

4 SEM TDC PHYH (CBCS) C 10

2022

(June/July)

PHYSICS

(Core)

Paper : C-10

(Analog Systems and Applications)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct answer : $1 \times 5 = 5$

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

- (i) width of depletion layer decreases
- (ii) potential barrier increases
- (iii) potential barrier decreases
- (iv) minority carrier increases

- (b) The rectification efficiency of full-wave rectifier is _____ of half-wave rectifier.
- (i) equal
 - (ii) half
 - (iii) double
 - (iv) 1.21 times
- (c) Quiescence is a state of
- (i) activity
 - (ii) inactivity
 - (iii) amplification
 - (iv) switching
- (d) In a transistor amplifier, the input impedance should be
- (i) low
 - (ii) high
 - (iii) negligible
 - (iv) None of the above

(e) Which of the following electrical characteristics is not exhibited by an ideal OP-AMP?

(i) Infinite voltage gain

(ii) Infinite bandwidth

(iii) Infinite output resistance

(iv) Infinite slew rate

2. (a) Explain how depletion layer is formed under unbiased situation of a $p-n$ junction diode.

3

(b) Explain the current flow mechanism in forward and reverse biased $p-n$ junction diode.

4

Or

Define the mobility of charge carriers and conductivity. Obtain an expression for the electrical conductivity of an intrinsic semiconductor.

1+3=4

3. (a) Explain with circuit diagram, the Zener diode as a voltage regulator. 3
- (b) Describe the working of LED. 2
4. (a) Draw the C-E circuit of a transistor. Sketch its output characteristics. Explain the active, cut-off and saturation regions. 1+1+2=4
- (b) Define α and β of a transistor. Write the relation between them. 2
5. (a) Draw a voltage-divider bias circuit and derive an expression for its stability factor. 4

Or

A germanium transistor with $\beta = 100$ is to be operated as a C-E amplifier with fixed bias method. The transistor operates at the signal collector current $I_C = 1 \text{ mA}$ and $V_{CE} = 4 \text{ V}$. If a load resistance of $2 \text{ k}\Omega$ is connected in the collector circuit, then find the base resistance to be connected. (For germanium transistor $V_{BE} = 0.3 \text{ V}$)

- (b) Draw the small signal hybrid equivalent circuit of a common-emitter transistor amplifier and derive the expressions for current gain and input impedance. 4

Or

Explain class A, class B and class C amplifiers with graphical representation.

6. Draw and discuss the frequency response curve of an R - C coupled transistor amplifier showing cut-off frequencies and the bandwidth. 3

7. Discuss the effect of negative feedback on the input and output impedances of an amplifier. 3

8. State Barkhausen's criterion and explain the conditions that must be satisfied for feedback amplifier to produce steady oscillations. 1+2=3

- (b) Draw the small signal hybrid equivalent circuit of a common-emitter transistor amplifier and derive the expressions for current gain and input impedance. 4

Or

Explain class A, class B and class C amplifiers with graphical representation.

6. Draw and discuss the frequency response curve of an R-C coupled transistor amplifier showing cut-off frequencies and the bandwidth. 3
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8. State Barkhausen's criterion and explain the conditions that must be satisfied for feedback amplifier to produce steady oscillations. 1+2=3

(6)

Or

Draw circuit diagram of an R-C phase shift oscillator and explain its operation.

3

9. (a) What is an OP-AMP? Draw the schematic block diagram of basic OP-AMP.

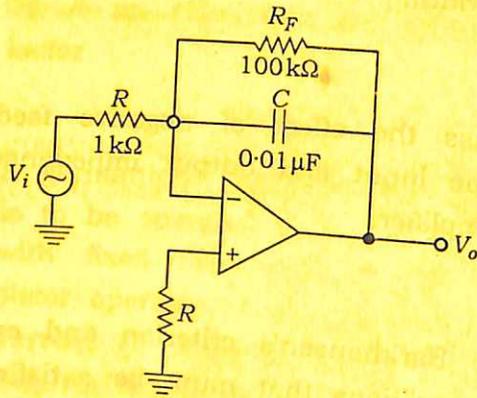
1+2=3

(b) Explain with circuit diagram, the adder and subtractor using OP-AMP.

4

(c) Determine the lower frequency limit (critical frequency) for the integrator circuit shown below :

3



Or

Discuss OP-AMP as log amplifier.

22P/1270

(Continued)

(7)

10. Draw the block diagram of successive approximation type A/D converter.

3

Or

Draw the circuit diagram of weighted resistor type D/A converter.

22P—5000/1270

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