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

(Academic Sessions 2018 – 2020 to 2020 – 2022)

MATHEMATICS 222-(INTER PART – II) Time Allowed : 30 Minutes

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

PAPER CODE = 8193

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.

LHR-G1-22

1-1	(0 , 0) is the solution of inequality : (A) $3x-7y<3$ (B) $x+y>2$ (C) $x-y>1$ (D) $3x+5y>7$
2	The slope of a line with inclination $90°$ is : (A) 0 (B) – 1 (C) Undefined (D) 1
3	If $\underline{a}$ and $\underline{b}$ are parallel vectors then $\underline{a} \times \underline{b} =$: (A) $\underline{0}$ (B) – 1 (C) 1 (D) 2
4	Two lines $\begin{matrix} a_1x+b_1y+c_1=0 \\ a_2x+b_2y+c_2=0 \end{matrix}$ are parallel if : (A) $\frac{a_1}{a_2}=\frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2}=-\frac{b_1}{b_2}$ (C) $\frac{b_1}{c_1}=\frac{b_2}{c_2}$ (D) $\frac{a_1}{c_1}=\frac{a_2}{c_2}$
5	The value of $3\,\underline{j}.\underline{k}\times\underline{i}$ is : (A) – 1 (B) – 3 (C) 3 (D) 0
6	If a straight line is parallel to x-axis, then its slope is : (A) Undefined (B) – 1 (C) 1 (D) 0
7	The centre of the circle $5x^2+5y^2+24x+36y+10=0$ is : (A) $\left(\frac{12}{5},\frac{18}{5}\right)$ (B) $\left(-\frac{12}{5},-\frac{18}{5}\right)$ (C) $\left(\frac{12}{5},-\frac{18}{5}\right)$ (D) $\left(-\frac{12}{5},\frac{18}{5}\right)$
8	The length of the latus rectum of the parabola $y^2=8x$ is : (A) 2 (B) 8 (C) 4 (D) $2\sqrt{8}$
9	The point of intersection of angle bisectors of a triangle is called : (A) Orthocentre (B) Centroid (C) In-centre (D) Circumcentre

(Turn Over)

10	The coordinates of the vertices of hyperbola $\frac{y^2}{16}-\frac{x^2}{49}=1$ are : (A) $(0,\pm7)$ (B) $(\pm4,0)$ (C) $(0,\pm4)$ (D) $(\pm7,0)$
11	$\frac{d}{dx}(\sin 2x+\cos 2x)=:$ (A) $(\cos 2x-\sin 2x)$ (B) $(\cos 2x+\sin 2x)$ (C) $(2\cos 2x+2\sin 2x)$ (D) $2(\cos 2x-\sin 2x)$
12	$\lim_{h\to 0}(1+2h)^{\frac{1}{h}}=:$ (A) e^2 (B) e (C) $\frac{1}{e}$ (D) $\frac{1}{e^2}$
13	$\int e^{\sin x}\cos x\,dx=:$ (A) $e^{\cos x}+c$ (B) $\ell n\|\sin x\|+c$ (C) $\ell n\|\cos x\|+c$ (D) $e^{\sin x}+c$
14	$\frac{d}{dx}(\cot^{-1}x)=:$ (A) $\frac{1}{1+x^2}$ (B) $\frac{1}{1-x^2}$ (C) $-\frac{1}{1+x^2}$ (D) $-\frac{1}{1-x^2}$
15	$\int e^x(\cos x+\sin x)\,dx=:$ (A) $e^{-x}\sin x+c$ (B) $e^x\sin x+c$ (C) $-e^x\sin x+c$ (D) $e^{-x}\cos x+c$
16	If $y=e^{-ax}$ then $\frac{dy}{dx}=:$ (A) ae^{-ax} (B) e^{-ax} (C) a^2e^{-ax} (D) $-ae^{-ax}$
17	$\int\frac{1}{1+x^2}dx=:$ (A) $\tan^{-1}x+c$ (B) $-\tan^{-1}x+c$ (C) $\sin^{-1}x+c$ (D) $\cos^{-1}x+c$
18	The range of $f(x)=\sqrt{x^2-9}$ is : (A) $(-\infty,0]$ (B) $[0,+\infty)$ (C) $(0,+\infty)$ (D) $(-\infty,\infty)$
19	$\int\sin x\cos x\,dx=:$ (A) $\ell n\|\sin x\|+c$ (B) $\frac{\cos^2 x}{2}+c$ (C) $\frac{\sin^2 x}{2}+c$ (D) $\frac{\sin^2 x\cos^2 x}{2}+c$
20	$\frac{d}{dx}\left(\frac{1}{\operatorname{cosec} x}\right)=:$ (A) $\frac{1}{\sec x}$ (B) $\operatorname{cosec}^2 x$ (C) $\cot x$ (D) $\frac{1}{\operatorname{cosec}^2 x}$

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MATHEMATICS 222-(INTER PART – II) Time Allowed : 2.30 hours

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

SECTION – I

LHR-92-22

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

(i) Find domain and range of $f(x)=\sqrt{x+1}$

(ii) Find $fof(x)$ if $f(x)=\sqrt{x+1}$

(iii) Obtain $f^{-1}(x)$ from $f(x)=3x^3+7$

(iv) Evaluate $\lim_{\theta\to 0}\dfrac{1-\cos\theta}{\theta}$

(v) Express $\lim_{x\to+\infty}\left(\dfrac{x}{1+x}\right)^x$ in terms of "e"

(vi) If $y=\dfrac{x^2+1}{x^2-3}$, then find $\dfrac{dy}{dx}$

(vii) Prove that derivative of $\tan^{-1}x$ w.r.t. "x" is $\dfrac{1}{1+x^2}$

(viii) Differentiate $\dfrac{1}{a}\sin^{-1}(\dfrac{a}{x})$ w.r.t. "x"

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

(x) If $y=e^{-x}(x^3+2x^2+1)$, then find $\dfrac{dy}{dx}$

(xi) Apply the Maclaurin's series expansion to prove that $e^x=1+\dfrac{x}{1!}+\dfrac{x^2}{2!}+\dfrac{x^3}{3!}+----$

(xii) Determine the interval in which $f(x)=\sin x\ ,x\in(-\pi,\pi)$ is decreasing.

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

(i) If $x^2+2y^2=16$, find $\dfrac{dy}{dx}$ by using differentials.

(ii) Evaluate $\int\dfrac{x}{x+2}dx$

(iii) Evaluate indefinite integral $\int\dfrac{\sec^2 x}{\sqrt{\tan x}}dx$

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

(v) Evaluate the definite integral $\int_{-1}^{1}(x^{1/3}+1)dx$

(vi) Find the area between the x-axis and the curve $y=x^2+1$ from $x=1$ to $x=2$

(vii) Evaluate $\int e^{-x}(\cos x-\sin x)dx$

(viii) Solve $x\,dy+y(x-1)dx=0$

(ix) Show that the points A (3 , 1) , B (– 2 , – 3) and C (2 , 2) are vertices of an isosceles triangle

(Turn Over)

3\. (x) Find an equation of line having x-intercept : -9 and slope : -4

(xi) Show that the lines $4x-3y-8=0$, $3x-4y-6=0$ and $x-y-2=0$ are concurrent.

(xii) What is homogeneous equation?

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

(i) Graph the solution set of $2x+1\geq 0$

(ii) Define problem constraint.

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

(iv) Find slope of tangent to $x^2+y^2=5$ at $(4,3)$

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

(vi) Find focus and vertex of $y^2=8x$

(vii) Find equation of ellipse with foci $(\pm 3, 0)$ and minor axis of length 10.

(viii) Find equation of hyperbola with centre $(0,0)$, focus $(6,0)$, vertex $(4,0)$

(ix) Find a vector from the point A to the origin where $\overrightarrow{AB}=4\underline{i}-2\underline{j}$ and B $(-2,5)$

(x) Find α so that $\left|\alpha\underline{i}+(\alpha+1)\underline{j}+2\underline{k}\right|=3$

(xi) Find the cosine of the angle θ between $\underline{u}$ and $\underline{v}$; $\underline{u}=\underline{i}-3\underline{j}+4\underline{k}$; $\underline{v}=4\underline{i}-\underline{j}+3\underline{k}$

(xii) Prove that $\underline{a}\times(\underline{b}+\underline{c})+\underline{b}\times(\underline{c}+\underline{a})+\underline{c}\times(\underline{a}+\underline{b})=0$

(xiii) A force $\vec{F}=7\underline{i}+4\underline{j}-3\underline{k}$ is applied at P $(1,-2,3)$. Find its moment about the point Q $(2,1,1)$

SECTION – II

Note : Attempt any THREE questions.

5\. (a) Discuss the continuity of $f(x)$ at $x=1$ $f(x)=\begin{cases} 3x-1 & \text{if } x<1 \\ 4 & \text{if } x=1 \\ 4x & \text{if } x>1 \end{cases}$ 5

(b) Show that $2^{x+h}=2^x\{1+(\ln 2)h+\frac{(\ln 2)^2h^2}{2!}+\frac{(\ln 2)^3h^3}{3!}+\ldots\}$ 5

6\. (a) Evaluate $\int\sqrt{4-5x^2}\,dx$ 5

(b) Find the equation of perpendicular bisector of segment joining the points A $(3,5)$ and B $(9,8)$ 5

7\. (a) Evaluate the integral $\int_0^{\pi/4}\frac{\cos\theta+\sin\theta}{2\cos^2\theta}\,d\theta$ 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 the interior angles whose vertices are A $(-2,11)$, B $(-6,-3)$, C $(4,-9)$ 5

(b) Find an equation of the circle passing through the points A $(4,5)$, B $(-4,-3)$, C $(8,-3)$ 5

9\. (a) Prove angle in a semi circle is right angle. 5

(b) Find an equation of the tangent to the parabola $y^2=-6x$ which is parallel to the line $2x+y+1=0$. Also find point of tangency. 5

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

PAPER CODE = 8192

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. LHR-G2-22

1-1 If the degree of a polynomial function is 1, then it is called :

(A) Identity function (B) Linear function (C) Constant function (D) Trigonometric function

2 $\lim\limits_{x\to 1} \dfrac{x^2-1}{x^2-x} =$:

(A) 2 (B) $\frac{1}{2}$ (C) 4 (D) 5

3 If $y = \dfrac{1}{x^2}$, then $\dfrac{dy}{dx}$ at $x = -1$ is :

(A) 2 (B) 3 (C) $\frac{1}{3}$ (D) 4

4 $\dfrac{d}{dx}(\cot^{-1} x) =$:

(A) $\dfrac{1}{1+x^2}$ (B) $\dfrac{-1}{1+x^2}$ (C) $-\operatorname{cosec}^2 x$ (D) $\sec^2 x$

5 Two positive integer whose sum is 30 and their product will be maximum are :

(A) 14 , 16 (B) 15 , 15 (C) 10 , 20 (D) 12 , 18

6 $\dfrac{d}{dx}\left[\dfrac{f(x)}{g(x)}\right] =$:

(A) $\dfrac{f(x)g'(x)-f'(x)g(x)}{[g(x)]^2}$ (B) $\dfrac{f'(x)g(x)-f(x)g'(x)}{[f(x)]^2}$

(C) $\dfrac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$ (D) $\dfrac{g'(x)f(x)-g(x)f(x)}{[g(x)]^2}$

7 $\int \sec x \, dx =$:

(A) $\ell n(\sec x + \tan x) + c$ (B) $\ell n(\operatorname{cosec} x + \cot x) + c$

(C) $\ell n(\sin x + \cos x) + c$ (D) $\sec x + \tan x + c$

8 The solution of differential equation $\dfrac{dy}{dx} = -y$ is :

(A) $y = xe^{-x}$ (B) $y = ce^{-x}$ (C) $y = e^x$ (D) $y = ce^x$

9 $\int_{-1}^{3} x^3 dx =$:

(A) 20 (B) 40 (C) 30 (D) 60

(Turn Over)

LHR-92-22

10	$\int \sin 3x\, dx =$: (A) $-\frac{\cos 3x}{3}+c$ (B) $\frac{\cos 3x}{3}+c$ (C) $3\cos 3x+c$ (D) $-3\cos 3x+c$
11	An equation of the horizontal line through the point P (7 , – 9) is : (A) $y=-9$ (B) $y=9$ (C) $x=7$ (D) $x=-7$
12	The perpendicular distance of line $3x+4y+10=0$ from the origin is : (A) 0 (B) 1 (C) 2 (D) 3
13	Slope of line perpendicular to line $3x-4y+5=0$ is : (A) $\frac{-3}{4}$ (B) $\frac{-4}{3}$ (C) $\frac{3}{4}$ (D) $\frac{4}{3}$
14	Point of intersection of lines $x-2y+1=0$ and $2x-y+2=0$ equals : (A) (1 , 0) (B) (0 , 1) (C) (– 1 , 0) (D) (0 , – 1)
15	(0 , 0) is the solution of inequality : (A) $7x+2y>3$ (B) $x-3y>0$ (C) $x+2y<6$ (D) $x-3y<0$
16	The condition for a line $y=mx+c$ to be the tangent to the circle $x^2+y^2=a^2$ is : (A) $c=\pm m\sqrt{(1+a^2)}$ (B) $c=\pm a\sqrt{1+m^2}$ (C) $c=\pm a\sqrt{1-m^2}$ (D) $c=\pm m\sqrt{1-a^2}$
17	In an ellipse, the foci lie on : (A) Major axis (B) Minor axis (C) Directrix (D) Z-axis
18	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) $g+f-c$ (D) $\sqrt{g^2+f^2-c}$
19	Length of the vector $2\hat{i}-\hat{j}+2\hat{k}$ is : (A) 6 (B) 4 (C) 3 (D) 5
20	Cosine of the angle between two non-zero vectors $\underline{a}$ and $\underline{b}$ is : (A) $\underline{a}\cdot\underline{b}$ (B) $\frac{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}{\underline{a}\cdot\underline{b}}$ (C) $\frac{\underline{a}\cdot\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$ (D) $\frac{\underline{a}\times\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : LHR-GK22 **16**

(i) Express perimeter " P" of a square as a function of its area " A"

(ii) Find $f^{-1}(x)$ for $f(x) = -2x + 8$

(iii) Evaluate $\lim\limits_{x \to 0} \dfrac{\sin x^{\circ}}{x}$

(iv) Define rational function with example.

(v) Evaluate $\lim\limits_{x \to \infty} \left(\dfrac{x}{1+x}\right)^{x}$

(vi) Find $\dfrac{dy}{dx}$ from first principle if $y = \sqrt{x+2}$

(vii) Differentiate w.r.t. " x "; $y = \dfrac{x^2+1}{x^2-3}$

(viii) Find $\dfrac{dy}{dx}$ if $xy + y^2 = 2$

(ix) Find derivative w.r.t. x if $y = \cot^{-1}\left(\dfrac{x}{a}\right)$

(x) Find $\dfrac{dy}{dx}$ if $y = \log_{10}(ax^2 + bx + c)$

(xi) Apply the Maclaurin Series to prove that $e^{2x} = 1 + 2x + \dfrac{4x^2}{\underline{|2}} + \dfrac{8x^3}{\underline{|3}} + ----$

(xii) Define increasing function with example.

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

(i) Find δy and dy in $y = \sqrt{x}$, when x changes from 4 to 4.41

(ii) Evaluate the integral $\int \dfrac{(\sqrt{\theta}-1)^2}{\sqrt{\theta}}\, d\theta$, $\theta > 0$

(iii) Find $\int \dfrac{1}{x(\ell nx)}\, dx$

(iv) Evaluate the integral $\int \dfrac{x+2}{\sqrt{x+3}}\, dx$

(v) Using by part method to evaluate $\int x^2 \,\ell nx\, dx$

(vi) Evaluate the definite integral $\displaystyle\int_0^{\frac{\pi}{3}} \cos^2\theta \sin\theta\, d\theta$

(vii) Find the area between the x-axis and the curve $y = \cos\frac{1}{2}x$ from $x = -\pi$ to π

(viii) Solve the differential equation $\sin y \operatorname{cosec} x \dfrac{dy}{dx} = 1$

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

(Turn Over)

 UHR-G1-22

3. (x) Two points $P(-5,-3)$ and $O'(-2,-6)$ are given in XY-coordinate, find the coordinate of P in xy-coordinate system.

(xi) Find equation of the line having x-intercept – 3 and y-intercept 4.

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

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

(i) Define problem constraint.

(ii) Graph the solution set of the linear inequality $3y-4\leq 0$

(iii) Find slope of tangent to $x^2+y^2=5$ at (4 , 3)

(iv) Find α if $\underline{u}=\alpha\underline{i}+2\alpha\underline{j}-\underline{k}$ and $\underline{v}=\underline{i}+\alpha\underline{j}+3\underline{k}$ are perpendicular to each other.

(v) Find the direction cosine of the vector $\overline{PQ}$, where P (2, 1, 5) and Q (1, 3, 1)

(vi) Find the vector from point A to origin where $\overline{AB}=4\underline{i}-2\underline{j}$ and B is the point (– 2 , 5)

(vii) Find cosine of the angle between $\underline{u}=[-3,5]$ and $\underline{v}=[6,-2]$

(viii) Write standard equation of the hyperbola.

(ix) Find the centre of the ellipse $9x^2+y^2=18$

(x) Find the equation of the circle with centre (5 , – 2) and radius is 4.

(xi) Find the equation of the hyperbola with foci $(\pm 5,0)$ and vertex (3 , 0)

(xii) Find centre and radius of the circle $4x^2+4y^2-8x+12y-25=0$

(xiii) Find focus and vertex of the parabola $x^2=5y$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that $\lim\limits_{x\to 0}\dfrac{a^x-1}{x}=\log_e a$ 5

(b) If $x=\dfrac{1-t^2}{1+t^2}, y=\dfrac{2t}{1+t^2}$ prove that $y\dfrac{dy}{dx}+x=0$ 5

6. (a) Evaluate $\int \ell n(x+\sqrt{x^2+1})\,dx$ 5

(b) Prove that the linear equation $ax+by+c=0$ in two variables x and y represents a straight line. 5

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

(b) Graph the solution region of the system of linear inequalities and find the corner points of $2x-3y\leq 6$, $2x+3y\leq 12$, $x\geq 0$ 5

8. (a) Find a joint equation of the lines through the origin and perpendicular to the lines represented by $x^2-2xy\tan\alpha-y^2=0$ 5

(b) Find equations of the tangent lines to the circle $x^2+y^2+4x+2y=0$ drawn from P (– 1 , 2) 5

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

(b) Prove that $\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$ 5