R20 Regulation *Subject code:3B1AA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech I Semester Supplementary Examinations, July 2025

LINEAR ALGEBRA, CALCULUS & PARTIAL DIFFERENTIAL EQUATION

(CE)

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	Find the rank of the matrix $A=\begin{bmatrix}1 & 1 & 1\\ 1 & -1 & 0\\ 1 & 1 & 1\end{bmatrix}$.	2M	1	L1
2	Define symmetric matrix.	2M	1	L1
3	If 'λ' is an Eigen value of the matrix A then 'λ' is also an Eigen value of A^T.	2M	2	L1
4	Express the following quadratic form matrix notation $2x^2 + 3y^2 - 5z^2 - 2xy + 6xz - 10yz$.	2M	2	L1
5	Find c using Cauchy's mean value theorem for the function $f(x)=e^x(\sin x-\cos x)$ in $[\frac{\pi}{4}, \frac{5\pi}{4}]$.	2M	3	L1
6	Define Beta and Gamma functions.	2M	3	L1
7	If $u = e^x \sin y$, $v= e^x \cos y$, then find jacobian $\frac{\partial(u,v)}{\partial(x,y)}$.	2M	4	L1
8	Write the sufficient condition's for the existence of maxima & minima of f(x,y).	2M	4	L1
9	Form a partial differential equation for the equation $z = ax + by + ct$	2M	5	L1
10	Form a partial differential equation by eliminating the arbitrary functions from $z = f(x^2 - y^2)$	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	Define Echelon form of a matrix and Find the rank of the matrix by reducing to Echelon form where $A = \begin{bmatrix}4 & 2 & 3\\ 8 & 4 & 6\\ -2 & -1 & -1\end{bmatrix}$.	10M	1	L2
	OR			
12	Show that the only real number λ for which the system $x +2y + 3z =\lambda x$; $3x + y +2z =\lambda y$; $2x + 3y + z =\lambda z$ has non-zero solution is 6 and solve them when $\lambda =6$.	10M	1	L2

13	Determine the Eigen values and Eigen vectors of the following matrices ; $A = \begin{bmatrix} 1 & 1 & 1 \\ -1 & -3 & -3 \\ 2 & 4 & 4 \end{bmatrix}$.	10M	2	L2
	OR			
14	Reduce the following quadratic form to canonical form by orthogonal transformation $3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2xz$.	10M	2	L2
15	Find c of Cauchy's mean value theorem for $f(x) = \sqrt{x}$ and $g(x) = \frac{1}{\sqrt{x}}$ in [a,b] 0<a<b.	10M	3	L2
	OR			
16	Prove that $\int_0^1 \frac{x^{m-1}(1-x)^{n-1}}{(x+a)^{m+n}} dx = \frac{B(m,n)}{a^n(1+a)^m}$.	10M	3	L2
17	If $x = e^r sec\theta$, $y = e^r tan\theta$ then prove that $JJ^I = 1$	10M	4	L2
	OR			
18	Find the extreme values $u(x,y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$.	10M	4	L2
19	Solve $z(z^2 + xy)(px - qy) = x^4$	10M	5	L2
	OR			
20	a) Solve $p - x^2 = q + y^2$ b) Solve $yp = 2yx + \log q$.	5M 5M	5	L2