



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 214120

Roll No.

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M.C.A.

(SEM. I) (ODD SEM.) THEORY

EXAMINATION, 2014-15

DISCRETE MATHEMATICS

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

1 Attempt any **four** of the following : **5×4=20**

- (a) Show that relation " xRy iff $(x - y)$ is divisible by 5" is an equivalence relation on the set of integers.
- (b) In a class of 120 students, 80 students study mathematics, 45 study history and 30 students study both the subjects. Find the number of students who study neither mathematics nor history.

- (c) Given $R = \{(1,1), (2,2), (2,3), (3,3), (3,4), (4,3), (3,1)\}$ for $A = \{1,2,3,4\}$ make its relation matrix M_R and check whether it is symmetric, reflexive or transitive.
- (d) If $A = \{1,3,4\}, B = \{2,3,4\}, C = \{1,2,3\}$ then find $(A \times B) - (A \times C)$ and $(B \times C) \cap (B \times A)$.
- (e) Let P and Q be two sets. If $P \rightarrow Q$ is one-one onto, then prove that $f^{-1}: Q \rightarrow P$ is also one-one onto.

2 Attempt any **four** of the following : $5 \times 4 = 20$

- (a) Show that $G = \{0,1,2,3,4\}$ is a cyclic group under addition modulo 5.
- (b) Find product of two permutations $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 1 & 2 & 3 \end{pmatrix}$ and $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 1 & 4 & 3 & 6 & 5 \end{pmatrix}$ check whether it is odd or even.
- (c) Show that in a group identity element is unique.
- (d) Prove that quotient group of an abelian group is abelian.
- (e) Show that Kernel is a normal subgroup in group isomorphism.

3 Attempt any two of the following : $10 \times 2 = 20$

- (a) Express the expression $xy' + xz + xy$ in CN as well as DN form.
- (b) Draw the Hasse diagram of $(P(S), \subseteq)$ where $S = \{\alpha, \beta, \gamma\}$, and show that it is a lattice.
- (c) For every element a and b in a Boolean algebra show that (i) $(a.b)' = a' + b'$
(ii) $(a + b)' = a'.b'$.
- (d) From the input/output table given below form a corresponding Boolean expression and make it's simplified circuit.

Input x_1	Input x_2	Output $f(x_1, x_2)$
1	1	1
1	0	1
0	1	0
0	0	1

4 Attempt any two of the following : $10 \times 2 = 20$

- (a) Show that $(p \Rightarrow (q \wedge r)) \Rightarrow (\neg r \Rightarrow \neg p)$ is a tautology. Using truth table and without truth table.
- (b) Test the validity of the following argument "If I enjoy studying, then I will study. I will do my homework or I will not study. I will not do my homework. Therefore, I do not enjoy studying."
- (c) Show that $(p \Rightarrow q) \wedge (r \Rightarrow q) \equiv (p \vee r) \Rightarrow q$.

5 Attempt any **two** of the following : **10×2=20**

(a) Solve the recurrence relation $T(1) = 1$,

$$T(n) = 3T(n/3) + n.$$

(b) (i) In a shipment there are 40 floppy disks of which 5 are defective. Determine in how many ways we can select (i) five non-defective floppy disks (ii) five floppy disks in which exactly three are defective.

(ii) Show that every complete bipartite graph is two colorable.

(c) Write notes on the following :

(1) Generating function

(2) Planar graph.