CBCS SCHEME

USN | | | | | | | | | | |

22MIA/MAR11

First Semester M.Tech. Degree Examination, Jan./Feb. 2023
Applied Mathematics

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.	Solve the system of equations $x+2y+3z=5$, $2x+8y+22z=6$, $3x+22y+82z=-10$ using Cholesky method.	10	L3	CO1
	b.	Find the inverse of the matrix using partition method $\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$	10	L3	CO1
		OR			
Q.2	a.	Solve the system of equations: $x_1+x_2+x_3=1$, $4x_1+3x_2-x_3=6$, $3x_1+5x_2+3x_3=4$ by triangularization method.	10	L3	CO1
	b.	Apply Gauss-Seidel iterative method to solve the system of equations. $10x_1-2x_2-x_3-x_4=3$, $-2x_1+10x_2-x_3-x_4=15$ $-x_1-x_2+10x_3-2x_4=27$, $-x_1-x_2-2x_3+10x_4=-9$	10	L3	CO1
		Module – 2			
Q.3	a.	Find the standard matrix for the linear transformation $T : R^3 \to R^2$ defined by $T(x, y, z) = (x - 2y, 2x + y)$.	10	L2	CO2
	b.	Show that the following function defines an inner product of R^2, where $u = (u_1, u_2)$ and $v = (v_1, v_2)$, $\langle u, v\rangle = u_1v_1 + 2u_2v_2$	10	L2	CO2
		OR			
Q.4	a.	Apply the Gram-Schmidt orthonormalization process to the basis for $\mathbb{R}^3$ shown below B={(1, 1, 0), (1, 2, 0), (0, 1, 2)}	10	L2	CO2
	b.	Find a least-square solution of the system AX = b for $A = \begin{bmatrix} 4 & 0 \\ 0 & 2 \\ 1 & 1 \end{bmatrix}$ and $b = \begin{bmatrix} 2 \\ 0 \\ 11 \end{bmatrix}$	10	L2	CO2
		Module – 3			
Q.5	a.	Diagonalize the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	10	L3	CO3

b. Find the largest eigen value and the eigen vector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by Power method. — 10 | L3 | CO3

OR

Q.6 a. Solve by Jacobi method $\begin{bmatrix} 2 & \sqrt{2} & 4 \\ \sqrt{2} & 6 & \sqrt{2} \\ 4 & \sqrt{2} & 2 \end{bmatrix}$. — 10 | L3 | CO3

b. Find singular value decomposition of a matrix $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$. — 10 | L3 | CO3

Module – 4

Q.7 a. Define: — 10 | L2 | CO4

(i) Random sampling
(ii) Sampling distribution
(iii) Statistical hypothesis
(iv) Null hypothesis
(v) Level of significance

b. Five dice were thrown 96 times and the numbers 1, 2 or 3 appearing on the face of the dice follows the frequency distribution as follows: — 10 | L2 | CO4

No. of dice shown 1, 2 or 3	5	4	3	2	1	0
Frequency	7	19	35	24	8	3

Test the hypothesis that the data follows a binomial distribution ($\chi^2_{0.05} = 11.07$ for 5 degree of freedom)

OR

Q.8 a. A certain stimulus administered to each of 12 patients resulted in the following increases of blood pressure 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will increase the blood pressure? (Table value: $t_{0.05}$ for 11 degree of freedom = 2.201) — 10 | L2 | CO4

b. In order to determine whether there is significant difference in the durability of 3 makes of computers, sample of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows: — 10 | L2 | CO4

Makes

A	5	6	8	9	7
B	8	10	11	12	4
C	7	3	5	4	1

In view of the above data test there is a significant difference in the durability of the 3 makes of computers. [$F_{5\%}$ ($V_1 = 2$, $V_2 = 12$) = 3.88]

Q.9	a.	The joint probability distribution of two random variables X and Y is given below: $$\begin{array}{c\|ccc} X \backslash Y & -3 & 2 & 4 \\ \hline 1 & 0.1 & 0.2 & 0.2 \\ 3 & 0.3 & 0.1 & 0.1 \end{array}$$ Find: (i) Marginal distribution of X and Y (ii) Covariance of X and Y (iii) Correlation of X and Y	10	L2	CO4
	b.	Show that $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ is a Regular Stochastic Matrix and find the corresponding unique fixed probability vector.	10	L2	CO4
		OR			
Q.10	a.	A software engineer goes to his workplace every day by motorbike or by car. He never goes by bike on two consecutive days but if he goes by car on a day he is equally likely to go by car or by bike on the next day. Find the transition matrix for the chain of the mode of transport he uses. If car is used on the first day of the week, find the probability that bike is used after 4 days.	10	L2	CO4
	b.	Cars arrive at a petrol pump, having one petrol unit in Poisson fashion with an average of 10 cars per hour. The service time is distributed exponentially with a mean of 3 minutes. Find: (i) Average number of cars in the system (ii) Average waiting time in the queue (iii) Average queue length (iv) The probability that the number of cars in the system is 2.	10	L2	CO4

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