



R20 Regulation

**TKR COLLEGE OF ENGINEERING AND TECHNOLOGY**

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

Subject code: 3B1AF

**B.Tech I Semester Supplementary Examinations, January 2024**

**LINEAR ALGEBRA & APPLIED CALCULUS**  
(Common to EEE & ME)

Maximum Marks: 70

Date: 18.01.2024

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)		CO	Bloom Tx
1	Define orthogonal matrix.	CO1	L1
2	Show that the system of linear equations $4x + 2y = 7$ , $2x + y = 6$ has no solution.	CO1	L2
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.	CO2	L3
4	Find the nature of the Quadratic form $Q = x^2 + 2y^2 + 2z^2 - 2xy + 2xz - 2yz$ .	CO2	L3
5	Evaluate $\int_0^{\pi/2} \int_0^{\pi/2} \sin(x+y) dx dy$ .	CO3	L5
6	Define surface integral.	CO3	L1
7	Show that $\beta(m,n) = \beta(n,m)$ .	CO4	L3
8	Find c using Cauchy's mean value theorem for the function $f(x) = e^x$ and $g(x) = e^{-x}$ in $[a,b]$ $0 < a < b$ .	CO4	L3
9	If $f = x^2 + y^2$ , then $\frac{\partial^2 f}{\partial x \partial y}$ .	CO5	L3
10	Find the degree of the homogeneous functions $Z = \frac{\sqrt{x} + \sqrt{y}}{x+y}$ .	CO5	L3

**Part-B**

Answer All the following questions. (5X10M=50Marks)			
11	Find the rank of the matrix by reducing to Normal form were $A = \begin{bmatrix} 2 & 3 & 1 & 4 \\ 5 & 2 & 3 & 0 \\ 9 & 8 & 0 & 8 \end{bmatrix}$ [10M]	CO1	L3

	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]	CO1	L5
13	Verify Cayley – 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]	CO2	L3
	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]	CO2	L3
15	By change the order of integration, evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \sqrt{a^2-x^2-y^2} dy dx$ . [10M]	CO3	L5
	OR		
16	Evaluate the integral by transforming into polar coordinates $\int_0^a \int_0^{\sqrt{a^2-x^2}} y \sqrt{x^2 + y^2} dx dy$ . [10M]	CO3	L5
17	If $a < b$ P.T $\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b-a}{1+a^2}$ using Lagrange's mean value theorem. Deduce the following $\frac{\pi}{4} + \frac{3}{25} < \tan^{-1} \frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$ . [10M]	CO4	L4
	OR		
18	P.T $\int_0^1 \frac{x^2}{\sqrt{1-x^4}} dx \cdot \int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}$ . [10M]	CO4	L4
19	Find the extreme values of $f(x, y) = \sin x \cdot \sin y \cdot \sin(x + y)$ [10M]	CO5	L3
	OR		
20	If $u = \frac{x^2 + y^2}{\sqrt{x+y}}$ , prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{3}{2}u$ . [10M]	CO5	L3