a)	With usual notation prove that $\tan\phi = r\dfrac{d\theta}{dr}$.	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 $\int \cos^n dx$. 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(Θ-sin Θ), y=a(1-cosΘ), a>0.	6	L2
b)	Determine the area of the cardioid r=a(1+cos0), a>0 .	7	L5
c)	Obtain the volume of the solid obtained by rotating the cissoids $y^2(2a-x)=x^3$, a>0 about its asymptote.	6	L2

* Bloom's Taxonomy, L* Level

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a) Test for convergence of the series :

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

(ii) $\sum_{n=1}^{\infty}\left(\frac{1}{\sqrt{n}+\sqrt{n+1}}\right)$ 6 L3

b) State Cauchy's integral test and use it to show that $\sum\frac{1}{n^{p}}$ converges for $p>1$ and diverges for $p\le 1$. 7 L5

c) Obtain the Taylor's series of $Sinx$ in powers of $\left(x-\frac{\pi}{2}\right)$ upto terms containing $\left(x-\frac{\pi}{2}\right)^{4}$. 7 L3

Unit – III

a) If $u=f(7x-3y,3y-4z,4z-7x)$, show that $\frac{1}{7}\frac{\partial u}{\partial x}+\frac{1}{3}\frac{\partial u}{\partial y}+\frac{1}{4}\frac{\partial u}{\partial z}=0$. 6 L3

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 $x^{2}+y^{2}+z^{2}=1$. 7 L4

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) $x^{2}\frac{\partial^{2}u}{\partial x^{2}}+y^{2}\frac{\partial^{2}u}{\partial y^{2}}+2xy\frac{\partial^{2}u}{\partial x\partial y}=n(n-1)u$ 7 L3

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. 6 L4

b) If $x=r\cos\theta, y=r\sin\theta$, th... 7 L3

c) Expand the function $f(x,y)=e^{x}\log$ ... third degree terms. 7 L3

Unit – IV

a) Find the angle of intersection between the curves ... $\frac{}{1+\theta}$ and $r=\frac{a}{1+\theta^{2}}$. 6 L4

b) If $y=f(x)$ is any cartesian curve, then prove that its radius of cur... $\rho=\frac{[1+y_1^2]^{3/2}}{y_2}$ where $y_1=y'$, $y_2=y''$. Hence find ρ for the curve $x^{2}+y^{2}=4x$. 7 L4

c) 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]. 7 L2

USN

NMAM 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

...tion: 3 Hours Max. Marks: 100

*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 $[1 \quad 0.8 \quad -0.8]^T$ 7 L3

Unit – II

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

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

(ii) $\log(ax+b)$ 6 L1

b) Obtain the Maclaurin's expansion of $\log(1+x)$ up to three non- vanishing terms. 7 L3

c) State D'Alemberts ratio test. Examine the following series for convergence :

$\frac{1}{2\sqrt{1}}+\frac{x^2}{3\sqrt{2}}+\frac{x^4}{4\sqrt{3}}+\frac{x^6}{5\sqrt{4}}+\ldots\ldots\infty$ 7 L4