QP Code: S253A020 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Third Semester – Regular and Supplementary) Examinations, Nov.,2025

23BCSBS23001– Discrete Mathematics

(CSE)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

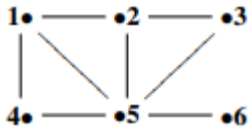
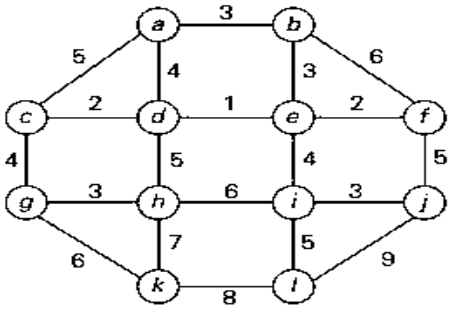
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Express the statement "if a person is female and is a parent, then this person is someone's mother" as a logical expression involving predicates and quantifiers.	CO1	K1
b. What form does a particular solution of the linear nonhomogeneous recurrence relation $a_n = 6a_{n-1} - 9a_{n-2} + F(n)$ has when $F(n) = 3^n$?	CO2	K2
c. Define modular lattice.	CO4	K1
d. Let $(A, .)$ be a group such that for every x in A, $x.x = e$ where e is the identity element. Show that $(A, .)$ is an abelian group.	CO5	K2
e. What does it mean for a graph to be planar? Give an example of a nonplanar graph?	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Translate the following into predicate logic: a) "Every person has a mother." b) "There is someone in this class who has taken every mathematics course." Then write their negations in simplest English.	5	CO1	K1
b. Prove that $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology.	5	CO1	K1
(OR)			
c. Prove by induction that $1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{2}$	5	CO2	K2
d. For the set of premises what relevant conclusion can be drawn "All foods that are healthy to eat do not taste good" "Tofu is healthy to eat" "You only eat what tastes good" "You do not eat Tofu" "Cheeseburgers are not healthy to eat"	5	CO1	K3
3.a. Explain Warshall's algorithm for finding the transitive closure of a relation in detail with an example.	5	CO4	K2
b. Solve the recurrence relation $a_n = a_{n-1} + a_{n-2}$, $a_0 = 0$, $a_1 = 1$ using generating function.	5	CO3	K2
(OR)			
c. Solve the following recurrence relation: $a_n - 3a_{n-1} + 2a_{n-2} = 4$, $a_0 = 1$, $a_1 = 2$	6	CO3	K2
d. How many integers between 1 and 1000 are divisible by 3 or 5 or 7?	4	CO3	K1

4.a.	Define the kernel of a group homomorphism. Show that the kernel of a homomorphism is always a normal subgroup of the domain group.	6	CO5	K2
b.	Verify whether the set $\{1, -1, i, -i\}$with multiplication is a group or not.	4	CO5	K2
	(OR)			
c.	Define a normal subgroup of a group and prove that every subgroup of an abelian group is normal.	5	CO5	K2
d.	Prove that the intersection of two subgroups of a group is also a subgroup.	5	CO5	K2
5.a.	Prove that in a distributive lattice the complement of an element is unique.	5	CO4	K2
b.	If the meet operation is distributive over the join operation in a lattice, then prove that the join operation is also distributive over meet operation.	5	CO4	K2
	(OR)			
c.	Prove that the set of all positive divisors of 20, $D_{20} = \{1,2,4,5,10,20\}$, ordered by divisibility ($a \leq b$ iff $a \mid b$), is a lattice.	5	CO4	K2
d.	Find the disjunctive normal form of the Boolean expression $E(x, y, z) = (x \vee (\bar{y} \wedge z)) \wedge (\bar{x} \vee y)$	5	CO4	K2
6.a.	What are the necessary conditions for isomorphism of two graphs ? Give an example of two graphs satisfying the necessary conditions but not isomorphic with justification.	5	CO6	K2
b.	State and prove Euler formula for the planar graph.	5	CO6	K2
	(OR)			
c.	Find the adjacency matrix of the graph 	5	CO6	K2
d.	Explain the Kruskal's algorithm to find the minimum spanning tree of the following graph. 	5	CO6	K2

--- End of Paper ---