U.S.N

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Semester End Examination; July / Aug. - 2022

Linear Algebra and Analysis

Time: 3 hrs *Max. Marks: 100*

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*

II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for a Maximum of* ***18 marks*** *from each unit.*

Q. No.	Questions	Marks	BLs	COs
	I : PART - A	**10**		
I a.	Define a Skew–symmetric matrix with example.	2	L1	CO1
b.	Define canonical form with example.	2	L1	CO2
c.	Write down Laplace equation.	2	L1	CO3
d.	Find the nature of $\sum_{n=1}^{\infty}\left(1+\frac{1}{n}\right)^{n^2}$	2	L1	CO4
e.	Define linearly dependent vectors.	2	L1	CO5
	II : PART - B	**90**		
	UNIT - I	**18**		
1 a.	i) If A is a symmetric matrix, prove that A^2 is also symmetric ii) Express $A = \begin{bmatrix} 1 & 5 & 3 \\ 7 & 9 & 0 \\ 3 & 1 & 1 \end{bmatrix}$ as a sum of symmetric and skew symmetric matrix	9	L2	CO1
b.	i) Define Hermitian, skew Hermitian and unitary matrices ii) If $A = \begin{bmatrix} -1 & 2+i & 5-3i \\ 2-i & 7 & 5i \\ 5+3i & -5i & 2 \end{bmatrix}$ verify that iA is Skew – Hermitian matrix.	9	L2	CO1
c.	Show that matrix $A = \frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ is orthogonal.	9	L2	CO1
	UNIT - II	**18**		
2 a.	Reduce the matrix A to its canonical form $A = \begin{bmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \end{bmatrix}$	9	L3	CO2
b.	Find A^{-1} by Cayley – Hamilton theorem if $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	9	L2	CO2
c.	Find the characteristic polynomial $\Delta(t)$ of $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & 1 \\ 2 & -1 & 3 \end{bmatrix}$	9	L2	CO2

Contd… 2

UNIT - III **18**

3 a.	Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to u(0,t) = 0, u(4,t) = 0, $u_t(x,0) = 0$ and $u(x,0) = x(4-x)$ by taking h = 1, k = 0.5 up to 4 steps	9	L2	CO3
b.	Solve numerically $\frac{\partial^2 u}{\partial x^2} = 0.0625\ \frac{\partial^2 u}{\partial t^2}$subjected to u(0,t) = 0, u(5-t) = 0, $u_t(x,0) = 0$, and $u(x,0) = x^2(x-5)$ by taking h = 1 for $0 \le t \le 1$	9	L2	CO3
c.	Solve$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5$, $t \ge 0$ given that $u(x, 0) = 20$, u(0,t) = 0, u(5,t) = 100. Compute u for time-step with h = 1 by crank–Nicholson method.	9	L3	CO3

UNIT - IV **18**

4 a.	Discuss the nature of the series, $$\frac{1}{4\cdot\ 7\cdot\ 10}+\frac{4}{7\cdot\ 10\cdot\ \ 13}+\frac{9}{10\cdot 13\cdot 16}+\frac{16}{13\cdot 16\cdot 19}+\cdots$$	9	L2	CO4
b.	Test for the convergence of the series $\frac{1^2}{2}+\frac{2^2}{2^2}+\frac{3^2}{2^3}+\frac{4^2}{2^4}+\cdots$	9	L3	CO4
c.	Find the nature of series $\sum_{n=1}^{\infty}\frac{1}{3^n}\left(\frac{n+1}{n}\right)^{n^2}$	9	L3	CO5

UNIT - V **18**

5 a.	Verify whether the following are subspace at set of all matrices, a vector space over R i) S = {A϶ $M_n(F)$ = V | A is a diagonal matrix} ii) S = { A϶ $M_n(F)$ = V | A is a upper triangular matrix}	9	L2	CO5
b.	Show that S = {(1, 2, 1) , (2, 1, 0) (1, -1, 2)} forms a basis of R^3 (R)	9	L3	CO5
c.	i) Define linearly independent vectors ii) Show that the following vectors are linearly independent in R^3 (1, 2, -1), (2, 2, 1), (1, -2, 3)	9	L3	CO5

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