**SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY**

**(AUTONOMOUS)**

II B. Tech I Sem – Question Bank

**DISCRETE MATHEMATICS**

**[R204GA05401]**

**(CSE) **

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| **CO** | **COURSE OUTCOMES** | **BL** |
| CO1 | Understand the logical connectives, normal forms, predicates and verify the validity of an argument by the rules of inference. | Understand |
| CO2 | Explain functions and its properties such as homomorphism and isomorphism. | Understand |
| CO3 | Explain the general Properties of Semigroups, Monoids, Groups, and Lattices. | Understand |
| CO4 | Illustrate the concepts like partially ordered relation (POSET), compatibility relation and Equivalence relations. | Apply |
| CO5 | Find Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Apply Chromatic number of a graph and spanning trees in a graph. | Apply |
| CO6 | Apply the concepts of permutations, combinations, principle of inclusion and exclusion, binomial and multinomial theorems to solve the counting problems. | Apply |

**\**Note:*** *1.Remeber(****R****), 2.Understand (****U****), 3. Apply (****A****) 4. Analyze (****An****), 5. Evaluate (****E****), 6. Create(****C****)*

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| **UNIT – 1 (2 Marks)** | | | |
| **#** | **Questions** | **CO** | **BL** |
| 1 | Construct the truth table ¬ (¬ P V ¬ Q). | CO1 | Understand |
| 2 | What is Conjunction. Give an example. | CO1 | Remember |
| 3 | Show that the formula Q V ( P∧ **¬** Q ) V (**¬** P ∧ Q ) is a tautology. | CO1 | Remember |
| 4 | Define Disjunction. Give an example. | CO1 | Remember |
| 5 | What is the negation of statement, “2 is even and -3 is negative”? | CO1 | Remember |
| 6 | Define predicates. | CO1 | Remember |
| 7 | Define tautology and contradiction. | CO1 | Remember |
| 8 | Show that the propositions P → Q and ¬ P V Q are logically equivalent. | CO1 | Remember |
| 9 | Construct the truth table for (P∧Q) V(Q ∧R) V (P∧**¬**R). | CO1 | Understand |
| 10 | Define law of duality. | CO1 | Remember |

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| **UNIT – 1 (5/10 Marks)** | | | | |
| **#** | **Questions** | **M** | **CO** | **BL** |
| 1 | Obtain the principal conjunctive normal form of the formula S given by ( **¬** P →R ) ∧ ( Q *↔* P ). | 5 | CO1 | Understand |
| 2 | Show that (R ∨S) follows logically from the premises (C∨D), (C ∨D) → ¬ H, ¬H →(A ⋀ ¬ B) and (A⋀¬ B) → (R∨S). | 5 | CO1 | Remember |
| 3 | Construct the truth table for (Q ⋀ (P → Q) → P). | 5 | CO1 | Understand |
| 4 | Show that R ⋀(P∨Q) is a valid conclusion from the premises P∨Q, Q→R, P→M and ¬M. | 5 | CO1 | Remember |
| 5 | Obtain the principal disjunctive normal form of (**¬** P ∧Q) and (P ∧ Q) V (**¬** P ∧ R) V ( Q ∧ R). | 10 | CO1 | Understand |
| 6 | Show that S V R is tautologically implied by (P∨Q) ⋀ (P →R) ⋀ (Q →S). | 5 | CO1 | Remember |
| 7 | Explain the conjunctive normal form. | 5 | CO1 | Understand |
| 8 | Explain the well - formed formulas with an example. | 5 | CO1 | Understand |
| 9 | Explain disjunctive normal Form. | 5 | CO1 | Understand |
| 10 | Explain the inference theory for predicate calculus. | 10 | CO1 | Understand |

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| **UNIT – 2 (2 Marks)** | | | |
| **#** | **Questions** | **CO** | **BL** |
| 1 | Define the Power set. Give an example. | CO2 | Remember |
| 2 | Define Inclusion and equality of sets. | CO2 | Remember |
| 3 | What is relative complement and absolute complement. | CO2 | Remember |
| 4 | 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. | CO2 | Remember |
| 5 | What is universal set and null set. | CO2 | Remember |
| 6 | Define inverse function. | CO2 | Remember |
| 7 | Define functions. | CO2 | Remember |
| 8 | Define recursive function. | CO2 | Remember |
| 9 | What is composition of function? | CO2 | Remember |
| 10 | Define binary relation. | CO4 | Remember |

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| **UNIT – 2 (5/10 Marks)** | | | | |
| **#** | **Questions** | **M** | **CO** | **BL** |
| 1 | Explain transitive closure with an example. | 5 | CO4 | Understand |
| 2 | Explain lattice and write its properties. | 5 | CO3 | Understand |
| 3 | Explain the principle of inclusion and exclusion. | 10 | CO2 | Understand |
| 4 | Explain relation matrix and digraph with an example. | 10 | CO4 | Understand |
| 5 | What is relation? Explain the properties of binary relations with examples. | 10 | CO4 | Understand |
| 6 | 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 | CO4 | Understand |
| 7 | Let f(x)= x2- 3x + 2, find f(x2), f(y-x) and f(x+3). | 5 | CO2 | Remember |
| 8 | Show that functions f(x)= x3, g(x) =x1/3 for x ∈ R. Are inverse of each other. | 5 | CO2 | Remember |
| 9 | Let f(x)= x+2, g(x)=x-2 and h(x) = 3x for x ∈ R where R is set of real numbers. Find g *◦* f; f *◦* g ; f *◦*f; g *◦* g; f *◦* h; h *◦* g; h *◦* f and f *◦* h *◦* g. | 10 | CO2 | Remember |
| 10 | Show that f(x, y) = x + y is primitive recursive. | 5 | CO2 | Remember |

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| **UNIT – 3 (2 Marks)** | | | |
| **#** | **Questions** | **CO** | **BL** |
| 1 | What is an algebraic system? | CO3 | Remember |
| 2 | Define abelian group. | CO3 | Remember |
| 3 | If (G, \*) is a group and a, b ∈ G, then show that (a \* b)-1 = b-1 \* a-1. | CO3 | Understand |
| 4 | If (G, \*) is an abelian group, then for all a, b ∈ G, show that (a\*b) n = an \* bn. | CO3 | Understand |
| 5 | What do you mean by group isomorphism? Give an example. | CO3 | Remember |
| 6 | Define cyclic group. | CO3 | Remember |
| 7 | Write the properties of integers. | CO6 | Apply |
| 8 | Find the GCD of 826, 1890. | CO6 | Apply |
| 9 | Define LCM. Give an example. | CO6 | Apply |
| 10 | What is congruence relation. Give an example. | CO6 | Apply |

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| **UNIT – 3 (5/10 Marks)** | | | | |
| **#** | **Questions** | **M** | **CO** | **BL** |
| 1 | Show that every cyclic group of order n is isomorphic to the group < Zn, tn>. | 5 | CO3 | Understand |
| 2 | Prove that a subset S ≠ Φ of G is a subgroup of < G, \* >, if any pair of elements a, b ∈ S, a \* b -1 ∈ S. | 5 | CO3 | Understand |
| 3 | Explain Groups, Subgroups and Normal subgroups. | 10 | CO3 | Understand |
| 4 | Let G1 and G2 be subgroups of a group G, show that G1∩G2 is also a subgroup of G and Is G1∪G2 is always a subgroup of G. | 10 | CO3 | Understand |
| 5 | Explain about homomorphism. | 5 | CO2 | Understand |
| 6 | Write the Euclidian algorithm with an example. | 10 | CO6 | Apply |
| 7 | Explain the Fermat’s theorem and Euler’s theorem with an example. | 10 | CO6 | Apply |
| 8 | Explain division theorem. Give an example. | 10 | CO6 | Apply |
| 9 | Explain the testing for prime numbers with an example. | 10 | CO6 | Apply |
| 10 | Define a semigroup and monoid. Give an example of a monoid which is not a group. Justify the answer. | 5 | CO3 | Understand |

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| **UNIT – 4 (2 Marks)** | | | |
| **#** | **Questions** | **CO** | **BL** |
| 1 | Write the basic of counting principles. | CO6 | Understand |
| 2 | In how many ways can the letters of the word 'READER' be arranged? | CO6 | Remember |
| 3 | Define permutation. Give an example. | CO6 | Apply |
| 4 | Find the generating function of the sequence an= n, n ≥ m. | CO6 | Remember |
| 5 | Define combinations. Give an example. | CO6 | Apply |
| 6 | How many ways can 12 white pawns and 12 black pawns be placed on the black squares of 8 X 8 chess board? | CO6 | Remember |
| 7 | In how many ways can a hand of 5 cards be selected from a deck of 52 cards? | CO6 | Remember |
| 8 | From a group of professors how many ways can a committee of 5 members be formed so that at least one of professor A and professor B will be included? | CO6 | Understand |
| 9 | In how many ways can 12 of the 14 people be distributed into 3 teams where the first team has 3 members, the second has 5, and the third team has 4 members? | CO6 | Remember |
| 10 | Suppose that Florida state university has a residence hall that has 5 single rooms, 5 double rooms, and 3 rooms for 3 students each. In how many ways can 24 students be assigned to the 13 rooms. | CO6 | Understand |

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| **UNIT – 4 (5/10 Marks)** | | | | |
| **#** | **Questions** | **M** | **CO** | **BL** |
| 1 | Explain the permutations and combinations with an example. | 10 | CO6 | Apply |
| 2 | Write about generating functions with an example. | 5 | CO6 | Apply |
| 3 | Suppose that 200 faculty members can speak French and 50 can speak Russian, while only 20 can speak both French and Russian. How many faculty members can speak either French or Russian. | 5 | CO6 | Understand |
| 4 | How many different outcomes are possible by tossing 10 similar coins? | 5 | CO6 | Remember |
| 5 | Explain the circular permutations. Give an example. | 10 | CO6 | Apply |
| 6 | Explain the enumerating permutations with constrained repetitions. | 10 | CO6 | Understand |
| 7 | Explain the principles of inclusion – exclusion. | 10 | CO6 | Understand |
| 8 | Explain pigeonhole principle and its applications. | 10 | CO6 | Understand |
| 9 | Explain the multinomial theorem. Give an example. | 10 | CO6 | Understand |
| 10 | State and prove binomial theorem. | 10 | CO6 | Apply |
| 11 | Find out the coefficient of x9y3 in the expansion of (x+2y)12 using binomial theorem. | 5 | CO6 | Apply |
| 12 | Find out the coefficient of a2b3c2d5 in the expansion of (a+2b-3c+2d+5)16 using multinomial theorem. | 5 | CO6 | Apply |

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| **UNIT – 5 (2 Marks)** | | | |
| **#** | **Questions** | **CO** | **BL** |
| 1 | Define graph coloring. Give an example. | CO5 | Apply |
| 2 | Draw the graph of K2,5. | CO5 | Understand |
| 3 | Define multigraph. Give an example. | CO5 | Apply |
| 4 | Mention the importance of graph coloring. | CO5 | Understand |
| 5 | How many edges are there in a graph with 10 vertices each of degree 6? | CO5 | Remember |
| 6 | Find a chromatic number of bipartite graphs? | CO5 | Remember |
| 7 | Define planar graph. Give an example. | CO5 | Apply |
| 8 | What is bipartite graph. Give an example. | CO5 | Remember |
| 9 | What do you mean by graph isomorphism, show it by example? | CO5 | Remember |
| 10 | Define spanning tree. | CO5 | Remember |

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| **UNIT – 5 (5/10 Marks)** | | | | | |
| **#** | **Questions** | **M** | **CO** | **BL** |
| 1 | Define K- regular graph. Give examples of 2- regular, 3- regular, 4- regular graphs. | 10 | CO5 | Apply |
| 2 | Prove that the complete graph of 5 vertices is non-planar. | 5 | CO5 | Apply |
| 3 | Show that a connected graph ‘G’ with ‘n’ vertices has at least ‘n-1’ edges. | 5 | CO5 | Understand |
| 4 | When it can be said that two graphs G1 and G2 are isomorphic? | 5 | CO5 | Remember |
| 5 | Prove that a connected graph G is Euler if and only if all the vertices of G are even degree. | 5 | CO5 | Apply |
| 6 | State and explain four color theorem with an example. | 5 | CO5 | Apply |
| 7 | Explain krushkal’s algorithm with an example. | 5 | CO5 | Apply |
| 8 | Differentiate between Eulerian graph & Hamiltonian graph with example. And also give an example of a graph which Eulerian but not Hamiltonian. | 10 | CO5 | Apply |
| 9 | Write the algorithms for spanning trees with an example. | 10 | CO5 | Apply |
| 10 | Explain the matrix representation of graphs with example. | 10 | CO5 | Apply |

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