U124-331 COMP, U124-351 AIML, U124-361 CSE DS, U124-371 IoT, U124-381 CSE, U124-3101-IT

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May 2024 (ENDSEM) EXAM

F.Y. B. TECH (SEMESTER - II)

COURSE NAME: Linear Algebra Branch: Common COURSE CODE: BS10231

(PATTERN 2023)

Time: [1Hr. 30 Min] **[Max. Marks: 40]**

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data wherever required**
4) **All questions are compulsory. Solve any one sub question from Question 3 and any two sub questions each from Questions 4 ,5 and 6 respectively.**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Find solution of Non homogenous equations $y + 2z = 2$ $x + 3y = 3$ $x - 6z = -3$	[2]	CO1	Understand
Q.2	a) Find Column space basis of the matrix $A = \begin{bmatrix} 0 & 0 & 1 & 4 \\ 0 & 1 & 1 & 1 \\ 0 & 2 & 3 & 6 \end{bmatrix}$	[2]	CO2	Understand
Q.3	a) Does the Linear Transformation $T\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6x - 3y + 9z \\ 2x - y + 3z \\ 2x - y + 3z \end{bmatrix}$ Regular? Find Basis and dimensions of Kernel of Linear Transformation.	[6]	CO3	Remember
	b) Verify whether the Linear Transformation $T\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \frac{2}{3}x + \frac{2}{3}y + \frac{1}{3}z \\ \frac{2}{3}x - \frac{1}{3}y + \frac{2}{3}z \\ -\frac{1}{3}x + \frac{2}{3}y + \frac{2}{3}z \end{bmatrix}$ is orthogonal? Also determine basis and dimensions of Image of Linear Transform.	[6]	CO3	Remember
Q.4	a) Apply the Gram-Schmidt orthogonalization process to find orthogonal basis, for the set of the vectors $S = \left\{ \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix} \right\}$	[5]	CO4	Apply

	b) For the vectors $v_1 = t$, $v_2 = t^2$, $v_3 = t^3$ with the inner product $\langle v_i \quad v_j\rangle = \int_{-1}^{1} v_i v_j dt$ Find I) $\langle v_1 \quad v_2\rangle$ II) $\|\| V_3 \|\|$ III) Projection $of\ V_2\ on\ V_3$	[5]	CO4	Apply
	c) Apply the Gram-Schmidt orthogonalization process to find orthogonal basis, for the set of the vectors S= $\{v_1 = 1 + t,\ v_2 = t + t^2\}$ of polynomial space, with the inner product $\langle u, v\rangle = \int_0^1 uvdt$	[5]	CO4	Apply
Q.5	a) Find all Eigen values of the matrix A= $\begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$ and hence find Eigen Vector corresponding to maximum Eigen Value of the matrix A hence determine algebraic multiplicity and geometric multiplicity of maximum Eigen value.	[5]	CO5	Under stand
	b) For the matrix A= $\begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$ find diagonal matrix D and nonsingular matrix P so that $A = PDP^{-1}$	[5]	CO5	Under stand
	c) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & -1 & 2 \\ 2 & 1 & 3 \end{bmatrix}$ and use it find A^{-1} if it exists.	[5]	CO5	Under stand
Q.6)	a) Construct the analytic function f(z) of which the real part is $e^x cosy$ .Also find f(z) in terms of z.	[5]	CO6	Apply
	b) If $w = \phi + i\Psi$ represent the complex potential for an electric field and $\Psi = x^2 - y^2$ then determine the harmonic function ϕ . Also, express w in terms of z.	[5]	CO6	Apply
	c)$Evaluate\ \oint_C \oint \frac{sin2z}{\left(z-\frac{\pi}{2}\right)^2} dz\ \ where\ C\ is\ the\ Ellipse\ \frac{x^2}{25} + \frac{y^2}{16} = 1$	[5]	CO6	Apply