Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2022 – 2024)

MATHEMATICS 224-1st Annual-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – II (Objective Type) GROUP – I Maximum Marks : 20

PAPER CODE = 8195 LHR-1-24

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $f(x)=3-\sqrt{x}$ then $f'(1)$ is equal to : (A) $-\frac{1}{2}$ (B) 0 (C) $\frac{1}{2}$ (D) 1
2	$4\int_0^{\pi/4} \sin 2x\,dx =$: (A) $4-2\sqrt{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{1}{2}$ (D) $\sqrt{3}$
3	$\lim_{x\to 0} \frac{\sin ax}{\sin bx} =$: (A) $-\frac{a}{b}$ (B) $-\frac{b}{a}$ (C) $\frac{a}{b}$ (D) $\frac{b}{a}$
4	$\int \ell nx\,dx =$: (A) $\frac{1}{x}+c$ (B) $x\,\ell nx+c$ (C) $\frac{(\ell nx)^2}{2}+c$ (D) $x(\ell nx-1)+c$
5	Let $f(x)=\sqrt{1-x^2}$ in R then domain of f is : (A) Real numbers (B) $\lvert x\rvert\le 1$ (C) Negative real numbers (D) Integers
6	If $\int x\,e^{x^2}\,dx = k\,e^{x^2}$ then k = : (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{x}{3}$ (D) $\frac{x}{2}$
7	If $f(x)$ has second derivative at c such that $f'(c)=0$ and $f''(c)<0$ then c is point of : (A) Maxima (B) Minima (C) Point of inflection (D) Origin
8	If $y=\cot x$, then $\frac{dy}{dx}$ is given by : (A) $\text{cosec}^2 x$ (B) $-\text{cosec}^2 x$ (C) $\tan x$ (D) $-\text{cosec}\,x\cot x$
9	$\int \frac{1}{x^2+a^2}dx =$: (A) $\tan^{-1}\frac{x}{a}+c$ (B) $\frac{1}{a}\tan^{-1}\frac{x}{a}+c$ (C) $\frac{a}{x}\tan^{-1}\frac{x}{a}+c$ (D) $\frac{1}{a}\tan^{-1}\frac{a}{x}+c$

(Turn Over)

1-10	For $y = \log_e 5x$, $\frac{dy}{dx} =$: (A) $\frac{1}{x}$ (B) 5 (C) $\frac{1}{5x}$ (D) 1
11	The straight line $y = mx + c$ is tangent to the parabola $y^2 = 4ax$ if : (A) $c = \frac{a}{m}$ (B) $c = \frac{m}{a}$ (C) $c = \frac{a^2}{m^2}$ (D) $c = am$
12	y-coordinate of any point on x-axis is : (A) 0 (B) x (C) 1 (D) y
13	The volume of parallelepiped determined by $\underline{u} = \underline{i} + 2\underline{j} - \underline{k}$, $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$, $\underline{w} = \underline{i} - 7\underline{j} - 4\underline{k}$ is : (A) 48 (B) 50 (C) 52 (D) 55
14	The distance between the centres of the circles $x^2 + y^2 + 2x + 2y + 1 = 0$ and $x^2 + y^2 - 4x - 6y - 3 = 0$ is : (A) 1 (B) 4 (C) 5 (D) 15
15	If $\underline{a} + \underline{b} + \underline{c} = 0$ then which one is correct : (A) $\underline{a} \times \underline{b} \times \underline{c} = 0$ (B) $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$ (C) $\underline{a} \cdot \underline{b} = \underline{b} \cdot \underline{c} = \underline{c} \cdot \underline{a}$ (D) $\underline{a} = \underline{b} = \underline{c}$
16	The x-intercept of the line $2x + 3y - 1 = 0$ is : (A) 2 (B) 3 (C) $\frac{1}{3}$ (D) $\frac{1}{2}$
17	The graph of $2x - 3y \leq 6$ is : (A) On the origin side (B) Not on the origin side (C) Not decided (D) Through the origin
18	The area of the triangle having $\underline{a}$ and $\underline{b}$ as its two sides is given by : (A) $\lvert \underline{a} \cdot \underline{b} \rvert$ (B) $\frac{1}{2} \lvert \underline{a} \cdot \underline{b} \rvert$ (C) $\lvert \underline{a} \times \underline{b} \rvert$ (D) $\frac{1}{2} \lvert \underline{a} \times \underline{b} \rvert$
19	Homogeneous equation of second degree $ax^2 + 2hxy + by^2 = 0$ where a, b, h are not all zero, represents two imaginary lines if : (A) $h^2 = ab$ (B) $h^2 > ab$ (C) $h^2 < ab$ (D) $h = ab$
20	The eccentricity of the ellipse $\frac{x^2}{64} + \frac{y^2}{28} = 1$ is : (A) $\frac{3}{4}$ (B) $\frac{4}{3}$ (C) $\sqrt{\frac{3}{4}}$ (D) $\sqrt{\frac{4}{3}}$

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2022 – 2024)

MATHEMATICS 224-1st Annual-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I LHR-1-24

2. Write short answers to any EIGHT (8) questions : 16

(i) Prove that $\cos h^2 x - \sin h^2 x = 1$

(ii) If $f(x) = \sqrt{x+4}$ then find $f(x-1)$

(iii) Evaluate $\lim\limits_{x \to 3} \dfrac{x-3}{\sqrt{x}-\sqrt{3}}$

(iv) Evaluate $\lim\limits_{x \to 0} \dfrac{1-\cos 2x}{x^2}$

(v) Differentiate $y = (x^2+5)(x^3+7)$ with respect to x.

(vi) Differentiate $\dfrac{x^2+1}{x^2-3}$ with respect to x.

(vii) Find derivative of $(x^3+1)^9$ with respect to x.

(viii) Differentiate $\cos\sqrt{x} + \sqrt{\sin x}$ with respect to the variable involved.

(ix) $\dfrac{dy}{dx} = ?$ If $y = e^{x^2+1}$

(x) Find Maclaurin Series for $\sin x$

(xi) Determine the interval in which $f(x) = 4 - x^2$, $x \in (-2, 2)$ is increasing or decreasing.

(xii) Find $f'(x)$ if $f(x) = \sqrt{\ell n(e^{2x} + e^{-2x})}$

3. Write short answers to any EIGHT (8) questions : 16

(i) Using differential to find $\dfrac{dy}{dx}$ if $xy + x = 4$

(ii) Evaluate $\int (a-2x)^{\frac{3}{2}}\, dx$

(iii) Evaluate $\int \sec x\, dx$

(iv) Evaluate $\int x\, \ell nx\, dx$

(v) Evaluate $\int_1^2 \dfrac{x}{x^2+2}\, dx$

(vi) Find the area bounded by cos function from $x = -\dfrac{\pi}{2}$ to $x = \dfrac{\pi}{2}$

(vii) Solve the differential equation $\dfrac{dy}{dx} = \dfrac{y}{x^2}$

(viii) Find h such that A (– 1 , h) , B (3 , 2) and C (7 , 3) are collinear.

(ix) The coordinates of a point P are (3 , 2). The axes are translated through the point $O'(1,3)$. Find the coordinates of P referred to new axes.

(x) Find k so that the line joining A (7 , 3) ; B (k , – 6) and the line joining C (– 4 , 5) ; D (– 6 , 4) are parallel.

(xi) Find the point of intersection of the lines $x - 2y + 1 = 0$ and $2x - y + 2 = 0$

(xii) Find measure of the angle between the lines represented by $9x^2 + 24xy + 16y^2 = 0$

(Turn Over)

4. Write short answers to any NINE (9) questions : **18**

(i) Graph the solution set of inequality $3x-2y\geq 6$

(ii) Define feasible region.

(iii) Find the equation of circle whose ends of diameter are (– 3 , 2) and (5 , – 6)

(iv) Find the position of the point (5 , 6) w.r.t the circle $2x^2+2y^2+12x-8y+1=0$

(v) Find the focus and vertex of parabola $y^2=-8(x-3)$

(vi) Find the eccentricity of ellipse $x^2+4y^2=16$

(vii) Find the centre and eccentricity of the conic $\frac{y^2}{4}-x^2=1$

(viii) Identify the conic represented by $4x^2-4xy+y^2-6=0$

(ix) Find the work done by a constant force $\vec{F}=2\hat{i}+4\hat{j}$, if its point of application to a body moves it from A (1 , 1) to B (4 , 6)

(x) Find the value of ' α ' such that $\alpha\underline{i}+\underline{j}$, $\underline{i}+\underline{j}+3\underline{k}$ and $2\underline{i}+\underline{j}-2\underline{k}$ are coplanar.

(xi) If $\vec{u}=2i-j+k$ and $\vec{v}=4i+2j-k$ find $\vec{u}\times\vec{v}$

(xii) Find a vector whose magnitude is 4 and is parallel to $2\underline{i}-3\underline{j}+6\underline{k}$

(xiii) If A (1 , – 1) , B (2 , 0) , C (– 1 , 3) and D (– 2 , 2) are given points, find the sum of the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Find m and n , so that given function f is continuous at $x = 3$

$$f(x)=\begin{cases} mx & if\ x<3 \\ n & if\ x=3 \\ -2x+9 & if\ x>3 \end{cases}$$ 5

(b) Prove that $y\frac{dy}{dx}+x=0$ if $x=\frac{1-t^2}{1+t^2}$, $y=\frac{2t}{1+t^2}$ 5

6. (a) If $y=e^{-ax}$, then show that $\frac{d^3y}{dx^3}+a^3y=0$ 5

(b) Evaluate the indefinite integral $\int\sqrt{x^2-a^2}\,dx$ 5

7. (a) Solve the differential equation $2e^x\tan y\,dx+(1-e^x)\sec^2 y\,dy=0$ 5

(b) Maximize $f(x,y)=x+3y$ subject to the constraints
$2x+5y\leq 30$; $5x+4y\leq 20$, $x\geq 0$, $y\geq 0$ 5

8. (a) Find equations of the tangents to the circle $x^2+y^2=2$ perpendicular to the line $3x+2y=6$ 5

(b) Using vectors, prove that $\sin(\alpha+\beta)=\sin\alpha\cos\beta+\cos\alpha\sin\beta$ 5

9. (a) Find centre, foci, eccentricity, vertices and equation of directrices of $\frac{(y+2)^2}{9}-\frac{(x-2)^2}{16}=1$ 5

(b) Find the equations of altitudes of the triangle whose vertices are
A (– 3 , 2) , B (5 , 4) , C (3 , – 8) 5

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2022 – 2024)

MATHEMATICS 224-1st Annual-(INTER PART – II) Time Allowed : 30 Minutes

Q.PAPER – IL(Objective Type) GROUP – II Maximum Marks : 20

PAPER CODE = 8192 LHR-2-24

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $f(x)=\frac{1}{x^2}$ when which of the following is equal to $fof(x)$: (A) x^4 (B) x^2 (C) 1 (D) $\frac{1}{x^4}$
2	What is the value of $\lim_{x\to 0}(x\sin x)$: (A) α (B) -1 (C) 1 (D) 0
3	What is the value of $\sqrt{1-x^2}\frac{d}{dx}(\sin^{-1}x+\cos^{-1}x)$: (A) $\sqrt{1-x^2}$ (B) 0 (C) 2 (D) $\frac{1}{x}$
4	$\frac{d}{dx}(\sin h^{-1}x)=$: (A) $\frac{1}{\sqrt{1-x^2}}$ (B) $\frac{-1}{\sqrt{1-x^2}}$ (C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{-1}{\sqrt{1+x^2}}$
5	Derivative of x^3 w.r.t x^3 is : (A) 0 (B) 1 (C) x^3 (D) $3x^2$
6	If $f(x)=a^x$ then $f'(x)=$: (A) $a^x\ell na$ (B) $a^x\ell nx$ (C) $a^x(\ell na)^2$ (D) $(a^x)^2\ell na$
7	$\int x^{-1}dx$: (A) 0 (B) $-x^{-2}+c$ (C) ∞ (D) $\ell nx+c$
8	$\int_0^1 \frac{1}{\sqrt{1-x^2}}dx=$: (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$
9	$\int \tan x\,dx=$: (A) $\ell n\cot x+c$ (B) $\ell n\sec x+c$ (C) $\ell n\sin x+c$ (D) $\ell n\cos ec\,x+c$

(Turn Over)

1.10	$\int_0^{\pi} \sin x\,dx =$: (A) 0 (B) 1 (C) 2 (D) π
11	A linear equation in two variables represents : (A) Circle (B) Ellipse (C) Hyperbola (D) Straight line
12	Intercept form of equation of line is : (A) $\frac{x}{a}+\frac{y}{b}=1$ (B) $\frac{x}{a}+\frac{y}{b}=0$ (C) $\frac{x}{a}-\frac{y}{b}=1$ (D) $\frac{x}{a}-\frac{y}{b}=0$
13	Distance of point $(\cos 3x\ ,\ \sin 3x)$ from origin is : (A) 3 (B) 6 (C) 9 (D) 1
14	(0 , 0) is one of the solution of inequality : (A) $3x+5y>4$ (B) $2x+3y<4$ (C) $x+3y>5$ (D) $2x+3y>5$
15	Equation of circle with centre (3 , 0) and radius $\sqrt{9}$ is : (A) $x^2+y^2-6x=0$ (B) $x^2-6x=9$ (C) $x^2+y^2=9$ (D) $9x^2+y^2=9$
16	Equation of directrix of parabola $y^2=-12x$ is : (A) $x=-3$ (B) $x=3$ (C) $y=3$ (D) $y=-3$
17	Co-vertices of ellipse $\frac{x^2}{b^2}+\frac{y^2}{a^2}=1\ ;\ a>b$ are : (A) $(\pm a,0)$ (B) $(0,\pm a)$ (C) $(0,\pm b)$ (D) $(\pm b,0)$
18	Which of the following vectors is equal to the vector $\underline{i}.\underline{j}\times\underline{k}$: (A) 0 (B) 1 (C) -1 (D) $\underline{i}$
19	For what value of P [2 P 5] is perpendicular to [3 1 P] : (A) $\frac{2}{3}$ (B) -1 (C) 1 (D) $\sqrt{5}$
20	If $\underline{a}$ and $\underline{b}$ are parallel vectors then $\underline{a}\times\underline{b}=$: (A) 0 (B) 1 (C) -1 (D) 2

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2022 – 2024)

MATHEMATICS 224-1st Annual-(INTER PART – II) Time Allowed : 2.30 hours

PAPER – II (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I LHR-2-24

2. Write short answers to any EIGHT (8) questions : **16**

(i) Given that $f(x)=\cos x$ find $\frac{f(a+h)-f(a)}{h}$ and simplify.

(ii) If $f(x)=(-x+9)^3$, find $f^{-1}(x)$

(iii) By rationalizing, find $\lim_{x\to 0}\frac{\sqrt{x+a}-\sqrt{a}}{x}$

(iv) Write down the domain and range of $f(x)=2x-5$

(v) Calculate derivative of $f(x)=x^{2/3}$ at $x=8$

(vi) Find derivative of $\frac{1+x}{1-x}$ *w.r.t.* x

(vii) If $y=x^4+2x^2+2$, find $\frac{dy}{dx}$

(viii) Find $\frac{dy}{dx}$ of implicit function $x^2-4xy-5y=0$

(ix) Apply chain rule to find $\frac{dy}{du}$ if $y=x^2+\frac{1}{x^2}$ and $u=x-\frac{1}{x}$

(x) Differentiate $\sin^2 x$ *w.r.t* $\cos^4 x$

(xi) Find $f'(x)$ if $f(x)=x^3 e^{\frac{1}{x}}$

(xii) Find y_2 if $y=x^2.e^{-x}$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Using differential to find $\frac{dx}{dy}$ of $x^4+y^2=xy^2$

(ii) Evaluate $\int (2x+3)^{\frac{1}{2}}\,dx$

(iii) Evaluate $\int x\sqrt{x-a}\,dx$

(iv) Evaluate $\int (\ell nx)^2\,dx$

(v) Evaluate $\int_1^2 \left(x+\frac{1}{x}\right)^{\frac{1}{2}}\left(1-\frac{1}{x^2}\right)dx$

(vi) Find the area bounded by cos function from $x=-\frac{\pi}{2}$ to $x=\frac{\pi}{2}$

(vii) Solve $\frac{dy}{dx}+\frac{2xy}{2y+1}=x$

(viii) Find the mid-points of the line joining the two points A (– 8 , 3) , B (2 , – 1).

(ix) Find h such that the points A (– 1 , h) , B (3 , 2) and C (7 , 3) are collinear.

(x) In the triangle A (8 , 6) , B (– 4 , 2) , C (– 2 , – 6), find the slope of altitude of triangle.

(xi) Using slopes, show that the triangle with vertices A (6 , 1) , B (2 , 7) , C (– 6 , – 7) is a right triangle.

(xii) Find the point of intersection of the lines $x+4y-12=0$, $x-3y+3=0$

4. Write short answers to any NINE (9) questions : **18**

(i) Define feasible region.

(ii) Graph the solution set of $5x - 4y \leq 20$

(iii) Write the standard and general equation of circle.

(iv) Find centre and radius of $5x^2 + 5y^2 + 24x + 36y + 10 = 0$

(v) Check the position of the point (5 , 6) with respect to the circle $x^2 + y^2 = 81$

(vi) Find the length of the tangent drawn from the point (– 5 , 4) to the circle $5x^2 + 5y^2 - 10x + 15y - 131 = 0$

(vii) Find foci and eccentricity of ellipse $x^2 + 4y^2 = 16$

(viii) Find the points of intersection of $x^2 + y^2 = 8$ and $x^2 - y^2 = 1$

(ix) If $\underline{u} = 2\underline{i} - 7\underline{j}$, $\underline{v} = \underline{i} - 6\underline{j}$ and $\underline{w} = -\underline{i} + \underline{j}$, find $\frac{1}{2}\underline{u} + \frac{1}{2}\underline{v} + \frac{1}{2}\underline{w}$

(x) Find a vector whose magnitude is 4 and is parallel to $2\underline{i} - 3\underline{j} + 6\underline{k}$

(xi) Find α so that the vector $\underline{u}$ and $\underline{v}$ are perpendicular ; $\underline{u} = \alpha\underline{i} + 2\alpha\underline{j} - \underline{k}$ and $\underline{v} = \underline{i} + \alpha\underline{j} + 3\underline{k}$

(xii) Find the area of parallelogram whose vertices are A (1 , 2 , – 1) ; B (4 , 2 , – 3) ; C (6 , – 5 , 2) ; D (9 , – 5 , 0)

(xiii) Prove that $\underline{u}.(\underline{v} \times \underline{w}) + \underline{v}.(\underline{w} \times \underline{u}) + \underline{w}.(\underline{u} \times \underline{v}) = 3\underline{u}.(\underline{v} \times \underline{w})$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Evaluate $\lim_{x \to 0} \frac{\sec x - \cos x}{x}$ 5

(b) Find the derivative w.r.t. x $\sin\sqrt{\frac{1+2x}{1+x}}$ 5

6. (a) If $y = (\cos^{-1} x)^2$, prove that $(1 - x^2)\, y_2 - xy_1 - 2 = 0$ 5

(b) Evaluate $\int \frac{2x}{1 - \sin x}\, dx$ 5

7. (a) Find the area between the x-axis and the curve $y = \sqrt{2ax - x^2}$ when $a > 0$ 5

(b) Maximize $f(x, y) = 2x + 5y$ subject to the constraints $2y - x \leq 8$; $x - y \leq 4$, $x \geq 0$, $y \geq 0$ 5

8. (a) Find equation of the circle passing through the points A (3 , – 1) , B (0 , 1) and having centre at $4x - 3y - 3 = 0$ 5

(b) Use vectors to prove that $\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$ 5

9. (a) Mid-points of sides of triangle are (1 , – 1) , (– 4 , – 3) and (– 1 , 1). Find coordinates of vertices of triangle. 5

(b) Show that equation of parabola with focus at $(a\cos\alpha, a\sin\alpha)$ and directrix $x\cos\alpha + y\sin\alpha + a = 0$ is $(x\sin\alpha - y\cos\alpha)^2 = 4a(x\cos\alpha + y\sin\alpha)$ 5