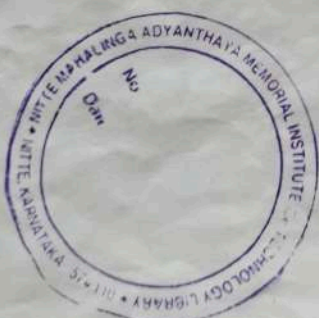


16MA101

Make up - January 2017

- a) With usual notation prove that $\tan \phi = r \frac{d\theta}{dr}$. 6 L2
- b) Find the radius of curvature ρ at any point of the cycloid $x = a(\cos t + t \sin t)$; $y = a(\sin t - t \cos t)$, $a > 0$. 7 L4
- c) State and prove Lagrange's mean value theorem. 7 L4
- a) Obtain the reduction formula $\int \cos^n x \, dx$. Hence evaluate $\int_0^{\pi/2} \cos^n x \, dx$ where n is a positive integer. 7 L2
- b) Trace the curve $xy^2 = a^2(a-x)$, $a > 0$ with explanation. 7 L1
- c) Evaluate (i) $\int_0^{\pi} x \sin^8 x \, dx$ (ii) $\int_0^{\infty} x^2 (1+x^6)^{-7/2} \, dx$. 6 L3
- a) Find the length of an arch of the cycloid $x = a(\theta - \sin \theta)$, $y = a(1 - \cos \theta)$, $a > 0$. 6 L2
- b) Determine the area of the cardioid $r = a(1 + \cos \theta)$, $a > 0$. 7 L5
- c) Obtain the volume of the solid obtained by rotating the cisoids $y^2(2a-x) = x^3$, $a > 0$ about its asymptote. 6 L2

• Bloom's Taxonomy, L* Level



Test for convergence of the series :

(i) $\sum \left(\frac{n+1}{3n} \right)^n$

(ii) $\sum_{n=1}^{\infty} \left(\frac{1}{\sqrt{n} + \sqrt{n+1}} \right)$

b) State Cauchy's integral test and use it to show that $\sum_{n=1}^{\infty} \frac{1}{n^p}$ converges for $p > 1$ and diverges for $p \leq 1$.

c) Obtain the Taylor's series of $\sin x$ in powers of $\left(x - \frac{\pi}{2} \right)$ upto terms containing

$\left(x - \frac{\pi}{2} \right)^4$.

Unit - III

a) If $u = f(7x - 3y, 3y - 4z, 4z - 7x)$, show that $\frac{1}{7} \frac{\partial u}{\partial x} + \frac{1}{3} \frac{\partial u}{\partial y} + \frac{1}{4} \frac{\partial u}{\partial z} = 0$.

b) The temperature T at any point (x, y, z) in space is $T = 400xyz^2$. Find the highest temperature on the surface of the unit sphere $x^2 + y^2 + z^2 = 1$.

c) If u is a homogeneous function of degree n in x and y , then prove that

(i) $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = nu$

(ii) $x^2 \frac{\partial^2 u}{\partial x^2} + y^2 \frac{\partial^2 u}{\partial y^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} = n(n-1)u$

a) The diameter and altitude of a can in the shape of a right circular cylinder are measured to be 4 cms and 6 cms respectively. The error in each measurement is 0.1 cm. Find the errors in the values computed for volume and lateral surface area.

b) If $x = r \cos \theta, y = r \sin \theta$, $u =$

c) Expand the function $f(x, y) = e^x \ln y$

third degree terms.

Unit - IV

d) Find the angle of intersection between the curves

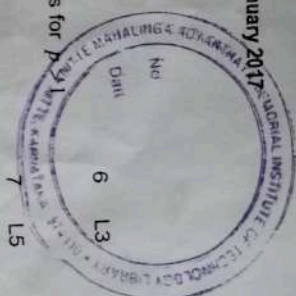
$r = \frac{a}{1+\theta^2}$

e) If $y = f(x)$ is any cartesian curve, then prove that its radius of curvature

$\rho = \frac{[1 + y'^2]^{3/2}}{y''}$ where $y_1 = y', y_2 = y''$. Hence find ρ for the curve

$x^2 + y^2 = 4x$.

f) State Cauchy's mean Value Theorem. Verify Cauchy's mean value theorem for the functions $f(x) = x^2 + 3, g(x) = x^3 + 1$ in $[1, 3]$.



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NMMAM INSTITUTE OF TECHNOLOGY, NITTE
(An Autonomous Institution affiliated to VTU, Belagavi)
First Semester B.E. (Credit System) Degree Examinations
Make up Examinations – January 2017

16MA101 – ENGINEERING MATHEMATICS - I

Max. Marks: 100

Duration: 3 Hours

Note: Answer Five full questions choosing One full question from each Unit.

Unit – I

Marks BT*

- a) Determine the rank of the following matrix

$$\begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -2 & 4 & 0 \\ 3 & -8 & 10 & -5 \\ 1 & 1 & 0 & 2 \end{bmatrix}$$

6 L*3

- b) Using the Gauss-Seidel iteration method, solve the following system of linear equations.

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Start with $x^{(0)} = y^{(0)} = z^{(0)} = 0$. Carry out three iterations.

7 L2

- c) Reduce the quadratic form
- $x^2 + 3y^2 + 3z^2 - 2zy$
- to canonical form. Also specify the matrix of the transformation.

7 L3

- a) Find
- a, b
- and
- c
- if
- $A = \frac{1}{3} \begin{bmatrix} a & -2 & 2 \\ 2 & b & 1 \\ -2 & 1 & c \end{bmatrix}$
- is an orthogonal matrix.

6 L3

- b) Using the Gauss elimination method solve

$$x + 2y + 3z = 2$$

$$2x + y - 2z = -1$$

$$3x - y - 3z = 1$$

7 L2

- c) Using the Rayleigh's power method, find the dominant eigen value and the corresponding eigen vector of the matrix
- $\begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$
- . Take the initial approximation to the eigen vector as
- $\begin{bmatrix} 1 & 0.8 & -0.8 \end{bmatrix}^T$

7 L3

Unit – II

- a) Find the
- n^{th}
- derivative of the following:

(i) $(ax+b)^m, (m > n)$

6 L1

(ii) $\log(ax+b)$

- b) Obtain the Maclaurin's expansion of
- $\log(1+x)$
- up to three non-vanishing terms.

7 L3

- c) State D'Alembert's ratio test. Examine the following series for convergence:

$$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots \infty$$

7 L4