1204E21

Candidate's Seat No : _____

Time : 2-30 Hours]

[Max. Marks : 70

Instructions:

(1) All questions carry equal marks.
(2) All Symbols have their usual scientific meanings.

Total marks-70

Q-1

(a) What is strain gage? Derive the expression of gage factor.   7

(b) What is displacement transducer? Name different types of displacement transducers and explain potentiometric transducer in detail.   7

OR

(a) Explain the working of thermocouple for measurement of temperature.   7

(b) Name the different types of photosensitive devices. Discuss the working of multiplier phototube with necessary diagram.   7

Q-2

(a) Explain amplitude and phase spectra. Sketch the single- and double-sided amplitude and phase spectra for the signal   7

$$x(t) = 10 \sin\left(10\pi t - \frac{2\pi}{3}\right), \quad -\infty < t < \infty$$

(b) Classify the systems. Explain linear and nonlinear systems. Check the linearity of the system represented by following equation   7

$$\frac{dy(t)}{dt} + 8y(t) + 10 = 3x(t)$$

OR

(a) Find the Z-transform for $x(n) = n^2 u(n)$.   7

(b) Using long division method, determine the inverse Z-transform of   7

$$X(z) = \frac{1}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}} \quad \text{when ROC:} |z| > 1$$

Q-3

(a) What is Hysteresis? Explain it with necessary figures.   7

(b) Obtain Maxwell's equations and discuss displacement current term.   7

OR

(a) State and prove uniqueness theorem.   7

(b) Write a note on radiation pressure and momentum.   7

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Q-4

(a) Discuss the band theory using collective approach.   7

(b) Obtain the expression of conductivity of semiconductor in terms of charge carrier densities and their mobility.   7

OR

(a) Explain the 'diffusion' and 'generation and recombination' terms of the continuity equation.   7

(b) Consider a bar of P-type semiconductor uniformly doped and irradiated by radiation of appropriate frequency. If irradiation is abruptly shut off at t=0; calculate the concentration of minority carrier at time t using continuity equation.   7

Q-5   Write short answers for following questions. (Any seven)   14

1. Why thermistor is called transducer?
2. What is photo voltaic cell?
3. What is piezoelectric transducer?
4. Define unit ramp function.
5. Write one advantage of digital signal processing.
6. What is Z-transform?
7. Define plane polarized electromagnetic waves.
8. Write Laplace equation in rectangular coordinate system.
9. Write any two properties of the electromagnetic waves.
10. Sketch the potential well diagram of two 'Na'(Sodium) atoms and show the positions of free and bonded electrons.
11. Give the difference between semiconductor and insulator.
12. Draw the energy band diagram of collector and insulator.

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