

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-91-22

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) 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 $3 \underline{j} \cdot \underline{k} \times \underline{i}$ 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)

(2) LHR-G 1-22

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	$\lim_{h \rightarrow 0} (1 + 2h)^{\frac{1}{h}} = :$ (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) $\ln \sin x + c$ (C) $\ln \cos x + c$ (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) $a^2 e^{-ax}$ (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) $\ln \sin x + c$ (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

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

UR-92-22

16

- (i) Find domain and range of $f(x) = \sqrt{x+1}$
- (ii) Find $f \circ f(x)$ if $f(x) = \sqrt{x+1}$
- (iii) Obtain $f^{-1}(x)$ from $f(x) = 3x^3 + 7$
- (iv) Evaluate $\lim_{\theta \rightarrow 0} \frac{1 - \cos \theta}{\theta}$
- (v) Express $\lim_{x \rightarrow +\infty} \left(\frac{x}{1+x} \right)^x$ in terms of "e"
- (vi) If $y = \frac{x^2 + 1}{x^2 - 3}$, then find $\frac{dy}{dx}$
- (vii) Prove that derivative of $\tan^{-1} x$ w.r.t. "x" is $\frac{1}{1+x^2}$
- (viii) Differentiate $\frac{1}{a} \sin^{-1} \left(\frac{a}{x} \right)$ w.r.t. "x"
- (ix) Find $\frac{dy}{dx}$ if $y = x^2 \ln \sqrt{x}$
- (x) If $y = e^{-x}(x^3 + 2x^2 + 1)$, then find $\frac{dy}{dx}$
- (xi) Apply the Maclaurin's series expansion to prove that $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$
- (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 :

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- (i) If $x^2 + 2y^2 = 16$, find $\frac{dy}{dx}$ by using differentials.
- (ii) Evaluate $\int \frac{x}{x+2} dx$
- (iii) Evaluate indefinite integral $\int \frac{\sec^2 x}{\sqrt{\tan x}} dx$
- (iv) Evaluate $\int \ln x dx$
- (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)

(2) LHR C, 2-22

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 $\vec{AB} = 4\hat{i} - 2\hat{j}$ and B $(-2, 5)$
(x) Find α so that $|\alpha\hat{i} + (\alpha+1)\hat{j} + 2\hat{k}| = 3$
(xi) Find the cosine of the angle θ between \underline{u} and \underline{v} ; $\underline{u} = \hat{i} - 3\hat{j} + 4\hat{k}$; $\underline{v} = 4\hat{i} - \hat{j} + 3\hat{k}$
(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 $\vec{F} = 7\hat{i} + 4\hat{j} - 3\hat{k}$ 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 $2^{x+h} = 2^x \left\{ 1 + (\ln 2)h + \frac{(\ln 2)^2 h^2}{2!} + \frac{(\ln 2)^3 h^3}{3!} + \dots \right\}$ 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 $\int_0^{\pi/4} \frac{\cos \theta + \sin \theta}{2 \cos^2 \theta} d\theta$ 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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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. 14R-9)-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	$\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - x} = :$ (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)

(2)

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) $\frac{ \underline{a} \underline{b} }{\underline{a} \cdot \underline{b}}$ (C) $\frac{\underline{a} \cdot \underline{b}}{ \underline{a} \underline{b} }$ (D) $\frac{\underline{a} \times \underline{b}}{ \underline{a} \underline{b} }$

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MATHEMATICS 222-(INTER PART – II)
PAPER – II (Essay Type) GROUP – I

Time Allowed : 2.30 hours
Maximum Marks : 80

SECTION – I

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

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- (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 $\lim_{x \rightarrow 0} \frac{\sin x^\circ}{x}$
- (iv) Define rational function with example.
- (v) Evaluate $\lim_{x \rightarrow \infty} \left(\frac{x}{1+x} \right)^x$
- (vi) Find $\frac{dy}{dx}$ from first principle if $y = \sqrt{x+2}$
- (vii) Differentiate w.r.t. "x"; $y = \frac{x^2+1}{x^2-3}$
- (viii) Find $\frac{dy}{dx}$ if $xy + y^2 = 2$
- (ix) Find derivative w.r.t. x if $y = \cot^{-1} \left(\frac{x}{a} \right)$
- (x) Find $\frac{dy}{dx}$ if $y = \log_{10}(ax^2 + bx + c)$
- (xi) Apply the Maclaurin Series to prove that $e^{2x} = 1 + 2x + \frac{4x^2}{2} + \frac{8x^3}{3} + \dots$
- (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 $\int \frac{(\sqrt{\theta}-1)^2}{\sqrt{\theta}} d\theta, \theta > 0$
- (iii) Find $\int \frac{1}{x(\ln x)} dx$
- (iv) Evaluate the integral $\int \frac{x+2}{\sqrt{x+3}} dx$
- (v) Using by part method to evaluate $\int x^2 \ln x dx$
- (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 $\sin y \operatorname{cosec} x \frac{dy}{dx} = 1$
- (ix) Find h such that A (-1, h), B (3, 2), C (7, 3) are collinear.

(Turn Over)

(2) UR-91-22

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 $\lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \log_e a$ 5
- (b) If $x = \frac{1-t^2}{1+t^2}$, $y = \frac{2t}{1+t^2}$ prove that $y \frac{dy}{dx} + x = 0$ 5
6. (a) Evaluate $\int \ln(x + \sqrt{x^2 + 1}) dx$ 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 $\frac{y^2}{16} - \frac{x^2}{9} = 1$ 5
- (b) Prove that $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$ 5