electronics

(b) A force of 81 Ib is applied to a steel beam that is 6 inch long and has a cross sectional area of 0.1 inch<sup>2</sup>. The strain gage bonded to the beam has a nominal resistance of 350Ω and a gage factor of 1.96. Calculate the change in resistance of the strain gage and the change of the steel beam length. ( $E = 30.02328 \times 10^6$  psi).



**Question No 3:**

A dc motor that drives a conveyor belt has a maximum speed of 1720 r/min. It is necessary to monitor the speed with a resolution of 1 r/min and provide new number every 100 ms. How many pulses per revolution are required ?

- If it were necessary to use a 6-pulse/revolution reflective optical sensor, describe the degradation in performance.

**Question No 4 :**

Draw the 4-bit R-2R DAC circuit,

- (a) Show that the output impedance of this converter is R, regardless of number of bits
- (b) Deduce the input-output relationship for this converter.
- (c) Find the full scale output.
- (d) Find analog output voltage for the digital word 1010 if  $V_{ref}=10\text{ V}$  and  $R_f = 2R$ .

**Question No 5 :**

- (a) Compare between counter-type ADC and tracking-type ADC in terms of design and conversion time.
- (b) If we use a 12-bits tracking-type ADC, find the maximum conversion time to digitize a 2 KHz sinusoidal signal defined as:

$$V_i(t) = V \sin wt$$

**Question No 6 :**

- (a) Explain the working principle of the following:
  - i. 5-bits Successive Approximation ADC
  - ii. 5-bits Flash-type ADC showing advantages and disadvantages.
  - iii. For both ADCs, if  $V_{ref} = 16\text{ V}$ , find the digital output if the input voltage is  $V_i = 11.5\text{V}$ .

**Achieved ILOS :**

Question No		Q1	Q2	Q3	Q4	Q5	Q6
Achieved ILOs	A- Knowledge & Understanding	•			•	•	
	B- Intellectual skills		•		•		•
	C- Professional and practical skills			•	•		•
	D- General and transferable skills	•		•		•	