CBCS SCHEME

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22MCA11

First Semester MCA Degree Examination, Jan./Feb. 2023
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.	Define, cardinality of a set, singleton set and universal set with example.	6	L2	CO1
	b.	Define union and intersection of two sets with example.	4	L2	CO1
	c.	Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 7 & 3 \\ 3 & -1 \end{bmatrix}$.	10	L2	CO1
		OR			
Q.2	a.	Define matrix. Explain different types of matrices with example.	8	L2	CO1
	b.	Let $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{6, 7, 8, 9, 10\}$ and $f : A \to B$ be a function defined by $f = \{(1, 7)(2, 7)(3, 8)(4, 6)(5, 9)(6, 9)\}$. Determine $f^{-1}(6)$ and $f^{-1}(9)$. Also if $B_1 = \{7, 8\}$, $B_2 = \{8, 9, 10\}$ then find $f^{-1}(B_1)$ and $f^{-1}(B_2)$.	4	L1	CO1
	c.	In a class of 52 students, 30 are studying C++, 28 are studying pascal and 13 are studying both languages. How many in this class are studying at least one of these languages? How many are studying neither of these languages?	6	L2	CO1
	d.	State and explain Pigeon hole principle.	2	L1	CO1
		Module – 2			
Q.3	a.	State the laws of logic.	8	L2	CO2
	b.	Write the contra positive, converse and the inverse of the conditional statement. "If oxygen is a gas then Gold is compound".	6	L1	CO2
	c.	Define Tautology. Show that the compound proposition, $[P \to (q \to r)] \to [(p \to q) \to (p \to r)]$ is a Tautology.	6	L3	CO2
		OR			
Q.4	a.	Prove the following is valid argument : $\begin{array}{l} p \to r \\ \neg p \to q \\ q \to s \\ \hline \therefore \neg r \to s \end{array}$	8	L2	CO2

<table>
<tr><td></td><td>b.</td><td>Give the direct proof of the following statement "If n is an odd integer, then n^2 is odd".</td><td>6</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>What is a proposition? Let p and q be the propositions "Swimming in the New Jersy sea shore is allowed and sharks have been near the sea shore." Express each of the following compound propositions as an English sentence.
(i) $p \rightarrow \sim q$ (ii) $\sim p \rightarrow \sim q$ (iii) $p \leftrightarrow q$</td><td>6</td><td>L1</td><td>CO2</td></tr>
<tr><td colspan="6" align="center">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>Let A = {1, 2, 3, 4}, R = {(1, 3)(1, 1)(3, 1)(1, 2)(3, 3)(4, 4)} be a relation on A. Determine whether R is reflexive, symmetric, asymmetric and write matrix representation.</td><td>6</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>If A = {1, 2, 3, 4} and R = {(1, 2)(1, 3)(2, 4)(4, 4)},
S = {(1, 1)(1, 2)(1, 3)(1, 4)(2, 3)(2, 4)} be relations on A then find RoS, SoR, R^2 and S^2. Also write their matrices.</td><td>8</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Discuss briefly on partitions and equivalence classes with example.</td><td>6</td><td>L2</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Show that the set A={1, 2, 3, 4, 6, 8, 12} is a POSET with respect to the relation R defined as {(a, b) : a divides b} and draw its Hasse diagram.</td><td>8</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Draw the directed graph of relation,
R = {(1, 1)(1, 3)(2, 1)(2,3)(2, 4)(3, 1)(3, 2)(4, 1)} on the set {1, 2, 3, 4}. Also find in-degree and out-degree of each vertex.</td><td>6</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Define lattices. Determine whether the POSET ({1, 2, 3, 4, 5}, 1) is lattice or not.</td><td>6</td><td>L2</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>A random variable X has the following probability distribution.
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>P(X)</td><td>K</td><td>3K</td><td>5K</td><td>7K</td><td>9K</td><td>11K</td><td>13K</td></tr></table>(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 $P(X \leq 2) > 0.3$</td><td>10</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>The probability that a pen manufactured by a company will be defective is $\frac{1}{10}$. If 12 such pens are manufactured, find the probability that, (i) Exactly two will be defective (ii) at least two will be defective (iii) none will be defective.</td><td>10</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>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.</td><td>8</td><td>L2</td><td>CO4</td></tr>
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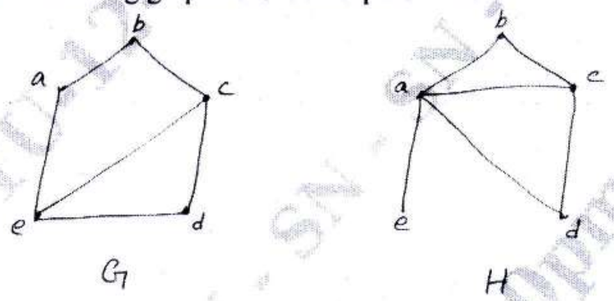
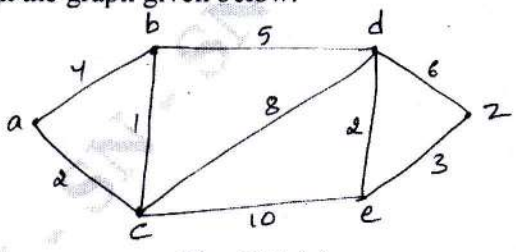
			Marks	Level	CO
	b.	The length of a telephone conversation has an exponential distribution with a mean of 3 minutes. Find the probability that a call (i) Ends in less than 3 minutes. (ii) Takes between 3 and 5 minutes.	6	L2	CO4
	c.	Find the constant C such that, $f(x)=\int_{-\infty}^{\infty}\begin{cases}Cx^2, & 0<x<3\\ 0, & \text{otherwise}\end{cases}$ is a probability density function. Also compute $P(1<X<2)$.	6	L2	CO4
		Module – 5			
Q.9	a.	Define the following with suitable examples: (i) Simple graph (ii) Complete graph (iii) Bipartite graph	6	L2	CO5
	b.	Verify the following graphs are isomorphic or not.  Fig.Q9 (b)	6	L2	CO5
	c.	Explain the Konigsberg bridge problem.	8	L1	CO5
		OR			
Q.10	a.	Determine $\lvert V\rvert$ for the graph $G=(V,E)$ if G has 10 edges with two vertices of degree 4 and others of degree 3.	4	L2	CO6
	b.	Define the following with suitable examples : (i) Euler's graph (ii) Hamilton graph	6	L2	CO6
	c.	Use Dijkstra's algorithm to find the length of a shortest path between the vertices a and z in the graph given below.  Fig. Q10 (c)	10	L2	CO6

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