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

(Academic Sessions 2019 – 2021 to 2021 – 2023)

MATHEMATICS 223-1st Annual-(INTER PART – II) Time Allowed : 30 Minutes

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

PAPER CODE = 8191 LHR-12-1-23

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	The perimeter P of a square as a function of its area A is given as :	(A) 4A	(B) $4\sqrt{A}$	(C) 2A	(D) $2\sqrt{A}$
2	Domain of cosine function $y = cosx$ is :	(A) Real numbers	(B) $[-1,1]$	(C) $(0,\infty)$	(D) $]-1,1[$
3	If $y = \tanh^{-1} x$, then $\frac{dy}{dx} =$:	(A) $\frac{1}{1+x^2}$	(B) $\frac{1}{1-x^2}$	(C) $\frac{-1}{1+x^2}$	(D) $\frac{-1}{1-x^2}$
4	$\frac{d}{dx}(a^{\lambda x}) =$:	(A) $a^{\lambda x}$	(B) $a^{\lambda x}\ell na$	(C) $\lambda a^{\lambda x}\ell na$	(D) $\frac{a^{\lambda x}}{\lambda \ell na}$
5	$\frac{d}{dx}(\sin\sqrt{x}) =$:	(A) $\cos\sqrt{x}$	(B) $\cos\sqrt{x}\cdot\frac{1}{\sqrt{x}}$	(C) $\sqrt{x}\cos\sqrt{x}$	(D) $\cos\sqrt{x}\cdot\frac{1}{2\sqrt{x}}$
6	If $y = x^2 - 1$, then $dy =$:	(A) $xdx + c$	(B) $(x-1)dx$	(C) $2x\,dx + c$	(D) $2x\,dx$
7	$\int_0^3 \frac{dx}{x^2+9} =$:	(A) $\frac{\pi}{4}$	(B) $\frac{-\pi}{4}$	(C) 0	(D) $\frac{\pi}{12}$
8	$\int e^x(\sin x + \cos x)\,dx =$:	(A) $e^x \cos x + c$	(B) $e^x \sin x$	(C) $e^x \sin x + c$	(D) $e^x \cos x$
9	$\int \frac{2}{x+2}dx =$:	(A) $\ell n\|x+2\| + c$	(B) $\ell n\|x+2\|^2 + c$	(C) $\frac{1}{\ell n\|x+2\|} + c$	(D) $2\ell nx + c$
10	$\int \frac{1}{\cos^2 x}dx =$:	(A) $\frac{1}{\sin^2 x} + c$	(B) $\tan x + c$	(C) $\sec^2 x + c$	(D) $\cos ec^2 x + c$

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11	The lines represented by $ax^2+2hxy+by^2=0$ are imaginary if : (A) $h^2-ab=0$ (B) $h^2-ab<0$ (C) $h^2-ab>0$ (D) $h^2-ab\neq 0$
12	Two lines $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ are parallel if : (A) $a_1a_2+b_1b_2=0$ (B) $a_1a_2-b_1b_2=0$ (C) $a_1b_2-a_2b_1=0$ (D) $a_1b_2+a_2b_1=0$
13	Inclination of the line joining the points (4 , 6) and (4 , 8) is : (A) 90° (B) 45° (C) 30° (D) Undefined
14	A region is said to feasible region which is restricted to : (A) I quadrant (B) II quadrant (C) III quadrant (D) IV quadrant
15	An angle in a semicircle is of measure : (A) 90° (B) 60° (C) 45° (D) 30°
16	The coordinate of the vertices of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is : (A) $(0,\pm b)$ (B) $(\pm b,0)$ (C) $(0,\pm a)$ (D) $(\pm a,0)$
17	Focus of the parabola $x^2-5y=0$ is : (A) $(\frac{5}{4},0)$ (B) $(0,\frac{5}{4})$ (C) $(0,\frac{-5}{4})$ (D) $(-\frac{5}{4},0)$
18	For parabola, value of eccentricity e is : (A) e = 0 (B) e < 1 (C) e > 1 (D) e = 1
19	If $\underline{u}, \underline{v}$ and $\underline{w}$ are coterminous edges of a tetrahedron, then its volume is : (A) $[\underline{u}\ \underline{v}\ \underline{w}]$ (B) $\frac{1}{3}[\underline{u}\ \underline{v}\ \underline{w}]$ (C) $\frac{1}{6}[\underline{u}\ \underline{v}\ \underline{w}]$ (D) $\frac{1}{9}[\underline{u}\ \underline{v}\ \underline{w}]$
20	A vector perpendicular to both vectors $\underline{a}$ and $\underline{b}$ is : (A) $\underline{a}\cdot\underline{b}$ (B) $\underline{a}\times\underline{b}$ (C) $\frac{\underline{a}\cdot\underline{b}}{\lvert\underline{a}\rvert}$ (D) $\underline{b}\cdot\underline{a}$

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

(Academic Sessions 2019 – 2021 to 2021 – 2023)

MATHEMATICS 223-1st Annual-(INTER PART – II) Time Allowed : 2.30 hours

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

SECTION – I LHR-12-1-23

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

(i) For $f(x)=\dfrac{2x+1}{x-1}$, find $f^{-1}(x)$

(ii) Evaluate $\lim\limits_{\theta\to 0}\dfrac{1-\cos\theta}{\sin\theta}$

(iii) Discuss the continuity of $f(x)$ at $x=c=2$, $f(x)=\begin{cases}2x+5 & \text{if } x\le 2\\ 4x+1 & \text{if } x>2\end{cases}$

(iv) Differentiate w.r.t 'x' $(x-5)(3-x)$

(v) Find $\dfrac{dy}{dx}$ if $y^2-xy-x^2+4=0$

(vi) Differentiate w.r.t. 'θ' $(\sin 2\theta-\cos 3\theta)^2$

(vii) Find $\dfrac{dy}{dx}$ if $y=x^2\ell n\dfrac{1}{x}$

(viii) Find y_4 if $y=(2x+5)^{3/2}$

(ix) Apply Maclaurin series expansion to prove that $\cos x=1-\dfrac{x^2}{2!}+\dfrac{x^4}{4!}-\dfrac{x^6}{6!}+\text{-----}$

(x) Find extreme values for $f(x)=x^2-x-2$

(xi) Define feasible region.

(xii) Graph the inequality $x+2y\le 6$

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

(i) Find δy and dy in the case $y=x^2+2x$ when x changes from 2 to 1.8

(ii) Evaluate $\displaystyle\int\frac{1}{\sqrt{x}(\sqrt{x}+1)}dx$, $x>0$

(iii) Evaluate $\displaystyle\int a^{x^2}x\,dx$ $(a>0, a\ne 1)$

(iv) Evaluate $\displaystyle\int\sqrt{4-5x^2}\,dx$

(v) Evaluate $\displaystyle\int_0^{\frac{\pi}{6}} x\cos x\,dx$

(vi) Find area below the curve $y=3\sqrt{x}$ and above the x-axis between $x=1$ and $x=4$

(vii) Solve the differential equation $x^2(2y+1)\dfrac{dy}{dx}-1=0$

(viii) Find the position vector of the point of division of the line segments joining the following pair of points, in the given ratio, point C with position vector $2\underline{i}-3\underline{j}$ and point D with position vector $3\underline{i}+2\underline{j}$ in the ratio 4 : 3

(ix) If $\underline{u}=2\underline{i}+3\underline{j}+4\underline{k}$, $\underline{v}=-\underline{i}+3\underline{j}-\underline{k}$ *and* $\underline{w}=\underline{i}+6\underline{j}+z\underline{k}$ represent the sides of a triangle, find the value of z.

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3. (x) Find the angle between the vectors $\underline{u}=2\underline{i}-\underline{j}+\underline{k}$ and $\underline{v}=-\underline{i}+\underline{j}$

(xi) If $\underline{a}=4\underline{i}+3\underline{j}+\underline{k}$ and $\underline{b}=2\underline{i}-\underline{j}+2\underline{k}$, find a unit vector perpendicular to both $\underline{a}$ and $\underline{b}$. Also find the sine of angle between the vectors $\underline{a}$ and $\underline{b}$.

(xii) Find the area of the triangle with vertices A (1 , – 1 , 1) , B (2 , 1, – 1) and C (– 1, 1, 2)

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

(i) Show that the points A (0, 2) , B ($\sqrt{3}$, –1) and C (0, – 2) are vertices of a right triangle.

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

(iii) Find an equation of line if its slope is 2 and y-intercept is 5.

(iv) Transform the equation $5x - 12y + 39 = 0$ into two-intercept form.

(v) Find the distance from the points P (6 , – 1) to the line $6x - 4y + 9 = 0$

(vi) Find the point of intersection of lines $3x + y + 12 = 0$ and $x + 2y - 1 = 0$

(vii) Find the angle between the lines represented by $x^2 - xy - 6y^2 = 0$

(viii) Find an equation of circle with centre at $(\sqrt{2}, -3\sqrt{3})$ and radius $2\sqrt{2}$

(ix) Find centre and radius of circle $x^2 + y^2 + 12x - 10y = 0$

(x) Find vertex and directrix of parabola $x^2 = 16y$

(xi) Find the focus and vertex of parabola $x^2 = 4(y-1)$

(xii) Find centre and foci of $4x^2 + 9y^2 = 36$

(xiii) Find eccentricity and vertices of $\dfrac{y^2}{16} - \dfrac{x^2}{9} = 1$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Evaluate $\lim\limits_{\theta \to 0} \dfrac{1-\cos p\theta}{1-\cos q\theta}$ 5

(b) If $\dfrac{y}{x} = \tan^{-1}\dfrac{x}{y}$ then prove that $\dfrac{dy}{dx} = \dfrac{y}{x}$ 5

6. (a) Evaluate $\displaystyle\int \frac{x}{x^4+2x^2+5}\,dx$ 5

(b) Find equations of two parallel lines perpendicular to $2x - y + 3 = 0$ such that the product of the x-intercept and y-intercept of each is 3. 5

7. (a) Evaluate $\displaystyle\int_0^{\frac{\pi}{4}} (1+\cos^2\theta)\tan^2\theta \, d\theta$ 5

(b) Minimize $z = 2x + y$ subject to the constraints
$x + y \geq 3$, $7x + 5y \leq 35$, $x \geq 0$, $y \geq 0$ 5

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

(b) Find equations of the tangents to the circle $x^2 + y^2 = 2$ and parallel to the line $x - 2y + 1 = 0$ 5

9. (a) Find volume of the tetrahedron with the vertices (0, 1, 2) , (3, 2, 1) (1, 2, 1) and (5, 5, 6) 5

(b) Find the centre, foci, eccentricity and directrices of ellipse $\dfrac{(2x-1)^2}{4} + \dfrac{(y+2)^2}{16} = 1$ 5