SE-SEM-III R-20-21 DATE:- 06/06/2026 COMP Pr. CODE 1T00733

Time: 3 Hours **Marks: 80**

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N.B. : 1) Question Number 1 is compulsory
2) Solve any three questions from the remaining questions
3) Make suitable assumptions if needed
4) Assume appropriate data whenever required. State all assumptions clearly.

1.	a.	Prove by Mathematical Induction that 7^{n-1} is divisible by 6 for all $n \geq 1$	5
	b.	Explain with example: i) Universal set ii) Proper subset	5
	c.	State and explain the Pigeonhole Principle. Show that among any six integers, there are at least two having the same remainder when divided by 5	5
	d.	Define a complete graph. Give an example and draw K_5.	5
2	a	Define transitive closure. Find the transitive closure of relation $R=\{(x,y) \mid x-y=2\}$ on $A=\{1,2,3,4,5,6\}$ using Warshall's algorithm.	10
	b.	Define a ring. Check whether the set $A=\{0,1,2,3,4\}$ under addition modulo 5 and multiplication modulo 5 forms a commutative ring. Justify.	10
3	a	Give the exponential generating function for the sequences 1) $\{1,1,1\ldots\}$ 2) $\{1,2,3,4,\ldots\}$ 3) $\{1, a, a^2, a^3, \ldots\}$	6

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b Find the number of positive integers n where $1 \leq n \leq 100$ and n is not divisible by 2,3 or 5. 6

c In a survey of 150 students: 8

70 like DBMS,

65 like OS,

60 like CN.

30 like DBMS & OS,

28 like OS & CN,

25 like DBMS & CN,

12 like all three.

Find: i) Students who like at least one subject

ii) Students who like only OS

4 a Let A={0, 1,2, 3, 4, 5} 10

i) Explain the term group.

ii) Prepare the composition table for the above set w.r.t. the operation of addition modulo 6.

iii) Determine whether it is a group.

iv) Whether elements of set A are invertible? If yes, then find the inverses of these elements.

v) Determine whether it is a cyclic group.

b Let f: R - {2/3} $\rightarrow$ R- {3/4} is defined as 6

$$f(x) = \frac{3x+5}{2x-3}.$$

Prove that f is **bijective** and find the rule for f-1

c Solve the following using the laws of logic: 4

$[(p \rightarrow q) \wedge (q \rightarrow r)] \vee (p \wedge \neg r)$

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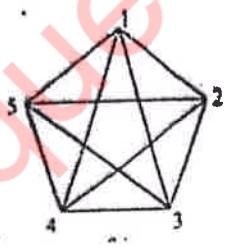
5 a Let D_{60} be the poset consisting of all the positive divisors of 60 under the partial order of divisibility. 8
(a) Write down the elements of D_{60}?
(b) Draw the Hasse Diagram of D_{60}.
(c) Give Maximal and Minimal Elements
(d) Define Lattice. Is D_{60} a lattice? Give a reason for your answer

b f: R⟶R is defined by $f(x)= 2x^2-1$ 8
g: R⟶R is defined by $g(x)= 3x+4$
h: R⟶R is defined by $h(x) = x^2+5$
Find the rule for defining
i) fog
ii) gof
iii) (goh)of
iv) go(hof)

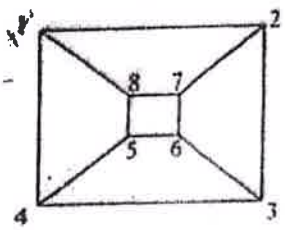
c If R is the set of all Real numbers other than zero and if a*b=2ab Prove that (R, *) is an Abelian group 4

6. a Explain the following terms with suitable example (any 4) 10
i) Hamiltonian path & circuit 8
ii) Bipartite graph
iii) Adjacency matrix
iv) Equivalence relation
iv) Cartesian product

b Define the terms Euler path & a circuit. Determine whether following graphs have Euler path or a circuit. 10



a)



b)

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