QUESTION BANK (DESCRIPTIVE – 12 MARKS)

Subject Name with Code: Discrete Mathematical Structures---22A0017T
Course & Branch: B. Tech & Common to CSE,AIML,CS,DS
Year& Semester: II B. Tech II Semester   **Regulation:** RG22

Q.No.	UNIT-I (Mathematical Logic)	
1.	a) Construct truth table for $[(P \lor Q) \land (\sim R)] \leftrightarrow Q$. (6m) b) Obtain the principal disjunctive and conjunctive normal forms of (P →(Q∧R)) ∧(┐P→(┐Q∧┐R)) using Truth table. (6m)	
2.	a) Define Well Formed Formula? Explain about Tautology with example? (6m) b) Explain in detail about the Connectives with Examples? (6m)	
3.	a) Find the PCNF of (~p↔r) ^(q↔p) using truthtable? (6m) b) Find the disjunctive Normal form of ~(p → (q^r)) using truthtable? (6m)	
4.	a) Prove that ((P→R) V(Q→R))↔((P∧Q)→R) is tautology without using truth table? (8m) b) Explain about Tautological Implication? (4m)	
5.	a) Show that ┐(P∧Q) → (┐P∨(┐P∨Q)) ⇔ (┐P∨Q) (6m) b) (P∨Q)∧(┐P∧(┐P∧Q)) ⇔ (┐P∧Q) (6m)	
6.	Prove that for any propositions p,q,r the compound proposition [(p→q) ∧(q→ r)] → (p→ r) is a tautology.(12m)	
7.	a) Without using truth table, show that $(P \land (P \lor Q)) \rightarrow Q$ is a tautology(6m) b) Explain in brief about duality Law?(6m)	
8.	a) Explain the steps involved in mathematical induction?(4m) b) Prove that, the mathematical induction for all n>=1 1.2+2.3+3.4+……..+n.(n+1)=(n(n+1)(n+2))/3(8m)	
9.	a) Define converse, contrapositive and inverse of an implication? (6m)	

	b) Without constructing the Truth Table prove that (p→q) →q=pvq? (6m)	
10.	Find the PCNF and PDNF of PV (~P-> (QV (Q -> ~R))) using truth tables? (12m)	

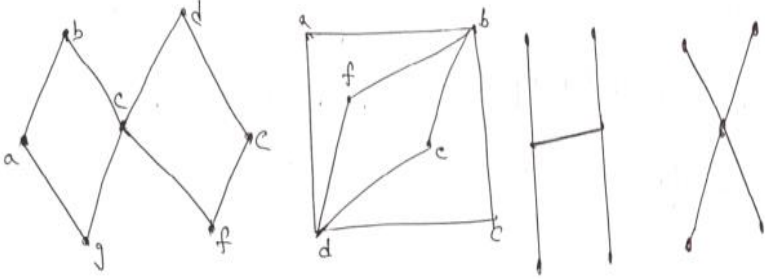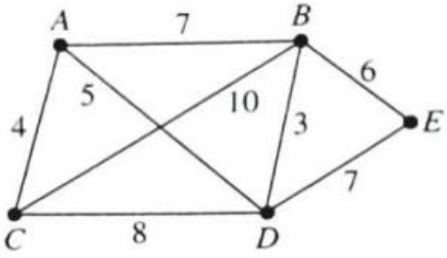| Q.No.	UNIT-II (Set theory)	
1.	Prove that $(S, \leq)$ is a Lattice, where S= {1,2,5,10} and $\leq$ is for divisibility. Prove that it is also a Distributive Lattice?(12m)	
2.	In A survey of 100 students, it was found that 30 studied Mathematics, 54 studied Statistics, 25 studied Operations Research, 1 studied all the three subjects, 20 studied Mathematics and Statistics, 3 studied Mathematics and Operations Research and 15 studied Statistics and Operation Research. Find how many students studied none of these subjects and how many students studied only Mathematics? (12m)	
3.	Prove that in a group G: (i) The inverse of any element is unique. (ii) The identity of any element is unique. (12m)	
4.	a) Show that the function f(x, y) = x + y is primitive recursive. Hence compute the value of f(2, 4). (6m) b) Explain atleast 3 types of functions with suitable examples?(6m)	
5.	Let A={1,2,3,4,6,12} on A define the relation R by aRb if and only if a divides b. Prove that R is a partial order on A and Draw the Hasse Diagram for this relation?(12m)	
6.	Find the inverse of the following functions with the proper steps: a) X={1,2,3},Y={p,q,r},and F={(1,p),(2,r),(3,q)} find inverse of f and explain the procedure in detail? (4m) b) F(x)=(3x+2)/(2x+1) (4m) c) F(x)=sqrt(x+4)-3 (4m)	
7.	a) Let X = {1, 2, 3} and f, g, h and s be the functions from X to X given by f = {(1, 2), (2, 3), (3, 1)} g = {(1, 2), (2, 1), (3, 3)} h = {(1, 1), (2, 2), (3, 1)} s = {(1, 1), (2, 2), (3, 3)} Find g ∘ f; f ∘ h ∘ g; s ∘ g.(6m) b) Define Partition and Covering of a Set with suitable set of examples	

	for satisfing and not satisfying conditions for the definition? (6m)		
8.	Let X={1,2,3,4,5,6,7} and R={(x, y /x-y is divisible by 5} in x. Show that R is an equivalence relation.(12m)		
9.	a) Define pigeon hole principle and what is the minimum no.of students required in a class to be sure that atleast 6 students will receive the same grades if there are 5 grades(A,B,C,D,E,F)?(4m) b) What is composition of functions? Let f and g be functions from R to R, where R is a set of real numbers defined by $f(x) = x^2 + 3x + 1$ and $g(x) = 2x - 3$. Find the composition of functions: i) f ∘ f ii) f ∘ g iii) g ∘ f.(8m)		
10.	For a fixed integer n>1,prove that the relation "congruent modulo n" is an equivalence relation on the set of all integers, Z.(12m)		
11.	Let G be a multiplicative group and f : G → G such that for a ∈ G, f(a) = a −1 . Prove that f is one-one and onto. Also, prove that f is homomorphism if and only if G is commutative.(12m)		

Q.No.	UNIT-III (Elementary Combinatorics)		
1.	From a commitiee consisting of 6 men and 7 women in how many ways can be select a committee of a) 3men and 4 women. b) 4 members which has atleast one women. c) 4 persons of both sexes. d) 4 person in which Mr. And Mrs kannan is not included		12m
2.	In a town council there are 10 democrats (6 men, 4 women) and 11 republicans (7 men, 4 women). Find the number of committees of 8 councilors which have equal number of men and women and equal number of members from both parties		12m
3.	Determine the coefficient of $x^5 y^5 z^5 w^5$ in $(x-3y +2z-5w)^{25}$		12m
4.	Use the Binomial Theorem to find the coefficient of: (i) $a^2 b^3 c^2 d^4$ in $(a +b)^5 (c +d)^6$ (ii) $a^3 b^2$ in $(a +b)^5 + (c +d)^4$.		12m
5.	Find the number of ways in which the complete collection of letters that appear in TALLAHASSEE can be arranged in a row so that:		12m

	(i) T appears at the beginning and E appears at the end. (ii) There are no adjacent A's	
6.	Find the coefficient of X^3Y^7 in (i) $(X+2Y)^{10}$ (ii)$(2X-9Y)^{10}$	12m
7.	Determine the coefficient of $x^5 y^{10} z^5 w^5$ $(x-7y+3z-2w)^{25}$	12m
8.	How many non negative integral solutions are there to the inequality $x_1 + x_2 + x_3 + x_4 + x_5 <=19$?.	12m
9.	If two indistinguishable dice are rolled, then a) How many ways can we get a sum of 4 or of 8? b) How many ways we get an even sum?	12m
10.	Find the number of ways in which the complete collection of letters that appear in MISSISSIPPI can be arranged in a row so that: (i) S appears at the beginning (ii) There are no adjacent I's	12m

Q.No.	UNIT-IV (Recurrence Relations)	
1.	What is the solution of the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$?	12m
2.	Find Fibonacci recurrence relation satisfy the recurrence relation $f_n = f_{n-1} + f_{n-2}$ with initial conditions $f_0 = 0$ and $f_1 = 1$.	12m
3.	What is the solution of the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$ with $a_0 = 1$ and $a_1 = 6$?	12m
4.	Use the technique of *backtracking*, to find an explicit formula for the sequence defined by the recurrence relation and initial condition for $a_n = 5a_{n-1} + 3$, $a_1 = 3$?	12m
5.	Solve the *recurrence relation* $a_n - a_{n-1} - 9 a_{n-2} + 9 a_{n-3} = 0$, $n \geq 3$, $a_0 = 0$, $a_1 = 1$, and $a_2 = 2$ using *generating functions*.	12m
6.	Solve the *recurrence relation* $a_n - 3 a_{n-2} + 2 a_{n-3} = 0$, $n \geq 3$, $a_0 = 1$, $a_1 = 0$, and $a_2 = 0$ using *character root functions*	12m
7.	a) Solve the *recurrence relation* $a_n - 9 a_{n-1} + 26 a_{n-2} - 24 a_{n-3} = 0$, $n \geq 3$, $a_0 = 0$, $a_1 = 1$, and $a_2 = 10$ using *substitute functions*.	12m

Q.No.	UNIT-V (Graphs)	
1.	Prove that the maximum number of edges in a simple graph with n vertices is $n*(n-1)/2$	12m
2.	Prove that a simple graph is bipartite if and only if it is possible to assign one of two different colours to each vertex of the graph so that no two adjacent vertices are assign the same colour	12m

3.	Draw all regular binary trees: (i) With exactly 7 vertices. (ii) With exactly 9 vertices. 5M	12m
4.	Write Kruskal's algorithm for finding a minimal spanning tree.	12m
5.	Check whether the following graphs are Euler or Hamiltonian.	12m
6.	Prove that a connected graph G is Euler graph if and only if every vertex of G is of even degree.	12m
7.	Define minimum spanning tree. Obtain a minimum spanning tree of the following graph.	12m
8.	Explain Isomorphism and give suitable example?	12m

QUESTIONBANK (2 Marks)

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Course & Branch: B. Tech & Common to CSE,AIML,CS,DS
Year& Semester: II B. Tech I Semester   **Regulation:** RG22

Q.No.	UNIT-I (Mathematical Logic)	
1.	What is tautology? Give some examples for it?	
2.	Explain WFF and duality with examples?	
3.	Define converse, contrapositive and inverse of an implication?	
4.	Explain about PDNF with examples?	
5.	What is duality law? Give suitable example?	
6.	Construct the Truth table for $\sim(\sim p \wedge \sim q)$?	

Q.No.	UNIT-II (Set theory)	
1.	Define a binary relation. 2M (d)	
2.	Define a semi group with example.	
3.	State the Pigeonhole principle. 2M (d)	
4.	Define semigroup and monoid. Give an example of a semigroup which is not a monoid	
5.	Define inverse function with example?	

Q.No.	UNIT-III (Elementary Combinatorics)	
1.	State the Multinomial theorem.?	
2.	State binomial theorem?	
3.	In how many ways can 6 persons occupy 3 vacant seats?	
4.	Differences between permutation and combination?	

Q.No.	UNIT-IV (Recurrence Relations)	
1.	Find the recurrence relation of the Fibonacci sequence. 2M	
2.	Find the closed form of the generating function for the sequence " s" with terms 1,2,3,4……..	
3.	Find the coefficient of X^{14} in $(1+X +X^2 +X^3)^{10}$.	
4.	Find the coefficient of y^{17} in $(1-y +y^2 -4y^3)^{16}$.	

Q.No.	UNIT-V (Graphs)	
1.	Define chromatic number? Give suitable example	
2.	Explain Euler formula? Give suitable example	
3.	Define Bipartite graph? Give suitable example	
4.	Define Binary tree? Give suitable example	
5.	Explain Four colours theorem? Give suitable example	
6.	When do you say that a graph is minimally connected?	
7.	Define a planar graph.? Give suitable example.	

Prepared By : (_____)