School of Computing Science and Engineering

B.Tech CSE
ETE - Jun 2023

Time : 3 Hours **Marks : 100**

Sem II - C1UC220T/BBS01T1003/BMA201/MATH1006
Linear Algebra and Differential Equations
Your answer should be specific to the question asked
Draw neat labeled diagrams wherever necessary

1.	Determine whether or not the vectors (1 , − 2 , 1) , (2 , 1 , − 1) , (7 ,− 4 , 1) are linearly independent.	K2 CO2	(5)
2.	Show that the set $\{q_1, q_2, q_3\}$ is an orthonormal in R^3 if $q_1 = \left(\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right), q_2 = \left(\frac{1}{\sqrt{2}}, 0, \frac{-1}{\sqrt{2}}\right), q_3 = \left(\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$.	K3 CO2	(5)
3.	Define Linear transformation. and check whether the mapping $T: R \to R$ be defined by $\mathrm{T(x)} = 2^{\mathrm{x}}$. Is a linear transformation.	K1 CO1	(5)
4.	Find (*a*) the characteristic polynomial of *B*, (*b*) the eigenvalues of *B*, (*c*) the eigen vectors of B and (*d*) the algebraic and geometric multiplicity of each eigenvalue. where $B = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$	K1 CO3	(10)
5)	Find the rank and nullity of the linear transformation $T: P_2 \to P_3$ defined by $T(p(x)) = xp(x)$.	K4 CO4	(10)
	OR		
	Check whether the following differential equation is exact or not. If exact then find the solution $e^y dx + (xe^y + 2y)dy = 0$	K4 CO4	(10)
6.	Find the general solution of the following differential equation: $\frac{d^2y}{dx^2} + 9y = cos2x + 2sinx$	K2 CO3	(10)
7.	Find the general solution of the Cauchy Euler equation: $x^2y'' + xy' + 4y = x$	K4 CO4	(10)
8)	Find the solution of initial value problem $u_t = u_{xx}, 0 < x < \pi, t > 0, \mathrm{u}(0,\mathrm{t}) = 0, \mathrm{u}(\pi,\mathrm{t}) = 0, \mathrm{u}(x,0) = 3\sin 2x.$	K4 CO4	(15)
	OR		
	Define vector space and show that *R(R)* is a vector space.	K4 CO4	(15)
9.	Solve the non-homogeneous differential equation by method of variation of parameter: $y'' + 10y' + 24y = e^{2x}$.	K3 CO3	(15)
10.	Determine whether *A* is diagonalizable and, if so, find an invertible matrix *P* and a diagonal matrix *D* such that $P^{-1}AP = D$ where $A = \begin{bmatrix} 5 & 2 \\ 2 & 5 \end{bmatrix}$	K3 CO4	(15)