MATHEMATICS 2019

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) The slope of the bisector of the 1st & the 3rd qiatramt os"

a) 0
b) -1
c) 1
d) ∞

(ii) The distance of point (2,3)·from x – axis is:

a) 5
b) 3
c) 2
d) 1

(iii) The length of the tangent from the point (1,2) to the circle $x^2 + y^2 - 2 = 0$ is:

a) $\sqrt{2}$
b) 1
c) $\sqrt{6}$
d) $\sqrt{3}$

(iv) Two lines, represented by $az^2 + 2hxy + by^2 = 0$, where a, h, b are not all zero, will be orthogonal, if:

a) $a - b = 0$
b) $a + b = 0$
c) $h = 0$
d) $a = 0$

(v) The radius of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ is:

a) $\sqrt{g^2 + f^2 - c}$
b) $\sqrt{g^2 + f^2 + c}$
c) $\sqrt{g^2 - f^2 - c}$
d) $\sqrt{g^2 + f^2 - c^2}$

(vi) $\frac{d}{dx} In\, x^2 =$:

a) ax^{0-1}
b) a/x
c) $x^2 \ln x$
d) $a^2 \ln a$

(vii) The necessary condition for f(x) to have entreme value is:

a) f”(x) = 0
b) f’(x) = 0

c) f (x) = 0
d) f' (x) = 1

(viii) $\int x^{-1}\, dx =$:
a) Xo + c
b) 1/x + c
c) $1/x^1$ + c
d) In x + c

(ix) $\int cosec^2\, x\, dx =$:
a) -cosecx + c
b) -cot x + c
c) Cos ecx cot x + c
d) In cot x + c

(x) The distance between foci of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is:
a) $\frac{2a}{e}$
b) 2a
c) 2ae
d) $\frac{2b^2}{a}$

(xi) If e = 3/2, then the conic is a / an :
a) Circle
b) Ellipse
c) Parabola
d) hyperbola

MATHEMATICS 2019

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 10 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) The centroid of triangle, whose two vertices are (2, 4) and (3, -4), is found to be (3, 1). Find its third vertex.

OR In what ratio is the line segment joining (1, 3) and (2, 7) divided by 3x + y = 9?

(ii) Find the equation of. the line which is perpendicular to 2x + 3y + 4 = 0 and passes through (2, -1).

(iii) A line, whose y - Intercept is 1 less than its x – intercept form with the coordinate axis a triangle of area 6 square units. What is its equation?

(iv) A particle acted upon by the forces 4i + j - 3k and 3i + j – k, is displaced from the point (1, 2, 3) to point (5, 4, 1). Find the work done.

OR Calculate (a, b) for vectors a = 2i + 3j + 4k and b = i – j + k

(v) Prove that: $[\bar{a} + \bar{b} \quad \bar{b} + \bar{c} \quad \bar{c} + \bar{a}] = 2[\bar{a} \quad \bar{b} \quad \bar{c}]$

ANALYTIC GEOMETRY (CONIC SECTIONS)

3.

(i) Find the equation of the circle of radius α which passes through the two points on the x - axis which are at a distance b from the origin.

(ii) Find the equation of the parabola with focus (3, 4) and directrix x + y – 1 = 0.

(iii) Find the equation of the ellipse whose center is at (0, 0); e = 2/3 latus return of length 20/3 and major axis ls along y – axis.

(iv) Find the eccentricity, foci and directories of hyperbola $9x^3 – y^2 + 1 = 0$.

(v) The length of the kajor axis of an ellipse is 25 units and its foci are the points (± 5, 0).Find its equation.

OR Show that the eccentricities e_1 and e_2 of two conjugate hyperbolae satisfy the relation: $e_1^2 + e_2^2 = e_1^2\, e_2^2$

CALCULUS

4.

(i) Find the derivative, by the first principle at any point x = α in the domain D(*f*) of the function $f(x) = \cos^2 x$ OR $f(x) = x^{2/3}$

(ii) Evaluate any two of the following:

(a) $\lim_{x \to 0} \frac{1-\cos x}{x^2}$ (b) $\lim_{x \to \infty} \frac{x^2 - 5x + 2}{5x^2 + 6x - 4}$

(c) $\lim_{x \to 0} \frac{3e^x - e^{-x} - 2}{x}$

(iii) Find the approximate value of sin 46° using differentials.

(iv) To polynomial functions *f* and g are;· defined by $f(x) = x^2 - 3x + 4$ and g(x) = x + 1, ∀x ϵ ℜ. .Find fog. gof an show that fog ≠ gof.

OR Find the limit of the sequence $\frac{3}{2}, \frac{2}{3}, \frac{5}{4}, \frac{4}{5}, \ldots\ldots..$

(v) · solve the differential equation: $2 + 2y \frac{dy}{dx} = 1 + 3x^2$, y (2) = 1

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

Note: answer any two questions from this section:

5. Evaluate any four of the following:

(i) $\int (x^3 + 1)^{7/5} x^5\, dx$

(ii) $\int e^x \frac{1+\sin x}{1+\cos x}\, dx$

(iii) $\int_{-6}^{-3} \frac{\sqrt{x^2 - 9}}{x}\, dx$

(iv) $\int \frac{dx}{x^2 - x + 1}$

(v) $\int \frac{7x - 25}{(x-3)(x-4)}\, dx$

(vi) $\int \frac{\sec x \tan x}{a+b\sec x}\, dx$

6. (a) Find the centroid of the triangle the equation of whose sides are $12x^2 — 20xy + 7y^2 = 0$ and $2x - 3y + 4 = 0$.

(b) The Coordinates of two points A and B are (3, 4) and (5, 2) respectively. Find the coordinates of any point P if PA = PB and the area of triangle PAB is 10 square units.

7. (a) Three vertices A, B and C of a triangle are (2, 1), (5, 2) and (3, 4) respectively. Find the coordinates of the circumcenter and the radius of the circumcircle of triangle ABC.

(b) Evaluate $\frac{dy}{dx}$ of any two of the following:

(i) $\sqrt{x^2 + y^2} = \text{in}\ (x^2 - y^2)$

(ii) $y = in\left[\frac{1-x^2}{1+x^2}\right]$

(iii) $X = a\cos^2 3\theta,\ y = b\sin^2 3\theta$

OR find the relative maximum and minimum values of the function $f(x) = e^x \sin x$

MATHEMATICS 2018

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) $\lim_{x\to 0} \frac{e^x-1}{x} =$:

a) e^x
b) e
c) 1
d) 0

(ii) $\lim_{x\to 0} \frac{sincx}{x}$:

a) 1
b) 1/c
c) 0
d) c

(iii) The least upper bond (l.u.b) of $\left\{-10, -5, 8, -\frac{1}{3}, 15, 21\right\}$is:

a) -10
b) 8
c) 15
d) 21

(iv) The coordinate of centroid of the triangle whose vertices are (2, 8) (8, 2) and (9, 2) are:

a) (3, 4)
b) (19, 19)
c) $\left[\frac{19}{3} \quad \frac{19}{3}\right]$
d) $\left[\frac{1}{3} \quad \frac{1}{3}\right]$

(v) The inclination of x- axis is:

a) 90^o
b) 45^o
c) 0^o
d) 270^o

(vi) The distance of point (3, 2) from x-axis is:
a) $\sqrt{3}$ units
b) 5 units
c) 3 units
d) 2 units

(vii) If two or more straight line meet at one point, then the lines are said to be:
a) Concurrent
b) Parallel
c) Perpendicular
d) Coincident

(viii) Some of the slopes of the pair of line $ax^2 + 2hxy + by^2 = 0$ is:
a) $\frac{a}{b}$
b) $\frac{h}{b}$
c) $\frac{-h}{2a}$
d) $\frac{-2h}{b}$

(ix) $\frac{d}{dx}(\text{cosec}^{-1} y)$:
a) $\frac{-1}{y\sqrt{y^2-1}}$
b) $\frac{1}{y\sqrt{1-y^2}}$
c) $\frac{-1}{y\sqrt{1-y^2}}$
d) $\frac{1}{y\sqrt{y^2-1}}$

(x) An antiderivative of a function is also called:
a) Definite integral
b) Indefinite integral
c) Summation
d) Differential

MATHEMATICS 2018

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 10 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) Find the ratio in which y-axis divides the join of (-5, 3) and (8, 6). Also find the coordination of the point of Division.

(ii) Reduce the equation 2x -3y + 4 = 0 into:

(a) Perpendicular form

(b) Slope-intercept form

(iii) Find the coordinates of the foot of the perpendicular from (-2, 5) to 3x + y + 11= 0.

(iv) Calculate sin $(\bar{a}, \bar{b})$ for vector $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$.

OR Find cosθ, when θ is the single between the vectors $2\hat{\imath} + \hat{\jmath} + 3\hat{k}$ and $-\hat{\imath} + 4\hat{\jmath} - 2\hat{k}$.

(v) Simplify: $\left[\vec{a}, \overrightarrow{2b}, -\overrightarrow{3c}, -\overrightarrow{2a} + \vec{b} + \vec{c}\right]$

(Analytic Geometry)(Conic Sections)

3.

(i) Find the equation of the circle concentric with the circle $x^2 + y^2 + 6x - 10y + 33 = 0$ and touching the line y = 0

(ii) Prove that the product of abscissas, of the point where the straight line y = mx meets the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ Is equal to $\frac{c}{1+m^2}$.

(iii) Prove that the focal radius of the point (a, b) on the parabola $x^2 = 4ay$ equals $|a+b|$.

OR Find the equation of the parabola whose vertex is (3, 2) and the ends of focal chord are (5, 6) and (5, -2).

(iv) Find the eccentricity of the ellipse whose axes are 32 and 24.

(v) Find the equation of the rectangular hyperbola with center at (0, 0) and vertices (0 ± 3).

OR Show that the eccentricities. e_1 the e_2 conjugate hyperbolas satisfy the relation $e_1^2 + e_2^2 = e_1^2 e_2^2$

CALCULUS

4.

(i) Find the derivative, by the first principle, at x = a, in the domain D(f), of the function f(x) = sec x OR $f(x) = 3x^2 + x$.

(ii) Evaluate any two of the following:

a) $\lim_{x \to 0} \frac{1-cosx}{x^2}$

b) $\lim_{x \to 0} \frac{e^{mx} - e^{nx}}{x^2}$

c) $\lim_{x \to 0} \frac{\sqrt{1+x}-1}{x}$

(iii) Calculate $\log_{10}(10.1)$ using differentials, given that $\log_{10} e = 0.4343$.

(iv) Find the area above the x-axis under the curve $y = 2e^{3x}$, between ordinates a = 2 And b = 5.

OR Solve the differential equation: $\frac{dy}{dx} = \sqrt{x, y}, x = 100, y = 9$

(v) Let $f : \Re \_ \Re$ be defined by $f(x) = \begin{cases} 0, when\ x \in Q \\ 1, when\ x \in \Re - Q \end{cases}, Q\ being\ the\ set\ of\ rationals$

Find $f(\sqrt{3})$, $f(\pi)$, $f(\frac{1}{5})$, f(2) and the value of f at1.5.

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

Note: answer any two questions from this section:

5. Evaluate any four of the following:

i. $\int_0^2 (x^2 + bx + c) - 2/3\left(x + \frac{b}{2}\right) dx$

ii. $\int tan^{-1} x \, dx$

iii. $\int \frac{dx}{\sqrt{5+4x-x^2}}$

iv. $\int \frac{7x-25}{(x-3)(x-4)} dx$

v. $\int_0^2 \frac{y^3 \, dy}{\sqrt{16-y^2}}$

vi. $\int \frac{\sec x \, tan \, x}{a+bsecx} dx$

6. (a) The coordinates of two points A and B are (3, 4) and (5, -2) respectively. Find the coordinates of any point P if PA = PB and the area of triangle PAB is 10 square units-

OR Find the combined equation of the pair of lines through the origin which are perpendicular to the line represented by $3x^2 + 7xy + 2y^2 = 0$.

(b) Find the equation of the tangents at the end of the latus rectum of the parabola $y^2 = 4ax$

7. (a) Find the equation of the straight line which passes through the point (-3, 2) and is such that the portion of it between axes is divided by the point in the ration 1: 2.

(c) Evaluate $\frac{dy}{dx}$ of any two of the following:

(i) y = $\sqrt{a^2 - x^2}$ + in $\sqrt{1 + x^2}$

(ii) $x^y . y^x = 10$

(iii) x = int +$\sin^{-1}$ t, y = e + cos t

OR Find a right angled triangle of maximum area with a hypotenuse of length h.

MATHEMATICS 2017

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) The radius of the circle $x^2 y^2 + 2gx + 2fy + c = 0$ is:

a) $\sqrt{g^2 + f^2 + c}$
b) $\sqrt{c - g^2 - f^2}$
c) $\sqrt{g^2 - f^2 - c}$
d) $\sqrt{g + f - c}$

(ii) The length of latus rectum of the parabola $x^2 = -28y$ is:

(a) 7
(b) 28
(c) 192
(d) -7

(iii) The equations of the directories of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are:

a) x = ± a
b) y = ± a
c) x = ± a/e

d) $y = \pm 1/a$

(iv) The vertex .of the parabola $(x + 2)^2 = 4(y - 2)$ is:

a) (-2, -2)
b) (3, -2)
c) (-2, 3)
d) (-2, 2)

(v) If $b^2 = a^2 (e^1 - 1)$, then the conic is:

a) Parabola
b) Ellipse
c) Hyperbola
d) Circle

(vi) $\vec{a}.\vec{b}$ x $\vec{c}$ =:

a) $\vec{a}\vec{b}\vec{c}$
b) $\vec{a}x\vec{b}x\vec{c}$
c) $\vec{a}.\vec{b}.\vec{c}$
d) $\vec{a}\ x\ \vec{b}.\vec{c}$

(vii) If $\vec{a}$ and $\vec{b}$ are perpendicular then $\vec{a}.\vec{b}$=:

a) 1
b) -1
c) 0
d) π/2

(viii) if f(x) = sinx cosx, then f(x) is:

a) even
b) odd
c) both even and odd
d) neither even nor odd

(ix) if $f : R \longrightarrow R$ is given $f(x) = \sqrt{x}$,then f(16)=:

a) -4
b) 6
c) 4
d) 8

(x) Every liner equation represent a:

a) Straight line
b) Circle
c) Curve
d) Point

MATHEMATICS 2017

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 10 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) Prove that the points, whose coordinates are (5, 1), (1, -1) and (11, 4), lie on a straight line. Find the Intercepts made by this line on the axes.

OR Find the measure of the angle from a line with slope -2/3 to:

a) y – axis
b) x -axis.

(ii) Find .the value of k when the vertices of the triangle are the points (2, 9), (-2, 1) & (k, 3) & its area is 28 square unit

(iii) The gradient of one of the lines $ax^2 + 2hxy + by^2 = 0$ is five times that of the other. Show that $5h^2 = 9ab$.

(iv) Find the unit vector perpendicular to both of the vectors $\vec{a} = \hat{\imath} + 2\hat{\jmath} + 4\hat{k}$ and $\vec{b} = 3\hat{\imath} - 2\hat{\jmath} + 4\hat{k}$. Also calculate sine of the angle between the given vectors.

OR Find cosθ, where θ is the angle between vectors $2\hat{\imath} - \hat{\jmath} + 3\hat{k}$ and $-\hat{\imath} - 4\hat{\jmath} + 2\hat{k}$.

(v) Resolve the vector i = (6, 8, -6) in the direction of vectors p_1 = (1,-1, 2), p_2 = (2, 2, -1)and p3 = (3, 7, -7)

ANALYTIC GEOMETRY (CONIC SECTIONS)

3.

(i) Find the equation of the circle containing the points (-1, -1) and (3, 1) and with the center on the line x - y +10 = 0.

(ii) Show that lines x = 5 and y = 7 both touch the circle $x^2 + y^2 - 4x - 8y + 11 = 0$.

(iii) Find the equation of the parabola whose focus is (3, 4) and the directrix is the line x + y -1= 0.

(iv) Find the center foci and equations of directories of the hyperbola $\frac{(x+2)^2}{4} - \frac{(y-1)^2}{9} = 1$

(v) Find the eccentricity of an ellipse whose latus rectum is equal to half of its major axes.

OR The length of the major axis of an ellipse is 25 & its foci are the points (±5, 0). Find the equation of the ellipse.

CALCULUS

4.

(i) Find the derivative, by the first principle, at x = aD(f) of the function f(x)= tan x OR f(x)= sin 2x.·

(ii) Evaluate any Two of the following:

a) $\lim_{x\to 0} \frac{sin^2(\frac{x}{3})}{x^2}$

b) $\lim_{x\to 0} \frac{3e^x - e^{-x} - 2}{x}$

c) $\lim_{x\to 0} \frac{tanx - sinx}{sin^3 x}$ **OR** $\lim_{x\to 0} \left(1 + \frac{3}{t}\right)$

(iii) Calculate the approximate value of cos 46° OR cos 59° using differentials. · '

(iv) Two polynomial functions f and g are defined by f (x) = x^2 - 3x + 4 and g(x) = x + 1, ∀x ϵ R. Show that fog is not equal to gof.

(v) Find the area above x - axis, under the curve, n $\frac{x^2}{4} + \frac{y^2}{9}$ = 1 between the ordinates x = -1and x = 1.

OR Solve the differential equation: $\frac{dy}{dx} = \frac{(1+x^2)}{sin\ 3y}$

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

5. Evaluate any four of the following:

(i) $\int_{-1}^{1} \frac{3x^2+1}{(x^3+x+6)^{\frac{1}{2}}} dx$ OR $\int_{-2}^{-1} x\sqrt{2x^2+3}\, dx$ (ii) $\int \frac{x+3}{x^2+2x+5} dx$

(iii) $\int \sqrt{4-x^2}\, dx$ (Using trigonometric substitution)

(iv) $\int \frac{2x-1}{x(x-1)(x-3)} dx$

(v) $\int x^2 \tan^{-1} x\, dx$

(vi) $\int_{0}^{\pi/2} \cos^4 x\, dx$

6. **(a)** The area of a triangle is 8· square units, two of its· vertices are the points A (1,-2) and 8 (2, 3) an the third vertex C lies on the line 2x + y - 2 = 0. Find the coordinates of the vertex C.

(b) Prove that the line tx + my + n = 0 and the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2}$ have just one point in common, if $a^2 l^2 + b^2m^2 - n^2 = 0$

7. **(a)** A is two - thirds the way from (1, 10) to (-8, 4) and B is the mid-point of (0 -7) and (6, -11). Find the distance AB.

(b) Evaluate $\frac{dy}{dx}$ of any two of the following:

i. $\sqrt{x^2+y^2}$ = in ($x^2 - y^2$)

ii. y = $\cos^{-1}\left(\frac{2x}{1-x^2}\right)$

iii. x = a(θ – sinθ), y = a (1 – cosθ)

OR Find the maximum and minimum value of the function f(x) = x^3 - 9x^2 +15x + 3, ∀x ϵ ℜ.

MATHEMATICS 2016

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) If *f* : [-1, 5] R is defined by *f*(x) = x^2 then then *f*(-2) =:

(a) 4

(b) -2

(c) Undefined

(d) -4

(ii) $\lim_{x-0} \frac{e^x - 1}{x}$ =:

(a) e^z In a

(b) 1

(c) In x

(d) $\frac{1}{ln\, x}$

(iii) The slope of a straight line which bisect the first and third quadrants is:

(a) 1

(b) 0

(c) -1

(d) ∞

(iv) The area of triangle whose vertices are (0,0) , (2,0) and (4, 0) is:

(a) 8 sq. units

(b) 4 sq. units

(c) 2 sq. units

(d) 1 sq. units

(v) If the equation of a straight line is 3x - y + 5 = 0, then the point (1, 2) lies:

(a) above the line

(b) below the line

(c) on the line

(d) on both sides of the line

(vi) The radius of the circle x^2 y^2 + 2gx + 2fy + c =0 is:

a) $\sqrt{g^2 + f^2 + c}$

b) $\sqrt{c - g^2 - f^2}$

c) $\sqrt{g^2 - f^2 - c}$

d) $\sqrt{g + f - c}$

(vii) The length of latus rectum of the parabola x^2 = -28y is:

a) 7

b) 28

c) 192

d) -7

(viii) The equations of the directories of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are:

a) x = ± a

b) y = ± a

c) x = ± a/e

d) y = ± 1/a

(ix) The vertex .of the parabola $(x + 2)^2 = 4(y - 2)$ is:

a) (-2, -2)

b) (3, -2)

c) (-2, 3)

d) (-2, 2)

(x) The point of concurrency of the medians of a triangle is called:

(a) In Centre

(b) Centroid

(c) Orthocenter

(d) Circumcenter

MATHEMATICS 2016

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 10 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) Find the ratio in which y-axis divides the join of (-5, 3) and (8, 6). Also find the coordinates of the point of division.

(ii) Find the equation of the line which passes through the point (-2, -4) and has sum of Intercepts equal to 3

(iii) Find the value of k for which the two lines (k,1) x + ky -5 = 0, kx + (2k -1) y + 7 = 0 Intersect at a point lying on the axis of x.

(iv) Prove that the point (5, -7.5) lies outside the circle whose equation is $x^2 + y^2 - 4x + 2y = 44$

(v) Find the equation of a circle with center at the point (1, -1) and touching the straight line 5x + 12 = 7.

(vi) Find the equation of the parabola with focus (2, 3) and directrix y – 5 = 0.

(vii) The length of the major axis of an ellipse is 25 units and its foci are the points (±5, 0). Find its equation.

(viii) Find the eccentricity foci, directories and length of the latus rectum of the hyperbola $9x^2 - y^2 + 1 = 0$.

(ix) A particle is acted upon by constant forces $4\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $3\hat{\imath} + 4\hat{\jmath} - \hat{k}$ and its displaced from the point $\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ to the point $5\hat{\imath} + \hat{4}\jmath - 3\hat{k}$ find the work done by forces.

(x) Prove that $\left[\vec{a} + \vec{b}\,\vec{b} + \vec{c}\,\vec{c} + \vec{a}\right] = 2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

CALCULUS

Note: Attempt 3 part questions from this section.

3.

(i) Find the limit of the sequence $\frac{1.2}{3.4}, \frac{3.4}{5.6}, \frac{5.6}{7.8}, \ldots$..

(ii) Find the derivative by the first principles at x = a in the domain D(*f*) of the function *f*(x) = tan x

OR Evaluate any two of the following

(a) $\lim\limits_{x \to 0} \frac{1 - \cos x}{\sin x}$ (b) $\lim\limits_{x \to 0} \frac{3e^x - e^{-x} - 2}{x}$

(c) $\lim\limits_{x \to 1} \left[\frac{1}{1-x} - \frac{3}{1-x^3}\right]$

(iii) Fin $\frac{dy}{dx}$ of any two of the following:

a) $y = \tan^2 x + \text{incosx}$

b) $2x^2 - 3xy + y^2 = 5$

c) $x = \text{In } t + \cos t,\ y = e^t + \sin t$

(iv) Using differentials, find the approximate value of cos 44°

(xv) Evaluate any two of the following:

(a) $\int \frac{dx}{\sqrt{1+x}-\sqrt{x}}$ (b) $\int \frac{\cos \ln x \, dx}{x(3-\sin \ln x)^{1/2}}$ (c) $\int \ln x \, dx$

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

4.

(a) Find the equation of the locus of a. moving point such that the slope of line Joining the point to A (1, 3) is three times the slope of the line joining the point to 8 (3, 1).

(b) The point (2, -5) is a vertex of a square, one of whose sides lies on the line z - 2y - 7 = 0. Calculate the area of the square.

5.

(a) if $y = ae^{x} + be^{2x} + ce^{3x}$, show that $\frac{d^3y}{dx^3}$ -6 $\frac{d^3y}{dx^2}$ + 11$\frac{dy}{dx}$ -6y = 0.

(b) Find the maximum and minimum values of the function $f(x) = e^{x} \sin x$.

6. (a) Evaluate any two of them:

(i) $\int \frac{\tan x}{\ln(\cos x)} \, dx$ (ii) $\int \frac{2x}{(1-x^2)(3+x^2)}$

(iii) $\int_1^2 (x+1)\sqrt[3]{x^2+2x+2} \, dx$

OR (i) Find the area above the x-axis under the curve y = tan x between the ordinates $x = \frac{\pi}{4}$ and $x = \frac{\pi}{3}$.

(ii) Solve the differential equation $\frac{dy}{dx} = \sqrt{xy}$ where y (9) = 100.

(b). Prove that parabolas $x^2 = 4ay$ and $y^2 = 4bx$ intersect at angle $\theta = \tan^{-1} \frac{3}{2} \left[\frac{a^{\frac{1}{3}} b^{\frac{1}{3}}}{a^{\frac{2}{3}} + b^{\frac{2}{3}}} \right]$

MATHEMATICS 2015

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) If $b^2 = a^2 (1 - e^2)$, then the conic is:

a) Circle
b) Parabola
c) Hyperbola
d) Ellipse

(ii) In the parabola $y^2 = 4ax$, l4al represents:

a) Focus
b) Vertex
c) Axis
d) length of latus rectum

(iii) If vectors $\vec{a}$ and $\vec{b}$ are perpendicular, then $\vec{a}.\vec{b}$ = :

a) 1
b) -1
c) 0
d) $\pi/2$

(iv) Magnitude of a vector (1, -$\sqrt{3}, -\sqrt{5}$) is:

a) 9
b) 3
c) $\sqrt{3}$
d) $\sqrt{5}$

(v) The function f(x) = cos x is:

a) Even
b) Odd
c) Modulus
d) Inverse

(vi) If *f* : [-1, 5] R is defined by *f*(x) = x^2 then then *f*(-2) =:

a) 4
b) -2
c) Undefined
d) -4

(vii) $\lim\limits_{x-0} \frac{e^x - 1}{x}$ =:

a) e^z In a
b) 1
c) In x
d) $\frac{1}{ln\, x}$

(viii) The slope of a straight line which bisect the first and third quadrants is:

a) 1
b) 0
c) -1
d) ∞

(ix) The area of triangle whose vertices are (0,0) , (2,0) and (4, 0) is:

a) 8 sq. units
b) 4 sq. units
c) 2 sq. units
d) 1 sq. units

(x) If the equation of a straight line is 3x - y + 5 = 0, then the point (1, 2) lies:

a) above the line
b) below the line
c) on the line
d) on both sides of the line

MATHEMATICS 2015

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 7 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) Find the co-ordinates of the foot of perpendicular from (-2, 5) to 3x + y + 11 = 0.
(ii) Using slopes, prove that (12, 8), (-2, 6) and (6, 0) are the vertices of a right triangle.
(iii)Show that the points (5, 1), (1, -1) and (11, 4) lie an straight line. Find its equation.
(iv)The area of a triangle ·Is 8 square unit, two of its vertices are the points A (1,-2) and 8 (2, 3) and third vertex C lies on the line 2x + y -2 = 0. Find co-ordinates of -vertex C.
(v) Find the equation of the circle containing the points (-1, -1) and (3, 1) and the line x - y + 10 = 0 passing through the center of the circle.
(vi)Find the eccentricity of an ellipse whose length of latus rectum is half of its major axes.
(vii) Prove that the two circle $x^2 + y^2 + 2gx + c = 0$ and $x^2 + y^2 + 2fy + c = 0$ touch each other if $\frac{1}{f^2} + \frac{1}{g^2} = \frac{1}{c}$.
(viii) Find center, foci and equation of directices of hyperbola $\frac{(x-1)^2}{4} - \frac{(y-2)^2}{9} = 1$.

OR Find the equation of circle whose diameter is the length of latus rectum of parabola $x^2 = 36y$.

(ix)Find constant 'a' such that the sets of vectors $2\hat{\imath} - \hat{\jmath} + \hat{k}, \hat{\imath} + 2\hat{\jmath} - 3\hat{k}, 3\hat{\imath} + a\hat{\jmath} + 5\hat{k}$ are coplanar.

OR Calculate Sin $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$, and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$.

(x) Resolve the vector 'a' in a plane in the direction of $P_1 P_2$, where a = (9, 4), P_1 = (2, -3), P_2 = (1, 2).

CALCULUS

Note: Attempt 3 part questions from this section.

3.

(i) Find the derivative by First Principia at x = a in the domain of D(f) of f (x) = cosec x OR f (x) = $3x^2 + x$.
(ii) Evaluate any two of the following:

(a) $\lim_{x\to 0} \frac{1-\cos x}{\sin x}$ (b) $\lim_{x\to 0} \frac{\sqrt{x^2+16}-4}{x}$ (c) $\lim_{x\to\infty} \frac{2t^2-2t+1}{t^2+4}$

OR Determine the limit of the sequence $\frac{1}{1.2}, \frac{1}{2.3}, \frac{1}{3.4} \ldots\ldots$

(iii) Calculate the approximate value of $\log_{10}(10.1)$, given that $\log_{10} e = 0.4343$.
(iv) Calculate the approximate value of sin 46° by using differential.
(v) Evaluate any two of the following:

a) $\int (ax^2 + bx + c)^{-2/3} . \left[x + \frac{b}{c}\right] dx$
b) $\int cos5x. sin3x\, dx$
c) $\int \frac{x^2}{\sqrt{1-x^6}}\, dx$

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

(a) Find the equation of the two straight lines passing through (3, -2) and inclined at 60° to the line $\sqrt{3}$ x + y = 1,

(b) Find the equation of circle passing through the focus of parabola $x^2 + 8y = 0$ and foci of ellipse, $16x^2 + 25y^2 = 400$.

OR Prove that the line Ix + my + n = 0 and the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ have just one point in common if $a^2i^2 + b^2m^2 – n^2 = 0$.

4.

(a) Evaluate any two of the following:

i. $\int \frac{7x - 25}{(x-3)(x-4)}\, dx$

ii. $\int x.tan^{-1}x\, dx$

iii. $\int \frac{x^3}{\sqrt{a^2 - x^2}}\, dx$

iv. $\int_0^2 \frac{dx}{9 - x^2}$

(b) If the line y - 2 = 0, intersects the pair of lines $x^2 - 7xy + 2y^2 = 0$ in A and B and 'O' be the origin. Find the area of triangle OAB.

5.

(a) (i). Find the area under the curve y = 3 sin x between the ordinates x = 0 and x = π/3

(ii) Solve the differential equation: $\frac{dy}{dx} = x \cos^2 y$.

(b) Find the extreme value of the function *f* given by *f* (x) = x(x – 1)(x – 2), ∀x ϵ ℜ.

MATHEMATICS 2014

Time: 20 Minutes — Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1.

(i) Magnitude of the vector $\vec{a} = 3\hat{\imath} - \hat{\jmath} + 2\hat{k}$ is:

a) 13
b) $\sqrt{12}$
c) $\sqrt{14}$
d) $\sqrt{11}$

(ii) $\lim_{x\to 0} \frac{sin2x}{x}$

a) 0
b) 1
c) ½
d) 2

(iii) A function f(x) = |x| - x^2 is:

a) Odd
b) Even
c) Neither even nor odd

d) Modulus

(iv) The vertex .of the parabola $(x + 2)^2 = 4(y - 2)$ is:

a) (-2, -2)
b) (3, -2)
c) (-2, 3)
d) (-2, 2)

(v) If $b^2 = a^2 (e^1 -1)$, then the conic is:

a) Parabola
b) Ellipse
c) Hyperbola
d) Circle

(vi) $\vec{a}.\vec{b}$ x $\vec{c}$ =:

a) $\vec{a}\vec{b}\vec{c}$
b) $\vec{a}x\vec{b}x\vec{c}$
c) $\vec{a}.\vec{b}.\vec{c}$
d) $\vec{a}\ x\ \vec{b}.\vec{c}$

(vii) If $\vec{a}$ and $\vec{b}$ are perpendicular then $\vec{a}.\vec{b}$=:

a) 1
b) -1
c) 0
d) $\pi/2$

(viii) if f(x) = sinx cosx, then f(x) is:

a) even
b) odd
c) both even and odd
d) neither even nor odd

(ix) if f : R $\longrightarrow$ R is given f(x) = $\sqrt{x}$,then f(16)=:

a) -4
b) 6
c) 4
d) 8

(x) Every liner equation represent a:

a) Straight line
b) Circle
c) Curve
d) Point

MATHEMATICS 2014

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 7 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) If the line through (2, 5) and (-3, -2) is perpendicular to the through (4,-1) and (x, 3), find x.

(ii) Find the combined equation of the pair of lines through the origin which are perpendicular to the lines Represented by $6x^2 - 13xy + 6y^2 = 0$.

OR The gradient of one of the lines $ax^2 + 2hxy + by2 = 0$ is two times that of the other. Show that $8h^2 = 9ab$

(iii) Find the distance two parallel lines 5x.-12y +10 = 0 and 5x -12y -16 = 0.

(iv) Fine the equation of the parabola having focus (-5, 3) and directrix y -7 = 0 .

(v) Find _the equation of the circle which is concentric with the circle $x^2 + y2 - 8x + 12y - 12 = 0$ and passes through the point (5, 4).

(vi) Find the center, focus and eccentricity of the ellipse $\frac{(x-3)^2}{25} + \frac{(y+1)^2}{9} = 1$.

(vii) Find the equation of the hyperbola with focus (8, 0) and directrix x = 4.

(viii) A particle, acted upon by the forces 4î+j-3k and 3i -j-k is displaced from the point (1, 2, 3) to point (5, 4, 1). Find the work done.

(ix) Find the unit vector perpendicular to both the vectors î+2j+2k and 3î-2j-4k. Also find sine of the angle them.

OR Simplify: $[\bar{a}, \overline{2b} - \overline{3c}, -\overline{2a} + \bar{b} + \bar{c}]$

(x) Find- the equation of the line passing through the intersection of the lines 2x+3y+1=0, 3x-4y-5 = 0 and passing through the point (2, 1).

OR Find the equation of the locus of the points which are equidistance from the point (0, 3) and the line y + 3 = 0.

<u>CALCULUS</u>

Note: Attempt any three part question from this section.

3.

(i) Find the derivative by first principle at x = a is the domain of D(f) of f(x) = cot x OR $f(x) = 3x^3 - x$.

(ii) Evaluate any two of the following:

a) $\lim\limits_{x \to a} \frac{x^m - a^m}{x^n - a^n}$

b) $\lim\limits_{x \to a} \frac{\sqrt{x^2+16} - 4}{x}$

c) $\lim\limits_{x \to a} \frac{\tan x - \sin x}{x}$

OR Find the limit of the sequence $\frac{1.2}{3.4} + \frac{3.4}{5.6} + \frac{5.6}{7.8} + \ldots\ldots$

(iii) Find $\frac{dy}{dx}$ of any two of the following:

a) $e^x \ln y = \sin^{-1} y$

b) $\sqrt{x^2 + y^2} = \ln (x^2 - y^2)$

c) $x^y . y^x = 10$

(iv) Evaluate any two of them:

(a) $\int \left(\sqrt{x} - \frac{1}{\sqrt{x}} \right) dx$ (b) $\int x \ln x \, dx$

(c) $\int \frac{\sin(\ln x)\, dx}{x\,(3 - \cos \ln x)^{\frac{1}{2}}}$

(v) Using differential, show that $\sqrt{x} + \frac{1}{2\sqrt{x}}\,dx$. Hence, find the value of $\sqrt{3.9}$

OR Calculate an approximate value of tan 44^{o} by using differential.

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

4.

(a) Find the equation of circle passing through the focus of parabola $x^2 + 8y = 0$ and foci of ellipse $16x^2 + 25y^2 = 400$.

OR Determine the vertex, focus and the equation of directrix of $y^2 + 4y + 3x - 92 = 0$.

(b) Find the condition that conics $ax^2 + by^2 = 1$ and a! x^2 + b! y^2 = 1 cut each other orthogonally.

5.

(a) Evaluate any Two of the following:

$$(i)\int_0^1 \frac{dx}{\sqrt{4-x^2}} \qquad (ii)\int \frac{2x\,dx}{\cos^2 2x} \qquad (iii)\int \frac{\sin x\,dx}{(1+\cos x)(2+\cos x)}$$

(b) Show that the eccentricities e_1 and of two conjugate hyperbola satisfy the relation $e_1^2 + e_2^2 = e_1^2 e_2^2$.

OR If $y = \sqrt{5}x + k$ is tangent to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$. What is k?

6.

(a) (i) Solve the differential equation: $2+2y\frac{dy}{dx} = 1 + 3x^2$, y(2) = 1

OR $\frac{du}{dv} = \sqrt{u.v}$ u = 100, v= 9

(ii) Find the area under curve $y = x - \frac{5}{x^2}$ between the ordinates x =2, x = 4.

(b) Find the relative maximum and minimum value of the function sin x OR $f(x) = x^3 - 9x^2 + 15x + 3$.

MATHEMATICS 2013

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1.

(i) The slope of the bisector of the 1st & the 3rd qiatramt os"

a) 0
b) -1
c) 1
d) ∞

(ii) The distance of point (2,3)·from x – axis is:

a) 5
b) 3
c) 2

d) 1

(iii) The length of the tangent from the point (1,2) to the circle $x^2 + y^2 – 2 = 0$ is:

a) $\sqrt{2}$
b) 1
c) $\sqrt{6}$
d) $\sqrt{3}$

(iv)Two lines, represented by $az^2 + 2hxy + by^2 = 0$, where a, h, b are not all zero, will be orthogonal, if:

a) a – b = 0
b) a + b = 0
c) h = 0
d) a = 0

(v) The radius of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ is:

a) $\sqrt{g^2 + f^2 - c}$
b) $\sqrt{g^2 + f^2 + c}$
c) $\sqrt{g^2 - f^2 - c}$
d) $\sqrt{g^2 + f^2 - c^2}$

(vi)$\frac{d}{dx}\ In\ x^2 =$:

a) ax^{0-1}
b) a/x
c) x^2lnx
d) a^2 ln a

(vii) The necessary condition for f(x) to have entreme value is:

a) f”(x) = 0
b) f’(x) = 0
c) f (x) = 0
d) f’ (x) = 1

(viii) $\int x^{-1}\, dx =$:

a) Xo + c
b) 1/x + c
c) $1/x^1 + c$
d) In x + c

(ix)$\int cosec^2\, x\, dx =$:

a) -cosecx + c
b) -cot x + c
c) Cos ecx cot x + c
d) In cot x + c

(x) The distance between foci of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is:

a) $\frac{2a}{e}$
b) 2a
c) 2ae
d) $\frac{2b^2}{a}$

(xi)If e = 3/2, then the conic is a / an :
a) Circle
b) Ellipse
c) Parabola
d) hyperbola

MATHEMATICS 2013

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 7 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) If the line through (2, 5) and (-3, -2) is perpendicular to the line through (4, -1) and (x, 3), find x.

(ii) Find the equation of the line which passes through the point (-3,-4) and has the sum of intercepts equal to 1.

(iii) Find the value of K when the vertices of the triangle are the points (2, 6), (6, 3) & (4, k) and area is 15 units.

(iv) The gradient of one of the lines $ax^2 + 2hxy + by = 0$ is five times that of the other. Show that $5h^2 = 9ab$.

(v) Find equation of the circle touching each of the axes in 4th quadrant at a distance of 5 units from the origin.

(vi) Find equation of the circle which is concentric with the circle $x^2 + y^2 - 8x + 12y + 15 = 0$ and passes through the point (5, 4).

(vii) Determine the vertex, focus and equation of directrix of the curve $x^2 + 4x + 4y – 12 = 0$.

(viii) Find equation of the hyperbola having focus (8, 0) and directrix x = 4. OR Find the eccentricity, foci and equations of directories of $25x^2 + 9y^2 = 225$.

(ix) Find sin $(\bar{a}, \bar{b})$ where $\bar{a}$ = î = 3j + 4k and $\bar{b}$ = -3î - 3k.

(x) Find volume of the parallelepiped whose three adjacent edges are represented by the vectors $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}, \vec{b} = \hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $\vec{c} = 3\hat{\imath} - \hat{\jmath} + 2\hat{k}$.

CALCULUS

Note: Attempt 3 part questions from this section.

3.

(i) Find the derivative by the first principles at x = a in the domain D(*f*) of *f*(x) = sin 2x.

(ii) Evaluate any Two of the following:

(a) $\lim_{\theta \to \frac{\pi}{2}} \frac{\cot\theta - \cos\theta}{\cos^3\theta}$ (b) $\lim_{x \to 0} \frac{e^{mx} - e^{nx}}{x}, m, n \in R$

(b) $\lim_{x \to 0} \frac{x}{\sqrt{1-\cos x}}$ OR $\lim_{x \to 1} \left[\frac{1}{1-x} - \frac{3}{1-x^3}\right]$

(iii) Find $\frac{dy}{dx}$ of any two of the following:

(a) $y = e^{\sin x + \cos x}$

(b) $y = (\sin^{-1} x)^3$

(c) $y = \sqrt[5]{(x^2 + 2x + 3)}$

(iv) Evaluate any two of the following:

a) $\int \frac{dx}{\sqrt{1+x}+\sqrt{x}}$

b) $\int \frac{dx}{9 - x^2}$

c) $\int \cos 4x \cos 2x \, dx$

(v) Using diff. show that $\sqrt{x + \Delta x}$ can be approximated to $\sqrt{x} + \frac{1}{2\sqrt{x}} \Delta x$. Hence find the value of $\sqrt{9.1}$.

OR Find the nth term and the limit of the sequence: $\frac{1.3}{2.4}, \frac{3.5}{4.6}, \frac{5.7}{6.8}, \ldots$..where dot "." Represents multiplication

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

4.

(a) Equation of a curve is given by $x^2 - 2xy + y^2 + 2x - 4 = 0$, find slope of the curve at the point (2, 2).

(b) Find equation of the circle containing the (-1, -1) and (3, 1) and with the center on the line x- y + 10 = 0

5.

(a) Evaluate any Two of the following:

(i) $\int \frac{\cos x \, dx}{\sin x(2 + \sin x)}$

(ii) $\int \frac{\sec \tan x \, dx}{a + b \sec x}$

(iii) $\int_0^{\frac{\pi}{2}} \cos^4 x \, dx$

(b) Prove that line $Ix + my + n = 0$ & the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ have just one point in common if $a^2 I^2 + b^2 m^2$ - n2 = 0.

6.

(a) (i). Find the area under the curve $y = 3x^4 - 2x^3 + 1$, above x-axis and between x = 1 and x = 2.

(ii). Solve the differential equation $dy / dx = y^2 \sin x$.

(b) Find the relative maximum and relative minimum values of the function $f(x) = \frac{Inx}{x}$.

MATHEMATICS 2012

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1.

(i) If $b^2 = a^2 (e^1 -1)$, then the conic is:

a) Parabola
b) Ellipse
c) Hyperbola
d) Circle

(ii) $\vec{a}.\vec{b}$ x $\vec{c}$ =:

a) $\vec{a}\vec{b}\vec{c}$
b) $\vec{a}x\vec{b}x\vec{c}$
c) $\vec{a}.\vec{b}.\vec{c}$
d) $\vec{a}\ x\ \vec{b}.\vec{c}$

(iii) If $\vec{a}$ and $\vec{b}$ are perpendicular then $\vec{a}.\vec{b}$=:

a) 1
b) -1
c) 0
d) π/2

(iv) if f(x) = sinx cosx, then f(x) is:

a) even
b) odd
c) both even and odd
d) neither even nor odd

(v) if f : R $\longrightarrow$ R is given f(x) = $\sqrt{x}$,then f(16)=:

a) -4
b) 6
c) 4
d) 8

(vi) Every liner equation represent a:

a) Straight line
b) Circle
c) Curve
d) Point

(vii)

(viii) The radius of the circle x^2 y^2 + 2gx + 2fy + c =0 is:

a) $\sqrt{g^2 + f^2 + c}$
b) $\sqrt{c - g^2 - f^2}$
c) $\sqrt{g^2 - f^2 - c}$
d) $\sqrt{g + f - c}$

(ix) The length of latus rectum of the parabola x^2 = -28y is:

a) 7
b) 28

c) 192
d) -7

(x) The equations of the directories of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are:

a) $x = \pm a$
b) $y = \pm a$
c) $x = \pm a/e$
d) $y = \pm 1/a$

MATHEMATICS 2012

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 7 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) A straight line passes through the points A (-12, -13) and B (-2, -5). Find the point on the line whose ordinate is -1

(ii) Find the equation of a line which passes through the point (-1, 2) and has sum of equal to 2.

(iii) Find the equation of a line through the intersection of the lines $7x - 13y + 46 = 0$, $19x + 1ly - 41 = 0$ and passing through the point (3, 1) by using K-method.

(iv) The point (-2, 1) is a vertex of a rectangle whose sides lie on the lines $3x - 2y - 5 = 0$, $2x + 3y + 7 = 0$. Find area of the rectangle.

(v) Find the equation of circle concentric with the circle $x^2 + y^2 + 6x - 10y + 33 = 0$ and touching the y-axis.

(vi) Prove that the straight line $y = x + c\sqrt{2}$ touches the circle $x^2 + c^2$, and find point of contact.

(vii) Find the equation of parabola with focus (2, 3) and directrix $y - 5 = 0$.

(viii) Find the equation of ellipse whose center is at (0, 0), $e = \frac{2}{3}$, latus rectum of length $\frac{20}{3}$ and major axis is along x-axis.

OR Find the eccentricity, foci and equations of directories of hyperbola $9x^2 - y^2 + 1 = 0$.

(ix) Find the unit vector perpendicular to both the vectors $\vec{a} = \hat{\imath} + \hat{\jmath}$ and $\vec{b} = \hat{\jmath} + \hat{k}$

(x) A particle acted upon the forces $4\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $3\hat{\imath} + \hat{\jmath} - \hat{k}$ is displaced from the point P (1, 2, 3) to the point Q (5, 4, 1). Find the work done.

CALCULUS

Note: Attempt 3 questions from this section.

3.

i. Find the derivative by the first principles at any point x in the domain D(f) of the function $f(x) = \cos^2 x$.

ii. Evaluate any Two of the following:

(a) $\lim_{x \to \infty} \frac{x^2 - 5x + 2}{5x^2 + 6x - 4}$ (b) $\lim_{x \to 0} \frac{3e^x - e^{-x} - 2}{x}$

(c) $\lim_{\theta \to 0} \frac{\operatorname{cosec}\theta - \cot\theta}{\theta}$

iii. Find $\frac{dy}{dx}$ of any Two of the following:

a) $y = (1nx)^{\tan-1x}$

b) $x^y.y^x = 1$

c) $x = \sin t^3 + \cos t^3$, $y = \sin t + 2\cos^{-1} t$

iv. Evaluate any two of the following:

a) $\int \sin 4y \sin 2y \, dy$

b) $\int_o^a \frac{dx}{(x^2 + a^2)^{3/2}}$

c) $\int \frac{dy}{\sqrt{4y - y^2}}$

v. By using differentials, calculate an approximate value of cos 44°.

OR Two polynomial functions f and g are defined by $f(x) = x^2 - 3x + 4$ and $g(x) = x + 1$, $\forall x \in \Re$

Find fog; gof and show that fog ≠ gof.

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

Note attempt any two question:

4.

a) The vertices A, B and C of a triangle are (2, 1), (5, 2) & (3, 4) respectively. Find the coordinates of the circum-center and radius of the circumcircle of the triangle ABC.

b) Find the condition that conic $ax^2 + by^2 = 1$ should cut $a/x^2 + b/y^2 = 1$ orthogonally.

5.

(a) Evaluate any Two of the following:

(i) $\int \frac{dx}{x^2 + 4x + 5}$ (ii) $\int e^x \frac{1 + \sin x}{1 + \cos x} dx$

(iii) $\int \frac{\cos x \, dx}{\sin x (2 + \sin x)}$ OR $\int_0^{\pi} \tan^3 x \sec x \, dx$

(b) Prove that the angle between the conics $x^2 = 4ay$ and $y^2 = 4bx$ at a point other than the origin is:

$\theta = \tan^{-1} \frac{3}{2} \left[\frac{a^{\frac{1}{3}} b^{\frac{1}{3}}}{a^{\frac{2}{3}} b^{\frac{2}{3}}} \right]$.

6.

(a) (i) Solve the following differential equation: $2 + 2y \frac{dy}{dx} = 1 + 3x^2$, $y(2) = 1$

(ii) Find the area above x-axis under the circle $x^2 + y^2 = 4$ and the ordinates x = ½ and x = 3/2.

(b) Find the relative maximum and minimum values of the function $f(X) = 2e^x + e^{-x}$.

MATHEMATICS 2011

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) If f : [-1, 5] R is defined by $f(x) = x^2$ then then $f(-2)$ =:

a) 4
b) -2
c) Undefined
d) -4

(ii) $\lim_{x-0} \frac{e^x - 1}{x}$ =:

a) e^z In a
b) 1
c) In x
d) $\frac{1}{ln\, x}$

(iii) The slope of a straight line which bisect the first and third quadrants is:

a) 1
b) 0
c) -1
d) ∞

(iv) The area of triangle whose vertices are (0,0) , (2,0) and (4, 0) is:

a) 8 sq. units
b) 4 sq. units
c) 2 sq. units
d) 1 sq. units

(v) If the equation of a straight line is 3x - y + 5 = 0, then the point (1, 2) lies:

a) above the line
b) below the line
c) on the line
d) on both sides of the line

(vi) The radius of the circle x^2 y^2 + 2gx + 2fy + c =0 is:

a) $\sqrt{g^2 + f^2 + c}$
b) $\sqrt{c - g^2 - f^2}$
c) $\sqrt{g^2 - f^2 - c}$
d) $\sqrt{g + f - c}$

(vii) The length of latus rectum of the parabola x^2 = -28y is:

a) 7
b) 28
c) 192
d) -7

(viii) The equations of the directories of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are:

a) x = ± a
b) y = ± a

c) $x = \pm a/e$
d) $y = \pm 1/a$

(ix) The vertex .of the parabola $(x + 2)^2 = 4(y - 2)$ is:
a) (-2, -2)
b) (3, -2)
c) (-2, 3)
d) (-2, 2)

(x) The point of concurrency of the medians of a triangle is called:
a) In Centre
b) Centroid
c) Orthocenter
d) Circumcenter

MATHEMATICS 2011

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 10 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) A is two-third the way from (1, 10) to (-8, 4) and B is the midpoint of (0, -7), (6, -11). Find the distance |AB|. Find the equation of the straight line which passes through the point (3, 4) and makes intercept on the axes such that the y-intercept is twice x-intercept.

(ii) The point (2, 3) is the foot of the perpendicular dropped from the origin to a straight line. Write the equation of this line.

(iii) Find the distance between the parallel lines $3x + 4y + 10 = 0$, $+8y - 9 = 0$.

(iv) Find the equation of a circle with center at the point (1, -1) and touching the straight line $5x + 12 = 7$.

(v) Find the equation of the parabola with focus (2, 3) and directrix $y - 5 = 0$.

(vi) The length of the major axis of an ellipse is 25 units and its foci are the points (±5, 0). Find its equation.

(vii) Find the eccentricity foci, directories and length of the latus rectum of the hyperbola $9x^2 - y^2 + 1 = 0$.

(viii) A particle is acted upon by constant forces $4\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $3\hat{\imath} + 4\hat{\jmath} - \hat{k}$ and its displaced from the point $\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ to the point $5\hat{\imath} + \widehat{4\jmath} - 3\hat{k}$ find the work done by forces.

(ix) Prove that $\left[\vec{a} + \vec{b}\;\vec{b} + \vec{c}\;\vec{c} + \vec{a}\right] = 2\left[\vec{a}\;\vec{b}\;\vec{c}\right]$

(x) Find the volume of the parallelepiped whose three adjacent edges are represented by the vectors: $\underline{a} = 2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}, \underline{b} = \hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $\underline{c} = 3\hat{\imath} - \hat{\jmath} + 2\hat{k}$.

CALCULUS

Note: Attempt 3 part questions from this section.

3.

(i) Find the derivative by first principles at any point x in the domain D(f) of the function $f(x) = \cot x$.

(ii) Evaluate any two of the following:

$$(a)\ \lim_{x\to 0}\frac{1-\cos x}{x^2} \quad (b)\ \lim_{x\to 1}\left(\frac{1}{1-x}-\frac{3}{1-x^3}\right) \quad (c)\ \lim_{x\to 0}\frac{e^{\lambda x}-e^{\mu x}}{x}$$

(iii) Fin $\frac{dy}{dx}$ of any two of the following :

d) $y = \tan^2 x + \text{In}\cos x$

e) $2x^2 - 3xy + y^2 = 5$

f) $x = \text{In}\ t + \cos t,\ y = e^t + \sin t$

(iv) Using differentials, find the approximate value of cos 44°

(v) Show that $\sqrt{x + \Delta x}$ can be approximated to $\sqrt{x} + \frac{1}{2\sqrt{x}}\Delta x$. Hence find approximated value of $\sqrt{3.9}$.

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

Note attempt any two question:

4.

a) Show that the lines $x^2 - 4xy + y^2 = 0$ and $x + y = 3$ form an equilateral triangle. Also find the area of the triangle.

b) Find the equation of circle containing the point (-1, -1) and (3, 1) and with center on the line $x - y + 10 = 0$.

5.

a) Evaluate any Two of the following:

$$(I)\ \int\frac{2x\,dx}{(1+x^2)(3+x^2)} \quad (ii)\ \int\frac{x^3\,dx}{\sqrt{a^2-x^2}} \quad (iii)\ \int\frac{\sec x\tan x\,dx}{a+b\sec x}$$

b) Find the eccentricity, center, vertices and the foci of the ellipse given by the equation $4x^2 - 16x + 25y^2 + 200y + 316 = 0$.

MATHEMATICS 2010

Time: 20 Minutes Max. Marks: 20

SECTION "A"(MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given option:

(i) $\int e^{\tan x}\sec^2 x\,dx$ is:

a) $e^{\sin x} + c$

b) $e^{\sin 2x} + c$

c) $e^{\tan x} + c$

d) $\sec^2 x + c$

(ii) The least upper bond (l.u.b) of $\left\{-10, -5, 8, -\frac{1}{3}, 15, 21\right\}$is:

a) -10

b) 8

c) 15

d) 21

(iii) The coordinate of centroid of the triangle whose vertices are (2, 8) (8, 2) and (9, 2) are:

a) (3, 4)

b) (19, 19)

c) $\begin{bmatrix} \frac{19}{3} & \frac{19}{3} \end{bmatrix}$

d) $\begin{bmatrix} \frac{1}{3} & \frac{1}{3} \end{bmatrix}$

(iv) The inclination of x- axis is:

a) 90^o

b) 45^o

c) 0^o

d) 270^o

(v) The distance of point (3, 2) from x-axis is:

a) $\sqrt{3}$ units

b) 5 units

c) 3 units

d) 2 units

(vi) If two or more straight line meet at one point, then the lines are said to be:

a) Concurrent

b) Parallel

c) Perpendicular

d) Coincident

(vii) Some of the slopes of the pair of line $ax^2 + 2hxy + by^2 = 0$ is:

a) $\frac{a}{b}$

b) $\frac{h}{b}$

c) $\frac{-h}{2a}$

d) $\frac{-2h}{b}$

(viii) $\frac{d}{dx}$ ($\operatorname{cosec}^{-1}$ y):

a) $\frac{-1}{y\sqrt{y^2-1}}$

b) $\frac{1}{y\sqrt{1-y^2}}$

c) $\frac{-1}{y\sqrt{1-y^2}}$

d) $\frac{1}{y\sqrt{y^2-1}}$

(ix) An antiderivative of a function is also called:

a) Definite integral

b) Indefinite integral

c) Summation

d) Differential

(x) The equations of the directories of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are:

a) $x = \pm a$

b) $y = \pm a$

c) $x = \pm a/e$

d) $y = \pm 1/a$

MATHEMATICS 2011

Time: 2 Hours 40 Minutes Marks: 80

SECTION 'B' (SHORT - ANSWER QUESTIONS)

NOTE: Answer any 10 questions from this section. At least three question from each section.

SECTION B (Analytic Geometry) (Straight Line & Vector Algebra)

2.

(i) If the line through (2, 5) and (-3, -2) is perpendicular to the line through (4, -1) and (x, 3), find x.

(ii) Find the equation of the line which passes through the point (-3, 4) and has the sum of its equal to 1.

(iii) Find the value of k when the vertices of the triangle are (2, 6), (6, 3) and (4, k) and area is 17 square units.

(iv) The gradient of one of the lines $ax^2 + 2hxy + by^2 = 0$ is five times that of the other, show that $5b^2$ 9ab.

(v) Find the equation of the circle whose diameter is the latus rectum of the parabola $y^2 = -36x$.

(vi) Find the eccentricity, foci and equations of directories of $25x^2 + 9y^2 = 225$.

OR Find the eccentricity of the hyperbola whose latus rectum is four times that of the transverse axis.

(vii) Fine the equation of the circle touching each of the axes in 4th quadrant at a distance of 6 from the origin.

(viii) Find the equation of the circle which is concentric with the circle $x^2 + y^2 - 8x + 12y - 12 = 0$ and passes through the point (5, 4).

(ix) Prove that $\left[\bar{a}, 2\bar{b} - 3\bar{c}, -2\bar{a} + \bar{b} + \bar{c}\right]=5\left[\bar{a}, \bar{b}, \bar{c}\right]$

OR Find the scalars x, y and z such that $x(3\hat{\imath} - 4\hat{k}) + y(-\hat{\imath} + \hat{\jmath} + 2\hat{k}) + z(\hat{\imath} - 4\hat{k}) = (5\hat{\imath} + 4\hat{\jmath} - 10\hat{k})$.

CALCULAS

NOTE: Attempt 3 questions from this section.

3.

(i) Find the derivative by the 1st principles at x = a in the domain D(f) of (x) = cosec x.

(ii) Evaluate $\lim_{n \to 0} \frac{tanx - sinx}{sin^3 x}$

(iii) Find $\frac{dy}{dx}$ of any two of the following:

(a) $y = x^{sinx + cosx}$

(b) $e^x In\ y = sin^{-1} y$

(c) $x = a(\theta - sin\theta)$, $y = a(1 - cos\theta)$ at $\theta = \pi/2$

OR If y = f (x) = a cosx + b sinx, $\forall x \in \Re$, show that $\frac{d^2y}{dx^2} + y = 0$

(iv) Evaluate any two of the following:

(a) $\int x\,lnx\,dx$ (b) $\int_1^2 (3x^2+2x)\sqrt[3]{x^3+x^2+7}\ dx$

(c) $\int \sin 3x \cos 5x\ dx$ OR $\int \frac{2x-3}{x^2+2x+2}\ dx$

(v) Using differential, find the approximate value of cos $44^{O.}$

SECTION 'C' (DETAILED - ANSWER QUESTIONS)

Note attempt any two question:

4.

(a) (i) D, E, F are the mid-points of the sides BC, CA, AB respectively of the triangle ABC show that AABC = 4ADEF.

(ii) Find the equation of the locus of a moving point such that the slope of the line Joining the point to A (l, 3) is three times that of the slope of the line Joining the point to B (3, 1)

(b) Prove that two circles $x^2 + y^2 + 2gx + c = 0$ and $x^2 + y^2 + 2fy + c = 0$ touch each other, if $\frac{1}{f^2}, \frac{1}{g^2}, \frac{1}{c}$

5.

(a) Evaluate any Two of the following:

(i) $\int x^2 \sqrt{4+x}\ dx$ (ii) $\int \frac{\cos x\, dx}{\sin x\,(2+\sin x)}$ (iii) $\int \frac{\tan x}{\ln \cos x}\ dx$

(b) Show that the eccentricities e_1 and e_2 of two conjugate hyperbolas satisfy the relation $e_1^2 + e_2^2 = e_1^2 . e_1^2$.

6.

(a) (i) Show the differential equation: $y\frac{dy}{dx} = x\,(y^4 + 2y^2 + 1)$, $y(-3) = 1$

(ii) Find the area above the x-axis between the ordinates $x = \pi/4$ and $x = \pi/3$ under the curve $y = \tan x$

(b) Show that the maximum value of f (x) = —Inx is 1.