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5 SEM TDC PHY M 4

2018

(November)

PHYSICS

(Major)

Course : 504

(**Electronics**)

Full Marks : 60

Pass Marks : 24/18

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct answer : 1×6=6

(a) The ratio of impurity atoms to intrinsic semiconductor atoms in an extrinsic semiconductor is

(i) 1 : 10

(ii) 1 : 10^3

(iii) 1 : 10^5

(iv) 1 : 10^8

(2)

(b) When reverse bias is applied to a junction diode

- (i) potential barrier decreases
- (ii) potential barrier increases
- (iii) majority carrier increases
- (iv) minority carrier increases

(c) The value of α of a transistor is

- (i) more than 1
- (ii) less than 1
- (iii) 1
- (iv) 0

(d) The feedback factor β at the frequency of oscillation of Wien bridge oscillator is

- (i) $\frac{1}{3}$
- (ii) $\frac{1}{29}$
- (iii) $\frac{3}{29}$
- (iv) 3

(3)

(e) CMRR in db can be expressed as

- (i) $20\log_{10} \frac{A_c}{A_d}$
- (ii) $20\log_{10} \frac{A_c}{2}$
- (iii) $10\log_{10} \frac{A_d}{A_c}$
- (iv) $20\log_{10} \frac{A_d}{2}$

(f) The number of half adders required to add two n -bit number is

- (i) $2n - 1$
- (ii) $2n + 1$
- (iii) $n - 1$
- (iv) $n + 1$

2. Answer the following questions : 2×6=12

(a) Explain the action of Zener diode as voltage regulator.

(b) Explain the process of recombination of electrons and holes in semiconductor.

(c) A transistor having $\alpha = 0.9$ and reverse saturation current $I_{CO} = 10 \mu A$ is operated in CE configuration. If the base current is $250 \mu A$, calculate the collector current.

- (d) Explain the effect of negative feedback on the stability of an amplifier.
- (e) Calculate the frequency of oscillation of a Hartley oscillator if $L_1 = L_2 = 25 \text{ mH}$ and the capacitor of resonant circuit is 200 pF .
- (f) Verify the following Boolean expression :

$$A + \bar{A}B = A + B$$

3. (a) How is a potential barrier formed in a p - n junction? Explain the mechanism of current flow under forward and reverse biased condition. Discuss any one method of junction breakdown. $2+3+2=7$

Or

Differentiate semiconductor, conductor and insulator on the basis of band theory. What is Fermi level in semiconductor? Show that the Fermi level of an intrinsic semiconductor lies at the middle of the forbidden gap. $3+1+3=7$

- (b) Explain the operation of a full-wave rectifier with shunt capacitor filter using necessary circuit diagram. Derive the expression for ripple factor and efficiency without filter. $3+4=7$

4. (a) Draw the circuit diagram for fixed bias considering an n - p - n transistor in CE configuration and explain its operation. Derive the expression for its stability factors. Mention the demerits of this circuit. $1+6=7$

Or

Draw the circuit diagram of an R - C coupled amplifier and its mid-frequency equivalent circuit. Derive an expression for gain at the mid-frequency range. $3+4=7$

- (b) Define hybrid parameter for a basic transistor circuit in CE configuration and give its hybrid model. 3

5. (a) Draw the circuit diagram of tuned collector oscillator and explain its operation. Find the expression for frequency of oscillation. $2\frac{1}{2}+2\frac{1}{2}=5$

Or

Explain the principle of operation of an R - C oscillator with circuit diagram. Derive the expression for frequency of oscillation. $2\frac{1}{2}+2\frac{1}{2}=5$

- (b) Describe the use of an operational amplifier as differentiator. 3

6. (a) Discuss the working of full adder with logic diagram and truth table.
- (b) Simplify the following Boolean expression with K-map and draw the simplified logic circuit :

$$Y = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$$

- (c) Determine the binary equivalent of 26.25.
