R20 Regulation *Subject code:3B1AF*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech I Semester Supplementary Examinations, July 2025

LINEAR ALGEBRA & APPLIED CALCULUS

(Common to EEE & ME)

Maximum Marks: 70 Date: 10.07.2025 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X2M=20 Marks)		Marks	CO	BTL
1	Define orthogonal matrix.	2M	1	L1
2	Show that the system of linear equations $4x + 2y = 7$, $2x + y = 6$ has no solution.	2M	1	L1
3	If '2' is an Eigen value of the matrix $A = \begin{bmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$, find the other two Eigen values.	2M	2	L1
4	Find the nature of the Quadratic form $Q = x^2 + 2y^2 + 2z^2 - 2xy + 2xz - 2yz$.	2M	2	L1
5	Evaluate $\int_0^{\pi/2} \int_0^{\pi/2} \sin(x+y)\, dxdy$.	2M	3	L1
6	Define double integral.	2M	3	L1
7	Evaluate $\beta\left(\frac{1}{2}, \frac{1}{2}\right)$.	2M	4	L1
8	Find c using Rolle's mean value theorem for the function $f(x) = \frac{\sin x}{e^x}$.	2M	4	L1
9	If $u=e^x$, find $\frac{\partial^2 u}{\partial y \partial x}$.	2M	5	L1
10	If $x = r\cos\theta$, $y = r\sin\theta$ then find $\frac{\partial(r,\theta)}{\partial(x,y)}$.	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	Find the rank of the matrix by reducing to Normal form where $A = \begin{bmatrix} 2 & 3 & 1 & 4 \\ 5 & 2 & 3 & 0 \\ 9 & 8 & 0 & 8 \end{bmatrix}$.	10M	1	L2
	OR			
12	Investigate for what values of k the equations $x + y + z = 1$; $2x + y + 4z = k$; $4x + y + 10z = k^2$ have infinite number of solutions.	10M	1	L2

13	Verify Canley – Hamilton theorem for $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and find A^{-1} and A^4.	10M	2	L2
	OR			
14	Determine the Eigen values and Eigen vectors of the following matrices $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$.	10M	2	L2
15	Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\infty} \frac{r}{(a^2+r^2)^2} dr d\theta$.	10M	3	L2
	OR			
16	Find $\iint (x+y)^2 \, dxdy$, over the area bounded by ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.	10M	3	L2
17	Verify Rolle's mean value theorem for the function $f(x) = log \frac{x^2+ab}{x(a+b)}$ in [a,b]; a>0,b>0.	10M	4	L2
	OR			
18	S.T $\beta(m,n) = \int_0^{\infty} \frac{x^{m-1}}{(1+x)^{m+n}} dx = \int_0^{\infty} \frac{x^{n-1}}{(1+x)^{m+n}} dx$.	10M	4	L2
19	If $x = e^r sec\theta$, $y = e^r tan\theta$ then prove that $JJ^I = 1$	10M	5	L2
	OR			
20	Find the extreme values $u(x,y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$.	10M	5	L2