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Question Paper Code: 21519

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013

First Semester

Civil Engineering

MA 2111/MA 12/080030001 — MATHEMATICS — I

(Common to All Branches)

(Regulation 2008)

Time: Three hours

Maximum: 100 marks

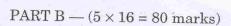
Answer ALL questions.

PART A $\sqrt{(10 \times 2)} = 20$ marks)

- 1. Find the eigen values of A^{-1} where $A = \begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$.
- 2. Write down the matrix of the quadratic form $2x^2 + 8z^2 + 4xy + 10xz 2yz$.
- 3. Find the equation of the sphere on the line joining the points (2,-3,1) and (1,-2,-1) as diameter.
- 4. Define right circular cone.
- 5. Find the radius of curvature of the curve $y = e^x$ at x = 0.
- 6. Find the envelope of the lines $\frac{x}{t} + yt = 2c$, 't' being a parameter.
- 7. Find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$ if $u = y^x$.
- 8. If $x = r \cos \theta$, $y = r \sin \theta$ find $\frac{\partial(r, \theta)}{\partial(x, y)}$.

9. Evaluate $\int_{1}^{b} \int_{1}^{a} \frac{dxdy}{xy}$.





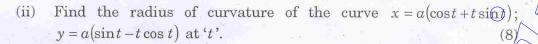
- 11. (a) (i) Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{pmatrix}.$ (8)
 - (ii) Show that the matrix $A = \begin{pmatrix} 2 & 1 & 2 \\ -1 & 2 & -1 \end{pmatrix}$ satisfies its own characteristic equation. Find also its inverse. (8)
 - (b) Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 2xy 2yz + 2zx$ into canonical form. (16)
- 12. (a) (i) Find the equation of the sphere passing through the points (4, -1, 2), (0, -2, 3), (1, 5, -1), (2, 0, 1).
 - (ii) Find the equation of the right circular cylinder whose axis is $\frac{x-1}{2} = \frac{y}{3} = \frac{z-3}{1}$ and radius '2'. (8)

Or

- (b) (i) Find the two tangent planes to the sphere $x^2 + y^2 + z^2 4x + 2y 6z + 5 = 0$ which are parallel to the plane 2x + 2y = z. Find their point of contact. (8)
 - (ii) Find the equation of the cone formed by rotating the line 2x + 3y = 5, z = 0 about the y axis. (8)
- Find the evolute of the parabola $x^2 = 4ay$. (8)
 - (ii) Find the radius of curvature of the curve $x^3 + xy^2 6y^2 = 0$ at (3,3).

Or

(b) (i) Find the centre of curvature of the curve $y = x^3 - 6x^2 + 3x + 1$ at the point (1, -1).



- 14. (a) (i) If u = xy + yz + zx where $x = \frac{1}{t}$, $y = e^t$ and $z = e^{-t}$ find $\frac{du}{dt}$. (8)
 - (ii) Test for maxima and minima of the function $f(x,y) = x^3 + y^3 12x 3y + 20$.

Or

- (b) (i) Expand $e^x \sin y$ in powers of x and y as far as the terms of the 3^{rd} degree using Taylor's expansion. (8)
 - (ii) Find the dimensions of the rectangular box, open at the top, of maximum capacity whose surface area is 432 square meter. (8)
- 15. (a) (i) Change the order of integration in $\int_{0}^{a} \frac{dx}{x^2+y^2} dx dy$ and hence evaluate it. (8)
 - (ii) Using double integral find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (8)
 - (b) (i) Evaluate $\int_{0}^{\log 2} \int_{0}^{x+\log y} e^{x+y+z} dz dy dx.$ (8)
 - (ii) Using double integral find the area bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. (8)