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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  $\alpha$  of a transistor is

- (i) more than 1
- (ii) less than  $\alpha$  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  $180^\circ$

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

(iv) The conduction angle of class AB amplifier lies between  $180^\circ$  and  $360^\circ$

(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)**  
2×5=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  $L_1=2$  mH,  $L_2 = 20 \mu$ 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
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