

M.Sc.(Phy.) Semester - 1 (CBCS) Examination

Oct/Nov. -2019 - [NEW COURSE]

Solid State Electronic Devices and Circuits (Core (New))

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
 2. Figures to the right indicate marks.
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1. Answer the following: (**any seven**) (14)

- (a) Write Schokley's equation for JFET.
- (b) Which logic gate is expressed by the following Boolean expression ?

$$F = (A + B) \cdot (A' + B')$$

- (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 $I_D = 1 \text{ mA}$
- (f) Calculate wavelength (λ_g) of light emission for GaP having band gap energy $E_g = 2.26 \text{ eV}$
- (g) Prove that product of all the Maxterms of a Boolean function of N-variable is zero
- (h) What is the relation between photometric and radiometric units of radiant energy ?
- (i) What is the operational principle of Solar cell ?
- (j) Simplify the following Boolean function: $F = (A + B)' \cdot (A' + B')$

2. Answer the following (**any two**) (14)

- (a) Compare: BJT and JFET. Describe the construction of N-channel JFET and explain its drain-source characteristics.
- (b)) For JFET, using the Schokley's equation and transconductance ,

$$g_m = \frac{dI_D}{dV_{GS}}, \quad \text{show that } g_m = \frac{2\sqrt{I_{DSS}} \sqrt{I_D}}{|V_P|}$$

- (c) Write a detailed note on JFET source follower

3. Answer the following: (14)

- (a) Draw the circuit of 2-input NAND gate using transistor-transistor (TTL) logic and explain its operation in detail. What is meant by fan-out ?

(b) Prepare truth table for the Boolean function:

$$F = A + B' \cdot C$$

OR

3. Answer the following: (14)

- (a) A logic circuit having three inputs should produce high output when its input binary number has majority of bits high. Design the logic circuit using K-Map and draw the circuit using AND-OR implementation.
- (b) Simplify the following Boolean function using Karnaugh Map method:

$$F(w, x, y, z) = \sum(3, 6, 7, 11, 14, 15,)$$

$$\text{And don't cares are: } d(w, x, y, z) = \sum(0, 2, 10)$$

4. Answer the following: (any two) (14)

- (a) What are thyristors ? Enumerate various types of thyristors. 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) What is meant by direct band gap and indirect band gap semiconductors ? Explain the physics of light emission in LED. 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?

5. Write short notes on any TWO (14)

- (a) Solar Cell
- (b) Thermistors
- (c) Zener diode and its application as voltage regulator
- (d) Uni-junction transistor
