/ S.E. / COMP / Sem - III / 'C' Scheme / Sub:- DS & GT / Date:- 14/11/2025
S.H. 2025

Time: 3 Hrs **Max. Marks: 80**

GR. Code:- 10095836

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. Define the following with suitable example 5
   a) Power Set b) Monoid c) Bipartite Graph d) Existential Quantifier
   b. Find the number of positive integer's n where $1 \leq n \leq 100$ and n is not divisible by 2, 3 or 5. 5
   c. Prove that the set A=(0,1,2,3,4,5) is a finite Abelian group under Addition modulo 6 5
   d. State the Pigeonhole principle and show that if any five numbers form 1 to 8 are chosen, then two of them will add to 9. 5

2 a Define Equivalence Relation. Let A={1,2,3,4,5,6,7,8,9} and define R by aRb if both a and b leave the same remainder when divided by 4. 10
(a) Prove that R is an equivalence relation.
(b) List all equivalence classes.

   b. 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.

3 a Let f: R→ R be a function defined by f(x)=2x-3. Prove that it is bijective & find inverse. 4

b Let A= {1,2,3,4} and R = { (1,2), (2,3), (3,4), (2,1) } Find the Transitive Closure of R by using Warshall's algorithm 8

c For the set A= {2,3,6,12,24,36}, a relation R defined by divisibility Answer the following 8
a) Draw the Hasse Diagram
b) What are the maximal and Minimal elements
c) Is the poset Lattice?
Give one example of chain and antichain

4 a If f: $R \rightarrow R$ and g: $R \rightarrow R$ are defined by $f(x) = x+2$ and $g(x) = x^2$ 8
find (i) f o g o f (ii) g o f o g

b Consider (3,6) encoding function given below is a group code 8
e(000) = 000000, e(001) = 000110, e(010) = 010010, e(011) = 010100
e(011) = 010100 e(100) = 100101 e(101) = 100011 e(110) = 110111,
e(111) = 110001.

c Prove by mathematical induction that 4
1+ 5 +9+.....+ (4n-3) = n(2n-1)

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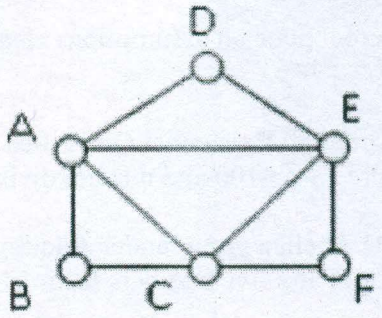
5 a Define Euler Path, Euler Circuit, Hamiltonian Path and Hamiltonian Circuit. Determine if the following diagram has Euler Path, Euler Circuit, Hamiltonian Path and Hamiltonian Circuit and state the path /circuit. 8



b Consider the Set A={1,2,3,4,5,6} under multiplication Modulo 7. 8
1. Is it a Cyclic group?
2. Find the orders and the Subgroups generated by {2,3}and {3,4}

c Find the complement of each element in D72. 4

6. a Draw the Hasse Diagram of D_{105} and check whether it is a Lattice. 8

b Find the complete solution of the Recurrence relation $a_n + 2a_{n-1}$ = n+3 for $n \geq 1$ and $a_0=3$ 8

c Define the following with suitable example. 4
a)Semigroup b) Bipartite Graph c) Distributive Lattice
d) Partial Order Relation

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