

2023

Time - 3 hours

Full Marks - 60

Answer all groups as per instructions.

Figures in the right hand margin indicate marks.

GROUP – A

1. Fill in the blanks. (all) [1 × 8
- (a) The temperature coefficient of resistance of silicon is _____.
- (b) _____ is the drift velocity per unit electric field.
- (c) The potential across the depletion region is called _____ potential.
- (d) The Zener diode is usually _____ biased.
- (e) _____ is the process of increasing the magnitude of a weak signal without any change in its shape.
- (f) The mid-frequency voltage gain of an RC-coupled amplifier is _____ of frequency.
- (g) Integrator can be used as a _____ pass filter.
- (h) An inverting amplifier has _____ feedback.

[2]

GROUP – B

2. Answer any eight of the following questions within two to three sentences each. [1½ × 8]

- (a) What are the minority charge carriers in P and N type semi-conductors ?
- (b) Define a graded PN junction.
- (c) Define dark resistance of a photodiode.
- (d) Why can a Zener diode be used as a voltage regulator ?
- (e) What are RC-coupled amplifiers ?
- (f) What is a power amplifier ?
- (g) Explain gain stability.
- (h) Define CMRR.
- (i) Define slew rate.
- (j) What is virtual ground ?

GROUP – C

3. Answer any eight of the following questions within 75 words each. [2 × 8]

- (a) What is the need of negative feedback in an operational amplifier ?
- (b) Write the characteristics of an ideal operational amplifier.

[3]

- (c) Differentiate between open loop gain and closed loop gain of an operational amplifier.
- (d) What is a voltage follower amplifier ?
- (e) What are the advantages of the Hartley oscillator ?
- (f) What are the disadvantages of Colpitt's oscillator ?
- (g) Discuss the effects of positive feedback in an amplifier.
- (h) State the disadvantages of RC-coupled amplifiers.
- (i) Explain frequency response and bandwidth of an amplifier.
- (j) Explain the barrier formation in a PN junction.

GROUP – D

Answer *all* questions within 500 words each.

4. Derive an expression for current for a step junction PN diode. [6]

OR

Explain the working principle and structure of LEDs and solar cells.

5. Describe voltage divider bias method of transistor biasing and find an expression for stability factor. [6]

OR

Write notes on within 250 words each. [3 × 2]

- (a) Thermal runaway
- (b) Stability factor

[4]

6. Derive an expression for the upper cutoff frequency of an RC-coupled amplifier. [6]

OR

With a neat circuit diagram, derive the expression for frequency of the Colpitt's oscillator.

7. With neat diagrams, explain the operation of an OPAMP adder and OPAMP subtractor. [6]

OR

With neat diagrams, explain the operation of an OPAMP zero crossing detector and OPAMP Weinbridge oscillator.