R20 Regulation *Subject code: 3B1AA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech I Semester Supplementary Examinations, January 2024

LINEAR ALGEBRA, CALCULUS & PARTIAL DIFFERENTIAL EQUATIONS

(Civil Engineering)

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	State the conditions to find the consistency of system of non-homogeneous equations.	CO1	L1
2	For which value of 'λ' the rank of the matrix $A = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ \lambda & 13 & 10 \end{bmatrix}$ is 2.	CO1	L2
3	If A is a square matrix of order 3x3 having eigen values 1,2,-1, then find the trace of the matrix $B = A - A^{-1} + A^2$.	CO2	L3
4	Find the nature of the Quadratic form $Q = x^2 + 2y^2 + 2z^2 - 2xy + 2xz - 2yz$.	CO2	L3
5	Show that $\beta(m,n) = \beta(n,m)$.	CO3	L3
6	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.	CO3	L3
7	If u = $e^x \sin y$, v= $e^x \cos y$, then find Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$.	CO4	L3
8	Write the sufficient condition's for the existence of maxima & minima of f(x,y).	CO4	L1
9	Form a partial differential equation for the equation $(x-a)(y-b) - z^2 = x^2 + y^2$	CO5	L3
10	Solve $\frac{\partial^2 u}{\partial x \partial t} = e^{-t} \cos x$.	CO5	L3

Part-B

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

	OR		
12	For what values of μ does the following system of equations possess a nontrivial solution? Obtain the solutions for real values of μ. $3x + y - \mu z = 0; 4x - 2y - 3z = 0; 2\mu x + 4y - \mu z = 0$. [10M]	CO1	L4
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	L5
	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	Prove that if $0 < a < 1, 0 < b < 1$ and $a < b$, then $\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1}b - \sin^{-1}a < \frac{b-a}{\sqrt{1-b^2}}$ and hence, deduce that $\frac{\pi}{6} - \frac{1}{2\sqrt{3}} < \sin^{-1}\frac{1}{4} < \frac{\pi}{6} - \frac{1}{\sqrt{15}}$ [10M]	CO3	L4
	OR		
16	S.T $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma m+n}$; where m>0;n>0 [10M]	CO3	L3
17	If $x = e^r sec\theta$, $y = e^r tan\theta$ then prove that $JJ^I = 1$ [10M]	CO4	L3
	OR		
18	Find the extreme values $u(x,y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$. [10M]	CO4	L3
19	Solve $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$ [10M]	CO5	L3
	OR		
20	Solve $(x^2 + y^2)(p^2 + q^2) = 1$. [10M]	CO5	L3