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	$\underset{x \to 0}{Lt} \frac{\sin ax}{\sin bx} =$:
	(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) $\ln|\sec x - \tan x|$ (D) $\ln|\sec x + \tan x|+c$
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) $\left(\dfrac{1}{2}, -\dfrac{3}{2}\right)$ (B) $\left(\dfrac{5}{2}, \dfrac{5}{2}\right)$ (C) $\left(\dfrac{1}{2}, \dfrac{3}{2}\right)$ (D) $\left(\dfrac{1}{2}, \dfrac{5}{2}\right)$
10	The derivative of $\dfrac{1}{1+x}$ 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	$\dfrac{d}{dx}(\cos^{-1} x) =$:
	(A) $\dfrac{1}{\sqrt{1-x^2}}$ (B) $\dfrac{-1}{\sqrt{1-x^2}}$ (C) $\dfrac{1}{\sqrt{1+x^2}}$ (D) $\dfrac{1}{1+x^2}$
17	$1 + x + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + - - - -$ 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	$\dfrac{d}{dx}\tan^{-1} x =$:
	(A) $\dfrac{1}{1-x^2}$ (B) $\dfrac{1}{\sqrt{1-x^2}}$ (C) $\dfrac{1}{\sqrt{1+x^2}}$ (D) $\dfrac{1}{1+x^2}$
20	The focus of parabola $y^2 = 4ax$ is :
	(A) $(0, a)$ (B) $(-a, 0)$ (C) $(a, 0)$ (D) $(0, -a)$

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

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

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

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

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

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

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

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

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

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

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

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

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

(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 $\displaystyle\int e^{2x}\left[-\sin x + 2\cos x\right] dx$

(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 $\displaystyle\int x \, \ell n x \, dx$

(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 $5x - 4y \leq 20$

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

      (viii)   Find a unit vector in the direction of $\underline{v} = -\dfrac{\sqrt{3}}{2}\underline{i} - \dfrac{1}{2}\underline{j}$

      (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 $\underline{v} \cdot \underline{i} = 0$, $\underline{v} \cdot \underline{j} = 0$ and $\underline{v} \cdot \underline{k} = 0$, 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 $\dfrac{dy}{dx} = \dfrac{y}{x}$ if $\dfrac{y}{x} = \tan^{-1}\dfrac{x}{y}$ 5

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

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

7.   (a)   Evaluate $\displaystyle\int_{0}^{\frac{\pi}{4}} \dfrac{1}{1 + \sin x}\,dx$ 5

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

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 $\dfrac{x^2}{18} + \dfrac{y^2}{8} = 1$ and $\dfrac{x^2}{3} - \dfrac{y^2}{3} = 1$ 5

.oll 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 $\dfrac{1}{1+x}$ is :			
	(A) x	(B) $1+x$	(C) $(1+x)^{-2}$	(D) $-1(1+x)^{-2}$
2	$\displaystyle\int \cos x \, dx =$:			
	(A) $1-\sin^2 x$	(B) $\sqrt{1-\sin^2 x}$	(C) $\sin x$	(D) $-\sin x$
3	$\displaystyle\int_{1}^{2} (x^2+1)\, dx =$:			
	(A) $\dfrac{10}{3}$	(B) $\dfrac{3}{10}$	(C) π	(D) $\dfrac{\pi}{2}$
4	If $y=\cot^{-1} x$, then $\dfrac{dy}{dx} =$:			
	(A) $\dfrac{1}{1-x^2}$	(B) $\dfrac{-1}{1+x^2}$	(C) $\dfrac{1}{x^2-1}$	(D) $\dfrac{1}{x^2+1}$
5	The derivative of $\ell n(\tanh x)$ is :			
	(A) $\dfrac{1}{\tanh x}$	(B) $\dfrac{\sec h^2 x}{\tanh x}$	(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 $\dfrac{dy}{dx} =$:			
	(A) $-\dfrac{x}{y}$	(B) $-\dfrac{y}{x}$	(C) $\dfrac{x}{y}$	(D) $\dfrac{y}{x}$
8	The order of $\dfrac{dy}{dx} = \dfrac{4}{3}x^3 + x - 3$ is :			
	(A) 1	(B) $\dfrac{3}{4}$	(C) $\dfrac{4}{3}$	(D) -3
9	$\displaystyle\int_{a}^{x} 3x^2 dx =$:			
	(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 $\displaystyle\lim_{\theta \to 0} \frac{\sin 7\theta}{\theta} =$:
	(A) 7 (B) $\dfrac{1}{7}$ (C) $\dfrac{7\pi}{22}$ (D) $\dfrac{7\pi}{12}$
11	The measure of the angle between the lines $ax^2 + 2hxy + by^2 = 0$ is given by $\tan\theta =$:
	(A) $\dfrac{\sqrt{h^2 - ab}}{a - b}$ (B) $\dfrac{2\sqrt{h^2 - ab}}{a + b}$ (C) $\dfrac{h^2 - ab}{a + b}$ (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 $\dfrac{y^2}{16} - \dfrac{x^2}{49} = 1$ 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) $\dfrac{1}{5}[3, -4]$ (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) $\dfrac{\vec{u} \cdot \vec{v}}{|u|}$ (B) $\dfrac{\vec{u} \cdot \vec{v}}{|v|}$ (C) $\dfrac{\vec{u} \cdot \vec{v}}{|u||v|}$ (D) $\dfrac{\vec{u} \cdot \vec{v}}{|u|+|v|}$
20	An angle inscribed in a semi-circle is :
	(A) 0 (B) $\dfrac{\pi}{2}$ (C) π (D) 2π

Roll No _____

_____ (To be filled in by the candidate)

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

PAPER – II (Essay Type)   GROUP – II   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 $f(x) = \dfrac{2x+1}{2x-1}$, $x > 1$. Find $f^{-1}(x)$

  (iii) Evaluate $\lim\limits_{x \to 3} \dfrac{x-3}{\sqrt{x} - \sqrt{3}}$

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

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

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

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

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

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

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

  (xi) Find $\dfrac{dy}{dx}$ 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 $\dfrac{dy}{dx}$ for $xy + x = 4$

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

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

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

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

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

  (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 $\dfrac{x^2}{4} - \dfrac{y^2}{9} = 1$

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

 (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 $f(x) = \begin{cases} \dfrac{\sqrt{2x+5} - \sqrt{x+7}}{x-2} &, x \neq 2 \\ k &, x = 2 \end{cases}$ 5

    is continuous at $x = 2$

  (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 $\displaystyle\int \dfrac{\sqrt{2}}{\sin x + \cos x}\, dx$ 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 $y = \dfrac{\ln x}{x}$ has maximum value at $x = e$ 5

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