2025

(NEP—2020)

(2nd Semester)

PHYSICS (MAJOR/MINOR)

(Basic Electronics)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided :   1×10=10

1. The reverse saturation current across a *p-n* junction is due to

   (a) minority carriers   (   )

   (b) majority carriers   (   )

   (c) depletion width   (   )

   (d) junction capacitance   (   )

2. Ripple factor of a half-wave rectifier is

    (a) 1·21   ( )

    (b) 1·11   ( )

    (c) 0·48   ( )

    (d) 0·81   ( )

3. A p-n junction that absorbs light energy to produce current is called a/an

    (a) LED   ( )

    (b) photodiode   ( )

    (c) tunnel diode   ( )

    (d) Zener diode   ( )

4. In P-N-P transistor, doping concentration is highest in the

    (a) P-region   ( )

    (b) N-region   ( )

    (c) collector   ( )

    (d) emitter   ( )

5. In a CB configuration transistor output characteristics, the region on the left side of $V_{CB} = 0$ is known as

   (a) input region   (   )

   (b) active region   (   )

   (c) cut-off region   (   )

   (d) saturation region   (   )

6. DC loadline of a transistor is a straight line drawn in graph between

   (a) I_C and V_{CB} (   )

   (b) I_E and V_{CB} (   )

   (c) I_C and V_{CE} (   )

   (d) V_{CE} and V_{CB} (   )

7. The efficiency of a class A amplifier is

   (a) 25%   (   )

   (b) 35%   (   )

   (c) 40%   (   )

   (d) 60%   (   )

8. In an amplifier, the negative feedback results in

    (a) increase in voltage gain   (   )

    (b) decrease in voltage gain   (   )

    (c) increase in current gain   (   )

    (d) decrease in bandwidth   (   )

9. _____ oscillator uses a capacitive voltage divider to provide feedback.

    (a) Colpitts   (   )

    (b) Hartley   (   )

    (c) Phase-shift   (   )

    (d) Cross-coupled   (   )

10. The output from CRO is displayed in

    (a) 4-dimensional   (   )

    (b) 3-dimensional   (   )

    (c) 2-dimensional   (   )

    (d) 1-dimensional   (   )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

Answer *five* questions, taking at least *one* from each Unit :   3×5=15

UNIT—I

1. Explain the significance of forbidden energy gap in brief.

2. Discuss the formation of *n*-type semiconductor.

UNIT—II

3. Explain the operating point of a transistor with a neat diagram.

4. Prove the relation, $\alpha = \dfrac{\beta}{1+\beta}$, where the symbols have their usual meanings.

UNIT—III

5. Mention the components and key features of class *B* amplifier.

6. Write the advantages of negative feedback of an amplifier.

UNIT—IV

7. Mention the Barkhausen's criterion required for self-sustained oscillations.

8. Explain the construction of CRT in CRO.

Answer *five* questions, taking at least *one* from each Unit : 10×5=50

UNIT—I

1. (a) Explain the formation of depletion layer and barrier voltage in *p-n* junction diode. 6

   (b) With a neat diagram, illustrate the working of full-wave rectifier. 4

2. (a) Explain in detail the construction, working and application of Zener diode. 6

   (b) Describe the principle of filtering action of *L*-filter and *C*-filter. 4

UNIT—II

3. (a) Illustrate with proper diagram, the construction and working of an *N-P-N* transistor. 4

   (b) What are the three types of configurations in a transistor? Explain the effect of different V_{CE} values in input characteristics of CE configuration of an *N-P-N* transistor. 6

4. (a) Explain active region, saturation region and cut-off region in output characteristics of CB configuration of a *P-N-P* transistor. 6

   (b) Write a note on voltage and power gains of a transistor. 4

UNIT—III

5. (a) What is a multistage transistor amplifier? Draw the circuit diagram of two-stage *R-C* coupled amplifier and explain its operation. 6

   (b) With neat diagram, describe the working principle of class *B* push-pull amplifier. 4

6. (a) What is distortion? Mention the causes and reduction of distortion in an amplifier. 6

   (b) How does negative feedback affect the gain and stability of an amplifier? 4

UNIT—IV

7. (a) Explain the construction and operation of phase-shift oscillator. 5

   (b) Write the applications of CRO. Explain the measurement of frequency using CRO. 5

8. (a) Describe electron gun and explain electrostatic focusing in CRO. 5

   (b) Illustrate in detail Hartley oscillator using appropriate circuit diagram. 5