

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), November 2016

B. Tech in Electronics and Communication Engineering, Semester III

Roll No.....

ECE302 Measurement and Instrumentation

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1 Objective type multiple choice questions (10 questions @ 1 mark)

10

A

- i. Instruments are subdivided into active and passive based on whether the output of instrument is produced by the quantity being measured simply changes the magnitude of some external power source. The pressure measuring device and the float-type petrol tank level indicator are example of
 - (a) Active instruments
 - (b) Passive instruments
 - (c) Former is active instrument and later is passive instrument
 - (d) Former is passive instrument and later is active instrument
- ii. If a pressure gauge of range 0-10 bar has a quoted inaccuracy of $\pm 1.0\%$ of full scale reading, then it means
 - (a) A. Minimum expected error in any reading is 0.1 bar
 - (b) Maximum expected error in any reading is 0.1 bar
 - (c) Maximum expected error in any reading is 1 bar
 - (d) Minimum expected error in any reading is 1 bar
- iii. Strain gauge is a
 - (a) Active device and converts mechanical displacement into a change of resistance
 - (b) Passive device and converts electrical displacement into a change of resistance
 - (c) Passive device and converts mechanical displacement into a change of resistance
 - (d) Active device and converts electrical displacement into a change of resistance
- iv. For an instrument the degree of repeatability or reproducibility in measurements is an alternative way of expressing its
 - (a) Precision
 - (b) Accuracy
 - (c) Sensitivity
 - (d) Linearity
- v. If a voltmeter can measure up to 150 V and it has 150 scale divisions where each division can read to $3/4$ divisions. Then the resolution of the voltmeter is
 - (a) 0.5 V
 - (b) 0.25 V
 - (c) 0.75 V
 - (d) 1 V
- vi. In a Wheatstone bridge, the formula for finding unknown resistance (R_2) is given by $R_2 = R_2 R_3 / R_1$
Where, $R_1 = 150\Omega \pm 0.1\%$, $R_2 = 250\Omega \pm 0.1\%$, $R_3 = 300\Omega \pm 0.1\%$ and The value of

	unknown resistance is (a) $R_2 = 250\Omega \pm 0.1\%$ (c) $R_2 = 750\Omega \pm 0.3\%$	(b) $R_2 = 300\Omega \pm 0.3\%$ (d) $R_2 = 500\Omega \pm 0.3\%$
vii	The thermocouple instruments works on the principle of Seebeck effect. The amount of heat produced is (a) Directly proportional to the current (b) Directly proportional to the square of current (c) Inversely proportional to the current (d) Inversely proportional to the square of current	
viii	Low resistance is the resistance of the order of (a) 1 ohm and less than 1 ohm (c) More than one ohm	
	(b) 1 ohm to 1 mega ohm (d) None of these	
ix	The vibration galvanometers are sensitive to power for frequency range of (a) 200 Hz and below (c) 4 kHz and above	
	(b) 200 Hz to about 4 kHz (d) Any frequency	
x	Which part is called as heart of CRO? (a) CRT (c) Trigger circuit	
	(b) Sweep generator (d) Amplifier	

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i	Explain the suitability of electronic instruments over electrical and mechanical instruments.	
ii	Why is it preferable in bridge circuit, that the equation of balance are independent of frequency? Explain.	
iii	List the various type of temperature transducer and describe the application of each.	
iv	Explain the sources of errors in bridges circuits.	

Q.3A	What are basic block of a generalized instrument system? Draw the various blocks and explain their functions.	05
Q.3B	A wattmeter having a range of 1000 watt has an error of $\pm 1\%$ of full scale deflection. If the true power is 100 watt, what would be the range of reading? Suppose the error specified as percentage of true value, what would be the range of reading?	05

Q.4A	Explain static and dynamic characteristics of a measuring instruments.	05
Q.4B	Explain the working of dual slope type Analogue to digital converter and with suitable diagram.	05

Q.5A	Describe the working of Maxwell inductance- capacitance Bridge for measurement of inductance. Derive the equation for balance and draw the phasor diagram under condition of balance.	05
Q.5B	A bridge consists of following : Arm ab - a choke coil having a resistance R_1 and inductance L_1 . Arm bc - a non-inductive resistance R_3 . Arm cd - a mica condenser C_4 in series with a non-inductive resistance R_4 . Arm da - a non-inductive resistance R_2 When this bridge is fed from a source of 500 Hz, balance is obtained under following conditions. $R_2 = 2410$ ohm, $R_3 = 750$ ohm, $R_4 = 64.5$ ohm and	05

$C_4 = 0.35 \mu\text{F}$. The resistance of capacitor is 0.4 ohm. Calculate the resistance and inductance of choke coil.

Q.6A	Draw the basic block diagram of an oscilloscope and state the function of each block.	05
Q.6B	What is piezo electric effect? Describe with diagram the operation of a piezo -electric transducer.	05
OR		
Q.6B	The output of an LVDT is connected to a 5 volt voltmeter through an amplifier, whose amplification factor is 250. An output of 2 mVolt appear across the terminals of LVDT when the core moves through a distance of 0.5 mm. Calculate the sensitivity of LVDT and that of th whole setup. The milli-voltmeter scale has 100 divisions. The scale can be read to 1/5 of a division. Calculate the resolution of the instrument in mm.	05
Q.7A	Explain the working of successive approximation type Analogue to digital converter and with suitable diagram.	05
Q.7B	Explain the working of dual slope integrating type digital voltmeter with suitable diagram.	05
OR		
Q.7B	A 4 terminal resistor of approximately $50 \mu\Omega$ resistance was measured by means of kelvin's bridge having the following component resistances : Standard resistor = 100.03; Internal ratio arm = 100.31Ω and 200Ω ; outer ratio arms = 100.24Ω and 200Ω ; resistance of link connecting the standard and the unknown resistance = $700 \mu\Omega$. Calculate the unknown resistance to the nearest $0.01 \mu\Omega$.	05
Q.8A	Define the term error. Classify the various type of errors and explain these error by giving suitable example. Discuss the mean adopted to minimize these errors.	10
Q.9A	Explain the method of measuring displacement using LVDT. State advantages and disadvantages of LVDT.	10
Q.9B	Define the term strain gauge and gauge factor. Describe the operation and construction of strain gauge. State its limitation.	10
OR		
Q.9B	An integrator contain a $100 \text{ k}\Omega$ and $1 \mu\text{F}$ capacitor. If the voltage applied to the integrator input is 1 volt, what voltage will be present at the output of the integrator after 1 second? Now if a reference voltage is applied to the integrator at t_1 is 5 volt in amplitude, what is the time interval of t_2 ?	10