

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Apr-May, 2016

B. Tech. in Electronics & Communication Engineering, Semester IV

Roll No.....

ECE406: MEASUREMENT & INSTRUMENTATION

Time: 3.0 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.
4. Use of Non-Programmable calculator is allowed.

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

- a. A 0 to 300 V voltmeter has an error of $\pm 2\%$ of full scale deflection. What would be the range of readings if true voltage is 30 V?
 - a) 24V- 36V
 - b) 29.4 V - 30.6V
 - c) 20 V to 40 V
 - d) None of above
- b. In a CRO which of the following is not a part of electron gun
 - a) Cathode
 - b) Grid
 - c) accelerating anode
 - d) x-y plates
- c. Two resistors $R_1 = 36 \Omega \pm 5\%$ and $R_2 = 75 \Omega \pm 5\%$ are connected in series. The total resistance is
 - a) $111 \pm 0 \Omega$
 - b) $111 \pm 2.778 \Omega$
 - c) $111 \pm 5.55 \Omega$
 - d) None of above
- d. Heating effect of current is used in
 - a) Ammeters
 - b) Voltmeters
 - c) both ammeters and voltmeters
 - d) wattmeters
- e. An LCD requires a power of
 - a) 20 W
 - b) 20 mW
 - c) $20 \mu W$
 - d) 20 nW
- f. Thermocouples are
 - a) Passive transducers
 - b) Active transducers



- c) Both active and passive transducers
- d) Output transducers.
- g. The input resistance of a CRO is the order of
 - a) tens of ohm
 - b) megaohm
 - c) kilohm
 - d) fraction of an ohm
- h. Write the full form of LED.
- i. What do you understand with Repeatability?
- j. Write the full form of LCD.

Q.2 Each Question is of 2.5 marks 10

- i. A tape receives 12000 numbers per second. The tape speed is 1.5 m/s. Determine the number density of the tape.
- ii. Write a short note on "Sources of errors in Bridges".
- iii. Measurement on a human nerve cell indicates an open circuit voltage of 80mV, and a current of 5 nA through a 6 MΩ load. What is a maximum power available from the cell?
- iv. Calculate the noise power available in 100 kHz of bandwidth at a temperature of 300 °K. The Boltzmann constant is $1.38 \times 10^{-23} \text{ J/}^\circ\text{K}$.

Q.3A Design a decade counter for counting the sequence 0 to 9. 05

Q.3B What are the different types of Strain Gauge? Explain Unbonded metal strain gauge in detail. 05

Q.4A Explain advantages, disadvantages and applications of LVDT. 05

Q.4B A capacitive transducers uses two quartz diaphragms of area 750 mm² separated by a distance of 3.5 mm. A pressure of 900kN/m² when applied to the top diaphragm produces a deflection of 0.6 mm. The capacitance is 370 pF when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of 900 kN/m². 05

Q.5A A barium titanate pickup has the dimensions of 5 mm x 5 mm x 1.25 mm. The force acting on it is 5 N. The charge sensitivity of barium titanate is 150 pC/N and its permittivity is $12.5 \times 10^{-9} \text{ F/m}$. If the modulus of elasticity of barium titanate is $12 \times 10^6 \text{ N/m}^2$. Calculate. 05

- i. Strain
- ii. Charge
- iii. Capacitance

Q.5B An analog transducer with a 0-10 V input is able to distinguish a change of 10 mV in its input signal. Calculate 05

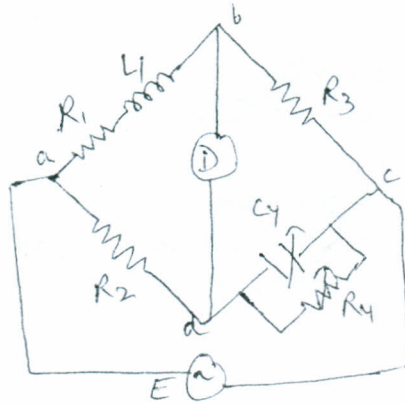
- i. Its resolution
- ii. Number of bits of an A/D converter so that the digital output has almost the same resolution as the transducer. The A/D converter uses a binary code.

- iii. Quantization error
- iv. Number of decision levels

Q.6A Explain seven segmental and fourteen segmental display in detail along with example. 05

- Q.6B
- i. What is resolution of a $3\frac{1}{2}$ digit display? 05
 - ii. Find the resolution of a $3\frac{1}{2}$ digit meter in case its range is 1V.
 - iii. Find the resolution of the meter for 10 V range.

Q.7A A Maxwell's capacitance bridge shown in the given figure is used to measure an unknown inductance in comparison with capacitance. The various values at balance, $R_2=400\ \Omega$; $R_3=600\ \Omega$; $R_4=1000\ \Omega$; $C_4=0.5\ \mu\text{F}$. 05



- i. Calculate the value of R_1 and L_1 .
- ii. Calculate the value of storage (Q) factor of coil if frequency is 1000 Hz

Q.7B State the number of significant figures in each of the following numbers: 05

- i. 302 A
- ii. 302.10 V
- iii. 0.00030 Ω
- iv. 5.01×10^4
- v. 502000

Q.8A How a LED is controlled by a transistor switch? List the major advantages (any five) of LED in electronic display. 05

OR

Q.8A Explain strip chart recorder in detail using suitable diagrams. 05

Q.8B Draw the block diagram of general purpose CRO and explains the functions of following controls 05

- i. Intensity
- ii. Focus
- iii. Trigger
- iv. synchronization

Q.9 i. Explain binary weighted resistance method of D/A converter using suitable diagram. Also derive the expression of output current. 07+03

- ii. A digital to analog converter has 6 bits and a reference voltage of 10 V. Calculate the minimum value of R such that the maximum value of output current doesn't exceed 10 mA.

OR

Q.9 What are the different A/D converter techniques? List the name. Explain any two of them using suitable diagram. 10

Q.10 Explain Ramp type digital voltmeter in detail using suitable diagram and timing waveforms. 10

OR

Q.10 Explain the different principles of working of capacitive transducers along with equations and diagrams. 10