Unit – IV

a) With usual notation prove that $\rho=\frac{\left(1+y_1^2\right)^{\frac{3}{2}}}{y_2}$. 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 $r=a\log\theta$ 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 $r=a(1-\cos\theta)$ 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 $r=a\sin 2\theta$ 7 L 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 L

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

Bloom's Taxonomy, L* Level

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

(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 is 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.

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

Make up Examinations – January 2016

15MA101 – 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) 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. L2

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

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) $\int_0^{\infty} \frac{dx}{\left(1+x^2\right)^8}$ 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

* Bloom's Taxonomy, L* Level

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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 $a^2=r^2\cos2\theta$

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

Supplementary Examinations - July 2016

15MA101 – ENGINEERING MATHEMATICS - I

: 3 Hours

Max. Marks: 100

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

Unit – I

	Marks	BT*
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

	Marks	BT*
...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 $y^2\left(2a-x\right)=x^3$, 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 $x = a\left(\theta - \sin\theta\right), y = a\left(1-\cos\theta\right)$, a>0 about its base. 6 L3

Bloom's Taxonomy, L* Level

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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.

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

November - December 2016

16MA101 – ENGINEERING MATHEMATICS - I

n: 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