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 : 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	$\lim_{x\to 0}\frac{\sin ax}{\sin bx} = :$ (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)

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

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(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 $g(x)=\frac{2}{\sqrt{x}}$, $x\neq 0$

(iii) Evaluate $\lim_{\theta\to 0}\frac{1-\cos\theta}{\theta}$

(iv) Evaluate $\lim_{x\to 1}\frac{x^3-3x^2+2x-1}{x^3-x}$

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

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

(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 $\frac{d}{dx}(\operatorname{cosec}^{-1}x)=\frac{-1}{|x|\sqrt{x^2-1}}$

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

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

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

(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 $\int\frac{dx}{\sqrt{x+1}-\sqrt{x}}$

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

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

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

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

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

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

(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	$\int_a^x 3x^2dx =$:			
	(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

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

(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 : $2x + y \leq 6$

(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 $\underline{b} \times \underline{a}$: $a = 2\underline{i} + \underline{j} - \underline{k}$; $\underline{b} = \underline{i} - \underline{j} + \underline{k}$.

(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 $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2} & , \ x \neq 2 \\ k & , \ x = 2 \end{cases}$ 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
$2y - x \leq 8$, $x - y \leq 4$, $x \geq 0$, $y \geq 0$

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