Seat No. : _____

# AF-117

**April-2015**

**B.Sc., Sem.-VI**

## ELECTRONICS

## 310 – (Physics of Electronics)

**Time : 3 Hours]** **[Max. Marks : 70**

**Instructions :** (i) Figure to the right indicate marks.
(ii) Symbols have their usual meanings.

1. (a) Describe the use of thermocouple as temperature measuring device and write at least three possibilities of error while taking the measurement. **8**

**OR**

How do the Photosensitive devices work as transducer ? Name the different type of Photosensitive devices and give their introduction in two-three sentences.

(b) What is strain gage ? Derive the expression of gage factor. **6**

**OR**

Explain Linear variable differential transformer in detail.

2. (a) Give the answers of following questions : **6**

(i) If $x_1(t) = 10 \sin 5\pi t$ and $x_2(t) = \sin 20\pi t$, then check the periodicity of $x_3(t) = x_1(t) + x_2(t)$.

(ii) Sketch the signal $x(t) = 2\pi (t - 1/4)$.

(iii) Sketch the double sided amplitude and phase spectra for

$$x_1(t) = 10 \sin\left(10\pi t - \frac{-2\pi}{3}\right), -\infty < t < \infty.$$

**OR**

Classify the systems and explain static and linear systems. Check the linearity of the system represented by following differential equation.

$$\frac{dy(t)}{dt} + y(t) + 5 = 10\, x(t)$$

(b) What is z-transform ? Write linearity property of z-transform. Find the z-transform for $x(n) = \sin \omega_o n$ for $n \geq 0$. 8

**OR**

Write correlation property of z-transform and determine correlation sequence r(n) for following pair of signals.

$x_1(n) = \{1, 2, 3, 4\}$

$x_2(n) = \{4, 3, 2, 1\}$

3. (a) Explain uniqueness theorem for potential in electrostatics. 6

**OR**

Derive Maxwell's equations and explain displacement current term.

(b) Discuss the Polarization of Electromagnetic waves with necessary equations. 8

**OR**

Show that $\vec{E}$ and $\vec{H}$ propagate in non conducting medium with same velocity and same phase.

4. (a) Discuss the motion of electron in the absence and presence of electric field. 7

**OR**

Explain the diffusion of minority charge carrier in n-type semiconductor with necessary equations.

(b) Obtain the Einstein relationship for motion of majority charge carrier in P-type semiconductor. 7

**OR**

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

5. Answer in brief :

(1) Define force-summing device.

(2) Write the principle of oscillation transducer.

(3) Give the working principle of Piezo-electric transducer.

(4) Define Energy Signal.

(5) Calculate $\int_{-\infty}^{\infty} e^{-\alpha t^2} \delta(t - 10)\, dt$ using properties of delta function.

(6) Sketch the signal $u(n + 4)$.

(7) Find z-transform for $x(n) = \{1, 2, 5, 4, 0, 1\}$.

(8) What is hysteresis ?

(9) Lorentz transformation equation relate which two electromagnetic quantities ?

(10) What is poynting vector ?

(11) Define intrinsic semiconductor.

(12) Give examples of materials that are good conductors and state the reasons. Why ?

(13) What are the two conduction processes in semiconductors ?

(14) Why the effective mass of electron is considered negative at the top of valance bond ?