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

Question Paper Code: 51002

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

First Semester

Civil Engineering

01UMA102 - ENGINEERING MATHEMATICS – I

(Common to ALL branches)

(Regulation 2013)

Duration: 1:45 hour Maximum: 50 Marks

PART A - (10 x 2 = 20 Marks)

(Answer any ten of the following questions)

1. State Cayley – Hamilton theorem and its uses.
2. Prove that, if A is orthogonal then A^T and A^{-1} are orthogonal.
3. Find the center and radius of the sphere $3(x^2+y^2+z^2)–2x–3y–4z–22=0$.
4. Define the right circular cylinder.
5. Find the curvature of the curve $2x^2+2y^2+5x-2y+1=0$.
6. Find the radius of curvature for $y = e^x$ at the point where it cuts the Y- axis (or) at x=0.
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. Evaluate $\int_0^1\int_0^{x^2} (x^2+y^2)dydx$.
10. Evaluate $\int_0^1\int_0^2\int_0^3 xy^2z\ dzdydx$.
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. Find the Eigen values and Eigenvectors of the matrix $A=\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$. (10)

17. Find the center, radius and area of the circle $x^2+y^2+z^2-2x-4y-6z-2=0$, $x+2y+2z=20$. (10)

18. Find the radius of curvature at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$ on the curve $x^3 + y^3 = 3axy$. (10)

19. If $u = 2xy$, $\vartheta = x^2 - y^2$ where if $x = r\cos\theta$, $y = r\sin\theta$ find $\frac{\partial(u,\vartheta)}{\partial(r,\theta)}$. (10)

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