Ref No: Ex/EE/5/T/311/2019(old)

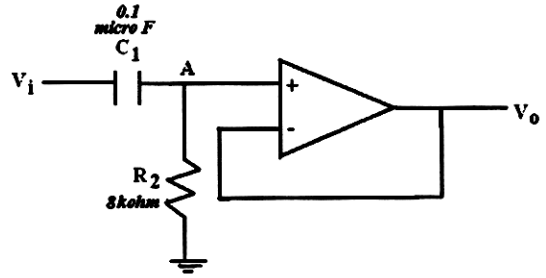
B.E.E. (EVENING) 3RD YEAR 1ST SEMESTER EXAMINATION, 2019(OLD)

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-I	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: $H(s)=\frac{15s^2}{s^2+4549s+10349030}$ 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 12.5 V using successive approximation type ADC. Reference voltage is 14 V. Find out the conversion time in seconds and quantization error in volts. The clock frequency is 2kHz.	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	

[Turn over

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BACHELOR OF ELECTRICAL ENGINEERING 3RD YR 1ST SEMESTER EXAMINATION, 2019

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

SUBJECT: - ELECTRICAL INSTRUMENTATION

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

Full Marks 50
(50 marks for each part)

Use a separate Answer-Script for each part

	PART II	**Marks**
	[Two marks are reserved for appropriate answers]	
1.	***Answer any three Questions:***	
	a) Derive the expression of transfer function and voltage sensitivity per unit of core displacement of a LVDT when its secondary is connected to meter load.	
	b) For a given LVDT sensor explain how phase sensitive detector can produce signal proportional to core displacement.	**8+8=16**
2.		
	a) Derive the expression of error voltage as output from a AC bridge, whose adjacent arms include two same capacitive elements (C1,C2) of a differential capacitive sensor and change by	
	b) Illustrate a suitable scheme for measurement of liquid level using cylindrical capacitive sensor. Derive expression of change in capacitance due to change in liquid level in a tank.	**8+8=16**
3.		
	a) An ultrasonic transmitter and receiver are mounted at the extreme end of a pipe of length 'L' , through which fluid is flowing with velocity 'V' . Find the expression of difference in time taken by ultrasonic wave to reach from transmitter to receiver. If two pairs of transceivers are mounted , what advantages will be obtained?	
	b) What is Doppler effect? Explain how this effect can be utilized to measure the velocity of fluid. Also derive the expression for change in frequency of sound wave due to Doppler effect when the i) source is moving to stationary observer and ii)	

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BACHELOR OF ELECTRICAL ENGINEERING 3RD YR 1ST SEMESTER EXAMINATION, 2019

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

SUBJECT: - ELECTRICAL INSTRUMENTATION

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

Full Marks 50
(50 marks for each part)

	observer is moving to stationary source with same velocity	**8+8=16**
4.	a) 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. b) Explain with diagram, the working principle of piezo-electric accelerometer.	
5.	**Write short notes on any two of the following:** a) Column type load cell b) Hot-wire anemometer c) Torque sensor d) Velocity sensor	**8+8=16** **2x8=16**