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) $\cos\sqrt{x}\,.\,\frac{1}{\sqrt{x}}$ (C) $\sqrt{x}\cos\sqrt{x}$ (D) $\cos\sqrt{x}\,.\,\frac{1}{2\sqrt{x}}$
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) $\ell n\lvert x+2\rvert + c$ (B) $\ell n\lvert x+2\rvert^2 + c$ (C) $\frac{1}{\ell n\lvert x+2\rvert} + c$ (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) $\underline{b}\cdot\underline{a}$

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

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

SECTION – I L HR-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 $\cos x=1-\dfrac{x^2}{2!}+\dfrac{x^4}{4!}-\dfrac{x^6}{6!}+------$

(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 $\int \dfrac{1}{\sqrt{x}(\sqrt{x}+1)}dx$, $x>0$

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

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

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

(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 $\frac{y^2}{16} - \frac{x^2}{9} = 1$

SECTION – II

Note : Attempt any THREE questions.

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

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

6. (a) Evaluate $\int \frac{x}{x^4 + 2x^2 + 5}\, dx$ 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 $\int_0^{\frac{\pi}{4}} (1+\cos^2\theta)\tan^2\theta \, d\theta$ 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 $\frac{(2x-1)^2}{4} + \frac{(y+2)^2}{16} = 1$ 5

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

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

PAPER CODE = 8194 LHR-12-2-23

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 mid point of the line segment joining the foci of an ellipse is called : (A) Vertex (B) Directrix (C) Centre (D) Minor axis
2	If (3 , 5) is mid point of (5 , a) and (b, 7) then : (A) $a=4$, $b=2$ (B) $a=3$, $b=3$ (C) $a=7$, $b=-2$ (D) $a=3$, $b=1$
3	If 2 and 2 are x and y components of a vector, then its angle with x-axis is : (A) 30° (B) 60° (C) 45° (D) 90°
4	(3 , 2) is not a solution of the inequality : (A) $x-y>1$ (B) $x+y>2$ (C) $3x+5y>8$ (D) $3x-7y<3$
5	$\underline{i} \times \underline{j} =$: (A) $\underline{k}$ (B) $\underline{i}$ (C) $-\underline{k}$ (D) $\underline{j}$
6	Slope of line $3x-2y+5=0$ is : (A) $\frac{-2}{3}$ (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) $\frac{-3}{2}$
7	Length of the diameter of the circle $(x+5)^2+(y-8)^2=12$: (A) $2\sqrt{3}$ (B) 12 (C) 24 (D) $4\sqrt{3}$
8	Transverse axis of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is : (A) $x=\frac{a}{e}$ (B) $y=0$ (C) $x=0$ (D) $y=\frac{a}{e}$
9	Equation of line in slope intercept form is : (A) $y=mx+c$ (B) $\frac{x}{a}+\frac{y}{b}=1$ (C) $y-y_1=m(x-x_1)$ (D) $x\cos\alpha+y\sin\alpha=p$
10	The condition for a line $y=mx+c$ to be tangent to the circle $x^2+y^2=a^2$ is that : (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) $c=\pm\sqrt{1-m^2}$

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11	$f(x)=f(o)+xf'(o)+\frac{x^2}{2!}f''(o)+\frac{x^3}{3!}f'''(o)+----$ is called : (A) Taylor's series (B) Binomial series (C) Maclaurin's series (D) Laurent series
12	$\lim_{x\to 0}\frac{\sin 7x}{x}=:$ (A) 7 (B) -7 (C) $\frac{-1}{7}$ (D) $\frac{1}{7}$
13	$\int\frac{e^x}{e^x+1}dx=:$ (A) $\ell n(e^x+1)+c$ (B) ℓne^x+c (C) $e^{-x}+c$ (D) e^x+c
14	$\frac{d}{dx}(x^2+1)^2=:$ (A) $2x(x^2+1)$ (B) $\frac{(x^2+1)^3}{3}$ (C) $2(x^2+1)$ (D) $4x(x^2+1)$
15	$\int\sin^2 x\,dx=:$ (A) $\frac{x}{2}-\frac{\sin 2x}{4}+c$ (B) $\frac{x}{2}+\frac{\sin 2x}{4}+c$ (C) $\frac{x}{2}-\frac{\sin 2x}{2}+c$ (D) $\frac{x}{2}+\frac{\sin 2x}{2}+c$
16	$\frac{d}{dx}(\tan x^2)=:$ (A) $\sec^2 x^2$ (B) $2x\sec^2 x^2$ (C) $-\sec^2 x^2$ (D) $-2x\sec x^2$
17	$\int e^x(\cos x-\sin x)\,dx=:$ (A) $e^x\sin x+c$ (B) $e^x\cos x+c$ (C) $e^x\tan x+c$ (D) $e^x\cot x+c$
18	If $f(x)=\sin x+\cos x$ then $f(x)$ is : (A) Even function (B) Odd function (C) Neither even nor odd (D) Constant function
19	$\int_0^3\frac{1}{9+x^2}dx=:$ (A) $\frac{\pi}{4}$ (B) $\frac{-\pi}{12}$ (C) $\frac{-\pi}{4}$ (D) $\frac{\pi}{12}$
20	$\frac{d}{dx}(f(x)\sin x)=:$ (A) $f(x)\cos x+f'(x)\sin x$ (B) $f'(x)\sin x-f(x)\cos x$ (C) $f'(x)\cos x$ (D) $f'(x)\cos x+f(x)\sin x$

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

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

SECTION – I LHR-12-2-23

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

(i) Find the domain and range of $f(x)=\sqrt{x^2-4}$

(ii) Show that $x=a\sec\theta$, $y=b\tan\theta$ represents the equation of hyperbola.

(iii) If $f(x)=-2x+8$, find $f^{-1}(x)$ and $f^{-1}(-1)$

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

(v) Find derivative of $\sqrt{\dfrac{1+x}{1-x}}$

(vi) If $y=x^4+2x^2+2$, prove $\dfrac{dy}{dx}=4x\sqrt{y-1}$

(vii) Find the derivative of $(x^3+1)^9$ w.r.t. 'x'

(viii) Find $\dfrac{dy}{dx}$ if $y^3-2xy^2+x^2y+3x=0$

(ix) Differentiate w.r.t. variable involved of $\tan^3\theta\sec^2\theta$

(x) Find $\dfrac{dy}{dx}$ if $y=a^x$

(xi) Define feasible region.

(xii) Graph the feasible region $2x-3y\le 6$ $\quad x\ge 0$, $y\ge 0$

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

(i) Using differentials to find $\dfrac{dy}{dx}$ if $xy-\ell nx=c$

(ii) Evaluate $\int\left(\sqrt{x}+\dfrac{1}{\sqrt{x}}\right)dx$

(iii) Evaluate $\int\dfrac{e^x}{e^x+3}dx$

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

(v) Evaluate $\int_{-6}^{2}\sqrt{3-x}\,dx$

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

(vii) Solve the differential equation $\sec^2 x\tan y\,dx+\sec^2 y\tan x\,dy=0$

(viii) Find the magnitude of the vector $\underline{u}=\hat{i}+\hat{j}$

(ix) Find direction cosines of $\vec{v}=3\hat{i}-\hat{j}+2\hat{k}$

(x) Calculate the projection of $\vec{b}$ along $\vec{a}$ if $\vec{a}=\hat{i}-\hat{k}$; $\vec{b}=\hat{j}+\hat{k}$

(xi) If $\vec{a}=2\hat{i}+\hat{j}-\hat{k}$; $\vec{b}=\hat{i}-\hat{j}+\hat{k}$, find $\vec{b}\times\vec{a}$

(xii) Prove that the vectors $\hat{i}-2\hat{j}+3\hat{k}$, $-2\hat{i}+3\hat{j}-4\hat{k}$ and $\hat{i}-3\hat{j}+5\hat{k}$ are coplanar.

(Turn Over)

LHR-12-2-23

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

(i) Find the equation of the straight line whose slope is 2 and y-intercept is 5.

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

(iii) Find an equation of the line through (– 4 , 7) and parallel to the line $2x-7y+4=0$

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

(v) Write intercepts form of equation of straight line.

(vi) Check whether the following lines are concurrent or not

$3x-4y-3=0$

$5x+12y+1=0$

$32x+4y-17=0$

(vii) Find the slope and inclination of the line joining points (– 2 , 4) and (5, 11)

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

(ix) Define focus and directrix of the parabola.

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

(xi) Find equation of tangent to $y^2=4ax$ at (x_1,y_1)

(xii) Show that the equation $5x^2+5y^2+24x+36y+10=0$ represents a circle. Find its centre.

(xiii) Find an equation of the ellipse with given data : Foci (0 , – 1) and (0 , – 5) and major axis of length 6.

SECTION – II

Note : Attempt any THREE questions.

5. (a) If θ is measured in radians then prove that $\lim\limits_{\theta\to 0}\dfrac{\sin\theta}{\theta}=1$ — 5

(b) Find $\dfrac{dy}{dx}$ if $y=(1+2\sqrt{x})^3 \, . \, x^{\frac{3}{2}}$ — 5

6. (a) Evaluate $\int \ln(x+\sqrt{x^2+1})\,dx$ — 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) 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 constraints

$2x+5y\le 30$, $5x+4y\le 20$, $x\ge 0$, $y\ge 0$ — 5

8. (a) If $y=e^x\sin x$, show that $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}+2y=0$ — 5

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

9. (a) Show that the equation $9x^2-18x+4y^2+8y-23=0$ represents an ellipse. Find its elements and sketch its graph. — 5

(b) Prove that in any triangle ABC $c=a\cos B+b\cos A$ — 5

LHR-I-21

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MATHEMATICS 221-(INTER PART – II) Time Allowed : 30 Minutes

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

PAPER CODE = 8195

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	$\int (2x+3)^{\frac{1}{2}}\,dx =$: (A) $\frac{(2x+3)^{\frac{3}{2}}}{2}+c$ (B) $\frac{1}{3}(2x+3)^{\frac{3}{2}}+c$ (C) $\frac{1}{2}(2x+3)^{\frac{1}{3}}+c$ (D) $\frac{1}{3}(2x+3)^{\frac{-1}{2}}+c$
2	Distance between A (3 , 1) and B (– 2 , – 4) is : (A) $\sqrt{17}$ (B) $5\sqrt{2}$ (C) $\sqrt{26}$ (D) $2\sqrt{5}$
3	If $f(x)=\frac{x}{x^2-4}$ then range of $f(x)$ is : (A) All real number (B) Rational number (C) All negative real number (D) Integer
4	Slope 'm' through $A(x_1,y_1)$ $B(x_2,y_2)$ is : (A) $\frac{x_2-x_1}{y_2-y_1}$ (B) $\frac{x_2+x_1}{y_2-y_1}$ (C) $\frac{y_2-y_1}{x_2-x_1}$ (D) $\frac{y_1-y_2}{x_1+x_2}$
5	$\underset{x\to 0}{Lt}\frac{\sin ax}{\sin bx} =$: (A) $\frac{b}{a}$ (B) a (C) $\frac{a}{b}$ (D) $\frac{1}{b}$
6	$\int (a-2x)^{\frac{3}{2}}\,dx =$: (A) $\frac{1}{5}(a-2x)^{\frac{3}{2}}+c$ (B) $\frac{1}{5}(a-2x)^{\frac{5}{2}}+c$ (C) $-\frac{1}{5}(a-2x)^{\frac{5}{2}}+c$ (D) $-\frac{3}{5}(a-2x)^{\frac{5}{2}}+c$
7	$\int \sec x\,dx =$: (A) $\sec x+\tan x$ (B) $\sec^2 x$ (C) $\ln\lvert\sec x-\tan x\rvert$ (D) $\ln\lvert\sec x+\tan x\rvert+c$
8	If $f(x)=\frac{1}{x^m}$ then $f'(x) =$: (A) $-xm^{-1}$ (B) $-mx^{-m-1}$ (C) $-mx^{-m+1}$ (D) $-m^{-1}x$

(Turn Over)

LHR-I-21

1-9	Midpoint of the line segment joining A (3, 1) and B (– 2 , – 4) is : (A) $\left(\frac{1}{2},-\frac{3}{2}\right)$ (B) $\left(\frac{5}{2},\frac{5}{2}\right)$ (C) $\left(\frac{1}{2},\frac{3}{2}\right)$ (D) $\left(\frac{1}{2},\frac{5}{2}\right)$
10	The derivative of $\frac{1}{1+x}$ is : (A) x (B) $1+x$ (C) $(1+x)^{-2}$ (D) $-1(1+x)^{-2}$
11	In circle $x^2+y^2+2gx+2fy+c=0$, the radius is : (A) $\sqrt{g^2+f^2+c}$ (B) g^2+f^2-c (C) $\sqrt{g^2+f^2-c}$ (D) g^2+f^2+c
12	$x=5$ is the solution of inequality : (A) $2x-3>0$ (B) $2x+3<0$ (C) $x+4<0$ (D) $x+3<0$
13	In vectors $\vec{a}\times\vec{b}=$: (A) $\vec{b}\times\vec{a}$ (B) $-\vec{b}\times\vec{a}$ (C) $-\vec{b}$ (D) $-\vec{a}\times\vec{b}$
14	In equation of circle $x^2+y^2=r^2$ the centre of circle is : (A) (x,y) (B) (0 , 0) (C) (1 , 0) (D) (0 , r)
15	Magnitude of vector $\vec{u}=2i-7j$ is : (A) $\sqrt{53}$ (B) $\sqrt{55}$ (C) $\sqrt{48}$ (D) $\sqrt{52}$
16	$\frac{d}{dx}(\cos^{-1}x)=$: (A) $\frac{1}{\sqrt{1-x^2}}$ (B) $\frac{-1}{\sqrt{1-x^2}}$ (C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{1}{1+x^2}$
17	$1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+----$ is Maclaurin series for : (A) e^x (B) $\sqrt{1+x}$ (C) $\cos x$ (D) $\sin x$
18	The vector $\overrightarrow{PQ}$ through P (0 , 5) and Q (– 1 , – 6) is : (A) [– 1 , 11] (B) [– 1 , – 11] (C) [0 , 11] (D) [1 , 1]
19	$\frac{d}{dx}\tan^{-1}x=$: (A) $\frac{1}{1-x^2}$ (B) $\frac{1}{\sqrt{1-x^2}}$ (C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{1}{1+x^2}$
20	The focus of parabola $y^2=4ax$ is : (A) $(0,a)$ (B) $(-a,0)$ (C) $(a,0)$ (D) $(0,-a)$

LHR-I-21

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

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II) Time Allowed : 2.30 hours

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

SECTION – I

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

(i) Find the domain and range of the function g defined by : $g(x)=\sqrt{x^2-4}$

(ii) The real valued functions f and g are given. Find fog (x), if

$f(x)=3x^4-2x^2$ and $g(x)=\dfrac{2}{\sqrt{x}}$, $x\neq 0$

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

(iv) Evaluate $\lim\limits_{x\to 1}\dfrac{x^3-3x^2+2x-1}{x^3-x}$

(v) Find $\dfrac{dy}{dx}$ if $x^2-4xy-5y=0$

(vi) Differentiate w.r.t. 'x' $\cot^{-1}(\dfrac{x}{a})$

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

(viii) Find y_2 if $x^3-y^3=a^3$

(ix) Prove that $\dfrac{d}{dx}(\operatorname{cosec}^{-1}x)=\dfrac{-1}{|x|\sqrt{x^2-1}}$

(x) Differentiate $\dfrac{2x-1}{\sqrt{x^2+1}}$

(xi) Find the interval in which function is increasing or decreasing :

$f(x)=\cos x \quad x\in\left(\dfrac{-\pi}{2},\dfrac{\pi}{2}\right)$

(xii) Find y_4 if $y=\sin 3x$

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

(i) Use differentials to approximate the value of $\sqrt[4]{17}$

(ii) Solve $\displaystyle\int\frac{dx}{\sqrt{x+1}-\sqrt{x}}$

(iii) Evaluate $\displaystyle\int\frac{\cot\sqrt{x}}{\sqrt{x}}dx$

(iv) Solve $\displaystyle\int\frac{\sec^2 x}{\sqrt{\tan x}}dx$

(v) Solve $\displaystyle\int e^{2x}[-\sin x+2\cos x]dx$

(vi) Evaluate $\displaystyle\int_0^{\frac{\pi}{4}}\sec x(\sec x+\tan x)\,dx$

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

(viii) Evaluate $\displaystyle\int x\,\ell nx\,dx$

(ix) The points A (– 5 , – 2) , B (5 , – 4) are ends of a diameter of a circle. Find centre and radius of it.

(Turn Over)

3. (x) Transform the equation $5x-12y+39=0$ into normal form.
(xi) Find k so that the lines joining A (7 , 3) , B (k , – 6) and C (– 4 , 5), D (– 6 , 4) are parallel.
(xii) Find the lines represented by $2x^2+3xy-5y^2=0$

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

(i) Graph the inequality $5x-4y \le 20$
(ii) Find the equation of the circle with ends of diameter at (– 3 , 2) and (5 , – 6)
(iii) Find the centre of the circle $4x^2+4y^2-8x+12y-25=0$
(iv) Find the length of the tangent from the point (– 5, 10) to the circle $5x^2+5y^2+14x-12y-10=0$
(v) Find the coordinates of the points of intersection of the line $x+2y=6$ with the circle $x^2+y^2-2x-2y-39=0$
(vi) Find the vertex of the parabola $x^2=4(y-1)$
(vii) Find the foci of the hyperbola $\frac{y^2}{16}-\frac{x^2}{9}=1$
(viii) Find a unit vector in the direction of $\underline{v}=-\frac{\sqrt{3}}{2}\underline{i}-\frac{1}{2}\underline{j}$
(ix) Find a vector whose magnitude is 4 and is parallel to $2\underline{i}-3\underline{j}+6\underline{k}$
(x) If $\underline{v}$ is a vector for which $\underline{v}.\underline{i}=0$, $\underline{v}.\underline{j}=0$ and $\underline{v}.\underline{k}=0$, find $\underline{v}$
(xi) If $\underline{a}+\underline{b}+\underline{c}=0$, then prove that $\underline{a}\times\underline{b}=\underline{b}\times\underline{c}=\underline{c}\times\underline{a}$
(xii) Find the volume of parallelepiped for which the vectors $\underline{u}=\underline{i}-4\underline{j}-\underline{k}$, $\underline{v}=\underline{i}-\underline{j}-2\underline{k}$ and $\underline{w}=2\underline{i}-3\underline{j}+\underline{k}$ are three edges.
(xiii) Give a force $\underline{F}=2\underline{i}+\underline{j}-3\underline{k}$ acting at a point A (1 , – 2 , 1). Find the moment of $\underline{F}$ about the point B (2 , 0 , – 2)

SECTION – II

Note : Attempt any THREE questions.

5. (a) Discuss the continuity of $f(x)$ at x = c $f(x)=\begin{cases} 3x-1 & \text{if } x<1 \\ 4 & \text{if } x=1 \\ 2x & \text{if } x>1 \end{cases}$, c = 1 5

(b) Show that $\frac{dy}{dx}=\frac{y}{x}$ if $\frac{y}{x}=\tan^{-1}\frac{x}{y}$ 5

6. (a) Evaluate $\int x\sin^{-1}x\,dx$ 5

(b) Find the interior angles of the triangle with vertices A (6, 1) , B (2, 7) , C (– 6, – 7) 5

7. (a) Evaluate $\int_0^{\frac{\pi}{4}}\frac{1}{1+\sin x}dx$ 5

(b) Minimize $z=2x+y$ subject to constraints 5
$x+y \ge 3$, $7x+5y \le 35$; $x \ge 0$, $y \ge 0$

8. (a) Prove that in any triangle ABC $b^2=c^2+a^2-2ca\cos B$. 5
(b) Find the length of the chord cut off from the line $2x+3y=13$ by the circle $x^2+y^2=26$ 5

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

(b) Find the points of intersection of the given conic $\frac{x^2}{18}+\frac{y^2}{8}=1$ and $\frac{x^2}{3}-\frac{y^2}{3}=1$ 5

LHR-II-21

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

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II) Time Allowed : 30 Minutes

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

PAPER CODE = 8198

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 derivative of $\frac{1}{1+x}$ is : (A) x (B) $1+x$ (C) $(1+x)^{-2}$ (D) $-1(1+x)^{-2}$
2	$\int \cos x\,dx =$: (A) $1-\sin^2 x$ (B) $\sqrt{1-\sin^2 x}$ (C) $\sin x$ (D) $-\sin x$
3	$\int_1^2 (x^2+1)\,dx =$: (A) $\frac{10}{3}$ (B) $\frac{3}{10}$ (C) π (D) $\frac{\pi}{2}$
4	If $y=\cot^{-1} x$, then $\frac{dy}{dx} =$: (A) $\frac{1}{1-x^2}$ (B) $\frac{-1}{1+x^2}$ (C) $\frac{1}{x^2-1}$ (D) $\frac{1}{x^2+1}$
5	The derivative of $\ell n(\tanh x)$ is : (A) $\frac{1}{\tanh x}$ (B) $\frac{\sec h^2 x}{\tanh x}$ (C) $\sec h^2 x$ (D) $\sec hx$
6	$x=at^2$ and $y=2at$ are parametric equations of : (A) Parabola (B) Ellipse (C) Circle (D) Hyperbola
7	If $y^2+x^2=a^2$, then $\frac{dy}{dx} =$: (A) $-\frac{x}{y}$ (B) $-\frac{y}{x}$ (C) $\frac{x}{y}$ (D) $\frac{y}{x}$
8	The order of $\frac{dy}{dx}=\frac{4}{3}x^3+x-3$ is : (A) 1 (B) $\frac{3}{4}$ (C) $\frac{4}{3}$ (D) -3
9	$\int_a^x 3x^2\,dx =$: (A) x^3+a^3 (B) x^3-a^3 (C) $3x^3$ (D) x^3

(Turn Over)

1-10	If θ is measured in radian then $\lim_{\theta \to 0} \frac{\sin 7\theta}{\theta} =$: (A) 7 (B) $\frac{1}{7}$ (C) $\frac{7\pi}{22}$ (D) $\frac{7\pi}{12}$
11	The measure of the angle between the lines $ax^2 + 2hxy + by^2 = 0$ is given by $\tan\theta =$: (A) $\frac{\sqrt{h^2 - ab}}{a-b}$ (B) $\frac{2\sqrt{h^2 - ab}}{a+b}$ (C) $\frac{h^2 - ab}{a+b}$ (D) ∞
12	If $\vec{a} = \hat{i} - \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$ then $\vec{a} \cdot \vec{b} =$: (A) 0 (B) 1 (C) -1 (D) $\sqrt{2}$
13	The feasible solution which maximize or minimize the objective function is called : (A) Boundary (B) Half plane (C) Optimal solution (D) Initial values
14	The value of c for $\frac{y^2}{16} - \frac{x^2}{49} = 1$ is : (A) 16 (B) 49 (C) 65 (D) $\sqrt{65}$
15	The equation of a straight line represented by $x\cos\alpha + y\sin\alpha = P$ is called : (A) Normal form (B) Angular form (C) Symmetric form (D) P – form
16	The unit vector in the direction of $\vec{v} = [3, -4]$: (A) $5[3, -4]$ (B) $\frac{1}{5}[3, -4]$ (C) $\hat{i}$ (D) $\hat{j}$
17	The points A (– 5 , – 2) , B (5 , – 4) are ends point of a diameter of the circle. The centre will be : (A) (0 , 3) (B) (0 , – 3) (C) (5 , 2) (D) (– 5 , 4)
18	$xy = 0$ represents : (A) A pair of lines (B) Hyperbola (C) Parabola (D) Ellipse
19	The projection of $\vec{v}$ along $\vec{u}$ is : (A) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert}$ (B) $\frac{\vec{u} \cdot \vec{v}}{\lvert v \rvert}$ (C) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert \lvert v \rvert}$ (D) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert + \lvert v \rvert}$
20	An angle inscribed in a semi-circle is : (A) 0 (B) $\frac{\pi}{2}$ (C) π (D) 2π

LHR-II-21

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

(Academic Sessions 2017 – 2019 to 2019 – 2021)

MATHEMATICS 221-(INTER PART – II)

PAPER – II (Essay Type) GROUP – II

Time Allowed : 2.30 hours

Maximum Marks : 80

SECTION – I

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

(i) Express the area A of a circle as a function of its circumference C.

(ii) For the real-valued function $f(x)=\frac{2x+1}{2x-1}$, $x>1$. Find $f^{-1}(x)$

(iii) Evaluate $\lim_{x\to3}\frac{x-3}{\sqrt{x}-\sqrt{3}}$

(iv) Find the domain and range of $g(x)=|x-3|$

(v) If $y=\left(\sqrt{x}-\frac{1}{\sqrt{x}}\right)^2$, find $\frac{dy}{dx}$

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

(vii) Differentiate $\sin x$ $w.r.t.$ $\cot x$

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

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

(x) If $y=\ell n(\tanh x)$, find $\frac{dy}{dx}$

(xi) Find $\frac{dy}{dx}$ if $y=(x^2+5)(x^3+7)$

(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) Use differential to find $\frac{dy}{dx}$ for $xy+x=4$

(ii) Evaluate the integral $\int\frac{3x+2}{\sqrt{x}}dx$

(iii) Evaluate $\int\frac{x+b}{(x^2+2bx+c)^{1/2}}dx$

(iv) Evaluate $\int e^x(\cos x+\sin x)\,dx$

(v) Evaluate $\int\frac{(a-b)x}{(x-a)(x-b)}dx$

(vi) Evaluate $\int_{-1}^{1}(x^{1/3}+1)\,dx$

(vii) Find the area above the x-axis and under the curve $y=5-x^2$ from $x=-1$ to $x=2$

(viii) Solve differential equation $ydx+xdy=0$

(ix) Find mid-point of line segment joining A (– 8 , 3) ; B (2 , – 1)

(x) Two points ' P ' and ' O' ' given in xy-coordinate system. Find XY-coordinates of ' P ' referred to translated axis $O'X$ and $O'Y$ for P (– 2 , 6) ; O'(– 3 , 2)

(xi) Find equation of the line joining (– 5 , – 3) and (9 , – 1)

(xii) Find equation of vertical line through (– 5 , 3)

(Turn Over)

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

(i) Graph the solution set of given linear inequality in xy-plane : $2x + y \le 6$

(ii) Find the centre and radius of the circle with the given equation $5x^2 + 5y^2 + 14x + 12y - 10 = 0$

(iii) Find the focus and vertex of the parabola $x^2 = -16y$

(iv) Write an equation of parabola with given elements : Focus $(-3, 1)$; directrix $x - 2y - 3 = 0$

(v) Find an equation of directrices of given hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$

(vi) Find the centre and eccentricity of given hyperbola $\frac{y^2}{16} - \frac{x^2}{9} = 1$

(vii) Find the unit vector in the same direction as the vector $\underline{v} = [3, -4]$

(viii) Find the constant a so that the vectors $\underline{v} = \underline{i} - 3\underline{j} + 4\underline{k}$ and $\underline{w} = a\underline{i} + 9\underline{j} - 12\underline{k}$ are parallel.

(ix) Find a vector of length 2 in the direction opposite that of $\underline{v} = -\underline{i} + \underline{j} + \underline{k}$

(x) Find the cosine of the angle θ between $\underline{u}$ and $\underline{v}$ $\underline{u} = [2, -3, 1]$ and $\underline{v} = [2, 4, 1]$

(xi) Compute $\underline{b} \times \underline{a}$. Check your answer by showing that $\underline{b}$ is perpendicular to $\underline{b} \times \underline{a}$: $\underline{a} = 2\underline{i} + \underline{j} - \underline{k}$; $\underline{b} = \underline{i} - \underline{j} + \underline{k}$.

(xii) If $\underline{a} + \underline{b} + \underline{c} = 0$, then prove that $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$

(xiii) Give a force $\underline{F} = 2\underline{i} + \underline{j} - 3\underline{k}$ acting at a point A $(1, -2, 1)$. Find the moment of $\underline{F}$ about the point B $(2, 0, -2)$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Find value of k, if the function $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2}, & x \ne 2 \\ k, & x = 2 \end{cases}$ is continuous at $x = 2$ — 5

(b) If $y = \tan(p \tan^{-1} x)$ then show that $(1 + x^2)y_1 - p(1 + y^2) = 0$ — 5

6. (a) Evaluate $\int \frac{\sqrt{2}}{\sin x + \cos x} dx$ — 5

(b) Find an equation of the line through the intersection of the lines $x - y - 4 = 0$ and $7x + y + 20 = 0$ and parallel to the line $6x + y - 14 = 0$ — 5

7. (a) Find the area bounded by the curve $y = x^3 - 4x$ and the x-axis. — 5

(b) Maximize $f(x, y) = 2x + 5y$ subject to the constraints — 5

$2y - x \le 8$, $x - y \le 4$, $x \ge 0$, $y \ge 0$

8. (a) Write equation of the circle passing through the points A $(-7, 7)$, B $(5, -1)$ and C $(10, 0)$ — 5

(b) Find a vector of length 5 in the direction opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$ — 5

9. (a) Show that $y = \frac{\ell nx}{x}$ has maximum value at $x = e$ — 5

(b) Find focus, vertex and directrix of parabola $x^2 - 4x - 8y + 4 = 0$ — 5

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 $a_1x+b_1y+c_1=0$, $a_2x+b_2y+c_2=0$ 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) $(0,\pm 7)$ (B) $(\pm 4,0)$ (C) $(0,\pm 4)$ (D) $(\pm 7,0)$
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) $\ell n\lvert\sin x\rvert+c$ (C) $\ell n\lvert\cos x\rvert+c$ (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) $\ell n\lvert\sin x\rvert+c$ (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) $\frac{1}{\operatorname{cosec}^2 x}$

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

(Academic Sessions 2018 – 2020 to 2020 – 2022)

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 $\lim\limits_{\theta\to 0}\dfrac{1-\cos\theta}{\theta}$

(v) Express $\lim\limits_{x\to+\infty}\left(\dfrac{x}{1+x}\right)^x$ 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 $2^{x+h}=2^x\left\{1+(\ell n\, 2)h+\dfrac{(\ell n\, 2)^2h^2}{2!}+\dfrac{(\ell n\, 2)^3h^3}{3!}+\ldots\right\}$ 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 $\int_0^{\pi/4}\dfrac{\cos\theta+\sin\theta}{2\cos^2\theta}\,d\theta$ 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

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 – 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 $\lim_{x \to 1} \frac{x^2-1}{x^2-x} =$:

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

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

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

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

(A) $\frac{1}{1+x^2}$ (B) $\frac{-1}{1+x^2}$ (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 $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] =$:

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

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

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

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

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

8 The solution of differential equation $\frac{dy}{dx} = -y$ 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-G2-22

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) $\frac{\underline{a}\times\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$

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

(Academic Sessions 2018 – 2020 to 2020 – 2022)

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

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : LHR-GK-22 **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 $\int_0^{\frac{\pi}{3}}\cos^2\theta\sin\theta\,d\theta$

(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)

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 $3y-4\le 0$

(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 $(\pm5,0)$ 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 $\lim\limits_{x\to0}\dfrac{a^x-1}{x}=\log_e a$ 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 $2x-3y\le 6$, $2x+3y\le 12$, $x\ge 0$ 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