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**M.Sc. COMPUTER SCIENCE WITH SPECIALISATION IN DATA SCIENCE**  
**FIRST SEMESTER EXAMINATION, FEBRUARY 2022**  
**20-359-0105 MATHEMATICS FOR MACHINE LEARNING**  
**(Regular)**

Time : 3 Hours

Maximum Marks:50

(Answer ANY FIVE questions)

Each question carries 10 Marks

QUESTIONS		Marks
1	<p>a) Check whether the given system of linear equations is consistent.</p> $\begin{aligned} 3x + 2y - 5z &= 4 \\ x + y - 2z &= 1 \\ 5x + 3y - 8z &= 6 \end{aligned}$ <p>b) Solve the following system of equations using Gauss Elimination method</p> $\begin{aligned} 2x + 8y + 4z &= 2 \\ 2x + 5y + z &= 5 \\ 4x + 10y - z &= 1 \end{aligned}$	10
2	<p>a) Find vector norms of the vector <math>x^T = [2 \ -3 \ 0 \ 1 \ -4]</math></p> <p>b) Define basis of a vector space. Check whether the vectors <math>(1,0,0), (1,1,0), (1,1,1)</math> form a basis of the vector space <math>R^3</math></p>	10
3	<p>a) Find the eigenvalues and corresponding Eigen vectors of the matrix:</p> $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 4 & 5 \\ 0 & 4 & 3 \end{bmatrix}$ <p>b) One of the eigenvalues of the matrix <math>A</math> is 2. Find the other two eigenvalues of this matrix without constructing the characteristic equation?</p> $A = \begin{bmatrix} 1 & k & k \\ 2 & 1 & 1 \\ m & 2 & 2 \end{bmatrix}$	10
4	<p>a) Explain Principal component analysis and its features.</p> <p>b) Find the derivative of <math>f(x) = x^2\sqrt{1-x^2}</math></p>	10
5	<p>a) Compute the Taylor polynomial <math>T_n</math> at <math>n=6</math> for <math>f(x) = x^4</math> at <math>x_0 = 1</math></p> <p>b) Find gradient of the function <math>f(x, y) = x+y^2</math></p>	10



6	<p>a) Consider a set of linearly independent vectors <math>b_1, b_2, b_3, b_4 \in \mathbb{R}^n</math> and</p> $x_1 = b_1 - 2b_2 + b_3 - b_4$ $x_2 = -4b_1 - 2b_2 + 4b_4$ $x_3 = 2b_1 + 3b_2 - b_3 - 3b_4$ $x_4 = 17b_1 - 10b_2 + 11b_3 + b_4$ <p>Are the vectors <math>x_1, x_2, x_3, x_4 \in \mathbb{R}^n</math> linearly independent?</p> <p>b) Find the inverse of the matrix using Gauss Jordan method</p> $A = \begin{bmatrix} 3 & -1 & 1 \\ 2 & 1 & 0 \\ 1 & 2 & -1 \end{bmatrix}$	10
7	<p>a) Explain the differences of Row Echelon Form and Reduced Row Echelon Form of a matrix with the help of examples.</p> <p>b) State rank nullity theorem. Using it find the nullity of the given matrix</p> $A = \begin{bmatrix} 0 & -3 & -6 & 4 & 9 \\ -1 & -2 & -1 & 3 & 1 \\ -2 & -3 & 0 & 3 & -1 \\ 1 & 4 & 5 & -9 & -7 \end{bmatrix}$	10