Ref No: Ex/EE/5/T/311/2018 (S)

BACHELOR OF ELECTRICAL ENGINEERING 3RD YR 1ST SEMESTER EXAMINATION, 2018

(1st / ~~2nd~~-Semester/~~Repeat~~/Supplementary/~~Annual~~/~~Bi-Annual~~)

SUBJECT: - ELECTRCAL INSTRUMENTATION

Full Marks 100

Time: ~~Two hours~~/Three hours/ ~~Four hours~~/ ~~Six hours~~

(50 marks for each part)

Use a separate Answer-Script for each part

	PART I	Marks
1.	***Answer Question:1 and any TWO from the rest:*** **Answer any four :** a) For LVDT, the PSD converts the AC signal into bipolar DC signal -Justify. b) Why differential capacitive sensor can produce linear output? c) Why piezoelectric sensor can be used only for vibrating load condition but not for steady load condition? d) Explain in brief how the signal conditioning circuit used with accelerometer can produce outputs as vibration , velocity and acceleration components. e) Why lifting gate control valve is used for flow control of fluid containing solid matters? f) What is the difference in operation of ultrasonic sensor operating in Doppler frequency shift and pulse echo modes?	4 X 5=20
2.	a) Draw equivalent circuit of a LVDT, whose output is connected to meter. Also derive the expression for frequency domain transfer function. b) Illustrate a scheme for measurement of displacement by LVDT under dynamic condition. c) Draw the reactive AC bridge circuit for capacitive sensor Also derive the expression of bridge output for change in capacitance in null and direct method.	5+5+5

[Turn over

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3.	a) Discuss in brief about the working principle of diaphragm type capacitive sensor. b) Draw the equivalent circuit of a piezoelectric sensor and derive the expression of frequency domain transfer function considering voltage as output and displacement as input.	7+8
4.	a) Illustrate a scheme for liquid level measurement in a tank by ultrasonic sensor following pulse-echo method. b) Illustrate a scheme for liquid flow rate measurement for bi-directional flow using ultrasonic sensor.	8+7
5.	**Write short notes on any three:** i) Thickness measurement by capacitive sensor. ii) Humidity measurement by capacitive sensor. iii) Force and Torque measurement. iv) Hot wire anemometer. v) Electromagnetic type velocity sensor. vi) Servo type accelerometer.	3X5

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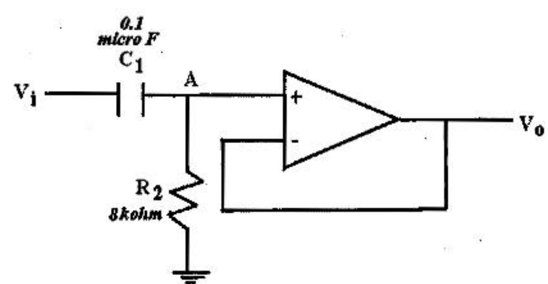
B.E.E. (EVENING) 3RD YEAR 1ST SEMESTER
SUPPLEMENTARY EXAMINATION, 2018

SUBJECT: - ELECTRICAL INSTRUMENTATION

Time: Three hours **Full Marks 100**
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART-II	Marks
	Answer any two	
1. a)	Prove that Butterworth poles are situated on an *s*-plane unit circle.	(10+15=25)
b)	The transfer function of an electrical filter circuit is given as follows: $H(s)=\dfrac{10}{s^2+4549s+10349030}$ Realize the above transfer function using an active filter circuit. Find the pass-band gain and cut-off frequency.	
2. a)	What are *Rounding off* and *Truncation* type Analog to Digital converters (ADCs)?	6
b)	Explain the operation of successive approximation type ADC for 3 bits.	8
c)	Obtain a 4-bit binary representation of an analog signal value of 10.75 V using successive approximation type ADC. Reference voltage is 12 V. Find out the conversion time in seconds and quantization error in volts. The clock frequency is 1kHz.	7
d)	What are gain and offset errors of ADC?	4
3. a)	Explain the principle of operation of switched capacitor circuit. What are the main advantages of such circuits in IC technology?	6+4
b)	Derive the transfer function of a band pass filter using switched capacitor representation (Draw necessary circuit realization).	10
c)	Draw the Switched capacitor implementation of the following circuit. Assume switching frequency is 1kHz. 	5
4.	Write notes on any *two*	(12½X2=25)
a)	Operation of a 3 bit unipolar R-2R ladder network based DAC	
b)	Linear model of phase locked loop (PLL)	
c)	State variable Filter	
d)	Storage Oscilloscope	