SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

II B. Tech I Sem – Question Bank

DISCRETE MATHEMATICS AND GRAPH THEORY

[23MAT07]

(Common to CSE & CSM)

SRIT R23

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CO	COURSE OUTCOMES	BL
CO1	Discuss the basic concepts of discrete mathematics and graph theory.	Understand
CO2	Make use of mathematical logic to statements and predicate calculus.	Apply
CO3	Identify structures of algebraic nature by using the concepts of functions.	Apply
CO4	Solve combinatorial problems by using basic counting techniques.	Apply
CO5	Determine functions by using various recurrence relations.	Apply
CO6	Calculate the given problems involving Graph, Paths, Trees, Network flows and Graph colouring.	Apply

Note:* *1. Remember(L1**), 2. Understand (**L2**), 3. Apply (**L3**) 4. Analyze (**L4**), 5. Evaluate (**L5**), 6. Create(**L6**)*

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UNIT – 1 (2 Marks)				
#	Questions	M	CO	BL
1	Construct the truth table ¬ (¬ P V ¬ Q).	2	CO2	L3
2	What is conjunction. Give an example.	2	CO1	L2
3	Show that $\neg Q, P \to Q \Rightarrow \neg P.$	2	CO2	L3
4	Define Disjunction. Give an example.	2	CO1	L2
5	Show that the sets $\{\neg, \wedge\}$ and $\{\neg, \vee\}$ are functionally complete.	2	CO2	L3
6	Define Elementary Product and Elementary Sum.	2	CO1	L2
7	Define Tautology and Contradiction.	2	CO1	L2
8	Define predicates.	2	CO1	L2
9	Define Free and Bound variables.	2	CO1	L2
10	Define law of duality.	2	CO1	L2

UNIT – 1 (5/10 Marks)				
#	Questions	M	CO	BL
1	Construct the truth table for (Q ∨ (P → Q) → P).	5	CO2	L3
2	Without constructing the truth table, show that $(\neg P \wedge (P \vee Q)) \to Q$ is a tautology.	5	CO2	L3
3	Show the implication $P \to Q \Rightarrow P \to (P \wedge Q)$ without using the truth table.	10	CO2	L3
4	Find the PDNF of $P \to Q$ using truth table.	5	CO2	L3

5	Obtain the CNF of $\neg(P \vee Q) \leftrightarrow (P \wedge Q)$.	5	CO2	L3
6	Write the Principal conjunctive normal $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$ without using truth table.	10	CO2	L3
7	Show that $R \vee S$ follows logically from the premises $C \vee D, (C \vee D) \rightarrow \neg H, \neg H \rightarrow (A \wedge \neg B), (A \wedge \neg B) \rightarrow (R \vee S)$.	10	CO2	L3
8	By indirect method of proof, show that $\neg Q, P \rightarrow Q, P \vee R \Rightarrow R$.	10	CO2	L3
9	Explain inference theory of predicate calculus.	10	CO2	L3
10	Show that $\exists(x)M(x)$ follows logically from a given premises $(x)(H(x) \rightarrow M(x)) \wedge \exists(x)H(x)$.	5	CO2	L3

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UNIT – 2 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Define the Power set. Give an example.	2	CO1	L2
2	Given A= {2,5,6}, B= {3,4,2}, C= {1,3,4}, find A- B and B – A. Show that A – B ≠ B – A and A – C = A.	2	CO3	L3
3	Define Cartesian product of Sets. Give an example.	2	CO1	L2
4	Define the principle of inclusion and Exclusion.	2	CO1	L2
5	Define Equivalence relation.	2	CO1	L2
6	Define composition of functions.	2	CO1	L2
7	What is an algebraic system and give an example.	2	CO1	L2
8	Define semi group and monoid.	2	CO1	L2
9	Define abelian group with example.	2	CO1	L2
10	Define Epimorphism and Monomorphism	2	CO1	L2

UNIT – 2 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Prove that $A \oplus (B \oplus C) = (A \oplus B) \oplus (A \oplus C)$	5	CO3	L3
2	Explain relation matrix and digraph with an example.	5	CO3	L3
3	Let X = {2, 3, 6,12,24,36} and the relation ≤ be such that x ≤ y if x divides y. Draw the Hasse diagram of (X, ≤).	5	CO3	L3
4	Show that functions $f(x) = x^3$ and $g(x) = x^{1/3}$ for x ∈ Rare inverse of each other.	5	CO3	L3
5	Ler L= $\{1,2,3,5,30\}$ and R be the relation “is Divisible” defined on L. Show that L is Lattice or not.	10	CO3	L3
6	Illustrate pigeonhole principle and its applications.	5	CO3	L3
7	Show that the identity element in a group is unique.	5	CO3	L3
8	Show that any group G is abelian iff $(ab)^2 = a^2b^2$ for all a, b ∈ G	10	CO3	L3

9	Prove that $\langle Z_5, +_5 \rangle$ is an abelian group of order 5.	10	CO3	L3
10	Define the following terms (i) Homomorphism (ii) Isomorphism (iii) Automorphism.	5	CO3	L3

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UNIT –3 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Define sum rule and product rule.	2	CO1	L2
2	Suppose a person has 3 shirts and 5 ties. In how many ways a person can choose a shirt and a tie.	2	CO4	L3
3	Define a permutation. Give an example.	2	CO1	L2
4	Define combinations. Give an example.	2	CO1	L2
5	How many different string of length 4 can be formed by using the letter of word FLOWER.	2	CO4	L3
6	Find the number of permutations of the letters of the word SUCCESS.	2	CO4	L3
7	How many ways are there to sit 10 boys and 10 girl's around circular table.	2	CO4	L3
8	In how many ways can we distribute 10 identical marbles among 6 distinct containers?	2	CO4	L3
9	State Binomial theorem.	2	CO1	L2
10	Compute $\binom{8}{4,\ 2,\ 2,\ 0}$.	2	CO4	L3

UNIT –3 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Explain the basic rules of counting with examples.	10	CO4	L3
2	Find the number of 3–digit even numbers with no repeated digit.	5	CO4	L3
3	Find the number of permutations of the letters of the word MASSASAUGA. In how many of these all four A's are together? How many of them begin with S.	10	CO4	L3
4	In how many ways can 6 men and 6 women are seated in a row, I) if any person may sit next to any other. II) If men and women occupy alternate seats.	10	CO4	L3
5	Enumerating the number of ways of placing 20 indistinguishable ball into 5 boxes where each box is non-empty.	10	CO4	L3
6	Find out the coefficient of $x9y3$ in the expansion of $(x + 2y)12$ using binomial theorem.	5	CO4	L3
7	Find out the coefficient of $a2b3c2d5$ in the expansion of $(a+2b-3c+2d+5)^{16}$ using multinomial theorem.	5	CO4	L3
8	Find the middle term of $(2x - \frac{1}{3x})^{10}$.	5	CO4	L3

9	Expand $(2a+5b)^6$ using binomial theorem.	5	CO4	L3
10	Prove that $C_0 + C_2 + C_4 + ... = C_1 + C_3 + C_5 + ... = 2^{n-1}$.	10	CO4	L3

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UNIT – 4 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Define generating function.	2	CO1	L2
2	Find the sequence generated by the function $(1 + 3x)^{\frac{-1}{3}}$.	2	CO5	L3
3	Find the sequence generated by the function $(3 + x)^3$.	2	CO5	L3
4	Find the generating function of the sequence 0, 1, -2, 3, -4.	2	CO5	L3
5	Find the generating function of the sequence $1^2, 2^2, 3^2, ---$.	2	CO5	L3
6	Define recurrence relation.	2	CO1	L2
7	Solve the relation $a_r - 7a_{r-1} + 12a_{r-2} = 0$.	2	CO5	L3
8	Solve the recurrence relation $4a_r - 5a_{r-1} = 0$, $r \geq 1$, $a_0 = 1$.	2	CO5	L3
9	Solve the recurrence relation $a_r + 9a_{r-1} + 27a_{r-2} + 27a_{r-3} = 0$, by characteristic equation.	2	CO5	L3
10	Define the solution of inhomogeneous recurrence relation.	2	CO1	L2

UNIT – 4 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Find the generating function of the sequence $0, 2, 6, 12, 20, 30, 42, ...$	5	CO5	L3
2	Determine the generating function for $a_r = 2^r$, *if r is even* & -2^r, *if r is odd.*	10	CO5	L3
3	Find the coefficient of x^{27} for the function $(x^4 + x^5 + x^6)^5$.	10	CO5	L3
4	Find the coefficient of x^{18} for the product of $(x + x^2 + x^3 + x^4 + x^5)\ (x^2 + x^3 + x^4 + ...)^5$	10	CO5	L3
5	Solve the recurrence relation $a_{n+1} = 5a_n$, for $n \geq 0$, *given that* $a_0 = 2$.	5	CO5	L3
6	Find the general solution of $a_r - 7a_{r-1} + 10a_{r-2} = 7.3^r$, $r \geq 2$.	10	CO5	L3
7	Determine the constants b & c and solve a_n , If $a_0 = 0, a_1 = 1, a_2 = 4, a_3 = 37$ satisfy the recurrence relation $a_{n+2} + ba_{n+1} + ca_n = 0$, $n \geq 0$,	10	CO5	L3
8	Find a generating function for the recurrence relation $a_{n+1} - a_n = 3^n$, $n \geq 0$,and $a_0 = 1$ and hence solve the relation.	5	CO5	L3
9	Using generating function solve $y_{n+2} - 4y_{n+1} + 3y_n = 0$, when $y_0 = 2$, $y_1 = 4$.	10	CO5	L3

10	Find a generating function for the recurrence relation $a_{n+2} - 3a_{n+1} + 2a_n = 0\ n \geq 0$, when $a_0 = 1$, $a_1 = 6$.	10	CO5	L3

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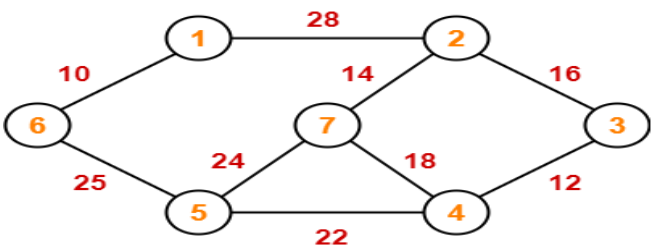
UNIT – 5 (2 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Define Walk and Path.	2	CO1	L2
2	Differentiate between planar and non-planar graphs.	2	CO1	L2
3	What is Multi graph. Give an example.	2	CO1	L2
4	Define Hamilton circuit. Give an example.	2	CO1	L2
5	Define complete graph. Give an example.	2	CO1	L2
6	Define Directed trees and Binary trees.	2	CO1	L2
7	Define graph coloring. Give an example.	2	CO1	L2
8	Define weighted graph. Give an example.	2	CO1	L2
9	Define spanning tree.	2	CO1	L2
10	Define Chromatic number. Give an example.	2	CO1	L2

UNIT – 5 (5/10 Marks)				
#	**Questions**	**M**	**CO**	**BL**
1	Explain Adjacent Matrix and Incidence Matrix with example.	5	CO6	L3
2	When it can be said that two graphs G1 and G2 are isomorphic?	5	CO6	L3
3	Show that a connected graph ‘G’ with ‘n’ vertices has at least ‘n-1’ edges.	10	CO6	L3
4	Prove that there is one and only one path between every pair of vertices.	10	CO6	L3
5	State and prove the Euler’s formula for planar graph.	10	CO6	L3
6	Prove that the complete graph of 5 vertices is non-planar.	5	CO6	L3
7	Explain Eulerian graph and Hamilton graph with examples.	5	CO6	L3
8	Find the chromatic number of the $K_{3,3}$ and $K_{2,3}$	5	CO6	L3
9	What is minimum spanning tree? Explain minimal spanning tree Algorithms with examples.	10	CO6	L3
10	Find minimal spanning tree by using Krushkal’s algorithm. 	10	CO6	L3

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