BACHELOR OF TECHNOLOGY (CBCS) (2021-COURSE)
B. Tech. Sem - II COMPUTER SCIENCE & BUSINESS SYSTEMS : SUMMER : 2024
SUBJECT: LINEAR ALGEBRA

Day : Tuesday | Time : 10:00 AM-01:00 PM
Date : 21/05/2024 | **S-24136-2024** | Max. Marks : 60

N.B :

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagrams **WHEREVER** necessary.
4) Use of non programmable **CALCULATOR** is allowed.
5) Assume suitable data if necessary.

Q.1 Solve with the help of matrices, the simultaneous equations: **(10)**

$$x+y+z=3,\quad x+2y+3z=4,\quad x+4y+9z=6$$

OR

Q.1 Prove that : $\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$ **(10)**

Q.2 Solve the following system by the method of LU-factorization **(10)**

$$x+3y+8z=4,\quad x+4y+3z=-2,\quad x+3y+4z=1$$

OR

Q.2 Solve the following equations by Gauss elimination method: **(10)**

$$3x-y+2z=12$$
$$x+2y+3z=11$$
$$2x-2y-z=2$$

Q.3 Show that the set $M_2(R)$ of all 2 x 2 matrices is a vector space over R under matrix addition and scalar multiplication defined by **(10)**

$$\alpha\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} \alpha a & \alpha b \\ \alpha c & \alpha d \end{bmatrix}$$

OR

Q.3 Find the dimension of the subspace spanned by the vector **(10)**

(1, 0, 2), (2, 0, 1), (1, 0, 1) in R^3

Q.4 Find the orthonormal basis of R^3 with standard inner product using Gram-Schmidt orthogonalization to the vectors **(10)**

$$\alpha_1=(1,0,1),\quad \alpha_2=(1,2,-2),\quad \alpha_3=(2,-2,1)$$

OR

Q.4 Find QR factorization of $\begin{bmatrix} 1 & \sqrt{5} \\ 2 & 0 \\ 0 & -\sqrt{5} \end{bmatrix}$ **(10)**

P.T.O.

Q.5 Find eigen values and eigen vectors of $A=\begin{bmatrix}1 & 2 & -1\\ 1 & 1 & 1\\ 1 & 3 & -1\end{bmatrix}$ (10)

OR

Q.5 Prove that: $\frac{1}{2}\begin{bmatrix}1+i & -1+i\\ 1+i & 1-i\end{bmatrix}$ is a unitary matrix. (10)

Q.6 Find singular value decomposition of $A=\begin{bmatrix}1 & 1\\ 1 & 0\\ 0 & 1\end{bmatrix}$ (10)

OR

Q.6 Given the following data, use principal component analysis to reduce the dimension from 2 to 1 (10)

Feature	Example1	Example2	Example3	Example4
X	7	8	13	4
Y	14	4	5	11

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