BACHELOR OF TECHNOLOGY (CBCS) (2021-COURSE)

Computer Science & Engineering

B. Tech. Sem - I :SUMMER : 2023

SUBJECT : MATHEMATICS FOR COMPUTING-I

Day : Tuesday | Time : 10:00 AM-01:00 PM

Date : 09-05-2023 | **S-24018-2023** | Max. Marks : 60

N.B:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Assume suitable data if necessary.

Q.1 Reduce the matrix $A = \begin{bmatrix} 3 & -2 & 0 & -1 \\ 0 & 2 & 2 & 7 \\ 1 & -2 & -3 & 2 \\ 0 & 1 & 2 & 1 \end{bmatrix}$ to an echelon form and further reduce A to its row canonical form. **[10]**

OR

Q.1 Solve the following system of linear equations: **[10]**

$x+2y-4z=-4$

$2x+5y-9z=-10$

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

Q.2 Extend $\{u_1=(1,1,1,1),\ u_2=(2,2,3,4)\}$ to a basis of R^4. **[10]**

OR

Q.2 Examine for linear dependent or independent the following system of vectors. If dependent, find the relation between them. **[10]**
$u_1=(2,3,4,-2)$, $u_2=(-1,-2,-2,1)$, $u_3=(1,1,2,-1)$.

Q.3 Let $F: R^4 \to R^3$ be the linear mapping defined by $F(x, y, z, t)=(x-y+z+t,\ x+2z-t,\ x+y+3z-3t)$ **[10]**
Find basis and dimension of image of F and kernel of F.

OR

Q.3 Show that linear operator T on R^3 is nonsingular and find a formula for T^{-1}, where $T(x, y, z)=(x-3y-2z,\ y-4z,\ z)$. **[10]**

Q.4 Consider the following basis of R^2 **[10]**
$E=\{e_1, e_2\}=\{(1,0),(0,1)\}$; $S=\{u_1, u_2\}=\{(1,3),(1,4)\}$
Find the change of basis matrix P from the usual basis E to S. find the change of basis matrix Q from S back to E.

P.T.O.

OR

Q.4 Let G be the linear operator on R^3 defined by $G(x, y, z) = (2y + z, x - 4y, 3x)$. **[10]**
Find the matrix representation of G relative to the basis.
$S = \{w_1, w_2, w_3\} = \{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$
Verify $[G][v] = [G(v)]$ for any vector v in R^3.

Q.5 Let V be the vector space of polynomials $f(t)$ with inner product $\langle f, g \rangle = \int_{-1}^{1} f(t)g(t)dt$. Apply the Gram- Schmidt orthogonolization process to $\{1, t, t^2, t^3\}$ to find an orthogonal basis $\{f_0, f_1, f_2, f_3\}$ with integer coefficients for $P_3(t)$. **[10]**

OR

Q.5 Suppose $v = (1, 3, 5, 7)$. Find the projection of v onto W, where W is the subspace of R^4 spanned by $v_1 = (1, 1, 1, 1)$, $v_2 = (1, 2, 3, 2)$ **[10]**

Q.6 Find the Eigen values and Eigen vectors of matrix A, when **[10]**

$$A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

OR

Q.6 Verify Cayley-Hamilton theorem for the matrix A and use it to find A^4 and A^{-1}. **[10]**

$$A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$$

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