24CB205/24CM205/24CS205/24DS205/24IT205

Hall Ticket Number:

I/IV B.Tech(Regular)DEGREE EXAMINATION

June,2025 | **Common to CB, CM,CS, DS &IT**

Second Semester | **Discrete Mathematics**

Time: Three Hours | **Maximum:60 Marks**

Answer question 1 compulsorily. **(12X1 = 12 Marks)**

Answer one question from each unit. **(4X12=48 Marks)**

			CO	BL	M
1.	a)	Define equivalence relation.	CO1	L1	1M
	b)	State Bijection function.	CO1	L1	1M
	c)	Translate the statement into symbolic form "**some men are not giants**".	CO1	L2	1M
	d)	State the rule of universal specification.	CO2	L1	1M
	e)	How many ways are there to seat10 boys and 10 girls around a circular table?	CO2	L2	1M
	f)	How many permutations are possible for the word "TENNESSEE".	CO2	L2	1M
	g)	Compute the coefficient of X^{32} in $(1+X^5+X^9)^{10}$.	CO3	L2	1M
	h)	Write the generating function of $\frac{1}{(1-X)^5}$	CO3	L1	1M
	i)	Give the characteristic polynomial for the recurrence relation $a_n-7a_{n-1}+12a_{n-2}=0$	CO3	L2	1M
	j)	Draw a digraph of the relation "**transitive and reflexive, but not symmetric**".	CO4	L1	1M
	k)	Differentiate **path** and **cycle** in a digraph.	CO4	L2	1M
	l)	Define a POSET.	CO4	L1	1M

Unit –I

			CO	BL	M
2.	a)	Prove that $\{[P\rightarrow(Q \vee R)] \wedge (\sim Q)\} \rightarrow (P \rightarrow R)$ is tautology.	CO1	L3	6M
	b)	Determine the following inference pattern is valid or invalid.	CO1	L3	6M

$$\begin{array}{l} p \rightarrow (r \rightarrow s) \\ \sim r \rightarrow \sim p \\ \underline{p \qquad\qquad} \\ \therefore s \end{array}$$

(OR)

			CO	BL	M
3.	a)	State the converse, opposite and contra positive to the following: (i) If triangle ABC is a right triangle then $\|AB\|^2 + \|BC\|^2 = \|AC\|^2$. (ii) If the triangle is equiangular, then it is equilateral.	CO1	L1	6M
	b)	Suppose that the 10 integers1,2,...,10 are randomly positioned around a circular wheel. Show that the sum of some set of 3consecutively positioned numbers is at least 17. (Proof by contradiction)	CO1	L3	6M

Unit –II

			CO	BL	M
4.	a)	Prove by mathematical induction that $8^{n+2}+9^{2n+1}$is divisible by **73** for each positive integer n.	CO2	L3	6M
	b)	Prove (or) disprove the validity of the following argument : Every living thing is a Plant or animal. David's dog is alive and it is not a plant. All animals have hearts. Hence, David's dog has a heart.	CO2	L3	6M

P.T.O

(OR)

5.	a)	How many integral solutions are there to $X_1 + X_2 + X_3 + X_4 + X_5 = 20$ where $X_1 >= -3, X_2 >= 0, X_3 >= 4, X_4 >= 2, X_5 >= 2$.	CO2	L2	6M
	b)	Prove or disprove the validity of the following arguments: Some dogs are animals. Some cats are animals. Therefore, some dogs are cats.	CO2	L3	6M

Unit –III

6.	a)	Compute the coefficient of X^{20} in $(X + X^2 + X^3 + X^4 + X^5)(X^2 + X^3 + X^4 + \ldots)^5$.	CO3	L3	6M
	b)	Solve the recurrence relation $a_n - 5a_{n-1} + 6a_{n-2} = 0$ for $n >= 2$ by using Generating functions.	CO3	L3	6M

(OR)

7.	a)	Solve the recurrence relation $a_n - 7a_{n-1} + 16a_{n-2} - 12a_{n-3} = 0$ for $n \geq 3$ with the initial conditions $a_0 = 1$, $a_1 = 4$, and $a_2 = 8$.	CO3	L3	6M
	b)	Solve the recurrence relations $a_n = a_{n-1} + \frac{1}{n\ (n+1)}$ by substitution method where $a_0 = 1$.	CO3	L3	6M

Unit –IV

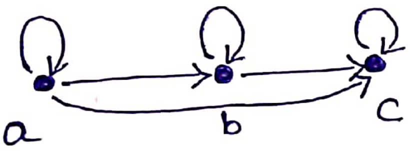
8.	a)	Find the complete solution to the IHR: $a_n - 7a_{n-1} + 10a_{n-2} = 4^n$ for $n \geq 2$.	CO4	L3	6M
	b)	Compute the adjacency matrix of the transitive closure of the digraph	CO4	L3	6M

using Warshall's method.

(OR)

9.	a)	Find a particular solution of $a_n - 4a_{n-1} + 4a_{n-2} = 2^n$ for $n \geq 2$.	CO4	L3	6M
	b)	Draw a POSET diagram for [D_{20} ; |] and determine all maximal and minimal elements and greatest and least elements if they exist. Specify the POSET is lattice or not.	CO4	L3	6M

Q.No	Answer	Marks
1 a)	An equivalence relation is a relationship on a set, that is reflexive, symmetric and transitive for everything in the set.	1M
1 b)	A bijection (or) bijective function is a function that is both one-to-one (injective) and onto (surjective)	1M
1 c)	Symbolic form of "some men are not gaints" Let $M(x)$: x is a men $G(x)$: x is a gaint $\boxed{\exists x, [M(x) \wedge \sim G(x)]}$	1M
1 d)	Universal Specification :- If a statement of the form $\forall x, P(x)$ is true, then $P(c)$ is true for arbitrary c in the universe of discourse. This can be written as : $\dfrac{\forall x,\ P(x)}{\therefore\ P(c)}$ for all c.	1M
1 e)	There are $(20-1)!$ ways (or) $19!$ ways	1M
1 f)	Possible permutations : $\dfrac{9!}{1! \cdot 4! \cdot 2! \cdot 2!}$ Letter – no. of. Times T – 1 E – 4 N – 2 S – 2	1M

Q.No	Answer	Marks
1g)	The coefficient of x^{32} is : $\frac{10!}{3!\cdot 1!\cdot 6!} = 840$ Non-negative integral soln: $e_1 + e_2 + e_3 + e_4 + e_5 + e_6 + e_7 + e_8 + e_9 + e_{10} = 32$ $9 + 9 + 9 + 5 + 0 + 0 + 0 + 0 + 0 + 0 = 32$	1M
1h)	The generating function of $\frac{1}{(1-x)^5} = \sum_{r=0}^{\infty} c(n-1+r, r)x^r$ Here $n = 5$ $= \sum_{r=0}^{\infty} c(5-1+r, r)x^r$ $\boxed{= \sum_{r=0}^{\infty} c(4+r, r)x^r}$	1M
1i)	characteristic polynomial for the R.R : $a_n - 7a_{n-1} + 12a_{n-2} = 0$ $\boxed{c(t) = t^2 - 7t + 12}$	1M
1j)	Digraph for "Transitive and reflexive, but not symmetric"  	1M
1k)	Path : A Path is a sequence of vertices and edges that connects two distinct vertices without repeating any edges or vertices. cycle : A cycle is a specific type of path where the starting and ending vertices are the same.	1M
1l)	POSET : A POSET (or) Partially ordered set is a set equipped with a relation that satisfies Reflexive, Anti-Symmetry and Transitive.	1M

Q.No	Answer	Marks
	UNIT - I	
2 a)	Given Propositional function: $\{[P \to (Q \vee R)] \wedge (\sim Q)\} \to (P \to R)$	6 M

P	Q	R	$Q \vee R$	$P \to (Q \vee R)$	$\sim Q$	$P \to (Q \vee R) \wedge (\sim Q)$	$P \to R$	$[P \to (Q \vee R) \wedge (\sim Q)] \to (P \to R)$
F	F	F	F	T	T	T	T	T
F	F	T	T	T	T	T	T	T
F	T	F	T	T	F	F	T	T
F	T	T	T	T	F	F	T	T
T	F	F	F	F	T	F	F	T
T	F	T	T	T	T	T	T	T
T	T	F	T	T	F	F	F	T
T	T	T	T	T	F	F	T	T

Hence, the result of the given P.F is tautology.

2 b) Given inference pattern is

$$\begin{array}{l} p \to (r \to s) \\ \sim r \to \sim p \\ p \\ \hline \therefore s \end{array}$$

6M

1)	p	Premise
2)	$p \to (r \to s)$	Premise
3)	$r \to s$	From (1) (2) & modus ponens $\to$ $\left[\begin{array}{l} p \\ p \to q \\ \hline \therefore q \end{array}\right]$
4)	$\sim r \to \sim p$	Premise
5)	$p \to r$	From (4) & contrapositive
6)	r	From (1) (5) & modus ponens
7)	s	From (3) (6) & modus ponens

Therefore, the given inference pattern is Valid

Q.No	Answer	Marks
	(OR)	6M
3 a)	(i) If triangle ABC is a right triangle then $\|AB\|^2+\|BC\|^2=\|AC\|^2$	
	converse : If $\|AB\|^2+\|BC\|^2=\|AC\|^2$ then triangle ABC is a right triangle.	
	opposite : If triangle ABC is not a right triangle then $\|AB\|^2+\|BC\|^2\neq\|AC\|^2$	
	contrapositive: If $\|AB\|^2+\|BC\|^2\neq\|AC\|^2$ then triangle ABC is not a right triangle.	3M
	(ii) If the triangle is equiangular then it is equilateral.	
	converse : If the triangle is ~~equiangular~~ equilateral then it is equiangular.	
	opposite : If the triangle is not equiangular then it is not equilateral.	
	contrapositive: If the triangle is not equilateral then it is not equiangular.	3M
3 b)	Let x_i represent the integer positioned at position i on the wheel. Then we have to prove : $x_1+x_2+x_3\geq 17$ $x_2+x_3+x_4\geq 17$ $x_3+x_4+x_5\geq 17$ $\vdots$ $x_{10}+x_1+x_2\geq 17$	6M

Q.No	Answer	Marks

on the contrary, we assume that the conclusion is false.

then
$$x_1 + x_2 + x_3 < 17$$
$$x_2 + x_3 + x_4 < 17$$
$$x_3 + x_4 + x_5 < 17$$
$$\vdots$$
$$x_{10} + x_1 + x_2 < 17$$

Now taking the sum of all these inequalities, the above inequalities is ≤ 16 rather than 17

$$3(x_1 + x_2 + x_3 + \cdots + x_{10}) \leq 10(16)$$

$$3\left(\frac{\cancel{10}^{5}(10+1)}{\cancel{2}}\right) \leq 160$$

$$165 \leq 160$$

clearly, this is contradiction.

UNIT – II

4a) (i) Basis of induction: First we show that $8^{n+2} + 9^{2n+1}$ is divisible by 73.

Put $n=1$ $8^{1+2} + 9^{2(1)+1}$

$512 + 729 = 1241 \div 73 = 17$

It is true for $n=1$. — 6M

(ii) Inductive hypothesis: Next, we assume that it is true for $n=K$.

then $8^{K+2} + 9^{2K+1} = 73x$

for some integer x.

Q.No	Answer	Marks
	iii) Inductive step: Then we show that, on the basis of inductive hypothesis $n=k+1$ is true. $8^{(k+1)+2} + 9^{2(k+1)+1} = 8^{k+3} + 9^{2k+3}$ $= 8^{k+2}\cdot 8 + 9^{2k+1}\cdot 9^{2}$ $= 8^{k+2}\cdot 8 + 9^{2k+1}\cdot 81$ $= 8^{k+2}\cdot 8 + 9^{2k+1}\cdot(73+8)$ $= 8^{k+2}\cdot 8 + 9^{2k+1}\cdot 73 + 9^{2k+1}\cdot 8$ $= 8(8^{k+2} + 9^{2k+1}) + 9^{2k+1}\cdot 73$ $= 8\cdot(73x) + 9^{2k+1}\cdot 73$ $= 73(8x + 9^{2k+1})$ $= 73(y)$ where y is an integer Hence, $8^{k+3}+9^{2k+3}$ is divisible by 73 and by the principle of mathematical induction $8^{n+2}+9^{2n+1}$ is divisible by 73 for each positive integer n.	
4b)	Let the universe consist of all living things & Let $P(x)$: x is a plant $A(x)$: x is an animal $H(x)$: x has a heart a : David's dog then the pattern is: $\forall x, [P(x) \vee A(x)]$ $\sim P(a)$ $\forall x, [A(x) \rightarrow H(x)]$ $\therefore H(a)$	6M

Q.No	Answer	Marks

The proof of validity is the following

1) $\forall x, [P(x) \vee A(x)]$ Premise

2) $\sim P(a)$ Premise

3) $P(a) \vee A(a)$ From (1) & universal specification

4) $A(a)$ From (2) (3) & disjunctive syllogism

5) $\forall x, [A(x) \rightarrow H(x)]$ Premise

6) $A(a) \rightarrow H(a)$ From (5) & universal specification

7) $H(a)$ From (4) (6) & modus ponens

Hence, the given argument is valid.

(OR)

5a) Here, we interpret placing -3 balls in box 1 as actually increasing the total number of balls from 20 to 23. Then placing 4 in box 3, and 2 in each of boxes 4 and 5, we now wish to count the number of integral solutions of **6M**

$$y_1 + y_2 + y_3 + y_4 + y_5 = 15 \text{ where each } y_i \geq 0$$

Here $n=5$ and $r=15$

There are $C(n-1+r, r)$ solutions

$C(5-1+15, 15)$

$\underline{C(19, 15)}$ $\underline{\text{solutions}}$

$$\frac{19!}{15!\,(19-15)!} = \frac{19\times \cancel{18}^{3}\times 17\times \cancel{16}^{4}}{\cancel{4}\times\cancel{3}\times\cancel{2}\times 1} = 3{,}876 \text{ solutions}$$

Q.No	Answer	Marks
5 b)	Let us assume	6M

$D(x)$: x is a dog
$A(x)$: x is an animal
$C(x)$: x is a cat

then the given pattern is :

$$\begin{array}{l} \exists x,\ D(x) \land A(x) \\ \exists x,\ C(x) \land A(x) \\ \hline \therefore \exists x,\ D(x) \land C(x) \end{array}$$

The proof of validity is the following sequence of steps.

(1)	$\exists x,\ D(x) \land A(x)$	Premise
(2)	$D(n) \land A(n)$	From (1) & Existential specification
(3)	$D(n)$	From (2) & simplification ~~conjunction~~
(4)	$\exists x,\ C(x) \land A(x)$	Premise
(5)	$C(n) \land A(n)$	From (4) & Existential specification
(6)	$C(n)$	From (5) & simplification ~~conjunction~~
(7)	$D(n) \land C(n)$	From (3), (6) & conjunction
(8)	$\exists x,\ D(x) \land C(x)$	From (7) & Existential Generalization

Hence, the given arguments are valid.

Q.No	Answer	Marks
	UNIT – III	
6a)	The coefficient of x^{20} in $(x+x^2+x^3+x^4+x^5)(x^2+x^3+\cdots)^5$ $= x(1+x+x^2+x^3+x^4)\,x^{10}(1+x+x^2+\cdots)^5$ $= x^{11}(1+x+x^2+x^3+x^4)(1+x+x^2+\cdots)^5$ $= x^{11}\cdot\left(\frac{1-x^{4+1}}{1-x}\right)\left(\frac{1}{1-x}\right)^5$ $= x^{11}\cdot(1-x^5)\cdot\frac{1}{(1-x)^6}$ $= (x^{11}-x^{16})\cdot\sum_{r=0}^{\infty} c(6-1+r,r)x^r$ $= x^{11}\cdot\sum_{r=0}^{\infty} c(5+r,r)x^r - x^{16}\cdot\sum_{r=0}^{\infty} c(5+r,r)x^r$ The coefficient of x^{20} becomes $r=9$ $r=4$ $= x^{11}\cdot\sum_{r=0}^{\infty} c(5+9,9)x^9 - x^{16}\cdot\sum_{r=0}^{\infty} c(5+4,4)x^4$ therefore coefficient of x^{20} is : $\boxed{c(14,9)-c(9,4)}$	6M
6b)	The steps of the procedure 1) Let $A(x)=\sum_{n=0}^{\infty} a_n x^n = a_0+a_1x+a_2x^2+\cdots+a_nx^n$. 2. multiply each term in the R.R by x^n and sum from 2 to ∞ $\sum_{n=2}^{\infty} a_n x^n - 5\cdot\sum_{n=2}^{\infty} a_{n-1}x^n + 6\cdot\sum_{n=2}^{\infty} a_{n-2}x^n = 0$ 3) Replace each infinite sum by an expression $(a_2x^2+a_3x^3+\cdots)-5\cdot(a_1x^2+a_2x^3+\cdots)+6(a_0x^2+a_1x^3+\cdots)=0$ $(a_2x^2+a_3x^3+\cdots)-5x(a_1x+a_2x^2+\cdots)+6x^2(a_0+a_1x+\cdots)=0$	6M

Q.No	Answer	Marks
	$(A(x)-a_0-a_1x)-5x(A(x)-a_0)+6x^2(A(x))=0$	
	4). Simplify	
	$A(x)-5xA(x)+6x^2A(x)=a_0+a_1x-5a_0x$	
	$A(x)\left[1-5x+6x^2\right]=a_0+(a_1-5a_0)x$	
	$A(x)=\dfrac{a_0+(a_1-5a_0)x}{1-5x+6x^2}$	
	5) Decompose $A(x)$ as a sum of partial fractions	
	$A(x)=\dfrac{a_0+(a_1-5a_0)x}{1-2x-3x+6x^2}=\dfrac{a_0+(a_1-5a_0)x}{(1-2x)(1-3x)}$	
	$=\dfrac{c_1}{1-2x}+\dfrac{c_2}{1-3x}$	
	6). Express $A(x)$ as a sum of familiar series	
	$\sum_{n=0}^{\infty}a_nx^n=c_1\cdot\sum_{n=0}^{\infty}2^nx^n+c_2\cdot\sum_{n=0}^{\infty}3^nx^n$	
	7) Express a_n as the coefficient of x^n in $A(x)$	
	$\boxed{a_n=c_1\cdot 2^n+c_2\cdot 3^n}$	
	So, the solution for the given R.R is $\boxed{a_n=c_1\cdot 2^n+c_2\cdot 3^n}$	
	(OR)	
7a)	Given R.R is : $a_n-7a_{n-1}+16a_{n-2}-12a_{n-3}=0$ $\forall n\geq 3$	6M
	Initial conditions $a_0=1$, $a_1=4$ and $a_2=8$.	
	characteristic polynomial $c(t)$: $t^3-7t^2+16t-12$	
	Find the roots using synthetic division method	

Q.No	Answer	Marks

$$
\begin{array}{c|cccc}
2 & 1 & -7 & +16 & -12 \\
 & \times & +2 & -10 & +12 \\ \hline
2 & 1 & -5 & +6 & \boxed{0} \\
 & \times & +2 & -6 & \\ \hline
3 & 1 & -3 & \boxed{0} & \\
 & \times & +3 & & \\ \hline
 & 1 & \boxed{0} & &
\end{array}
$$

so, $c(t) = (t-2)^2(t-3)$

The general solution is $\boxed{a_n = c_1 \cdot 2^n + c_2 \cdot n 2^n + c_3 \cdot 3^n}$

But, from the initial conditions

$n=0$, $c_1 + c_3 = 1$ —(1)

$n=1$ $2c_1 + 2c_2 + 3c_3 = 4$ —(2)

$n=2$ $4c_1 + 8c_2 + 9c_3 = 8$ —(3)

consider eq (2) & (3)

$4 \times (2)$: $8c_1 + \cancel{8c_2} + 12c_3 = 16$

(3) : $-4c_1 \mp \cancel{8c_2} \mp 9c_3 = \mp 8$

$4c_1 + 3c_3 = 8$ —(4)

From eq (1) & (4)

$4 \times (1)$: $\cancel{4c_1} + 4c_3 = 4$

(4) : $\cancel{4c_1} + 3c_3 = 8$

$+c_3 = -4 \Rightarrow \boxed{c_3 = -4}$

$c_1 = 1 + 4 = 5 \Rightarrow \boxed{c_1 = 5}$

$\therefore 2(5) + 2c_2 + 3(-4) = 4$

$2c_2 = 16 - 10$

$\boxed{c_2 = 3}$

Thus, the required solution of the recurrence relation is

$$\boxed{a_n = (5) \cdot 2^n + (3) n\, 2^n - (4) \cdot 3^n}$$

Q.No	Answer	Marks
7 b)	Solve the R.R $a_n = a_{n-1} + \frac{1}{n.(n+1)}$ using substitution method. where $a_0 = 1$	6M

Substitute $n=1$ in the R.R

$$a_1 = a_0 + \frac{1}{1.2}$$

$n=2$ $\quad a_2 = a_1 + \frac{1}{2.3} = a_0 + \frac{1}{1.2} + \frac{1}{2.3}$

$n=3$ $\quad a_3 = a_2 + \frac{1}{3.4} = a_0 + \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4}$

$\vdots \qquad \vdots$

n^{th} substitution $\quad a_n = a_0 + \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{n(n+1)}$

So,

$$a_n = a_0 + \sum_{n=1}^{n} \frac{1}{n.(n+1)}$$

$$= a_0 + \sum_{n=1}^{n} \left(\frac{1}{n} - \frac{1}{n+1}\right)$$

$$= a_0 + \left(1 - \cancel{\frac{1}{2}} + \cancel{\frac{1}{2}} - \cancel{\frac{1}{3}} + \cancel{\frac{1}{3}} - \cancel{\frac{1}{4}} + \cdots + \cancel{\frac{1}{n}} - \frac{1}{n+1}\right)$$

$$= a_0 + 1 - \frac{1}{n+1}$$

$$= 1 + 1 - \frac{1}{n+1} \qquad \text{where } a_0 = 1$$

$$= 2 - \frac{1}{n+1}$$

$$= \frac{2(n+1) - 1}{n+1}$$

Therefore, solution for $\boxed{a_n = \frac{2n+1}{n+1}}$

Q.No	Answer	Marks
	UNIT – IV	
8a)	Solution to the IHR: $a_n - 7a_{n-1} + 10a_{n-2} = 4^n$ for $n \geq 2$ Characteristic polynomial $c(t)$ for homogeneous relation $c(t) = t^2 - 7t + 10$ $= t^2 - 2t - 5t + 10$ $= t(t-2) - 5(t-2)$ $= (t-2)(t-5)$ Homogeneous solution $\boxed{a_n^H = c_1 \cdot 2^n + c_2 \cdot 5^n}$ A particular solution will have the form $a_n^P = A \cdot 4^n$ Substitute $A4^n$ for a_n into IHR $a_n - 7a_{n-1} + 10a_{n-2} = 4^n$ then $A \cdot 4^n - 7A4^{n-1} + 10A \cdot 4^{n-2} = 4^n$ $A \cdot 4^{n-2}[\cancel{A} \cdot 4^2 - 7 \cdot 4 + 10] = 4^n$ $-2A = 4^2$ $\boxed{A = -8}$ $\Rightarrow a_n^P = (-8) \cdot 4^n$ is a particular solution. Thus, the complete solution for $\boxed{a_n = (-8) \cdot 4^n + c_1 \cdot 2^n + c_2 \cdot 5^n}$	6M
8b)	Given digraph: $a \longrightarrow b \longrightarrow c \longrightarrow d$ Transive closure of the digraph using warshall's algorithm as follows: Adjacency matrix for the given digraph: $M_0 = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ $M_1(1,2) = 1$	6M

Q.No	Answer	Marks

Next find M_1, consider first row and first column in M_0.

No change, so $M_0 = M_1$

$$M_1 = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \left.\begin{matrix} m_2(1,2)=1 \\ m_2(2,3)=1 \end{matrix}\right\} m_2(1,3)=1$$

Next M_2,

$$M_2 = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \left.\begin{matrix} m_3(1,3)=1 \\ m_3(2,3)=1 \\ m_3(3,4)=1 \end{matrix}\right\} \begin{matrix} m_3(1,4)=1 \\ m_3(2,4)=1 \end{matrix}$$

Next m_3,

$$M_3 = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \left.\begin{matrix} m_4(1,4)=1 \\ m_4(2,4)=1 \\ m_4(3,4)=1 \end{matrix}\right\} \text{no new one's}$$

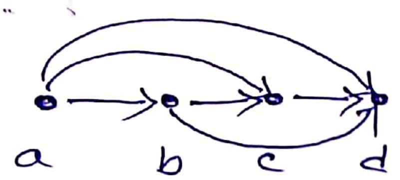
Next, find M_4:

$$M_4 = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Transitive closure of the digraph is:

$$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(or)



Q.No	Answer	Marks
	(OR)	
9a)	Particular solution of $a_n - 4a_{n-1} + 4a_{n-2} = 2^n$ for $n \geq 2$ as follows:	6M

The characteristic polynomial c(t) is : $t^2 - 4t + 4$

$$: t^2 - 2t - 2t + 4$$

$$t(t-2) - 2(t-2)$$

$$(t-2)(t-2)$$

2 is a root of multiplicity 2. $\boxed{a_n^H = c_1 \cdot 2^n + c_2 \cdot n 2^n}$

Then, particular solution $\boxed{a_n^P = A \cdot n^2 2^n}$

Substitute a_n^P in the given recurrence relation

$$A n^2 2^n - 4 \cdot A (n-1)^2 2^{n-1} + 4 \cdot A (n-2)^2 2^{n-2} = 2^n$$

$$A 2^{n-2} \left[n^2 \cdot 2^2 - 4 \cdot 2 (n-1)^2 + 4 \cdot (n-2)^2 \right] = 2^n$$

$$A \cdot 2^{n-2} \left[\cancel{4n^2} - \cancel{8n^2} + \cancel{16n} - 8 + \cancel{4n^2} - \cancel{16n} + 16 \right] = 2^n$$

$$A \cdot 8 = \frac{2^n}{2^{n-2}} = 2^2$$

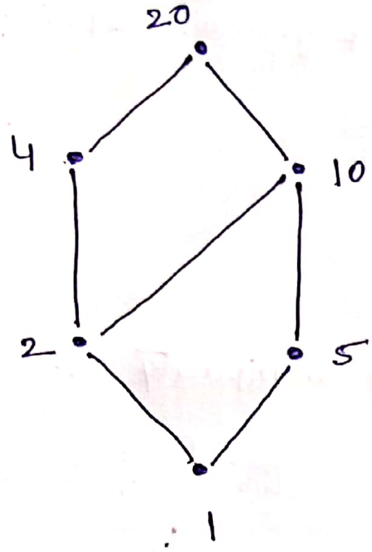
$$A = \frac{4}{8}$$

$$\boxed{A = 1/2}$$

particular solution is $\boxed{a_n^P = 1/2 \cdot n^2 2^n}$

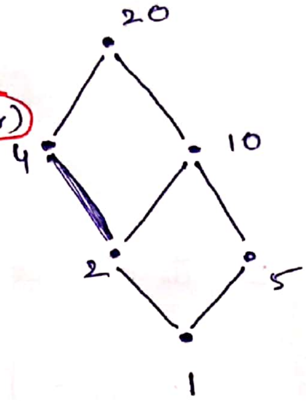
Q.No	Answer	Marks
9 b)	POSET diagram for $[D_{20}; \mid]$ is:	6M

$$[D_{20}; \mid] = [\{1, 2, 4, 5, 10, 20\}, \mid]$$



(a)

(or)



(b)

Maximal element = $\{20\}$

Minimal element = $\{1\}$

Greatest element = $\{20\}$

Least element = $\{1\}$

Pair of elements	GLB	LUB
(2, 5)	$\{1\}$	$\{10\}$
(2, 10)	$\{2\}$	$\{10\}$
(4, 10)	$\{2\}$	$\{20\}$
(1, 5)	$\{1\}$	$\{5\}$
⋮	⋮	⋮

Every pair of elements in a POSET have GLB & LUB

So, the given poset is a Lattice.

G. Prasad 07/07/2015
Signature of the Faculty

Signature of the HOD
Head of the Department
Information Technology
Bapatla Engineering College

Scheme Prepared by:

Mr.G.Prasad, Asst. Professor,

Department of Information Technology,

BEC, Bapatla-522102.

Signature of the Examiners:

S.No.	Name of Examiner & Designation	Name of College	Signature
1	M. VENKATESWARLU, ASST PROF	VRSEC	M. Venkateswarlu
2	K. Suman	BEC	[illegible]
3	Dr. V. Hanuman	BEC	[illegible]
4	A. GopiNath	BEC	A. Gopi
5	G. Saikeerthy	VLITS	[illegible]
6	N. Karunakar	BEC	N. Karuna