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63(FY) SEM-4/MAJ/PHYMAJ2054

2025
PHYSICS

(Major)

Paper : PHYMAJ2054



**[Analog Systems and applications
(Electronics-I)]**

Full Marks : 50

Pass Marks : 20

Time : Two hours

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

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

(a) The electrical conductivity of a semiconductor lies in the range -

(i) 10^5 to $10^9 \text{ ohm}^{-1}\text{m}^{-1}$

(ii) 10^5 to $10^{-4} \text{ ohm}^{-1}\text{m}^{-1}$

(iii) 10^{-4} to $10^{-8} \text{ ohm}^{-1}\text{m}^{-1}$

(iv) 10^{-5} to $10^9 \text{ ohm}^{-1}\text{m}^{-1}$

(b) The unit of the ratio of mobility and diffusion coefficient of a semiconductor is —

- (i) V^{-1}
- (ii) cmV^{-1}
- (iii) $V\ cm^{-1}$
- (iv) $V\ sec$

(c) The value of α of a transistor is

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

(d) Mark the only wrong statement regarding amplifier.

- (i) Class A amplifiers are used freedom from distortion is the prime requisite
- (ii) The conduction angle of class - B amplifier is 180°

(iii) Class C amplifier is mainly used for amplifying small signal

(iv) The conduction angle of class AB amplifier lies between 180° and 360°

(e) An OP-AMP can amplify :

- (i) Only AC
- (ii) Only DC
- (iii) Both AC and DC
- (iv) Neither AC nor DC

2. Answer the following questions : **(any five)**
 $2 \times 5 = 10$

- (a) Distinguish between conductor, semiconductor and insulator on the basis of band theory.
- (b) Write *two* applications of Zener diode.
- (c) Draw the output characteristics of a transistor in CB configuration.
- (d) Write *two* characteristics of Class - A amplifier.
- (e) Draw the frequency response curve of RC coupled amplifier.

(f) An amplifier has a voltage gain of 50. When negative feedback is applied, the gain reduced to 10. Determine the percentage of feedback.

(g) Draw the general Block diagram of ADC (Analog to Digital Converter).

3. Answer the following questions : **(any five)**
5×5=25

(a) Derive the expression for the potential barrier height of the p.n junction.

(b) Explain the load line analysis of a transistor.

(c) Draw the h -parameter equivalent circuit of transistor in CE configuration. Derive the expression for its voltage gain and current gain.

(d) Derive the expression for the voltage amplification of two stage RC coupled transistor in mid frequency range.

(e) Explain the effect of negative feedback on input impedance and output impedance.

(f) Show that in closed loop non-inverting OP-AMP, the voltage gain and gain of the feedback circuit are reciprocal.

(g) What is subtractor amplifier? Discuss its working with neat circuit diagram.

(h) A Hartly oscillator is designed with $L_1=2\text{ mH}$, $L_2 = 20\ \mu\text{H}$ and a variable capacitance. Determine the range of capacitance values, if the frequency of oscillations is varied between 950 and 2050 KHz.

4. Answer the following questions : **(any one)**
10×1=10

(a) Distinguish between Zener diode and ordinary junction diode. Explain the action of Zener diode as voltage regulator. Draw the $V-I$ characteristics of Zener diode and explain it.

2+4+4=10

(b) Write short notes on : 5+5=10

(i) Solar Cell

(ii) Class C Amplifier