

Five-Year Integrated M.Sc. Examination 2024
Semester-V
Course: PH-3-5-2
(Electronics)

Time: Four Hours

Full Marks: 80

Questions are of value as indicated in the margin.
Answer Question **No. 1** and **any three** from the rest.

1. Answer **any four** from the following:
 - (a) Explain the concepts of intrinsic and extrinsic semiconductors.
 - (b) Explain how the depletion layer is developed at the junction of a p-n semiconductor diode.
 - (c) Draw the circuit diagrams for the construction of AND, OR and NOT gates using NOR gates.
 - (d) Draw the circuit diagram and explain the working principle of a D flip flop using NAND gates.
 - (e) Write a brief note on comparator with moving trip point.
 - (f) Explain the working principle of a digital-to-analog converter.

4x5 = 20
2.
 - (a) Explain the different components of current in a p-n-p type transistor with base-emitter junction forward biased and base-collector junction reverse biased in CB mode.
 - (b) Draw the diagram of a RC coupled two-stage transistor amplifier in CE mode and explain its working principle briefly.
 - (c) Draw the schematic diagram of a feedback amplifier and find the expression of the closed-loop voltage gain in terms of the open-loop voltage gain.
 - (d) Explain the concept of Barkhausen criterion for oscillation.

4+6+6+4 = 20
3.
 - (a) Explain the concept of h-parameters of a linear circuit.
 - (b) Define the h-parameters of a linear circuit.
 - (c) Derive the expressions for input impedance, current gain and voltage gain of a linear circuit based on h-parameters.
 - (d) A transistor used in CE mode has $h_{ie} = 1700 \text{ ohm}$, $h_{re} = 1.3 \times 10^{-4}$, $h_{fe} = 38$ and $h_{oe} = 6 \times 10^{-6} \text{ mho}$ where $V_{CE} = 5 \text{ V}$ and $I_C = 1 \text{ mA}$. If $R_L = 4 \text{ kilo ohm}$, find input impedance, current gain and voltage gain.

2+6+6+6 = 20
4.
 - (a) Explain the concepts of input impedance and output impedance of an operational amplifier.
 - (b) Draw the diagrams and explain the working principles of the following circuits using operational amplifier: (i) adder, (ii) differential amplifier, (iii) integrator, (iv) differentiator.

(2+2)+(4x4) = 20

5. (a) Draw the circuit diagram and explain the working principle of a CS amplifier using n-channel JFET.
- (b) Write notes on the following: (i) depletion type MOSFET, (ii) enhancement type MOSFET.

$$6+(8+6) = 20$$