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Question Paper Code: 91002

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

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)

- The product of the Eigen values of $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is _____.
(a) $abcd$ (b) $ad - bc$ (c) a (d) 0 CO1- R
- The equation $|A - \lambda I| = 0$ is called the _____ of the matrix A .
(a) Characteristic equation (b) Characteristic polynomial
(c) Eigen value (d) None of the above CO1- R
- The n^{th} derivative of $y = f(x)$ at $x=a$ is denoted by
(a) $(y_n)_a$ (b) (y_n) (c) y_a (d) $(y_a)^n$ CO2- R
- $\frac{d}{dx} \left(\frac{u}{v} \right) =$
(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) $\frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v}$ CO2- R
- The degree of the homogeneous function $u = \frac{x^2 + y^2}{\sqrt{x} + \sqrt{y}}$ is _____.
(a) 2 (b) 1 (c) $3/2$ (d) 0 CO3- R

6. A point at which $f(x, y)$ has neither maximum nor minimum is called CO3- R
 (a) Saddle point (b) Stationary point (c) Maximum point (d) Minimum point
7. $\int (ax + b)^n dx$ CO4- R
 (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- R
 (a) $\frac{x}{2} - \frac{\sin 2x}{4}$ (b) $\cos^2 x$ (c) $x - \frac{\cos 2x}{2}$ (d) $\frac{x}{2} - \frac{\cos 2x}{4}$
9. The value of $\int_2^4 \int_1^2 \frac{dx dy}{xy}$ is _____ CO5- R
 (a) $\log 2$ (b) $\log 2 / \log 2$ (c) $2 \log 2$ (d) 2
10. Change the order of integration in $\int_0^\infty \int_x^\infty f(x, y) dx dy$ is _____ CO5- R
 (a) $\int_0^\infty \int_x^\infty f(x, y) dx dy$ (b) $\int_0^\infty \int_0^\infty f(x, y) dx dy$
 (c) $\int_0^\infty \int_0^x f(x, y) dx dy$ (d) None of the above

PART – B (5 x 2= 10 Marks)

11. State Cayley Hamilton Theorem? CO1- R
12. Evaluate CO2- R

$$\lim_{x \rightarrow 1} \frac{x^3 - 1}{x - 1}$$
13. State Euler's theorem. CO3- R
14. Evaluate CO4- R

$$\int_0^{\frac{\pi}{2}} \sin^6 x dx$$
15. Evaluate CO5- R

$$\int_0^a \int_0^b \int_0^c dx dy dz.$$

PART – C (5 x 16= 80 Marks)

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 $e^{\cos x}$ by Maclaurin's series CO2- App (8)
- Or
- (b) Show that CO2- App (16)
- $$\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = n a^{n-1} \text{ for all relational values of } n.$$
18. (a) The temperature $u(x, y, z)$ at any point in space is CO3- Ana (16)
- $$u = 400xyz^2.$$
- Find the highest temperature on surface of the sphere $x^2 + y^2 + z^2 = 1$.
- Or
- (b) (i) Expand $e^x \cos y$ about $(0, \frac{\pi}{2})$ upto third term using Taylor's CO3- Ana (8)
- series.
- (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)
- $$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \text{ using integration.}$$
- Or

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

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