



B.Tech I Semester Supplementary Examinations, September 2023

MATHEMATICS I

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

Maximum Marks: 70

Date:29.09.2023 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. Define orthogonal matrix and prove that if 'A' is an orthogonal matrix, then  $A^{-1} = A^T$
2. Show that the system of linear equations  $4x + 2y = 7$ ,  $2x + y = 6$  has no solution.
3. Find the Eigen values of the matrix 
$$\begin{bmatrix} 2 & -1 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & -2 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$
4. Is the matrix diagonalizable  $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$
5. State comparison test.
6. Test the convergence of the series  $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n+1}}$
7. Verify  $\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial^2 f}{\partial y \partial x}$  for  $f = ax^2 + 2hxy + by^2$
8. If  $u = e^x \sin y$ ;  $v = e^x \cos y$  then find  $\frac{\partial(u,v)}{\partial(x,y)}$
9. Find the limits by change the order of integration  $\int_0^a \int_{x/a}^{\sqrt{x/a}} (x^2 + y^2) dx dy$
10. Evaluate  $\int_0^1 \int_0^1 \int_0^1 e^{x+y+z} dx dy dz$

PART B

Answer all the following questions

10Mx5=50Marks

11. Solve the following system of equations [10]  
 $2x + t - z + 3w = 8, \quad x + y + z - w = -2, \quad 3x + 2y - z = 6, \quad 4y + 3z + 2w = -8$   
 OR

12. Find the non singular matrices P and Q such that PAQ is the normal form, hence find the rank of the matrix when

$$A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & -8 \end{bmatrix} \quad [10]$$

13. Reduce the following quadratic form to canonical form by orthogonal transformation  
 $Q = 3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2xz$  [10]

OR

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

15. Test the convergence of the series  
 $x + \frac{1}{2} \frac{x^3}{3} + \frac{1.3}{2.4} \frac{x^5}{5} + \frac{1.3.5}{2.4.6} \frac{x^7}{7} + \dots +$  [10]

OR

16. Show that the series  $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \dots + \infty$  [10]

17. Verify  $JJ^1 = 1$  for the following functions  $x = u, y = u \tan v, z = w$  [10]

OR

18. A rectangular box open at the top is to have a volume of 32 cubic units, find the dimensions of the box requiring least material for its construction. [10]

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

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

OR

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