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 $\lim_{x \to 3} \frac{x-3}{\sqrt{x} - \sqrt{3}}$

(iv) Evaluate $\lim_{x \to 0} \frac{1 - \cos 2x}{x^2}$

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

(vi) Differentiate $\frac{x^2 + 1}{x^2 - 3}$ 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) $\frac{dy}{dx} = ?$ 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 $\frac{dy}{dx}$ 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 $\int_1^2 \frac{x}{x^2 + 2} dx$

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

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

(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