A **Reg. No. :** | | | | | | | | | | |

Question Paper Code:91M02

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

First Semester

Civil Engineering

19UMA102- ENGINEERING MATHEMATICS I

(Common to ALL branches)

(Regulation 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The product of the Eigen values of $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is_____. CO1-U

(a) $abcd$ (b) $ad - bc$ (c) a (d) 0

2. The equation $|A - \lambda I| = 0$ is called the_____ of the matrix A. CO1-U

(a) Characteristic equation (b) Characteristic polynomial

(c) Eigen value (d) None of the above

3. The n^{th} derivative of y =f(x) at x=a is denoted by CO2-U

(a) $(y_n)_a$ (b)(y_n) (c)y_a (d) $(y_a)^n$

4. $\frac{d}{dx}\left(\frac{u}{v}\right)$ = CO2-U

(a)$\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v^2}$ (b)$\frac{v\frac{du}{dx}+u\frac{dv}{dx}}{v^2}$ (c)$\frac{v\frac{du}{dx}/u\frac{dv}{dx}}{v^2}$ (d)$\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v}$

5. The degree of the homogeneous function CO3-U

$u = \frac{x^2+y^2}{\sqrt{x}+\sqrt{y}}$ is _____

(a) 2 (b)1 (c)3/2 (d)0

6. A point at which $f(x,y)$ has neither maximum nor minimum is called CO3-U

(a) Saddle point (b) Stationary point (c) Maximum point (d) Minimum point

7. $\int (ax+b)^n \, dx$ CO4-U

(a)$\frac{(ax+b)^{n+1}}{a(n+1)}$ (b)$\frac{(ax+b)^{n-1}}{a(n-1)}$ (c)$(ax+b)^n$ (d)$\frac{(ax+b)^n}{an}$

8. $\int \sin^2 x \, dx$ = CO4-U

(a) $\frac{x}{2} - \frac{sin2x}{4}$ (b) $\cos^2 x$ (c)$x - \frac{cos2x}{2}$ (d)$\frac{x}{2} - \frac{cos2x}{4}$

9. The value of $\int_2^4 \int_1^2 \frac{dxdy}{xy}$ is _____ CO5-U

(a) log2 (b) log 2/log2 (c) 2log 2 (d) 2

10. Change the order of integration in $\int_0^\infty \int_x^\infty f(x,\ y)\ dxdy$ is_____ CO5-U

(a)$\int_0^\infty \int_x^\infty f(x,\ y)\ dxdy$ (b)$\int_0^\infty \int_0^\infty f(x,\ y)\ dxdy$

(c)$\int_0^\infty \int_0^x f(x,\ y)\ dxdy$ (d) None of the above

PART – B (5 x 2= 10 Marks)

11. State CayleyHamilton Theorem? CO1-U

12. Evaluate CO2-U

$$\lim_{x\to 1} \frac{x^3-1}{x-1}$$

13. State Euler's theorem. CO3-U

14. Evaluate CO4-U

$$\int_0^{\frac{\pi}{2}} \sin^6 x \, dx$$

15. Evaluate CO5-U

$\int_0^a \int_0^b \int_0^c dxdydz.$

PART – C (5 x 16= 80Marks)

16. (a) Use orthogonal transformation to reduce the quadratic form into canonical form CO1- App (16)

$$Q = 2x_1^2 + x_2^2 + x_3^2 + 2x_1x_2 - 2x_1x_3 - 4x_3x_2$$

Or

(b) Show that the matrix CO1- App (16)

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

satisfies its own characteristic equation and hence find A^{-1}

17. (a) (i)Find the nth derivative of CO2- App (8)

$$\frac{1}{x^2 + a^2}$$

(ii) Expand e^{cosx} by Maclaurin's series CO2- App (8)

Or

(b) Show that CO2- App (16)

$\lim_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$ for all relational values of n.

18. (a) The temperature $u(x, y, z)$ at any point in space is $u = 400xyz^2$. Find the highest temperature on surface of the sphere $x^2 + y^2 + z^2 = 1$. CO3- Ana (16)

Or

(b) (i) Expand $e^x cosy$ about $\left(0, \frac{\pi}{2}\right)$ upto third term using Taylor's series. CO3- Ana (8)

(ii) If $u = \sin^{-1}\left(\frac{x^3+y^3}{x+y}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2\tan u$. CO3- Ana (8)

19. (a) Find the relation between Beta and Gamma function. CO4-App (16)

Or

(b) Evaluate CO4-App (16)

$$\int_0^{\frac{\pi}{2}} \cos^m x \sin^n x \, dx$$

20. (a) Find the volume of the ellipsoid CO5-App (16)

$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ using integration.

Or

(b) Change the order of integration and then evaluate CO5-App (16)

$\int_0^4 \int_{\frac{x^2}{4}}^{2\sqrt{x}} xydydx$.