2024

(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 leakage current across a *p-n* junction is due to

   (a) impurity ( )

   (b) minority carriers ( )

   (c) majority carriers ( )

   (d) junction capacitance ( )

2. The ripple factor of a full-wave rectifier is

(a) 1·21 ( )

(b) 1·11 ( )

(c) 0·48 ( )

(d) 0·81 ( )

3. A *p-n* junction that radiates energy as light is called a/an

(a) photodiode ( )

(b) LED ( )

(c) Zener diode ( )

(d) Schottky diode ( )

4. Doping concentration of a *p-n-p* transistor is lowest in the

(a) *p*-region ( )

(b) *n*-region ( )

(c) collector ( )

(d) emitter ( )

5. In a CB configuration transistor output characteristics, the region above $V_{CB} = 0$ and $I_E = 0$ is known as

(a) saturation region ( )

(b) input region ( )

(c) active region ( )

(d) cut-off region ( )

6. In the DC loadline, the point where the loadline intersects the Y axis is

(a) cut-off point ( )

(b) critical point ( )

(c) saturation point ( )

(d) subcritical point ( )

7. The efficiency of a class-A amplifier is

(a) 25% ( )

(b) 35% ( )

(c) 40% ( )

(d) 60% ( )

8. In a negative feedback amplifier, phase shift between the input and output signals is

(a) 0° ( )

(b) 90° ( )

(c) 180° ( )

(d) 360° ( )

9. The output voltage in Hartley oscillator is the voltage drop across

(a) L_1 ( )

(b) L_2 ( )

(c) M ( )

(d) C ( )

10. In a CRO, time-varying signals are displayed in

(a) 1-dimension ( )

(b) 2-dimension ( )

(c) 3-dimension ( )

(d) 4-dimension ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

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

UNIT—I

1. Show that the rectification efficiency of half-wave rectifier is 40·6%.

2. Discuss in brief the static and dynamic resistances.

UNIT—II

3. Explain DC load line of a transistor with a neat diagram.

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

UNIT—III

5. With a suitable diagram, describe class-A amplifier.

6. Compare positive and negative feedback of an amplifier.

UNIT—IV

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

8. Explain the measurement of voltage and current in a CRO.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

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

UNIT—I

1. *(a)* Explain the current flow mechanism in reverse biased diode.

(b) With graphical illustration, describe the *I-V* characteristics of a *p-n* junction diode.

(c) What is voltage regulation? Explain how Zener diode is used as a voltage regulator. 1+3=4

2. *(a)* Describe the working of light-emitting diode.

(b) Illustrate with diagram, the principle, construction and working of a photodiode.

(c) Explain filter in electronics. Describe the filtering action of π filter. 1+3=4

UNIT—II

3. *(a)* What is thermal runaway in a transistor?

(b) Discuss the construction and working of a *p-n-p* transistor with diagram.

(c) What is CE configuration in an *n-p-n* transistor? Explain with diagram, the input and output characteristics of CE configuration in an *n-p-n* transistor. 1+4=5

4. *(a)* Explain voltage and current gain of a transistor.

(b) What is a voltage divider circuit? Show how it prevents operating point changes.

(c) Describe base width modulation and transition time of a transistor.

UNIT—III

5. *(a)* What is an *R-C* coupled amplifier? Explain in detail its frequency response. 4

(b) Describe the working, power output and efficiency of the following amplifiers with suitable diagrams : 3×2=6

(i) Class-B push-pull amplifier

(ii) Class-AB amplifiers

6. *(a)* Write notes on power dissipation and distortion of an amplifier. 4

(b) Explain in particular the effect of negative feedback on the following : 2×3=6

(i) Input impedance

(ii) Gain

(iii) Noise

UNIT—IV

7. *(a)* What are sinusoidal and relaxation oscillators? Explain the working principle of oscillators. 3

(b) Mention at least three advantages of phase-shift oscillator. 3

(c) Illustrate in detail Colpitts' oscillator using appropriate circuit diagram. 4

8. *(a)* What is CRO? Draw and explain the block diagram of basic CRO. 3

(b) With appropriate diagram, describe the specifications of a CRO and their significance. 3

(c) Using a neat diagram, explain in detail the construction of CRT. What are electrostatic focusing and acceleration in an electron gun? 4

★ ★ ★

2024

(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 leakage current across a *p-n* junction is due to

   (a) impurity ( )

   (b) minority carriers ( )

   (c) majority carriers ( )

   (d) junction capacitance ( )

2. The ripple factor of a full-wave rectifier is

(a) 1·21 ( )

(b) 1·11 ( )

(c) 0·48 ( )

(d) 0·81 ( )

3. A *p-n* junction that radiates energy as light is called a/an

(a) photodiode ( )

(b) LED ( )

(c) Zener diode ( )

(d) Schottky diode ( )

4. Doping concentration of a *p-n-p* transistor is lowest in the

(a) *p*-region ( )

(b) *n*-region ( )

(c) collector ( )

(d) emitter ( )

5. In a CB configuration transistor output characteristics, the region above $V_{CB} = 0$ and $I_E = 0$ is known as

(a) saturation region ( )

(b) input region ( )

(c) active region ( )

(d) cut-off region ( )

6. In the DC loadline, the point where the loadline intersects the Y axis is

(a) cut-off point ( )

(b) critical point ( )

(c) saturation point ( )

(d) subcritical point ( )

7. The efficiency of a class-A amplifier is

(a) 25% ( )

(b) 35% ( )

(c) 40% ( )

(d) 60% ( )

8. In a negative feedback amplifier, phase shift between the input and output signals is

(a) 0° ( )

(b) 90° ( )

(c) 180° ( )

(d) 360° ( )

9. The output voltage in Hartley oscillator is the voltage drop across

(a) L_1 ( )

(b) L_2 ( )

(c) M ( )

(d) C ( )

10. In a CRO, time-varying signals are displayed in

(a) 1-dimension ( )

(b) 2-dimension ( )

(c) 3-dimension ( )

(d) 4-dimension ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

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

UNIT—I

1. Show that the rectification efficiency of half-wave rectifier is 40·6%.

2. Discuss in brief the static and dynamic resistances.

UNIT—II

3. Explain DC load line of a transistor with a neat diagram.

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

UNIT—III

5. With a suitable diagram, describe class-A amplifier.

6. Compare positive and negative feedback of an amplifier.

UNIT—IV

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

8. Explain the measurement of voltage and current in a CRO.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

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

UNIT—I

1. *(a)* Explain the current flow mechanism in reverse biased diode. 2

(b) With graphical illustration, describe the *I-V* characteristics of a *p-n* junction diode. 4

(c) What is voltage regulation? Explain how Zener diode is used as a voltage regulator. 1+3=4

2. *(a)* Describe the working of light-emitting diode. 2

(b) Illustrate with diagram, the principle, construction and working of a photodiode. 4

(c) Explain filter in electronics. Describe the filtering action of π filter. 1+3=4

UNIT—II

3. *(a)* What is thermal runaway in a transistor? 2

(b) Discuss the construction and working of a *p-n-p* transistor with diagram. 3

(c) What is CE configuration in an *n-p-n* transistor? Explain with diagram, the input and output characteristics of CE configuration in an *n-p-n* transistor. 1+4=5

4. *(a)* Explain voltage and current gain of a transistor. 3

(b) What is a voltage divider circuit? Show how it prevents operating point changes. 3

(c) Describe base width modulation and transition time of a transistor. 4

UNIT—III

5. *(a)* What is an *R-C* coupled amplifier? Explain in detail its frequency response. 4

(b) Describe the working, power output and efficiency of the following amplifiers with suitable diagrams : 3×2=6

(i) Class-B push-pull amplifier

(ii) Class-AB amplifiers

6. *(a)* Write notes on power dissipation and distortion of an amplifier. 4

(b) Explain in particular the effect of negative feedback on the following : 2×3=6

(i) Input impedance

(ii) Gain

(iii) Noise

UNIT—IV

7. *(a)* What are sinusoidal and relaxation oscillators? Explain the working principle of oscillators. 3

(b) Mention at least three advantages of phase-shift oscillator. 3

(c) Illustrate in detail Colpitts' oscillator using appropriate circuit diagram. 4

8. *(a)* What is CRO? Draw and explain the block diagram of basic CRO. 3

(b) With appropriate diagram, describe the specifications of a CRO and their significance. 3

(c) Using a neat diagram, explain in detail the construction of CRT. What are electrostatic focusing and acceleration in an electron gun? 4

★ ★ ★