Reg. No. : | | | | | | | | | | |

Question Paper Code: 41002

B.E. / B.Tech. DEGREE EXAMINATION, AUGUST 2021

First Semester

Civil Engineering

14UMA102 - ENGINEERING MATHEMATICS – I

(Common to ALL branches)

(Regulation 2014)

Duration: 1:45 hour Maximum: 50 Marks

PART A - (10 x 2 = 20 Marks)

(Answer any ten of the following questions)

1. Two of the Eigen values of $A=\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ are 3 and 6. Find the Eigen value of A^{-1}.
2. State Cayley – Hamilton theorem and its uses.
3. Find the equation of the sphere with centre (2, 3, 5) and touches the XoY – plane.
4. Define the right circular cylinder.
5. Find the curvature of the curve $2x^2+2y^2+5x-2y+1=0$.
6. Find the envelope of the family of curve $y = mx + \frac{a}{m}$.
7. If $u = \frac{x}{y} + \frac{y}{z} + \frac{z}{x}$, then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$.
8. If $x = r\cos\theta$ and $y = r\sin\theta$, then find $\frac{\partial(r,\theta)}{\partial(x,y)}$.
9. Evalute $\int_0^{\frac{\pi}{2}} \int_0^{\sin\theta} r \, d\theta \, dr$.

10.Evaluate $\int_0^1 \int_0^2 \int_0^e dz\, dy\, dx$.

11. Verify Cayley-Hamilton theorem for the matrix $\begin{bmatrix} 5 & 3 \\ 1 & 3 \end{bmatrix}$.

12. Test the convergence of the series $\sum_1^\infty \frac{n!2^n}{n^n}$ by D'Alembert's Ratio test.

13. Find the radius of curvature of the curve $y = e^x$ at $x = 0$.

14. If $x = u^2 - v^2$ and $y = 2uv$, find the Jacobian of x and y with respect to u and v.

15. Evaluate $\int_0^2 \int_0^\pi r \sin^2\theta \, d\theta \, dr$.

PART – B (3 x 10= 30 Marks)

(Answer any three of the following questions)

16. Diagonalize the matrix by orthogonal transformation $\begin{bmatrix} 10 & -2 & -5 \\ -2 & 2 & 3 \\ -5 & 3 & 5 \end{bmatrix}$. (10)

17. Show that the sum of the series $\frac{15}{16} + \frac{15}{16} \times \frac{21}{24} + \frac{15}{16} \times \frac{21}{24} \times \frac{27}{32} + \cdots \infty = \frac{47}{9}$. (10)

18. Find the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta)$ and $y = a(1 - \cos\theta)$. (10)

19. Find the Taylor's series of $e^x \log(1 + y)$ in powers of x and y up to third degree terms. (10)

20. Change the order of integration and evaluate $\int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx$. (10)