SET-1

H.T No | | | | | | | | | | |

Sreenidhi Institute of Science and Technology
(An Autonomous Institution)

Regulations: **A22**

Code No: 9HC11 **Date: 16-Mar-2023 (FN)**

B.Tech I-Year I- Semester External Examination, March-2023 (Regular)
MATRIX ALGEBRA AND CALCULUS (CIVIL, ECE, CS, and IOT)

Time: 3 Hours **Max.Marks:60**

Note: *a) No additional answer sheets will be provided.*
b) All sub-parts of a question must be answered at one place only, otherwise it will not be valued.
c) Missing data can be assumed suitably.

Bloom's Cognitive Levels of Learning (BCLL)

Remember	L1	Apply	L3	Evaluate	L5
Understand	L2	Analyze	L4	Create	L6

Part - A **Max.Marks: 6x2=12**

ANSWER ALL QUESTIONS, EACH QUESTION CARRIES 2 MARKS.

		BCLL	CO(s)	Marks
1	Show that the matrix $\begin{bmatrix} 5 & 3+2i & -1 \\ 3-2i & 8 & -6i \\ -1 & 6i & 0 \end{bmatrix}$ is Hermitian.	L2	CO1	[2M]
2	Find the Eigen values of A^3, where $A=\begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{bmatrix}$	L1	CO2	[2M]
3	Write the symmetric matrix of the quadratic form $-3x^2+6y^2+z^2-10xy+7xz+12yz$	L2	CO3	[2M]
4	Calculate c value where $c \in (1, e)$, for the functions $\log x$ and $\frac{1}{x}$ defined in $(1, e)$ by using Cauchy's mean value theorem.	L2	CO4	[2M]
5	State Newton's Law of cooling.	L2	CO5	[2M]
6	Find the complementary function of the differential equation $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+5y=0$	L2	CO6	[2M]

Part – B **Max.Marks: 6x8=48**

ANSWER ALL QUESTIONS. EACH QUESTION CARRIES 8 MARKS.

			BCLL	CO(s)	Marks
7.	a)	i) Apply Gauss Jordan method to find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$	L3	CO1	[4M]
		ii) Determine the rank of the matrix $\begin{bmatrix} 1 & 1 & -1 & 1 \\ -1 & 1 & -3 & -3 \\ 1 & 0 & 1 & 2 \\ 1 & -1 & 3 & 3 \end{bmatrix}$ by reducing the matrix to Echelon form.	L3	CO1	[4M]
		OR			
	b)	Solve the system of non-homogeneous linear equations $5x_1+3x_2+7x_3=4$, $3x_1+26x_2+2x_3=9$ and $7x_1+2x_2+10x_3=5$	L3	CO1	[8M]
8.	a)	i) Apply Cayley-Hamilton theorem to find A^4 of the matrix $A=\begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$	L3	CO2	[5M]

ii) Show that the matrix $\begin{bmatrix} i & 0 & 0 \\ 0 & 0 & i \\ 0 & i & 0 \end{bmatrix}$ is unitary. L2 CO2 [3M]

OR

b) Reduce the matrix $A=\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ to diagonal form by using modal matrix of *A* L3 CO2 [8M]

9. a) i) Discuss the rank and nature of the Quadratic form $x_1^2-x_2^2+4x_3^2+4x_1x_2+6x_1x_3+2x_2x_3$ using Eigen values of the matrix of quadratic form. L2 CO3 [4M]

ii) Reduce the quadratic form $x_1^2+x_2^2+2x_3^2-2x_1x_2+4x_1x_3+4x_2x_3$ to sum of the squares form by applying Lagrange's reduction. L3 CO3 [4M]

OR

b) By applying orthogonal transformation, reduce the quadratic form $x_1^2+3x_2^2+3x_3^2-2x_2x_3$ to canonical form and also find rank, index and nature of the quadratic form. L4 CO3 [8M]

10. a) i) Verify Rolle's theorem for the function $\frac{\sin x}{e^x}$ in $(0,\pi)$ L3 CO4 [4M]

ii) Write the series expansion of $f(x)=\log(1+x)$ in powers of x. L2 CO4 [4M]

OR

b) Apply Lagrange's mean value theorem to prove that $\frac{\pi}{3}-\frac{1}{5\sqrt{3}}>\cos^{-1}\frac{3}{5}>\frac{\pi}{3}-\frac{1}{8}$ L3 CO4 [8M]

11. a) i) Solve the first order non-exact differential equation $2xy\,dy-\left(x^2+y^2+1\right)dx=0$ L3 CO5 [4M]

ii) The temperature of cup of milk is 92^0C when freshly poured, it is placed in a room of temperature 24^0c. In one minute it was cooled to 80^0c. Determine the time at which temperature of cup of milk drops to 65^0c. L3 CO5 [4M]

OR

b) i) Solve the first order linear differential equation $x(x-1)\frac{dy}{dx}-y=x^2(x-1)^2$ L3 CO5 [4M]

ii) Bacteria in a culture grows exponentially so that initial number has doubled in 3 hours. How many times the initial number will be present after 9 hours ? L4 CO5 [4M]

12. a) Solve the second order linear differential equation $(D^2+4)y=e^x+\sin 2x-4\cos 3x$ where $D^2=\frac{d^2}{dx^2}$ L3 CO6 [8M]

OR

b) Make use the method of variation of parameters to solve the linear differential equation $\frac{d^2y}{dx^2}-y=\frac{2}{1+e^x}$ L4 CO6 [8M]

-- 00 -- 00 –