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

Question Paper Code: 41012

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

First Semester

Civil Engineering

14UMA102 - ENGINEERING MATHEMATICS – I

(Common to ALL branches)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. If 1 and 2 are the eigen values of 2x2 matrix A. what are the eigen values of A^2.

(a) 1 & 2 (b) 1 & 4 (c) 2 & 4 (d) 2 & 3

2. $\begin{vmatrix} 1 & 2 \\ 0 & 2 \end{vmatrix} =$

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

3. Is this series convergent or divergent? $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + ...$

(a) convergent (b) divergent

(c) Absolute converge (d) none of these

4. D'Alembert's test is also called

(a) Ratio test (b) Root test (c) Abel's test (d) none of these

5. The radius of curvature of the curve $y = e^x$ at (0,1) is

(a) $2\sqrt{2}$ (b) $\sqrt{2}$ (c) 2 (d) $2\sqrt{3}$

6. The envelope of the family of straight lines $2\sqrt{2}\ y = mx + am^2$, m being parameter is

(a) $y^2 = 4ax$ (b) $x^2 = 4ay$ (c) $y^2 = -4ax$ (d) $x^2 = -4ay$

7. If u = $(x-y)(y-z)(z-x)$, then $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} =$

(a) 0 (b) 1 (c) ∞ (d) none of these

8. If $x = r\cos\theta, y = r\sin\theta$, then $\frac{\partial(x,y)}{\partial(r,\theta)} =$

(a) 1 (b) r (c) r^2 (d) 0

9. $\int_0^a \int_0^b \int_0^c xyzdzdydx$

(a) $\frac{a^2b^2c^2}{8}$ (b) $\frac{abc}{8}$ (c) abc (d) $a^2b^2c^2$

10. $\int_0^1 \int_0^2 xy^2 dydx$

(a) 6/8 (b) 8/6 (c) 1/2 (d) 2

PART - B (5 x 2 = 10 Marks)

11. Find the characteristic equation of the matrix $\begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$

12. Test for convergence of the series $\sum_1^\infty \left[\sqrt[3]{n^3+1} - n\right]$.

13. Find the radius of curvature at the point (c, c) on the curve $xy = c^2$.

14. State Euler's theorem on homogeneous functions.

15. Indicate the region of integration of $\int_0^a \int_{\frac{x^2}{a}}^{x} xdydx$.

PART - C (5 x 16 = 80 Marks)

16. (a) Verify Cayley Hamilton's theorem and hence find the inverse of the matrix $\begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ (16)

Or

(b) Reduce the Q.F $x^2 + y^2 + z^2 - 2xy - 2yz - 2zx$ in to a canonical form by an orthogonal transformation. (16)

17. (a) Discuss the convergence of the series whose n[th] term is $\frac{3.6.9.....3n}{4.7.10.....3n+1}.\frac{2^n}{3n+2}$ (16)

Or

(b) Prove that if $b-1 > a > 0$, the series $1 + \frac{a}{b} + \frac{a(a+1)}{b(b+1)} + \frac{a(a+1)(a+2)}{b(b+1)(b+2)} + ...$ converges. (16)

18. (a) Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta); y = a(1 - \cos\theta)$ is $4a\cos\frac{\theta}{2}$. (16)

Or

(b) Considering the evolute as the envelope of normals, find the evolute of $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (16)

19. (a) Given the transformations $u = e^x \cos y$ *and* $v = e^x \sin y$ and that ϕ is a function of *u* and *v* and also of *x* and *y*, prove that $\frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} = (u^2 + v^2)\left[\frac{\partial^2\phi}{\partial u^2} + \frac{\partial^2\phi}{\partial v^2}\right]$. (16)

Or

(b) A rectangular box open at the top, is to have a volume of 32cc. Find the dimensions of the box, that requires the least material for its constructions. (16)

20. (a) Change the order of integration and hence evaluate it $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} xydydx$. (16)

Or

(b) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{\sqrt{x+y}} zdzdydx$. (16)