[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 2389 **F–4** **Your Roll No.....**

Unique Paper Code : 2221403

Name of the Course : **B.Sc. (Hons) Physics**

Name of the Paper : Analog System and Applications

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. **1** is compulsory.
4. Non programmable calculators are allowed.

1. Attempt any **five** of the following

(a) Draw the output-characteristics of a solar cell and label important parameters.

(b) Define accuracy and resolution for an D/A converter

(c) What is the difference between differential and common mode inputs for an op-amp.

(d) The energy gap of the semiconducting material of an LED is 1.37eV. What is the wavelength of the emitted light?

(e) Show that $I_c = \beta I_B + (1 + \beta) I_{CBO}$

(f) Distinguish between Class A and Class B amplifiers with the help of load line and Q point.

(g) Define PIV, ripple factor and rectification efficiency of a rectifier.

(3×5=15)

P.T.O.

2. (a) Obtain an expression for the barrier width of a p-n junction diode, assuming a step junction.

(b) In a Ge sample a donor type impurity is added to the extent of 1 atom per 10^8 Ge atoms. Find the concentration of electrons and holes in the sample. Given $N_i = 2.5 \times 10^{13}$ electrons / cm^3 and number of Ge atoms is 4.41×10^{22} per cm^3. (12,3)

3. (a) Explain the working of a center-tap full wave rectifier using suitable diagrams and obtain the expressions for

(i) ripple factor and

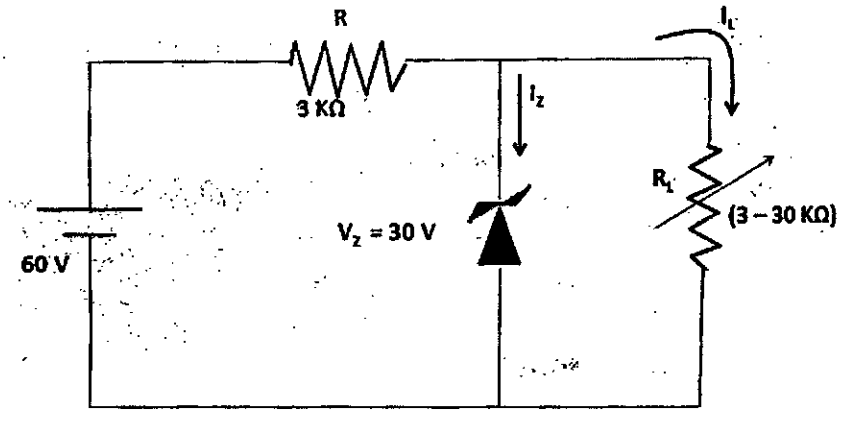
(ii) rectification efficiency.

(b) Find the current through the zener diode in the following circuit when load resistance R_L is :

(i) 30kΩ,

(ii) 5kΩ

(iii) 3kΩ



(11,4)

4. (a) Describe "load line" and "Q-point" of a transistor in CE configuration with appropriate diagram.

   (b) Draw a diagram for the voltage divider bias circuit of an n-p-n transistor in CE configuration. Derive an expression for the stability factor (S) using Thevenin's equivalent circuit.

   (c) Find the Q - point of the fixed bias circuit with $R_C = 4k\Omega$, $R_B = 1.2\ M\Omega$, $V_{CC} = 9.0$ V, $V_{BE} = 0.2$ V and $\beta = 80$. (4,4,7)

5. (a) Using 'h' parameters, obtain expressions for current gain, voltage gain, input impedance and output impedance for transistor in CE configuration.

   (b) For a 4-bit binary R-2R ladder D/A converter the input levels are 0=0V and 1=+10V. Find the output voltage caused by

   (i) 0011,

   (ii) 1001 and

   (iii) 1111. (12,3)

6. (a) Describe the conditions for sustained oscillations in an oscillator? Derive an expression for the frequency of a Colpitt's oscillator.

   (b) A phase shift oscillator has three identical RC sections $R_L=R=10k\Omega$ and $C=0.01\mu F$. Determine the frequency of oscillation. (12,3)

7. (a) Explain with the help of an appropriate circuit diagram the working of a logarithmic amplifier using an op-amp.

   (b) What would be the output of an op-amp in the inverting mode if input resistance is 1 kΩ and feedback resistance is

   (i) 2 kΩ and

(ii) 20kΩ for a dc input signal of 1.5 V? (V_{sat} = ±14 V).

(c) Draw the circuit of an Op-amp as an integrator and find an expression for its output. Draw the output waveform when the input to the integrator is a square wave. (6,3,6)