CBCS SCHEME

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22MCA11

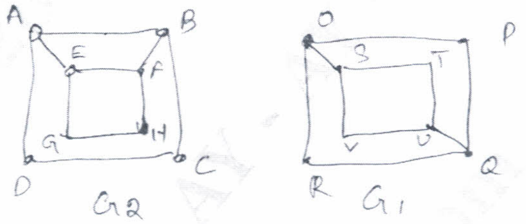
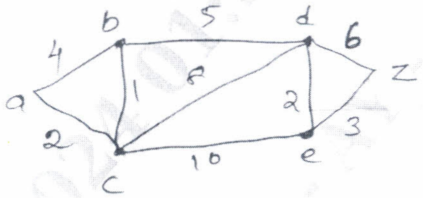
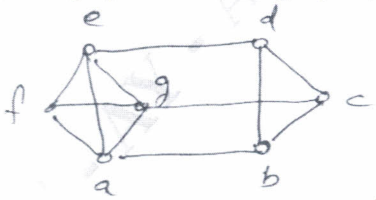
First Semester MCA Degree Examination, June/July 2024
Mathematical Foundation for Computer Applications

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 4, 6, 8\}$ and $B = \{2, 4, 5, 9\}$. Compute the following : (i) $\overline{A}$ (ii) $\overline{B}$ (iii) $\overline{A} \cup \overline{B}$ (iv) $\overline{A \cup B}$ (v) $\overline{A} \cap \overline{B}$ (vi) $\overline{A \cap B}$ (vii) $B - A$ (viii) $A - B$ (ix) $A \Delta B$	**10**	**L1**	**CO1**
	b.	Write down the Associative Laws of Set theory.	**5**	**L1**	**CO1**
	c.	For any Two sets A and B, prove the Demorgan's laws.	**5**	**L2**	**CO1**
		OR			
Q.2	**a.**	In survey of 60 people it was found that 25 read weekly magazines, 26 read fortnightly magazines. 26 read montly magazines, 9 read both weekly and monthly magazines. 11 read both weekly and fortnightly magazines. 8 read both fortnightly and monthly magazines and 3 read all 3 magazines. Find (i) The number of people who read at least one of the 3 magazines. (ii) The number of people who read exactly one magazine.	**10**	**L2**	**CO1**
	b.	Find all the Eigen values and the corresponding Eigen vectors of the matrix. $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$	**10**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Consider the following propositions concerned with a certain triangle ABC. p : ABC is isosceles, q : ABC is equilateral, r : ABC is equiangular Write down the following propositions in words : (i) $p \wedge (\neg q)$ (ii) $(\neg p) \vee q$ (iii) $p \to q$ (iv) $q \to p$ (v) $(\neg r) \to (\neg q)$	**10**	**L3**	**CO2**
	b.	Given the p is true and q is false, find the truth values of the following : (i) $(\neg p) \wedge q$ (ii) $\neg(p \wedge q) \vee \{\neg(q \leftrightarrow p)\}$ (iii) $\neg(p \to (\neg q))$ (iv) $(p \wedge q) \to (p \vee q)$ (v) $(p \to q) \vee \{\neg(p \leftrightarrow \neg q)\}$	**5**	**L2**	**CO2**
	c.	Prove that for any prepositions p, q, r the compound propositions, $\{p \to (q \to r)\} \to \{(p \to q) \to (p \to r)\}$ is a tautology.	**5**	**L2**	**CO2**

		OR			
Q.4	**a.**	Test whether the following arguments are valid: (i) $p \to q$ $r \to s$ $p \vee r$ $\overline{\therefore q \vee s}$ (ii) $p \to q$ $r \to s$ $\neg q \vee \neg s$ $\overline{\therefore \neg(p \wedge r)}$	**10**	**L1**	**CO2**
	b.	Construct the Truth tables for the following compound propositions, (i) $(p \wedge q) \to \neg r$ (ii) $q \wedge (\neg r \to p)$	**10**	**L1**	**CO2**
		Module – 3			
Q.5	**a.**	Let R_1 and R_2 be the relations represented by the matrices : $M_{R_1} = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$, $M_{R_2} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ Determine : (i) $R_1 \cup R_2$ (ii) $R_1 \cap R_2$ (iii) $\sim R_1$ (iv) $\sim R_2$ (v) $R \circ S$ (vi) $S \circ R$ (vii) $R \circ R$ (viii) $S \circ S$	**10**	**L2**	**CO3**
	b.	$A\{1,2,3,4,6,8,12\}$ is a POSET with respect to the relation R defined as $\{(a, b) : a \text{ divides } b\}$ and draw Hasse diagram.	**10**	**L1**	**CO3**
		OR			
Q.6	**a.**	Let A = {1, 2, 3} and B = {1, 2, 3, 4} and the Relations R and S from A to B are represented by the matrices, $M_R = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ and $M_S = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ Determine $R \cup S$, $R \cap S$, R', S', $R - S$, $S - R$, and their matrix representation.	**10**	**L2**	**CO3**
	b.	Draw the Hasse diagram for the positive divisors of 36 under divisibility relation.	**10**	**L1**	**CO3**
		Module – 4			
Q.7	**a.**	A random variable X has the following probability distribution, $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|c\|} \hline X & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\ \hline P(X) & K & 3K & 5K & 7K & 9K & 11K & 13K \\ \hline \end{array}$ (i) Find K. (ii) Evaluate P(X<4), $P(X \geq 5)$, $P(3 < X \leq 6)$. (iii) Find the minimum value of K so that $P(X \leq 2) > 0.3$	**10**	**L2**	**CO4**
	b.	The function f(X) is defined as, $f(x) = \begin{cases} e^{-x}, & x \geq 0 \\ 0, & 0 < 0 \end{cases}$ Is f(x) a probability density function? If so, determine the probability that the variate having this density will fall in the interval (1, 2). Also find the cumulative probability function F(2).	**10**	**L2**	**CO4**

		OR			
Q.8	**a.**	A box contains 100 transistors, 20 of which are defective and 10 are selected at random, find the probability that, (i) all are defective (ii) at least one is defective (iii) all are good (iv) at most 3 are defective.	**10**	**L2**	**CO4**
	b.	Given that 2% of the fuses manufactured by a firm are defective. Find by using Poisson distribution, the probability that a box containing 200 fuses has, (i) No defective fuses (ii) 3 or more defective fuses (iii) At least one defective fuse	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Define the following with suitable example : (i) Simple graph (ii) Complete graph (iii) Bipartite graph (iv) Complete bipartite graph (v) Isomorphism	**10**	**L2**	**CO5**
	b.	Show that the following two graphs are isomorphic :  Fig. Q9 (b)	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Use Dijikstra's Algorithm to find the length of a shortest path between the vertices a and z in the graph given below shown Fig. Q10 (a).  Fig. Q10 (a)	**10**	**L2**	**CO6**
	b.	Give the graph coloring of the graph shown in Fig. Q10 (b).  Fig. Q10 (b)	**10**	**L2**	**CO6**

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