

2017

(Pre-CBCS)

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

(Revised)

Full Marks :55

Time : 2½ hours

(PART : A – OBJECTIVE)

(Marks : 20)

SECTION – I

(Marks : 5)

Each question carries 1 mark

Tick (✓)the correct answer in the brackets provided :

- The energy gap between valence and conduction bands in an insulator is about
(a) 15 eV () (b) 1.5 eV ()
(c) 0 eV () (d) 0.5 eV ()
- The maximum efficiency of a half-wave rectifier is
(a) 50% () (b) 81.2% ()
(c) 25% () (d) 40.6% ()
- The phase difference between the input signal and output signal in a CE amplifier is (in radian)
(a) π () (b) $\pi/2$ ()
(c) 2π () (d) 0 ()
- In determining the load line, for $I_C = 0$, we have
(a) $V_{CE} = V_{CB}$ () (b) $V_{CE} = 0$ ()
(c) $V_{CE} = V_{CC}$ () (d) $V_{CC} = 0$ ()
- In an R-C coupled transistor amplifier, the mid-frequency ranges between
(a) 50 Hz to 20 kHz () (b) 20 Hz to 20 kHz ()
(c) 50 Hz to 200 Hz () (d) 20 Hz to 200 Hz ()

SECTION – II

(Marks : 15)

Each question carries 3 marks

Answer *any five* questions:

1. Write a short note on the effect of biasing on depletion layer of a junction diode.
2. What are the important electrical properties of capacitor and inductor in making a filter circuit?
3. What do you mean by thermal runaway? How will you avoid it in a transistor?
4. Explain in brief the working of a class B push-pull amplifier
5. What are the four dimensions of a h -parameters of a transistor?
6. Write a brief note on the formation of energy band in solids.
7. Show that $\beta = \alpha / 1 - \alpha$, where the symbols have their usual meanings in a transistor.
8. Write the steps of construction of d.c. load line.

(PART: B – DESCRIPTIVE)

(Marks : 35)

The figures in the margin indicate full marks for the questions

1. (a) What are intrinsic and extrinsic semiconductors? Briefly explain the formation of n -type semiconductor. 2+3=5
(b) Write down some important properties of a semiconductor. 2
- Or**
- (a) What is the difference between energy level and energy band? 2
(b) What do you mean by hole current? 3
(c) Explain the capacitive effects of junction diode. 2
2. (a) What is a rectifier? Show that the ripple factor of a full-wave rectifier is 0.48. 1+3=4
(b) Write a short note on the filter circuits consisting of an inductor. 3

Or

(3)

- (a) Write a short note on the reverse characteristics of a Zener diode with suitable diagram. 3
- (b) With suitable diagrams, explain the working of a n-filter. 4
3. (a) Describe with suitable diagram, the transistor static characteristic of CE configuration. Mention its difference with CB characteristics. 3+2=5
- (b) State and explain transistor biasing for normal operation. 2

Or

- (a) Define β of a transistor. Show that $I_E = (1 + \beta)I_B$. 1+2=3
- (b) Describe in brief N-P-N transistor. Explain with suitable diagram, the CB configuration of P-N-P transistor. 2+2=4
4. (a) Differentiate between the following : 2+2=4
- (i) Voltage gain and current gain (ii) Input resistance and output resistance
- (b) Write in brief power relations for class B amplifier. What is the maximum overall efficiency of a class A amplifier coupled with a transformer? 2+1=3

Or

- (a) What is a linear amplifier? Explain quiescent point of a transistor amplifier with suitable diagram showing cut-off and saturation. 1+3=4
- (b) Explain class A amplifier with graphical representation. 3
5. (a) What do you understand by hybrid parameter of a transistor? A transistor used in CE connection has the following set of h -parameters when the d.c. operating point is $V_{CE} = 5$ volts and $I_C = 1$ mA :

$$h_{ie} = 1700 \Omega, h_{re} = 1.3 \times 10^{-4}, h_{fe} = 38, h_{oe} = 6 \times 10^{-6} \text{ } \Omega$$

If the a.c. load r_L seen by the transistor is 2 k Ω , find (i) the input impedance, (ii) current gain and (iii) voltage gain. 1+3=4

- (b) With a neat circuit diagram, explain the operation of an R-C coupled transistor amplifier. 3

Or

- (a) With a suitable diagram, explain the frequency response of an R-C coupled transistor amplifier in the mid-, high-, and low-frequency ranges. 5
- (b) What are the limitations of h -parameters? 2

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