Anna University Exams Nov/Dec 2015 – Regulation 2013
Rejinpaul.com Unique Important Questions – 1st Semester BE/BTECH
MA6151 MATHEMATICS –I (Question Wise Important)

UNIT 1 – MATRICES

PART A

1. One of the eigen values of $\begin{pmatrix} 7 & 4 & -4 \\ 4 & -8 & -1 \\ 4 & -1 & -8 \end{pmatrix}$ is -9. Find the other two eigen values.

2. Find the sum and product of the eigen values of the matrix $A = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{pmatrix}$.

3. State Cayley Hamilton theorem.

PART B

1. Reduce the quadratic form $2x^2 + 6y^2 + 2z^2 + 8zx$ to canonical form through an orthogonal transformation. Also discuss the nature of the form, find the Rank, Signature, Index.

2. Verify Cayley Hamilton theorem and hence find A^{-1} and A^4 for $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$.

3. Find the eigen values and eigen vectors of $\begin{bmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$.

4. Diagonalize $A = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ by an orthogonal transformation.

UNIT 2 - SEQUENCES AND SERIES

PART A

1. Discuss the nature of the series $6-10+4+6-10+4 \cdots \cdots \infty$.

2. Show that the series $1 + \frac{1}{2^2} - \frac{1}{3^2} + \frac{1}{4^2} - \frac{1}{5^2} + \cdots \ldots \ldots$ is absolutely convergent.

PART B

1. Discuss the convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \cdots \ldots \ldots \infty$

2. Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{2^n n!}{n^n}$

3. Examine the convergence of $\sum_{n=2}^{\infty} \frac{1}{n(logn)^p}$.

4. Test $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1}$ for absolute and conditional convergence

UNIT 3 – APPLICATIONS OF DIFFERENTIAL CALCULUS

PART A

1. Find the curvature of the curve $2x^2 + 2y^2 + 5x - 2y + 1 = 0$.

2. Find the envelope of the family of circles $(x - \alpha)^2 + y^2 = 4\alpha$, α being the parameter.

PART B

1. Show that the circle of curvature of $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at $\left(\frac{a}{4}, \frac{a}{4} \right)$.

2.Find the evolute of the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$.

3.Find the equation of the envelope of $\dfrac{x}{a} + \dfrac{y}{b} = 1$ where $a^n + b^n = c^n$.

4.Considering the evolute of a curve as the envelope of its normals find the evolute of $x^2 = 4ay$.

UNIT 4 – DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES

PART A

1.If $u = \log\left(\dfrac{x^3 + y^3}{x + y}\right)$, show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = 2$.

2.If $x = u(1 - v)$, $y = uv$, find $\dfrac{\partial(u,v)}{\partial(x,y)}$.

PART B

1.Expand $e^x \log(1 + y)$ in powers of x and y up to terms of 3rd degree using Taylor's expansion.

2.Examine the function $f(x, y) = x^3 y^2 (12 - x - y)$ for extreme values.

3.A rectangular box open at the top is to have a volume 32cm. Find the dimensions of the box requiring least material for its construction

4.If $u = f\left(\dfrac{x}{y}, \dfrac{y}{z}, \dfrac{z}{x}\right)$, prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$.

UNIT 5 – MULTIPLE INTEGRALS

PART A

1.Sketch the region of $\displaystyle\int_0^1 \int_0^x f(x, y)\,dy\,dx$.

2.Evaluate $\displaystyle\int_0^\pi \int_0^{\cos\theta} r\,dr\,d\theta$

3.Evaluate $\displaystyle\int_0^1 \int_0^1 \int_0^1 (4z - y)\,dz\,dy\,dx$

PART B

1.Find the volume of the ellipsoid $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1$.

2.Change the order of integration in the integral $\displaystyle\int_0^a \int_{x^2/a}^{2a-x} xy\,dy\,dx$ and hence evaluate it.

3.Show that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\dfrac{16a^2}{3}$.

4.Evaluate by changing to polar co-ordinates the integral $\displaystyle\int_0^a \int_y^a \dfrac{x^2}{\sqrt{x^2 + y^2}}\,dx\,dy$.

MA6151 MATHEMATICS –I (Topic Wise Important)

UNIT 1	MATRICES	
	PART-B TOPICS	PART-A TOPICS

	1	Reduce Quadratic form to Canonical Form	Properties of Eigen Values And Eigen vectors
	2	Verify Cayley Hamilton Theorem and hence find A^{-1} & A^4	Find Eigen Values by Properties
	3	Find Eigen values and Eigen vectors	Cayley Hamilton Theorem
	4	Diagonalisation of symmetric matrix	Index, Signature, Rank, Positive, Negative Definite.
UNIT 2		**SEQUENCES & SERIES**	
		PART-B TOPICS	**PART-A TOPICS**
	1	Comparison test	Simple problems in Comparison test, Integral test, Leibnitz Test,
	2	Integral test	
	3	De'AlembertsRatioTest	
	4	Absoulte and Conditional Convergence (Leibnitz Test)	
UNIT 3		**APPLICATION OF DIFFERENTIAL CALCULUS**	
		PART-B TOPICS	**PART-A TOPICS**
	1	Find radius of curvature, centre of curvature, circle of curvature.	Find curvature, Radius of curvature, Centre of curvature.
	2	Find evolute of parabola, ellipse, hyperbola, rectangular hyperbola, cycloid, asteroid.	Find envelope of one parameter family
	3	Find envelope of two parameter family(straight line, ellipes)	
	4	Find evolute as a envelope of normal (parabola, ellipse, hyperbola)	
UNIT 4		**FUNCTION OF SEVERAL VARIABLES**	
		PART-B TOPICS	**PART-A TOPICS**
	1	Expand by Taylor's Series	Total derivative, verify Euler's theorem, Jacobianmaritx
	2	Find maxima and minima for f(x)	
	3	Find maxima and minima for constraint (lagranges 's method)	
	4	Total derivative, verify Euler's theorem, Jacobianmaritx	
UNIT 5		**MULTIPLE INTEGRALS**	
		PART-B TOPICS	**PART-A TOPICS**
	1	Change of order of integration(Cartesian, polar coordinates)	Sketch the region
	2	Find volume of Sphere, ellipsoid, tetrahedron	Change the order of integration
	3	Find the Area (Cartesian, polar coordinates)	Simple problems in area, COI, surface area

All the Best for Exams