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School of Engineering Sciences and Technology
Even Semester Examination-2023

Paper Name: Mathematical Foundations for Computer Applications
Paper Code: MCA-201

Time: 2.5 Hours

Note: Programmable calculator is not allowed.

Maximum Marks: 60

PART -A

(All questions are compulsory)

(4 X 5 = 20)

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S. No	Questions	Marks	Course Learning Outcomes	Blooms Taxonomy Level																		
Q.1	Define the following terms with example: (a) Complete graph (b) Planar graph. Prove that complete graph K_4 is planar.	5	CLO5	L1																		
Q.2	Estimate mean, mode, median, first quartile and third quartile from the following distribution of marks obtained by forty-nine students in the Mathematics class. <table border="1" style="margin: 10px auto;"> <tr> <td>x</td> <td>0-5</td> <td>5-10</td> <td>10-15</td> <td>15-20</td> <td>20-25</td> <td>25-30</td> <td>30-35</td> <td>35-40</td> </tr> <tr> <td>f(x)</td> <td>2</td> <td>4</td> <td>6</td> <td>15</td> <td>10</td> <td>5</td> <td>4</td> <td>3</td> </tr> </table>	x	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	f(x)	2	4	6	15	10	5	4	3	5	CLO4	L4
x	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40														
f(x)	2	4	6	15	10	5	4	3														
Q.3	Construct the distribution function and compute $P(X > \frac{1}{3})$, where $f(x) = \begin{cases} ke^{-x} & \text{if } x > 0 \\ 0 & \text{otherwise} \end{cases}$ is a probability density function for some constant k .	5	CLO3	L6																		
Q.4 (a)	Find the rank of the matrix A, where $A = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 3 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \end{bmatrix}$	3	CLO2	L4																		
(b)	Let Z denote the set of integers and the relation R in Z be defined by aRb if and only if a-b is an even integer. Then show that R is an equivalence relation.	2	CLO1	L3																		

PART – B

(Attempt any Four Questions out of Six)

(4 X 10 = 40)

S. No	Questions	Marks	Course Learning Outcomes	Blooms Taxonomy Level																
Q.1	Fit the straight line $Y = a + bX$ and $X = c + dY$ for the following data: <table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Y</td><td>1</td><td>5</td><td>10</td><td>22</td><td>38</td></tr></table>	X	0	1	2	3	4	Y	1	5	10	22	38	10	CLO4	L5				
X	0	1	2	3	4															
Y	1	5	10	22	38															
Q.2 (a)	Solve the difference equation $a_r + 5a_{r-1} + 6a_{r-2} = 3r^2$.	6	CLO1	L3																
(b)	Prove that the function $f: R \rightarrow R$, defined as $f(x) = x + 1$, for all $x \in R$, is a injective function, where R is the set of real numbers.	4	CLO1	L4																
Q.3	Investigate the values of θ & φ so that the equations $x+y+z=10, 2x + y -2z=7, x+y+\theta z=\varphi$ have (i) no solution (ii) a unique solution.	10	CLO2	L4																
Q.4	Explain the following terms with example: (i) Bipartite graph (ii) Eulerian path (iii) Eulerian circuit (iv) Complete bipartite graph (v) Weighted graph. Also explain handshaking theorem.	10	CLO5	L1																
Q.5	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> Determine (i) k (ii) $E(X)$ (iii) $E(X^2)$ (iv) variance (v) $P(2 \leq X \leq 5)$.	X	0	1	2	3	4	5	6	$P(x)$	K	3k	5k	7k	9k	11k	13k	10	CLO3	L3
X	0	1	2	3	4	5	6													
$P(x)$	K	3k	5k	7k	9k	11k	13k													
Q.6 (a)	In a bolt machines A, B and C produces 25%, 35% and 40% respectively of the total product. Of their output, 5%, 4% and 2% are defective bolts. A bolt is chosen at random from the product and found to be defective. What are the probabilities that the bolt was produced either by machine A or by machine B or by machine C?	6	CLO3	L4																
(b)	Find the eigenvalues and the corresponding eigenvectors of the matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$.	4	CLO2	L3																

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3- Applying, 4- Analyzing, 5- Evaluating, 6- Creating)

CO-Course Outcomes

*****End of Paper*****