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MPHY-508

Analog Electronics

M.Sc. Physics (MSCPHY)

2nd Semester Examination, 2023 (June)

Time : 2 Hours] **[Max. Marks : 35**

Note : This paper is of Thirty Five (35) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein. Candidates should limit their answer to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only. (2×9½=19)

1. Draw the circuit diagram of a two-stage RC-coupled CE transistor amplifier. Show how the magnitude and the phase angle of its voltage gain vary with frequency. Qualitatively explain these variations. Define the half-power frequencies.

2. What is a multivibrator? Discuss the operation of a bistable multivibrator, mention its uses.

3. Explain how a PNP transistor works. Describe with the help of a diagram the biasing arrangement for this transistors to obtain its output characteristics.

4. What is an Operational amplifier? What should be the input resistance, output resistance, voltage gain and bandwidth of an ideal operational amplifier? State the characteristics of an ideal OP AMP.

5. Write short notes on :

(a) CMRR.

(b) MOSFET bistable multivibrator.

(c) Schmitt trigger.

(d) Drift current density.

SECTION–B
(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. A transistor amplifier in CE configuration couples a source of internal resistance 1 k′Ω to a load of 20 k′Ω. Find the input and the output resistances if h_{ie} = lk′Ω, $h_{re} = 2.5 \times 10^{-4}$, h_{fe} = 150 and $1/h_{oe}$ = 40 k′Ω.

2. Define Fermi energy and Fermi energy level. Discuss the position of Fermi energy level in extrinsic semiconductor.

3. Explain the working of bridge rectifier with a neat circuit. Derive an expression for its efficiency.

4. Explain the working of a transistor and define its α and β parameters. Establish the relation $\beta = \alpha/1-\alpha$.

5. How is the bandwidth of an RC-coupled amplifier modified when negative feedback is used?

6. Give the circuit diagram of a Hartley oscillator and explain is operation.

7. Explain how square and triangular waveforms can be produced using OP AMPs.

8. Write a note on the use of an OP AMP as a differentiator and an integrator.