SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code : DM(18HS0836) **Course & Branch**: MCA

Year & Sem: I-MCA & I-Sem **Regulation:** R18

UNIT – I

MATHEMATICAL LOGIC

1. a) Explain conjunction and disjunction with suitable examples.	7M
b) Define tautology and contradiction with examples.	5M
2. Show that (a) $(\neg P \wedge \neg Q \wedge R) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$	7M
b) $(P \to Q) \to Q) \Rightarrow P \vee Q$ without constructing truth table	5M
3. a) Show that $P \to Q, P \to R, Q \to \neg R, P$ are consistent	5M
b) Give the converse, inverse and contrapositive of the proposition $P \to (Q \wedge R)$.	4M
c) Show that $(P \to Q) \wedge ((Q \to R) \Rightarrow (P \to Q)$	3M
4. a) What is principle disjunctive normal form? Obtain the PDNF of $P \to ((P \to Q) \wedge \neg(\neg Q \vee \neg P))$	7M
b) What is principle conjunctive normal form? Obtain the PCNF of $(\neg P \to R) \wedge (Q \leftrightarrow P)$	5M
5. a) Show that $S \vee R$ is a tautologically implied by $(P \vee Q) \wedge (P \to R) \wedge (Q \to S)$	7M
b) Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \to R, P \to M and \neg M$	5M
6. a) Prove that $(\exists x)(P(x) \wedge Q(x)) \Rightarrow (\exists x)(P(x) \wedge (\exists x)(Q(x)$	5M
b) Show that $(\forall x)(P(x) \to Q(x)) \wedge (\forall x)(Q(x) \to R(x)) \Rightarrow (\forall x)(P(x) \to R(x))$	7M
7. a) Define Quantifiers and types of Quantifiers with an examples.	7M
b) Show that $(\exists x)\ M(x)$ follows logically from the premises $(\forall x)(H(x) \to M(x))$ *and* $(\exists x)H(x)$	5M

8. a) Use indirect method of proof to prove that

$(\forall x)(P(x) \vee Q(x)) \Rightarrow (\forall x)P(x) \vee (\exists x)Q(x)$ 5M

b) Define Maxterms & Minterms of P & Q & give their truth tables 5M

9. a) Define NAND , NOR and XOR and give their truth tables. 6M

b) Define Exclusive & inclusive disjunctions with an example. 6M

10. a) Show that S is a valid conclusion from the premises $p \to q, p \to r, \neg(q \wedge r) and (S \vee p)$. 7M

b) Obtain PCNF of A= (p∧ q) ∨(~ p ∧ q) ∨ (q ∧ r) by constructing PDNF. 5M

UNIT II

RELATIONS & ALGEBRAIC STRUCTURES

1. a) Define an equivalence relation ? If R be a relation in the set of integers Z defined by 6M

R = {(x, y): x϶ Z, y ϶ Z, (x - y) is divisible by 6 }

then prove that R is an equivalence relation ?

b) Let A= {1,2,3,4,5,6,7 } .determine a relation R on A by aRb ⇔ 3 divides (a – b) , 6M

show that R is an equivalence relation ?

2. a) Let A = { 1,2,3,4}and and let R ={ (1,1),(1,2), (2,1), (2,2), (3,4), (4,3), (3,3), (4,4)} 7M

be an equivalence relation on R ? Determine A/R.

b) Define compatibility relation & maximal compatibility 5M

3. Let A be a given finite set and P(A) its power set . let $\subseteq$ be the inclusion relation on 12M

the elements of P(A). Draw the Hass diagram of (P(A) , $\subseteq$) for i) A = { a }

ii)) A ={ a ,b} iii)) A = { a,b,c } iv)) A = { a,b,c,d }

4. a) Define Bijective function with an 2 examples . 5M

b) Define primitive recursive function ?show that the function f(x, y) = x + y 7M

is primitive recursive.

5 a.) Let $f: A \to B$, $g: B \to C$, $h: C \to D$ then prove that $ho(gof) = (hog)of$ 5M

b.) If $f: R \to R$ such that f(x) = 2x+1, and $g: R \to R$ such that g(x) = x/3 7M

then verify that $(gof)^{-1} = f^{-1}og^{-1}$

6. a) Define a binary relation. Give an example. Let R be the relation from the set A = {1, 3, 4}

on itself and defined by R = { (1, 1), (1, 3), (3, 3), (4, 4)} the find the matrix of R,

draw the graph of R. 6M

b) Define and give an example for group, semigroup, subgroup & abelian group 6M

7. a) Prove that the set Z of all integers with the binary operation $*$, defined as 7M

$a*b = a+b+1,\ \forall a,b \in Z$ is an abelian group.

b) Explain the concepts of homomorphism and isomorphism of groups with examples. 5M

8. a) Let s={a,b,c} and let *denotes a binary operation on 's' is given below also let p={1,2,3} 7M

and addition be a binary operation on 'p' is given below. Show that (s,*) & (p,(+))

are isomorphic.

*	A	B	C
A	A	B	C
B	B	B	C
C	C	B	C

(+)	1	2	3
1	1	2	1
2	1	2	2
3	1	2	3

b) On the set Q of all rational number operation * is defined by a*b=a+b-a b.

Show that this operation Q froms a commutative monoid. 5M

9. a) The necessary and sufficient condition for a non – empty subset H of a group (G, *) to

be a subgroup is $a \in H, b \in H \Rightarrow a * b^{-1}$ 5M

b) Show that the set={1,2,3,4,5} is not a group under addition & multiplication modulo 6.

7M

10. a) Show that every homomorphic image of an abelian group is abelian. 5M

b) The necessary and sufficient condition for a non-empty sub-set H of a Group (G,*)

to be a sub group is aϵH,bϵH=>a*b⁻¹Єh 7M

UNIT- III

ELEMENTARY COMBINATORICS

1. a) In how many ways can a committee of 5 teachers and 4 students be chosen from 9

teachers and 15 students 7M

b) How many integral solutions are there to $x_1 + x_2 + x_3 + x_4 + x_5 = 20$ where each

$x_i \geq 2$? 5M

2 a) How many numbers can be formed using the digits 1, 3, 4, 5, 6, 8 and 9 if no repetitions

are allowed? 6M

b) What is the co-efficient of x^3y^7 in $(x+y)^{10}$? 6M

3. a) Out of 5 men and 2 women , a committee of 3 is to be formed . In how many ways canitbe formed if atleast one woman is to be included ? 7M

b) Find the number of arrangements of the letters in the word ACCOUNTANT. 5M

4. The question paper of mathematics contains two questions divided into two groups of 5 questions each. In how many ways can an examine answer six questions taking atleast two questions from each group 12M

5 a) In how many ways can the letters of the word COMPUTER be arranged? How many of them begin with C and end with R? How many of them do not begin with C but end with R? 5M

b) Out of 9 girls and 15 boys How many different committees can be formed each consisting of 6 boys and 4 girls? 7M

6. a) Define product rule? State Binomial theorem? Define permutation? 5M

b) Find the coefficient of (i) $x^3y^2z^2$ in $(x+y+z)^9$. (ii) x^6y^3 in $(x+y)^9$. 7M

7. a)Prove that Inclusion – Exclusion principle for two sets 5M

b) Let A and B be finite disjoint sets, then Prove that $|A \cup B| = |A| + |B|$ 7M

8. a) Find how many integers between 1 and 60 that are divisible by 2 nor by 3 and nor by 5. Also determine the number of integers divisible by 5 not by 2, not by 3. 5M

b) Out of 80 students in a class , 60 play foot ball, 53 play hockey , and 35 both the games. How many students (i) do not play of these games . (ii) play only hockey but not foot ball.6M

9. a) A survey among 100 students shows that of the three ice cream flavours vanilla, chocolate, strawberry. 50 students like vanilla, 43 like chocolate, 28 like straw berry, 13 like vanilla and chocolate, 11 like chocolate and straw berry, 12 like straw berry and vanilla and 5 like all of them. Find the following. 6M

1. Chocolate but not straw berry
2. Chocolate and straw berry but not vannila
3. Vanilla or Chocolate but not straw berry

b) How many different license plates are there that involve 1,2 or 3 letters followed by 4 digits? 6M

10. a) Applying pigeon hole principle show that of any 14 integers are selected from the set S = {1,2,3,……..,25 } there are atleast two whose seem is 26. Also write a statement that generalizes this result. 6M

b) Show that if 8 people are in a room, at least two of them have birthdays that occur on the same day of the week. **6**M

UNIT IV

RECURRRENCE RELATION

1. a) Solve $a_{n+2} - 4a_{n+1} + 4a_n = 2^n$ 6M

   b) Using generating function solve $a_n = 3a_{n-1} + 2$, $a_0 = 1$. 6M

2. a) Solve $a_n = a_{n-1} + 2a_{n-2}$,n > 2 with condition the initial $a_0 = 0$, $a_1 = 1$. 7M

   b) Solve $a_{n+2} - 5a_{n+1} + 6a_n = 2$, with condition the initial $a_0 = 1$, $a_1 = -1$. 5M

3. a) solve the following $y_{n+2} - y_{n+1} - 2y_n = n^2$. 7M

   b) Solve $a_n - 7a_{n-1} + 10a_{n-2} = 4^n$. 5M

4. a) Solve $a_n - 5a_{n-1} + 6a_{n-2} = 1$. 7M

   b) Solve the recurrence relation $a_r = a_{r-1} + a_{r-2}$ Using generating function. 5M

5. a) Solve the recurrence relation using generating functions $a_n - 9a_{n-1} + 20a_{n-2} = 0$ for $n \geq 2$ and $a_0 = -3, a_1 = -10$. 7M

   b) Solve the recurrence relation $a_n = a_{n-1} + n(n+1)/2$. 5M

6. Suppose there are n guests at a dinner party each person's shake hands with everybody else exactly once. Deduce the recurrence relation for number of shake hands and solve the relation by iteration method. 12M

7. a) Solve the RR $a_n=7a_{n-1}-10a_{n-2}$ with initial condition $a_0=4$ & $a_1=17$. 7M

   b) Solve the RR $a_{n+2}-2a_{n+1}+a_n=2^n$ with initial condition $a_0=2$ & $a_1=1$. 5M

8. Solve the recurrence relations

   a) $d_n=2d_{n-1}-d_{n-2}$ with initial conditions $d_1=1.5$ and $d_2=3$. 7M

   b) $b_n=3b_{n-1}-b_{n-2}$ with initial conditions $b_1=-2$ and $b_2=4$. 5M

9. a) Solve the recurrence relation $a_n = a_{n-1} + n(n+1)/2$. 7M

   b) Solve $a_n = a_{n-1} + 2a_{n-2}$,n > 2 with condition the initial $a_0 = 2$, $a_1 = 1$. 5M

10. a) Solve $a_n - 5a_{n-1} + 6a_{n-2} = 2^n$,n > 2 with condition the initial $a_0 = 1$, $a_1 = 1$. Using generating function . 6M

    b) Solve $a_n - 4a_{n-1} + 4a_{n-2} = (n+1)^2$ given $a_0 = 0$, $a_1 = 1$. 6M

UNIT–V

GRAPH THEORY

1. a) Determine the number of edges in 7M

 (i) Complete graph K_n(ii) Complete bipartite graph $K_{m,n}$

 (iii) Cycle graph C_n(iv) Path graph P_n (v) Null graph N_n

 b) Explain about (i) Chromatic numbers. (ii) Isomorphism. 5M

2. Define Spanning tree and explain the algorithm for Depth First Search (DFS) traversal of a graph with suitable example. 12M

3. a) Define isomorphism. Explain Isomorphism of graphs with a suitable example. 7M

 b) Explain krushkal's algorithm finds a minimal spanning tree with own graph. 5M

4. a) Explain graph coloring and chromatic give an example. 7M

 b) Explain complete graph and planar graph 5M

5. a) Explain different types of graphs. 6M

 b) Define Graph. Explain In degree and out degree of graph. 6M

6. a) Define isomorphism. Explain Isomorphism of graphs with a suitable example. 7M

 b) Explain krushkal's algorithm finds a minimal spanning tree with own graph. 5M

7. a) Explain about the adjacency matrix representation of graphs. Illustrate with an example? 6M

 b) What are the advantages of adjacency matrix representation 6M

8. a) A graph G has 21 edges, 3 vertices of degree4 and the other vertices are of degree 3 find the number of vertices in G? 6M

 b) How many edges has each of the following graph 6M

 (i) K_7 (ii)$K_{3, 6}$

9. Define the following graph with one suitable examples for each graphs 10M

 (i) complement graph (ii) subgraph (iii) induced subgraph (iv) spanning subgraph

10 a) Define graph? Give an example. Define graph colour 6M

 b) Define planar graph? What is tree? Define Hamiltonian graphs. 6M

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