

Ref No: Ex/EE/T/311/2017(OLD)(S)

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING
3RD YEAR 1ST SEMESTER SUPPLE EXAMINATION, 2017 (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
	<p><i>Answer any THREE questions.</i> <i>TWO marks are reserved for neatness.</i></p>	
1. (a)	Draw the schematic diagram and explain the operating principle of an LVDT.	05
(b)	An RC phase-compensation network has been employed with an LVDT to retard leading phase angle in the output. Perfect phase compensation could be achieved with $R = 900 \text{ k}\Omega$ and $C = 0.05 \text{ }\mu\text{F}$, when the excitation frequency is chosen as 50 Hz. Calculate the new value of R to be connected to achieve perfect phase compensation once more, when the excitation frequency is increased to 150 Hz and the value of C is kept unchanged. Derive the expression used.	07
(c)	How can Bellows be utilized in conjunction with LVDT to develop an electrical pressure transducer?	04
2. (a)	How can capacitive transducers be employed for measurement of angular displacement?	04
(b)	How can transformer ratio bridges be employed for measurement of capacitance by null method?	05
(c)	With a neat sketch explain the operating principle of total radiation pyrometer. What are the sources of errors in this method of measurement?	05+02
3. (a)	How can a force balance accelerometer be employed for measurement of linear acceleration? Give a detailed account of its dynamic performance.	10

No. of Questions	PART I	Marks
3. (b)	Describe in detail why and how charge amplifiers are used in conjunction with piezoelectric transducers.	06
4. (a)	What are the basic features of electromagnetic flowmeters? Explain in brief the operation of electromagnetic flowmeters with unipolar and bipolar pulsed excitation for the electromagnet coil.	03+05
(b)	How can you develop ultrasonic flowmeters with two sets of transmitters and receivers? Mention an important source of error in such flowmeters and its remedy. Compare between the electromagnetic and the ultrasonic flowmeters regarding the possibility of measuring the liquid flow in an existing installation without disturbing it.	04+02 +02
5.	Write short notes on <u>any two</u> of the following:	8×2=16
(i)	Capacitive transducer with solid dielectric of variable permittivity and air gap between parallel plates.	
(ii)	Phase sensitive rectification/demodulation and filtering in LVDT.	
(iii)	Constant current type anemometers.	
(iv)	Piezoelectric displacement or force transducers.	
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B.E.E. 3RD YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2017(OLD)**SUBJECT: - ELECTRICAL INSTRUMENTATION**

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Full Marks 100
(50 marks for each part)

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No. of Questions	PART-II	Marks
Answer any <i>Three</i> (2 marks for well organized answers)		
1. a)	Explain the principle of operation of switched capacitor circuit. What are the main advantages of such circuits in IC technology?	6+2
b)	Derive the transfer function of a second order switched capacitor type high pass filter?	8
2. a)	The step size of a 7 bit DAC is 10.3 mV. If all zeroes represent 0V, what output is produced for input code 1011011?	3
b)	What are the limitations of weighted resistor type DAC?	3
c)	Obtain a 5-bit binary representation of an analog signal value of 11.318 V using successive approximation type ADC. Reference voltage is 16 V. Find out the conversion time in seconds and quantization error in volts. The clock frequency is 10kHz.	4+2+2
	How the quantization error in ADC can be minimized?	2
3.a)	Define gain error of DAC. Why does this error occur in DACs?	4
b)	Compare the magnitude response of normalized Butterworth and Chebyshev filters.	5
c)	Find the transfer function of a Band-pass filter with center frequency 10krad/s and bandwidth 4krad/s, obtained by a low-pass to band-pass transformation from first order normalized low-pass maximally flat filter. Realize the filter circuit.	7
4. a)	Why Band-stop filters are used? How the band-pass filter mentioned in Q 3(c), can be converted into a band-stop filter of same center frequency and pass band gain 0 dB?	4
b)	Develop the linear model of PLL.	8
c)	Illustrate a suitable scheme to measure the phase difference between two signals using "Lissajous patterns" in CRO.	4
5.	Write Short notes on any <i>two</i> i) State variable filter ii) Storage oscilloscope iii) Linearity error of ADC	2X8=16