Make up – January 2016

Unit – IV

a) With usual notation prove that $p=\frac{\left(1+y_1^2\right)^{\frac{3}{2}}}{y_2}$ — 7 L2

b) State Cauchys Mean value theorem.Verify Cauchys Mean value theorem for $f(x)=\frac{1}{x^2}$, $g(x)=\frac{1}{x}$ in [a,b], $b>a>0$ — 7 L1 L3

c) Find the angle of intersection between the curves r=a logθ and $r=\frac{a}{\log\theta}$ — 6 L1 L3

a) State and Prove Lagranges Mean value theorem. — 7 L2

b) i)Find $\frac{ds}{d\theta}$ for the curve $r=a(1-\cos\theta)$ ii)Find $\frac{ds}{dx}$ for the curve $a\,y^2=x^3$ — 7 L1 L3

c) Find the pedal equation for $r^m=a^m \cos m\theta$ — 6 L1 L3

Unit – V

a) Obtain the reduction formula $\int \cos^n x dx$ and hence evaluate $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$ — 7 L2 L4

b) Find the area of the cardioid r=a(1-cosθ) — 7 L3

c) Evaluate i) $\int_0^{\infty} \frac{t^6}{(1+t^2)^7}dt$

ii) $\int_0^{\frac{\pi}{6}} \cos^4 3\theta \sin^3 6\theta\, d\theta$ — 6 L5

a) Trace the curve r=asin2θ — 7 L1 L4

b) Find the length of the arc of the parabola x^2=4ay measured from the vertex onto extremity of the latus-rectum. — 7 L3

c) Find the volume of the solid obtained by revolving the cissoid $y^2(2a-x)=x^3$ about its asymptote. — 6 L3

Bloom's Taxonomy, L* Level

****

b) Test for the convergence of the series (i) $\sum_{1}^{\infty} 3^n . (\frac{n}{(n+1)})^{n^2}$,

(ii) $2.3+\frac{3.4}{2^2\sqrt{2}}+\frac{4.5}{3^2\sqrt{3}}+.........\infty$

c) (i) State Leibnitz theorem.

(ii) If $y=\tan^{-1}(x)$, then show that
$(x^2+1)y_{n+2}+2x(n+1)y_{n+1}+n(n+1)y_n=0$.

4. a) Obtain the Maclaurin's series expansion of the function $f(x)=\log(1+e^x)$ upto terms containing x^4 .

b) (i) State Cauchy's integral test.

(ii) Test for the convergence of the series $\sum_{1}^{\infty} \frac{x^{(2n-2)}}{(n+1)\sqrt{n}}$.

c) Test for the convergence of the series (i) $\frac{\sqrt{2}-1}{3^3-1}+\frac{\sqrt{3}-1}{4^3-1}+\frac{\sqrt{4}-1}{5^3-1}+...............\infty$,

(ii) $1+\frac{2!}{2^2}+\frac{3!}{3^3}+........\infty$

Unit – III

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

b) The diameter and height of a right circular cone are measured as 4 cm and 6cm respectively, with a possible error of 0.1 cm. Find approximately the maximum possible error in the computed values of the volume $(=\pi r^2 h)$ and lateral surface area $(=2\pi r h)$.

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

6. a) If $u=x+y+z$, $uv=y+z$ and $uvw=z$ show that $\frac{\partial(x,y,z)}{\partial(u,v,w)}=u^2 v$.

b) If u ia a homogeneous function of degree n in x and y then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=nu$. Hence prove that $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x \partial y}+y^2\frac{\partial^2 u}{\partial y^2}=n(n-1)u$

c) Examine the function $f(x,y)=x^4+y^4-2x^2+4xy-2y^2$ for extreme values.

a) With usual

b) State Cauc
$f(x)=\frac{1}{x^2}$

c) Find the ang

a) State and Pr

b) i)Find $\frac{ds}{d\theta}$

c) Find the ped

a) Obtain the rec

b) Find the area

c) Evaluate

a) Trace the cu

b) Find the len extremity of

c) Find the volu asymptote.

Bloom's Taxonom

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 2016

15MA101 – ENGINEERING MATHEMATICS - I

ration: 3 Hours | Max. Marks: 100

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

Unit – I | Marks | BT*

a) Define the Rank of a Matrix. Find the rank of the matrix $\begin{bmatrix} 3 & 4 & 5 & 6 & 7 \\ 4 & 5 & 6 & 7 & 8 \\ 5 & 6 & 7 & 8 & 9 \\ 10 & 11 & 12 & 13 & 14 \\ 15 & 16 & 17 & 18 & 19 \end{bmatrix}$ using elementary row transformations. 7 L*1 L2

b) Check whether the system of equations
$x_1+x_2-x_3=0$
$2x_1-x_2+x_3=3$
$4x_1+2x_2-2x_3=2$ is consistent. Hence solve it by using Gauss elimination method. 7 L3

c) Check whether the linear transformation $\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ is orthogonal. 6 L3

a) Using Rayleigh's power method, obtain the largest eigen value and the corresponding eigen vector of the matrix $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$, select $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ as the initial eigen vector and carry out five iterations. 7 L5

b) If Y=AX is an orthogonal transformation with A= $\frac{1}{3}\begin{bmatrix} 1 & 2 & a \\ 2 & 1 & b \\ 2 & -2 & c \end{bmatrix}$ find a,b,c and A^{-1}. 7 L2

c) Find the spectral and modal matrix of A= $\begin{bmatrix} 5 & 3 \\ 3 & 5 \end{bmatrix}$. 6 L5

Unit – II

a) (i) State Cauchy's root test.

(ii) Test for the convergence of the series $\frac{2}{4}+\frac{2.4}{4.7}+\frac{2.4.6}{4.7.10}+........\infty$ L*

8.	a)	If ρ be the radius of curvature at any point P on the parabola $y^2=4ax$ and S be its focus then show that ρ^2 varies as $(SP)^3$	7	L3
	b)	State and prove Lagranges mean value theorem.	7	L2
	c)	Show that following curves intersect each other orthogonally $r^n=a^n \cos n\theta$, $r^n=b^n \sin n\theta$	6	L3

Unit – V

9.	a)	Obtain the reduction formula for $\int \sin^n x\,dx$. Hence evaluate $\int_0^{\pi/2} \sin^n x\,dx$ where n is a positive integer.	7	L4
	b)	Evaluate (i) $\int_0^{2a} \frac{x^3}{\sqrt{2ax-x^2}}dx$ (ii) $\int_0^{\infty} \frac{dx}{(1+x^2)^8}$	7	L5
	c)	Find the entire length of the cardioid x=a(1+cos θ).	6	L3
10.	a)	Trace the curve x=a $\cos^3 t$, y=a $\sin^3 t$.	7	L4
	b)	Find the area enclosed between one arch of the cycloid. x=a$(\theta-\sin\theta)$, y=a$(1-\cos\theta)$ and its base.	7	L3
	c)	Find the surface area generated by the revolution of the portion of the parabola y^2=4ax bounded between the vertex and the upper end of the latus rectum, about the x-axis.	6	L3

BT* Bloom's Taxonomy, L* Level

****

c) (i) State Leibnitz theorem.

(ii) If $y=(x^2-1)^n$,then show that $(x^2-1)y_{n+2}+2xy_{n+1}-n(n+1)y_n=0$.

4. a) (i) State D'Alembert's ratio test.

(ii)Test for the convergence of the series $\sum_1^{\infty}\left(\frac{n+2}{n+3}\right)^n x^n, x>0.$

b) Obtain Taylor's series expansion of $y=\tan^{-1}(x)$ at x=1 upto terms containing $(x-1)^5$

c) State Cauchy's integral test. Using Cauchy's integral test, test for convergence of the series $\sum_1^{\infty}\frac{5e^n}{e^{2n}+16}$.

Unit – III

5. a) If $u=2xy$, $v=x^2-y^2$ where $x=r\cos\theta$, $y=r\sin\theta$ find $\frac{\partial(u,v)}{\partial(r,\theta)}$.

b) State and prove Euler's theorem. If $\log u=\frac{x^3+y^3}{3x+4y}$ then show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=2u\log u$.

c) Expand $f(x,y)=(1+x-y)^{-1}$ in powers of $(x-1)$ and $(y-1)$ upto second degree terms.

6. a) Find the possible error in surface area $(=4\pi r^2)$ and volume $(=\frac{4}{3}\pi r^3)$ of a sphere of radius r, if r is measured as 18.5 inches with a possible error of 0.1 inch.

b) If $u=f(r,s,t)$ where $r=\frac{x}{y}$, $s=\frac{y}{z}$, $t=\frac{z}{x}$ then show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0.$

c) Determine the point in the plane $3x-4y+5z=50$ nearest to the origin.

Unit – IV

7. a) With usual notations prove that $\tan\phi=r\frac{d\theta}{dr}$

b) State Rolles theorem .Verify Rolles theorem for the function $f(x)=(x-a)^m(x-b)^n$ in [a,b], $b>a$ and $m,n>1$

c) Find the pedal equation of the curve $a^2=r^2\cos 2\theta$

USN | | | | | | | | | |

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester B.E. (Credit System) Degree Examinations

Supplementary Examinations - July 2016

15MA101 – ENGINEERING MATHEMATICS - I

n: 3 Hours Max. Marks: 100

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

	Marks	BT*
Unit – I		
Using Rayleigh's power method, obtain the largest eigen value and the corresponding eigen vector of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$, select $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ as the initial eigen vector and carry out five iterations.	7	L*3
) Test for consistency and solve the system of equations $2x+y+z=10$, $3x+2y+3z=18$, $x+4y+9z=16$ using Gauss elimination method.	7	L3
) If A= $\begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ 2 & 13 & 10 \end{bmatrix}$ and B= $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$ Find rank of A, rank of B and rank of A+B using elementary row transformations.	6	L3
) Show that the equations $y_1=x_1+2x_2+5x_3$, $y_2=2x_1+4x_2+11x_3$, $y_3=-x_2+2x_3$ represent a regular linear transformation. Find the inverse of this transformation.	7	L5
) Find the spectral and modal matrix of A= $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$	7	L3
Reduce the quadratic form $x_1^2+3x_2^2+3x_3^2-2x_2x_3$ into canonical form.	6	L3
Unit – II		
arison test. ergence of the series $\frac{1}{1^2}+\frac{1+2}{1^2+2^2}+\frac{1+2+3}{1^2+2^2+3^2}+\ldots\ldots\infty$	6	L3
vergence of the series (i) $\sum_1^\infty \frac{n!}{n^n}$, (ii) $\frac{3}{4}+\frac{3.6}{4.8}+\frac{3.6.9}{4.8.12}+\ldots\ldots\infty$	7	L3

Unit – V

a) Obtain the reduction formula $\int \sin^n x \, dx$. Hence evaluate $\int_0^{\frac{\pi}{2}} \sin^n x \, dx$ where n is a positive integer. 7 L3

b) Trace the curve $r = a\sin 3\theta$ 7 L3

c) Evaluate $(i)\int_0^1 x^2\left(1-x^2\right)^{\frac{3}{2}} dx \quad (ii)\int_0^2 \frac{x^4}{\sqrt{4-x^2}}dx$ 6 L3

a) Determine the area bounded by the cissoid $y^2(2a-x)=x^3$, a>0 with explanation and asymptote. 7 L5

b) Find the length of the parabola $y^2=8x$ cut off by the line $3y=8x$. 7 L3

c) Obtain the volume of the solid generated by the revolution of the cycloid $x=a(\theta-\sin\theta), y=a(1-\cos\theta)$, a>0 about its base. 6 L3

T* Bloom's Taxonomy, L* Level

****

4. a) Find the n^{th} derivative of $y=(ax+b)^m$ where $m>n$ and hence find the n^{th} derivative of $\frac{1}{ax+b}$.

b) Obtain the Taylor's series of $\sin x$ in powers of $\left(x-\frac{\pi}{2}\right)$ up to terms containing $\left(x-\frac{\pi}{2}\right)^4$.

c) Test the convergence of the following series:

$$\frac{x}{1\bullet 2}+\frac{x^2}{3\bullet 4}+\frac{x^3}{5\bullet 6}+\ldots\ldots\ldots\infty \quad (x>0)$$

Unit – III

5. a) Expand the function $f(x,y)=x^2+xy+y^2$ at (3,4) up to third degree terms.

b) If $\tan u=\left(\frac{x^3+y^3}{x-y}\right)$, then show that (i) $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$

(ii) $x^2\frac{\partial u^2}{\partial x^2}+y^2\frac{\partial u^2}{\partial y^2}+2xy\frac{\partial^2 u}{\partial x\partial y}=2\cos 3u\sin u$.

c) If $y_1=\frac{x_2x_3}{x_1}, y_2=\frac{x_3x_1}{x_2}$ and $y_3=\frac{x_1x_2}{x_3}$, find $\frac{\partial(y_1,y_2,y_3)}{\partial(x_1,x_2,x_3)}$.

6. a) Find the possible percentage error in computing the resistance r from the formula $\frac{1}{r}=\frac{1}{r_1}+\frac{1}{r_2}$, if both r_1 and r_2 are in errors by 2%.

b) A rectangular box open at the top is to have volume 32 cubic feet. Find the dimensions of the box requiring least material for its construction.

c) If $u=x+\frac{y^2}{x}, v=\frac{y^2}{x}$, then prove that $JJ'=1$.

Unit – IV

7. a) Find $\frac{ds}{d\theta}$ for the curve $r^2=a^2\cos 2\theta$.

b) If ρ is the radius of curvature at any point P on the parabola $y^2=4ax$ and S be its focus, then show that ρ^2 varies as $(SP)^3$

c) State and prove Lagrange's mean value theorem.

8. a) Find the pedal equation of the curve $\frac{2a}{r}=1-cos\theta$.

b) For a polar curve $r=f(\theta)$ prove that the radius of curvature $\rho=\frac{(r^2+r_1^2)^{\frac{3}{2}}}{r^2+2r_1^2-rr_2}$ where $r_1=f'(\theta)$, $r_2=f''(\theta)$

c) Show that the tangents drawn at the extremities of any chord of the cardioid $r=a(1+cos\theta)$ which passes through the pole are perpendicular to each other.

USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester B.E. (Credit System) Degree Examinations

November - December 2016

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) Find the modal and spectral matrix of $A=\begin{bmatrix}1 & 0 & 0\\ 0 & 3 & -1\\ 0 & -1 & 3\end{bmatrix}$ — 6 L*3

b) Using the Gauss elimination method solve
$x+2y+3z=9$
$2x+y-2z=-1$
$3x-y-3z=-4$ — 7 L2

c) Prove that the linear transformation $y_1=3x_1-3x_2+4x_3$, $y_2=2x_1-3x_2+4x_3$ and $y_3=-x_2+x_3$ is a regular linear transformation. Also find the inverse of this transformation. — 7 L3

a) Determine the rank of the following matrix $\begin{bmatrix}1 & -1 & 0 & 2\\ 2 & -1 & 2 & 5\\ 3 & -4 & -2 & 6\\ -1 & 0 & -1 & -3\end{bmatrix}$ — 6 L3

b) Reduce the quadratic form, $5x^2+2y^2+2z^2+2zy$, to canonical form. Also specify the matrix of the transformation. — 7 L2

c) Using the Rayleigh's power method, find the dominant eigen value and the corresponding eigen vector of the matrix $\begin{bmatrix}1 & 3 & -1\\ 3 & 2 & 4\\ -1 & 4 & 10\end{bmatrix}$. Take the initial approximation to the eigen vector as $[1,0,0]^T$ — 7 L3

Unit – II

a) Using Maclaurin's series obtain the expansion of $e^{\cos x}$ as far as terms containing x^4. — 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) State Cauchy's root test and examine the nature of the series:
$\sum\left(\frac{n+2}{n+3}\right)^n x^n$ where $x>0$. — 7 L3