

Time: 1:30 Hours

Marks: 42

**Instructions:**

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

Q.1 Answer the following: (any seven )

(14)

- (a) Simplify:  $X + X' \cdot Y$
- (b) Enumerate thyristors devices
- (c) Which logic family has the lowest power dissipation ?
- (d) Distinguish between direct and indirect band gap materials.
- (e) Calculate transconductance ( $g_m$ ) of JFET having the parameters:  
 $I_{DSS} = 16 \text{ mA}$ ,  $V_p = -4 \text{ V}$  for drain current  $I_D = 4 \text{ mA}$
- (f) For emission wavelength  $\lambda_g = 860 \text{ nm}$ , calculate band gap energy  $E_g$ .
- (g) Prove that product of all the maxterms of a Boolean function of N-variable is zero.
- (h) What is the relation between photometric unit lumen and radiometric unit watt ?
- (i) What is the operational principle of Solar cell ?
- (j) Obtain complement of the following Boolean function:

$$F(x, y, z) = x \cdot (y' \cdot z' + y \cdot z)$$

Q.2 Answer the following (any two)

(14)

- (a) Compare: BJT and JFET. Discuss various biasing methods for JFET.
- (b) Write Schokley's equation for JFET. For  $I_{DSS} = 12 \text{ mA}$  and Pinch off voltage  $V_p = -4 \text{ V}$ , calculate drain current values for  $V_{GS} = 1 \text{ V}$ ,  $1.5 \text{ V}$ ,  $2 \text{ V}$ ,  $2.5 \text{ V}$ ,  $3 \text{ V}$ , and  $3.5 \text{ V}$
- (c) Write a detailed note on JFET source follower.

Q.3 Answer the following. (any two)

(14)

- (a) Draw the circuit of 2-input NAND gate using transistor-transistor (TTL) logic and explain its operation. Explain current sinking and current sourcing in TTL
- (b) Write a detailed note on ECL logic family
- (c) A logic circuit having three inputs should produce high output for its input binary numbers: 001, 011, 101 and 111. Design the logic circuit using K-Map and draw the circuit using all NAND gates.
- (d) Simplify the following Boolean function using Karnaugh Map method:

$$F(w, x, y, z) = \sum(3, 7, 11, 15) \text{ and don't cares are: } d(w, x, y, z) = \sum(0, 1, 5)$$

Q.4 Answer the following: (any two)

(14)

- (a) Draw basic structure and symbol of Silicon Controlled Rectifier. Explain the current voltage characteristics of SCR and derive anode current expression for forward blocking state.
- (b) Explain the physics of light emission in LED. Explain in detail radiative recombination processes. Give a brief note on LED materials.
- (c) Discuss in detail the physics of photoconductive detectors hence Derive expression for photoconductive gain. What are the photoconductive materials?

Q.5 Write short notes on any TWO

(14)

- (a) Semiconductor laser
- (b) Liquid crystal displays
- (c) Zener diode voltage regulator
- (d) Uni-junction transistor and its application

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