

**DIGITAL LOGIC DESIGN
(MCAP 1101)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as
practicable.*

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) What is the binary equivalent of the decimal number 368?
 (a) 101110000 (b) 110110000
 (c) 111010000 (d) 111100000.
 - (ii) How many Flip-Flops are required for mod-16 counter?
 (a) 5 (b) 6 (c) 3 (d) 4.
 - (iii) The Boolean expression $A'.B + A.B' + A.B$ is equivalent to
 (a) $A+B$ (b) $A'.B$ (c) $(A+B)'$ (d) $A.B$.
 - (iv) The minimum number of 2:1 multiplexers required to realize 4:1 multiplexer is
 (a) 1 (b) 2 (c) 3 (d) 4.
 - (v) The code where all successive numbers differ from their preceding number by single bit is
 (a) Binary code (b) BCD (c) Excess - 3 (d) Gray.
 - (vi) A ring counter with 5 flip flops will have states.
 (a) 5 (b) 10 (c) 32 (d) infinite.
 - (vii) A full adder can be made out of
 (a) two half adders and a OR gate (b) two half adders
 (c) two half adders and a NOT gate (d) three half adders.
 - (viii) Complement of complement of $A'B + AB'$ is
 (a) $AB + A'B'$ (b) $(A' + B).(A + B')$
 (c) $A'B + AB'$ (d) all of these.

- (ix) What is the minimum number of two-input NAND gates required to perform the function of two input OR gate?
 (a) 1 (b) 2 (c) 3 (d) 4.
- (x) The octal equivalent of $(247)_{10}$ is
 (a) $(252)_8$ (b) $(350)_8$ (c) $(367)_8$ (d) $(400)_8$.

Group - B

2. (a) Convert the decimal number 82.67 to its binary, hexadecimal and octal equivalents.
 (b) Convert the decimal number 430 to Excess-3 code.
 (c) Convert the binary number 10110 to Gray code.
 $(2 + 2 + 2) + 3 + 3 = 12$
3. (a) Consider two unsigned numbers X and Y where $X = 1010100$ and $Y = 1000011$. Perform $Y-X$ using 2's complement.
 (b) Obtain the differences (i) $4A6_{16} - 1B3_{16}$ (ii) $7CA_{16} - 8AB_{16}$ using 15's complement and 16's complement.
 $4 + (4 + 4) = 12$

Group - C

4. (a) Simplify the following expression into Sum Of Products(SOP) using Karnaugh map

$$F(A, B, C, D) = \sum (1, 3, 4, 5, 6, 7, 9, 12, 13).$$

 (b) Explain the working principle of a two input X-OR gate with relevant logic diagram and truth table.
 (c) Write the POS form of the following SOP expression:

$$F(x, y, z) = x'yz + xyz' + xy'z.$$

 $6 + 3 + 3 = 12$
5. (a) Prove the following Boolean identities.
 (i) $XY + YZ + Y'Z = XY + Z$ and (ii) $A.B + A'.B + A'.B' = A' + B$.
 (b) Obtain the simplified expression in Product of Sum(POS) of the following: $F(x, y, z) = x'z' + y'z' + yz' + xyz$.
 Draw the gate implementation of the simplified expression using AND and OR gates.
 $6 + (3 + 3) = 12$

Group - D

6. (a) Design a logic circuit to convert BCD to Gray code. Draw the circuit and explain the design.
 (b) Distinguish among ROM, PROM, EPROM, EEPROM.
 $(4 + 2 + 2) + 4 = 12$
7. (a) Draw the 8 to 1 multiplexer by using two 4 to 1 multiplexer.
 (b) What is a decoder? Draw the logic circuit of a 3 line to 8 line decoder and explain its working.
 (c) What is a demultiplexer? Discuss the differences between a demultiplexer and a decoder.
 $2 + 6 + 4 = 12$

Group - E

8. (a) Explain the working principle of D flip flop with suitable diagram.
 (b) Draw the diagram of a 4-bit binary ripple counter using flip-flops that trigger on the positive edge.
 $6 + 6 = 12$
9. (a) What is a Shift Register? What are its various types? List out some applications of Shift Register.
 (b) Explain the working principle of master-slave JK flip flop with suitable diagram.
 $(2 + 2 + 2) + 6 = 12$