Reg. No. :

Question Paper Code: 11002

B.E./B.Tech. DEGREE EXAMINATION, NOV 2016

First Semester

Civil Engineering

01UMA102 - ENGINEERING MATHEMATICS - I

(Common to ALL Branches)

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Two eigen values of the matrix $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are equal to 1 each. Find the eigen values of A^{-1}.

2. Verify Cayley-Hamilton theorem for the matrix $\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.

3. Find the equation of the sphere on the join of (1, 2, 3) and (0, 4, -1) as diameter.

4. Find the equation of the right circular cylinder whose axis is x = 2y = -z and radius 4.

5. Find the radius of curvature at the point $y^2 = x^3 + 8$ at (-2, 0).

6. Find the envelope of the family of straight lines $y = mx + \frac{a}{m}$.

7. If $u = \frac{y^2}{x}$ and $v = \frac{x}{y}$ then find $\frac{\partial(x, y)}{\partial(u, v)}$.

8. If $u = \frac{x}{y} + \frac{y}{z} + \frac{z}{x}$ then find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$.

9. Change the order of integration in $\int_0^\infty \int_x^\infty f(x, y)\, dx\, dy$.

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

PART – B (5 x 16 = 80marks)

11. (a) Reduce the quadratic form $8x_1^2 + 7x_2^2 + 3x_3^2 - 12x_1x_2 - 8x_2x_3 + 4x_3x_1$ to the canonical form through an orthogonal transformation and also find its nature. (16)

Or

(b) Verify Cayley Hamilton theorem and hence find A^{-1} and A^4 for the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$. (16)

12. (a) (i) Find the equation of the sphere that passes through the circle $x^2 + y^2 + z^2 - 2x + 3y - 4z + 6 = 0,\ 3x - 4y + 5z - 15 = 0$ and cuts the sphere $x^2 + y^2 + z^2 + 2x + 4y - 6z + 11 = 0$ orthogonally. (8)

(ii) Find the equation of the enveloping cylinder of the sphere $x^2 + y^2 + z^2 - 2x + 4y = 1$ having its generators parallel to the line x = y = z. (8)

Or

(b) (i) Find the equations of the tangent line to the circle $x^2 + y^2 + z^2 + 5x - 7y + 2z - 8 = 0,\ 3x - 2y + 4z + 3 = 0$ at the point (-3, 5, 4). (8)

(ii) Find the angle between the lines of intersection of the plane $x - 3y + z = 0$ and the cone $x^2 - 5y^2 + z^2 = 0$. (8)

13. (a) Find the evolute of the parabola $y^2 = 4ax$ considering as the envelope of the normals. (16)

Or

(b) Find the equation of the circle of curvature of $\sqrt{x} + \sqrt{y} = a$ at $\left(\frac{a}{4}, \frac{a}{4}\right)$. (16)

14\. (a) (i) Find the volume of the greatest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$. (8)

(ii) Expand $e^x \log(1+y)$ in powers of x and y upto terms of third degree. (8)

Or

(b) (i) If $u = x^2 + y^2 + z^2$ and $x = e^t, y = e^t \sin t, z = e^t \cos t$, find $\frac{du}{dt}$. (8)

(ii) If $x = u(1-v)$, $y = uv$, verify that $\frac{\partial(x,y)}{\partial(u,v)} \times \frac{\partial(u,v)}{\partial(x,y)} = 1$. (8)

15\. (a) (i) Change the order of integration in $\int_0^a \int_x^a (x^2+y^2)\, dy\, dx$ and hence evaluate it. (8)

(ii) Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dz\, dy\, dx$. (8)

Or

(b) (i) Evaluate $\iiint_V \sqrt{1-x^2-y^2-z^2}\, dx\, dy\, dz$, where V is the volume of the sphere $x^2+y^2+z^2=1$. (8)

(ii) Find the area bounded the curves $y = x$ and $y = x^2$. (8)