21PHY1C4L

Sl. No.

M.Sc. I Semester Degree Examination, April/May - 2024

PHYSICS

Electronics

(NEP)

Time : 3 Hours   Maximum Marks : 70

Note : Answer **any five** of the following questions with Question No. **1 (Q.1)** is **Compulsory**. Each question carries **equal** marks.

1. (a) What is carrier concentration ? Derive the expression for carrier concentration in an n-type semiconductor.   **9**

   (b) What is the Fermi level ? Explain its variation with temperature in semiconductors.   **5**

2. (a) Describe the operation of a transistor in a common emitter (CE) configuration.   **8**

   (b) Describe how feedback criteria in electronic circuits contribute to sustained oscillations.   **6**

3. (a) How does an op-amp integrator circuit operate ? Explain how it performs mathematical integration of the input signal.   **7**

   (b) Discuss the principles and operation of active filters. What are the characteristics of first-order filter functions ?   **7**

4. (a) What are Boolean operations and how are they used in digital electronics ?   **8**

   (b) What is a Karnaugh map and how is it used to simplify Boolean expressions ?   **6**

5. (a) Explain the operation of an RS flip-flop. How does it differ from other types of flip-flops like D and JK flip-flops ?   **8**

   (b) Calculate the output of a binary ripple counter with four bits, starting from the initial state 0000 and incrementing with each clock pulse.   **6**

6. (a) Discuss the operational characteristics of a MOSFET in common drain (CD) configuration.   **7**

   (b) Explain the basic principles behind the operation of a phase-shift oscillator.   **7**

7. (a) Explain the difference between product of sums (POS) and sum of products (SOP) simplification techniques with an example. **7**

(b) Compare and contrast the characteristics of binary weighted and R-2R ladder digital-to-analog converters (DACs). **7**

8. (a) Calculate the voltage across a Si diode at room temperature, if it is forward biased with a current of 10 mA. Assume a typical barrier potential of 0.7 volts. **5**

(b) Calculate the base current (I_B) of a bipolar junction transistor (BJT) operating in a CE configuration if the collector current (I_C) is 2 mA and the current gain (β) is 100. **5**

(c) If an A/D converter has a resolution of 8 bits, what is the maximum number of discrete levels it can represent ? **4**

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