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Vellore Institute of Technology
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CHENNAI

Reg.No.:
Name:

Continuous Assessment Test - II (March 2023)

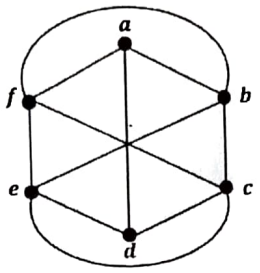
Programme	:	B.Tech.	**Semester**	:	Winter 2022-23
Course	:	Discrete Mathematics and Graph Theory	**Code**	:	BMAT205L
Faculty	:	Dr. Vidhya V, Dr. Durga Nagarajan, Dr. Sandip Dalui and Dr. Jayagopal R	**Class ID's**	:	CH2022235001875 CH2022235001876 CH2022235001877 CH2022235001878
			Slot		D2+TD2+TDD2
Duration	:	90 minutes	**Max. Marks**	:	50

Answer all the questions ($5 \times 10 = 50$ *Marks*)

Q. No.	Question Description	Marks
1.	a) Three married couples are to be seated in a row having six seats in a auditorium hall. If spouses are to be seated next to each other, in how many ways can they be seated? Find also the number of ways of their seating if all the ladies sit together.	5
	b) In how many ways can 8 people be seated in a row if (i) there are no restrictions on the seating arrangement, $8!$ (ii) persons X and Y must sit next to each other? $(n-1)2!$ (iii)there are 4 boys and 4 girls and no 2 boys or 2 girls can sit next to each other? (iv)there are 5 men and they must sit next to one another? (v) there are 4 married couples and each couple must sit together?	5
2.	Solve the recurrence relation $a_{n+1} + 4a_n + 4a_{n-1} = n - 1, n \geq 1, a_0 = 0, a_1 = 1.$	10
3.	a) Let D_{180} be the set of divisors of 180 and $\mid$ be the relation defined as $a \mid b$ if and only if a *divides* b. Draw the Hasse diagram. Also, find the upper bounds, lower bounds, GLB and LUB of $\{6,10,30\}$.	7
	b) Let $a, b \in Z$. The relation R is defined as aRb if and only if $a - b$ is a multiple of 4. Check whether the relation R is reflexive, symmetric, antisymmetric and transitive.	3
4.	Not in syllabus a) Using the Karnaugh map find the minimum sum of products of the following function $f(x, y, z, w) = \sum(0,2,3,4,6,10,12) + \sum_{\phi}(7,9)$	5
	b) Find the conjugate normal form (CNF) of the following function $f(x, y, z) = (x + y)(x' + z)(y + z')$	5

5. a) Calculate the number of edges in a graph with 10 vertices, four of which are of degree 2, three of which are of degree 3, and the remaining are pendent vertices. 3

b) Check whether the following graph is a ~~planar graph~~ or a bipartite graph. Justify your answer. Also, find the adjacency matrix. 7



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degree 1 vertices

10 vertices

3 → 3

3 → 1

$1+y'z+xyz+x'yz+xy'z'$ → 2

$1+y'z+xz'+x'yz$

$(x'+x)y'z'+yz(x+x')+xy'(z+x')+xyz'$

$y'z'+yz+y'z+xyz'$

$y(1)+yz+xyz'$

$y(z+xz')$

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Continuous Assessment Test (CAT- II) – JUNE 2023

Programme	:	B. Tech	Semester	:	Fall Inter Semester 2022-23
Course	:	Discrete Mathematics and Graph Theory	Code	:	BMAT205L
			Slot(s)	:	C1+TC1+TCC1
Faculty	:	Dr. Kalyan Manna, Dr. Avinash Kumar Mittal, Dr. Durga Nagrajan, Dr. Vidhya V, Dr. Devi Yamini S, Dr. Om Namah Shivay, Dr. Uma Maheswari S, Dr. Rajesh Kumar Mohapatra, Dr. Manigandla Prasannalakshmi, Dr. Sandip Dalui, Dr. Pulak Konar, Dr. Surath Ghosh,Dr. Lakshmanan S	Class Id	:	CH2022232500280 - CH2022232500287, CH2022232500292 - CH2022232500297
Time	:	90 Minutes	Max. Marks	:	50

Answer ALL the Questions (5 X 10 = 50 Marks)

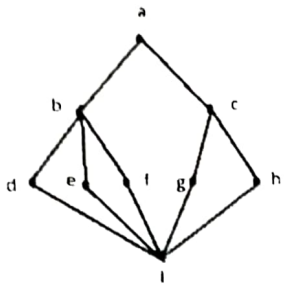
Q.No.	Sub. Sec.	Question Description	Marks
1.	a.	The number plates of cars must contain 3 letters of the alphabet denoting the place and area to which its owner belongs. This is to be followed by a three-digit number. How many different number plates can be formed if: (i) Repetition of letters and digits is not allowed. (ii) Repetition of letters and digits is allowed. (3)	5
	b.	(i)Kyle wants to buy coffee and a doughnut. The local doughnut shop has five kinds of doughnuts for sale and sells four varieties of coffee in three sizes (as shown in the table).	2+3

	Small	Medium	Large
Latte	small latte	medium latte	large latte
Mocha	small mocha	medium mocha	large mocha
Espresso	small espresso	medium espresso	large espresso
Cappuccino	small cappuccino	medium cappuccino	large cappuccino

How many different orders could Kyle make?

(ii) Jasmine is holding three cards from a regular deck of playing cards. She tells you that they are all hearts, and that she is holding at least one of the two highest cards in the suit (Ace and King). If you wanted to list all of the possible sets of cards she might be holding, how long would your list be?

2.		Using the method of undetermined coefficients, solve the recurrence relation. $a_{n+2} - 6a_{n+1} + 5a_n = 1 + n + 5^n, n \geq 0$ with $a_0 = 1; a_1 = 1$ (10)	10
3.	a.	(i)Prove that $(a + b') \cdot (b + c') \cdot (c + a') = (a' + b).(b' + c).(c' + a)$ (Using Boolean laws) (5)	3+2
		(ii)Simplify the Boolean expression: $ab + abc + a'b + ab'c$	
	b.	Prove that the following Hasse Diagram represents a Lattice.	



5

Also, check whether the lattice is (a) complemented or not (b) distributive or not.
(Justification required for each part)

4. Consider the set $A = \{\{1\},\{2\},\{5\},\{1,2\},\{1,5\},\{2,5\},\{3,5\},\{1,3,5\},\{2,3,5\}\}$ with subset $\subseteq$ as the relation.

(a) Prove that $(A, \subseteq)$ is a POSET.
(b) Draw the Hasse diagram.
(c) Find the minimal, maximal, greatest, least element if it exists.
(d) Find the upper bounds and least upper bound of $\{\{2\},\{5\}\}$, if it exists.
(e) Find the lower bounds and greatest lower bound of $\{\{1,3,5\},\{2,3,5\}\}$ if it exists.

10

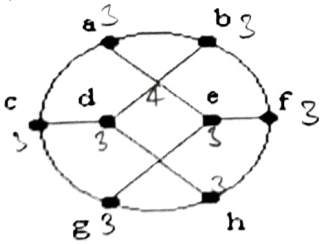
5. a. For the given incidence matrix

	v_1	v_2	v_3	v_4	v_5	v_6	v_7
e_1	0	0	0	0	0	1	1
e_2	0	1	0	1	0	0	1
e_3	0	0	0	1	1	0	0
e_4	0	0	0	1	1	0	0
e_5	0	0	0	0	0	0	1
e_6	1	0	0	1	0	0	0
e_7	0	0	0	0	0	1	1
e_8	0	0	0	1	0	1	0

4

Identify the following.
(i) Isolated vertices
(ii) Pendant vertices
(Justification required for each case)

b. (i) Check whether the degree sequence (6, 4, 3, 3, 2, 1, 1, 0) constitute a simple graph, if so, draw the graph, if not, add or delete exactly one vertex to make it a simple graph.
(ii) Check whether the following graph is planar. (Justification required)



4+2