Course Code: 1910001 **MLRITM- R19**

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INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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I B.Tech I Sem Supply End Examination, November 2020

MATHEMATICS-I

(CIVIL, EEE, MECH, ECE, CSE & IT)

Time: 2 Hours. **Max. Marks: 70**

Note: 1. Answer any FIVE questions.
2. Each question carries 14 marks and may have a, b as sub questions.

1 a) Determine the rank of the following Matrix. 7M

$$\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$

b) Apply Gauss elimination method to solve the following equations. 7M

$x+4y-z=-5,\ x+y-6z=-12,\ 3x-y-z=4$

2 Investigate the values of λ and μ so that the following system of equations $2x+3y+5z=9,\ 7x+3y-2z=8,\ 2x+3y+\lambda z=\mu$, have 14M

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

3 a) Find the Eigen values and Eigen vectors of the matrix 7M

$$A=\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}.$$

b) Using Cayley-Hamilton theorem, find the inverse of the matrix 7M

$$A=\begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}.$$

4 Test the convergence of the series 14M

$$1+\frac{2}{5}x+\frac{6}{9}x^2+\frac{14}{17}x^3+\Lambda\ +\frac{2^n-2}{2^n+1}x^{n-1}+\Lambda\ \infty(x>0).$$

5 a) Reduce the quadratic form $2xy+2xz-2yz$ to canonical form. 7M

b) Discuss the convergence of the series $\sum\frac{n^n x^n}{n!}$. 7M

6 14M

Show that $\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1} b - \sin^{-1} a < \frac{b-a}{\sqrt{1-b^2}}$, where $0 < a < b < 1$.

Hence deduce that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1}\frac{3}{5} < \frac{\pi}{6} + \frac{1}{8}$.

7 a) State and prove the relationship between Beta and Gamma Functions. 7M

b) If $u = u\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$, then show that $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} + z^2 \frac{\partial u}{\partial z} = 0$. 7M

8 A rectangular box open at the top is to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction. 14M

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