



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

PAPER ID : 113751

Roll No.

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B. Tech.

(SEM. VII) (ODD SEM.) THEORY
EXAMINATION, 2014-15
DISCRETE STRUCTURES

Time : 3 Hours]

[Total Marks : 100

Note : Attempt All questions.

- 1 Attempt any four parts : (4×5=20)
- (i) Show that n^3+2n is divisible by 3 using mathematical induction ?
 - (ii) Determine whether each of the following function are bijective or not :
 - a. $F: \mathbb{R} \rightarrow \mathbb{R}; f(x)=(x^2+1)/(x^2+2)$
 - b. $F: \mathbb{R} \rightarrow \mathbb{R}; f(x)=x^5+1$
 - (iii) Let R be a Relation from set A to B and S be a relation from set B to C, then show that
 $(R \circ S)^{-1} = (S^{-1} \circ R^{-1})$
 - (iv) Show that $R = \{(a, b) \mid a \equiv b \pmod{m}\}$ is an equivalent relation on Z. Show also if $x_1 \equiv y_1$ and $x_2 \equiv y_2$ then
 $(x_1+x_2) \equiv (y_1+y_2)$.

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- (v) Let $N = \{1, 2, 3, \dots\}$ and a relation is defined in $N \times N$ as follows: (a, b) is related to (c, d) iff $ad = bc$ then show that whether R is a equivalence relation.
- (vi) Composition function is commutative. Prove the statement or give counter example.

2 Attempt any **four** parts : **(4×5=20)**

- (i) If for each a and b in a group G , $(ab)^2 = a^2b^2$. Show that G is abelian.
- (ii) Define cyclic group with an example.
- (iii) Prove that $(Z_6, +_6)$ is an abelian group of order 6. Where $Z_6 = \{0, 1, 2, 3, 4, 5\}$.
- (iv) State and prove Lagrange's theorem.
- (v) Consider $G = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ under addition modulo 10. Find out order of each element of the group.
- (vi) Explain Field with an example.

3 Attempt any **two** parts : **(2×10=20)**

- (i) Simplify the Boolean expression
 $f(w, x, y, z) = \sum m(0, 2, 4, 5, 8, 14, 15)$,
 $d(w, x, y, z) = \sum m(7, 10, 13)$
- (ii) Explain POSET and Lattice with an example.
- (iii) Draw the Hasse Diagram for the following set under partial ordering: $(\{1, 2, 3, 4, 9, 36\}, /)$. Define Maximal, minimal, greatest and least element of POSET. Find these elements in the Hasse diagram. Is it a Lattice ?

4 Attempt any **two** parts : **(2×10=20)**

- (i) Check the validity of the following arguments using inference rules:
- a. $(p \wedge q) \rightarrow r, (r \rightarrow q), (r \wedge q) \rightarrow (q \wedge r)$
 $\vdash (p \wedge q) \rightarrow (q \wedge r)$
- b. $\sim p \wedge q, r \rightarrow p, \sim r \rightarrow s, s \rightarrow t \vdash t$

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- (ii) Prove the validity of the following argument using predicate calculus :
"Every living thing is a human being or an animal.
Mohan is alive and he is not an animal. All human being have hearts. Hence, Mohan has a heart"
- (iii) Show that $(P \oplus Q) \leftrightarrow ((P \wedge \neg Q) \vee (\neg P \wedge Q))$ is a tautology or contradiction or contingency?

5 Attempt any **two** parts : (2×10=20)

- (i) Solve the given recurrence relation :
 $a_n - 4a_{n-1} + 3a_{n-2} = 3n^2 - 3n + 1$
- (ii) Explain Extended Pigeonhole Principle. What is the minimum number of students required in a class to be sure that atleast 5 will receive the same grade if there are four possible grades ?
- (iii) Write a short note on the following :
- Planar graph
 - Euler graph
 - Graph coloring.

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