R18 Regulation *Subject code:2B1AA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech I Semester Supplementary Examinations, January 2025

Mathematics-I

(Common to CE, EEE, ME, ECE, CSE & IT)

Maximum Marks: 70 Date:22.01.2025 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)

1 If A,B are invertible matrices of the same order then prove that $(AB)^{-1} = B^{-1} A^{-1}$

2 Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 8 & 7 & 0 & 5 \end{bmatrix}$

3 Prove that if λ is an Eigen value of an orthogonal matrix then $\frac{1}{\lambda}$ is also an Eigen value.

4 Is the matrix diagonalizable $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

5 State comparison test.

6 Test the series for convergence $\sum_{n=1}^{\infty} \frac{1}{n^2+1}$

7 Find du/dt if $u = x/y$ where $x = e^t$; $y = \log t$.

8 Define i) Saddle point and ii) Stationary point

9 Evaluate $\int_0^1 \int_0^2 (x^2 + y^2)\ dy.dx$

10 $\int_0^{\pi/2} \int_0^{\pi/2} \sin(x + y) dx.dy$

Part-B

Answer All the following questions. (10M X 5=50Marks)

11 Discuss for what values of λ, μ the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ have [10M]

(i) no solution (ii) a unique solution (iii) an infinite number of solutions

OR

12 Solve 2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16 by Gauss elimination method. [10M]

13 Reduce the following quadratic form to canonical form by orthogonal transformation

$$Q = 3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2xz$$ [10M]

OR

14 Show that the matrix $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ satisfy Cayley – Hamiltan theorem And hence find A^{-1}, if it exists [10M]

15 Show that the series $1 + \frac{1}{2^2} + \frac{2^2}{3^3} + \frac{3^3}{4^3} + \ldots\ldots\ldots$ is divergent [10M]

OR

16 Discuss the nature of the series $\sum \frac{3.6.9....3n.}{4.7.10....(3n+1)} \cdot \frac{5^n}{(3n+2)}$ [10M]

17 Find the extreme values of the function sin x. sin y . sin (x+y) [10M]

OR

18 Verify $JJ^1 = 1$ of the function $x = e^u \cos v, y = e^u \sin v$ [10M]

19 Change the order of integration and evaluate [10M]

$$\int_0^a \int_x^a (x^2 + y^2) dy\, dx$$

OR

20 Evaluate $\int\int\int z^2\, dx\, dy\, dz$ taken over the volume bounded by $x^2 + y^2 = a^2$, $x^2 + y^2 = z$ and z = 0 [10M]