ELECTRONIC INSTRUMENTATION
(ELEC 3131)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   An inverse transducer converts
   (a) Electrical energy to light energy
   (b) Mechanical displacement into electrical signal
   (c) Electrical energy to mechanical form
   (c) Electrical energy to any other form of energy

   (ii)   The resistance of a thermometer is 5Ω at 30°C and 6.5Ω at 60°C. Using linear approximation the value of resistance temperature co-efficient at 45°C is
   (a) 0.009/°C   (b) 0.0087/°C
   (c) 0.0085/°C   (d) 0.01/°C

   (iii)   In an LVDT the core is made up of a
   (a) Non magnetic material
   (b) a solid ferro-electric material
   (c) high permeability, nickel iron hydrogen annealed material
   (d) all of the above

   (iv)   Capacitive transducers are normally used for
   (a) Static measurement   (b) dynamic measurement
   (c) both static and dynamic measurements   (d) transient measurement

   (v)   Piezoelectric transducers are
   (a) Passive transducer   (b) active transducer
   (c) secondary transducer   (d) inverse transducer

   (vi)   The operating frequency range of frequency selective wave analyzer is
   (a) 20Hz to 20KHz   (b) 20KHz to 20MHz
   (c) 10KHz to 18MHz   (d) 0 to 1GHz

(vii)   In a Q meter, the value of shunt resistance connected across the oscillator is
      (a) 2Ω (b) 0.02Ω
      (c) 0.002Ω (d) 0.2Ω

(viii) The true value of Q of a coil is 245 and the measure value is 244.5. The ratio of distributed capacitance to self capacitance of the coil is
      (a) 2.04×10^{-3} (b) 1.002
      (c) 0.997   (d) 1

(ix)   The components of Analog Data Acquisition Systems are
      (a) Transducer   (b) Signal Conditioner
      (c) Terminating devices like CRO, recorder etc. (d) All of the above.

(x)   The capacitors used in frequency selective wave analyzer are close tolerance
      (a) polystyrene capacitor   (b) paper capacitor
      (c) air capacitor   (d) oil capacitor.

Group – B

2. Compare the following types of transducers with suitable examples
    (i)   Transducer and inverse transducer
    (ii) Active and passive transducer
    (iii) Primary and secondary transducer
    (iv) Analog and digital transducer.

(4 × 3) = 12

3. What is LVDT? Explain the working principle of LVDT. How displacement and pressure are measured using LVDT.

(1 + 8 + 3) = 12

Group – C

4. (a) Explain how a parallel-plate capacitor serves as the most suitable transducer for measurement of linear and angular displacements.

    (b) A parallel plate capacitive transducer uses plates of area 400mm^2 which are separated by a distance of 0.15mm. Calculate the value of capacitance when the dielectric medium is air having a permittivity of 8.85×10^{-12}F/m. Also calculate the change in capacitance if a linear displacement reduces the distance between the plates to 0.12mm and the ratio of per unit change of capacitance to per unit change of displacement.

(3 + 3) + 6 = 12

5. (a) Describe the working principle of an electromagnetic type flow meter

    (b) Draw and explain the frequency response of charge amplifier.

(7 + 5) = 12

Group – D

6. What is Wave Analyzer? Explain with the help of block diagram the working principal of frequency selective wave analyzer? State the different applications of Wave Analyzer.

$$(1 + 9 + 2) = 12$$

7. (a) What is Q-meter? What are the different methods of connecting an unknown coil with Q-meter? How series resonance is obtained in Q-meter? How shunt resistance affects the Q- measurement of an unknown coil?

(b) Calculate the self-capacitance when following measurements are performed.
$f_1 = 2$ MHz; $C_1 = 500$ pF
$f_2 = 4$ MHz; $C_2 = 100$ pF

$$(1 + 1 + 5 + 2) + 3 = 12$$

Group – E

8. (a) What is Data Acquisition System? State and explain the different types of Data Acquisition System.

(b) Find the 4 bit binary representation of an analog signal of 10.6 Volt using successive approximation techniques. Assume reference voltage is 16 Volt.

$$(1 + 8) + 3 = 12$$

9. (a) What is 'Analog Multiplier'? State the different characteristics of 'Analog Multiplier'. Realize square root extractor using 'Analog Multiplier'.

(b) Explain 'Analog to Digital' and 'Digital to Analog' Multiplexing with block diagrams.

$$(1 + 1 + 6) + (2 + 2) = 12$$

Department & Section	Submission Link
EE	https://forms.gle/jNEfTnqzPJxrJTWJ6