R25 Regulation *Subject code:5BS1AA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech I Semester Regular Examinations, January 2026

MATRICES AND CALCULUS

(Common to CE, EEE, ECE, CSE, CSE(SI&ML), CSE(DS) & IT)

Maximum Marks: 60 Date:19.01.2026 Duration: 3 hours

Note:
1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 10 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 (5X2M=10Marks)		Marks	CO	BTL
1. a	Find the value of k such that the rank of $A = \begin{bmatrix} 1 & 1 & -1 & 1 \\ 1 & -1 & k & -1 \\ 3 & 1 & 0 & 1 \end{bmatrix}$ is 2.	2M	1	L2
b	Find the Eigen values of A^2 ,if $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.	2M	2	L3
c	Write the geometrical interpretation of Rolle's Mean Value Theorem.	2M	3	L6
d	Find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$, if $u = x + y + z, v = x + y, z = z$.	2M	4	L5
e	Evaluate $\int_0^a \int_0^b (x^2 + y^2)\, dy\, dx$.	2M	5	L3

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	Find the values of 'a' and 'b' for which the equations, $x + y + z = 3, x + 2y + 2z = 6, x + 9y + az = b$ have (i) No solution (ii) A unique solution (iii) Infinite number of solutions.	10M	1	L3
	OR			
3	Solve the following system of equations by Gauss-Seidel method. $x + 10y + z = 6, 10x + y + z = 6, x + y + 10z = 6$.	10M	1	L5
4	If $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ verify Cayley-Hamilton theorem. Find A^{-1} using Cayley - Hamilton theorem.	10M	2	L3
	OR			
5	Reduce the quadratic form $2x^2 + 2y^2 + 2z^2 - 2xy - 2yz - 2zx$ to canonical form by an orthogonal reduction and hence find rank, index, signature and nature of the quadratic form.	10M	2	L5

6	If $a < b$, prove that $\frac{(b-a)}{(1+b^2)} < tan^{-1}b - tan^{-1}a < \frac{(b-a)}{(1+a^2)}$ using Lagrange's Mean value theorem. Deduce the following: (i) $\frac{\pi}{4} + \frac{3}{25} < tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$ (ii) $\frac{5\pi+4}{20} < tan^{-1}2 < \frac{\pi+2}{4}$	10M	3	L3
	OR			
7	Trace the curve $y = x^4 - 8x^3 + 22x^2 - 24x + 1$.	10M	3	L4
8	Show that the functions $u = xy + yz + zx, v = x^2 + y^2 + z^2$ and $w = x + y + z$ are functionally related. Find the relation between them.	10M	4	L5
	OR			
9	Find the maximum and minimum values of the function $f(x,y) = x^3y^2(1 - x - y)$.	10M	4	L4
10	By changing the order of integration evaluate the double integral $\int_0^a \int_{x/a}^{\sqrt{x/a}} (x^2 + y^2)\, dx\, dy$.	10M	5	L5
	OR			
11	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dx\, dydz}{\sqrt{(1-x^2-y^2-z^2)}}$ by changing to spherical polar co-ordinates.	10M	5	L5