

7. (a) What are Basic logic gates ? Draw logic gates diagram for Boolean expression $Y = (A + B)(C + D)$ and $Y = ABC + ABC$. 8

(b) Use Boolean equation: $Y = ABC + ABCD + ABCD$

Show the simplified NAND-NAND and NOR-NOR circuit for this. 7

Roll No.

Total Pages : 04

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B.Tech. (All Branches) (RAI) (Re-appear)

(Second Semester)

PHYSICS

(Electromagnetism and Basic Electronics)

(BSC-101-E)

Time : 3 Hours]

[Maximum Marks : 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any four questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Show that the potential function $V = a(x^2 + y^2 + z^2)^{1/2}$ does not satisfy Laplace's equation. 1.5
- (b) What is vector potential ? Express it in terms of current density. 1.5
- (c) Differentiate conduction current and displacement current. 1.5

- (d) What is the difference between Zener diode and simple $p-n$ junction diode ? 1.5
- (e) Define current gain α and β . Write relation between them. 1.5
- (f) Implement Boolean functions $F = (A + BC)(D + E)$ using only NAND gates. 1.5
- (g) State the differences between analog and digital circuits. 1.5
- (h) Draw a circuit diagram of full subtractor. 1.5
- (i) How will you obtain NOT, OR, AND gates from the NAND and NOR gates ? 1.5
- (j) Convert : $(257)_{10} = ()_2 = ()_8 = ()_{16}$. 1.5

Part B

2. (a) What is Ampere's law ? Find the magnetic field, both inside and outside a long cylindrical wire of radius ' a ' carrying a steady current I . 10
- (b) Describe the divergence and curl of an electrostatic field. 5
3. (a) A charge $+Q$ is located at $(0, 0, d)$, while another charge $-Q$ is located at $(0, 0, -d)$. Determine E at any point on the x -axis. 5

- (b) Discuss about the Poynting's theorem and drive the expression for Poynting vector. 10
4. Explain full-subtractor. Implement a full-subtractor with two half-subtractors and an OR gate. Use Boolean equation: $Y = ABC + ABCD + ABCD$. Show the simplified NAND-NAND and NOR-NOR circuit for this. 15
5. (a) What is electric displacement ' D ' ? How is it related to the electric field E in the presence of dielectrics ? Also, explain the boundary conditions on electric displacement. 7
- (b) Prove that the curl of a static magnetic field is zero. Also, mention the physical significance of the expression. 8
6. (a) Draw the energy level diagram for n -type and p -type semiconductor. Discuss about the formation of energy bands of $p-n$ junction diode in both forward and reverse biasing. 8
- (b) Draw the I-V characteristics of a transistor in CB configuration. Explain the active, cut off and saturation regions. 7