Roll No LHR-G1-12-18 ( To be filled in by the candidate)

**(Academic Sessions 2014 – 2016 to 2016 – 2018 )**

**MATHEMATICS** 218-(INTER PART – II) Time Allowed : 30 Minutes

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

**PAPER CODE = 8197**

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 | If $y = \sqrt{1-x^2}$, $0 < x < 1$ *then* $\frac{dy}{dx} =$ : <br> (A) $\sqrt{x^2-1}$ (B) $\frac{1}{\sqrt{1-x^2}}$ (C) $\frac{x}{\sqrt{1-x^2}}$ (D) $\frac{-x}{\sqrt{1-x^2}}$ |
| 2 | $\int 3^x dx =$ : <br> (A) $3^x + c$ (B) $3^x \ell n\, 3 + c$ (C) $\frac{3^x}{\ell n\, 3} + c$ (D) $3\, \ell n\, 3^x + c$ |
| 3 | $\int_0^{\frac{\pi}{2}} \cos x\, dx =$ : <br> (A) 0 (B) 1 (C) 2 (D) 3 |
| 4 | If $f(x)$ has second derivative at " c " such that $f'(c) = 0$ *and* $f''(c) < 0$ then " c " is a point of : <br> (A) Maxima (B) Minima (C) Zero point (D) Point of inflection |
| 5 | If $y = e^{\sin x}$, then $\frac{dy}{dx} =$ : <br> (A) $e^{\sin x}$ (B) $e^{\sin x} \cos x$ (C) $e^{\sin x} + \cos x$ (D) $-e^{\sin x} \cos x$ |
| 6 | $\cosh^2 x - \sinh^2 x =$ : <br> (A) 1 (B) $-1$ (C) 0 (D) 2 |
| 7 | $\frac{d}{dx} \sin^{-1} x =$ : <br> (A) $\frac{1}{\sqrt{1+x^2}}$ (B) $\cos^{-1} x$ (C) $\frac{1}{\sqrt{1-x^2}}$ (D) $\frac{1}{\sqrt{1-x}}$ |
| 8 | $\int \frac{1}{f(x)} \times f'(x)\, dx =$ : <br> (A) $\ell nx + c$ (B) $\ell n[f'(x) + c]$ (C) $\frac{1}{f(x)} + c$ (D) $\ell n\lvert f(x)\rvert + c$ |
| 9 | The order of the differential equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} + 2x = 0$ is : <br> (A) 2 (B) 1 (C) 0 (D) 3 |

L-HR-G1-12-19 (2)

| | |
|---|---|
| 1-10 | Let $f(x) = x^2 + \cos x$, *then* $f(x)$ *is* :<br>(A) Odd function (B) Constant function<br>(C) Even function (D) Neither even nor odd |
| 11 | The centroid of a triangle divides each median in ratio :<br>(A) 2 : 1 (B) 1 : 2 (C) 2 : 3 (D) 1 : 1 |
| 12 | The straight line $y = mx + c$ is tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ if :<br>(A) $c^2 = a^2 m^2 - b^2$ (B) $c^2 = b^2 m^2 + a^2$<br>(C) $c^2 = b^2 m^2 - a^2$ (D) $c^2 = a^2 m^2 + b^2$ |
| 13 | The perpendicular distance of line $3x + 4y - 10 = 0$ from the origin is :<br>(A) 0 (B) 1 (C) $\frac{1}{2}$ (D) 2 |
| 14 | Axis of the parabola $x^2 = 4ay$ is :<br>(A) $y = 0$ (B) $x = 0$ (C) $x = y$ (D) $x = 1$ |
| 15 | If $\alpha$ is the inclination of the line $\ell$ then $\frac{x - x_1}{\cos\alpha} = \frac{y - y_1}{\sin\alpha} = r$ (say) is called :<br>(A) Point slope form (B) Normal form<br>(C) Symmetric form (D) Intercept form |
| 16 | The direction cosines of y-axis are :<br>(A) ( 0 , 1 , 0 ) (B) ( 1 , 0 , 0 ) (C) ( 0 , 0 , 1 ) (D) ( 0 , 0 , 0 ) |
| 17 | If $\alpha$ is the inclination of a line "$\ell$" then it must be true that :<br>(A) $0 \le \alpha < \frac{\pi}{2}$ (B) $\frac{\pi}{2} \le \alpha < \pi$ (C) $0 \le \alpha < \pi$ (D) $0 \le \alpha < 2\pi$ |
| 18 | The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle with centre :<br>(A) $(-g, -f)$ (B) $(-f, +g)$ (C) $(f, g)$ (D) ( 0 , 0 ) |
| 19 | Length of the vector $2\underline{i} - \underline{j} - 2\underline{k}$ is :<br>(A) 2 (B) 4 (C) 3 (D) 5 |
| 20 | The feasible solution which maximizes or minimizes the objective function is called :<br>(A) Exact solution (B) Optimal solution<br>(C) Final solution (D) Objective solution |

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**(Academic Sessions 2014 – 2016 to 2016 – 2018 )**

MATHEMATICS 218-(INTER PART – II) Time Allowed : 2.30 hours

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

**SECTION – I**

LHR-G1-12-18

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

(i) State sandwitch theorem.

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

(iii) If $f(x) = \begin{cases} x+2 & , x \le -1 \\ c+2 & , x > -1 \end{cases}$ , find " c " so that $\lim_{x \to -1} f(x)$ exists

(iv) Define differentiation.

(v) Differentiate $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2$ *w.r.t* $x$

(vi) Find $\frac{dy}{dx}$ if $xy + y^2 = 0$

(vii) Find $\frac{dy}{dx}$ if $y = x \cos y$

(viii) Prove that $\frac{d}{dx}(\cos^{-1} x) = \frac{-1}{\sqrt{1-x^2}}$ , $x \in (-1,1)$

(ix) Find $\frac{dy}{dx}$ if $y = x e^{\sin x}$

(x) Define power series.

(xi) Find extreme values for $f(x) = x^2 - x - 2$

(xii) Find $\frac{dy}{dx}$ if $y = \sin h^{-1}(\frac{x}{2})$

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

(i) Find $\frac{dy}{dx}$ using differentials if $xy - \log_e x = c$

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

(iii) Evaluate the integral $\int \frac{1}{a^2 - x^2} . dx$

(iv) Evaluate the integral $\int x \sin x \cos x \, dx$

(v) Evaluate the integral $\int x^2 e^{ax} . dx$

(vi) Evaluate the integral $\int e^{3x} \left(\frac{3\sin x - \cos x}{\sin^2 x}\right) dx$

(vii) Prove that $\int_a^b f(x).dx = -\int_a^b f(x).dx$

(viii) Evaluate the definite integral $\int_0^3 \frac{dx}{x^2 + 9}$

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



(Turn Over)

3. (x) Solve the differential equation $\sin y \operatorname{cosec} x \frac{dy}{dx} = 1$

(xi) Define optimal solution and feasible solution.

(xii) Graph the region indicated by $4x - 3y \leq 12$ , $x \geq -\frac{3}{2}$

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

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

(ii) Find an equation of a line through the points ( – 2 , 1 ) and ( 6 , – 4 )

(iii) Find an equation of the line bisecting the first and third quadrants.

(iv) Find an equation of the line with x-intercept : – 3 and y – intercept : 4

(v) Convert $2x - 4y + 11 = 0$ into slope intercept form.

(vi) Write an equation of the parabola with focus ( – 1 , 0 ) , vertex ( – 1 , 2 )

(vii) Find the focus and directrix of the parabola $y = 6x^2 - 1$

(viii) Find an equation of the ellipse with centre ( 0 , 0 ) , focus ( 0 , – 3 ) , vertex ( 0 , 4 )

(ix) Find the eccentricity and directrices of the ellipse whose equation is $25x^2 + 9y^2 = 225$

(x) Define unit vector.

(xi) Find a unit vector in the direction of the vector $\underline{v} = \frac{1}{2}\underline{i} + \frac{\sqrt{3}}{2}\underline{j}$

(xii) Find a vector whose magnitude is '4' and is parallel to $2\underline{i} - 3\underline{j} + 6\underline{k}$

(xiii) Find a scalar " $\alpha$ " so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular.

## SECTION – II

Note : Attempt any THREE questions.

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

Find value of k so that $f$ is continuous at $x = 2$

(b) Show that $y = x^x$ has maximum value at $x = \frac{1}{e}$ 5

6. (a) Evaluate $\int e^{2x} \cos 3x \, dx$ 5

(b) The three points A ( 7 , – 1 ) , B ( – 2 , 2 ) and C ( 1 , 4 ) are consecutive vertices of a parallelogram, find the fourth vertex. 5

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

(b) Minimize $z = 2x + y$ subject to the constraints 5

$x + y \geq 3$ , $7x + 5y \leq 35$ , $x \geq 0$ , $y \geq 0$

8. (a) Find the condition that the line $y = mx + c$ touches the circle $x^2 + y^2 = a^2$ at a single point. 5

(b) Find $x$ so that points A ( 1 , – 1 , 0 ) , B ( – 2 , 2 , 1 ) and C ( 0 , 2 , $x$ ) form triangle with right angle at C. 5

9. (a) Find the centre, foci, eccentricity, vertices and equations of directices of $\frac{y^2}{4} - x^2 = 1$ 5

(b) Find volume of the tetrahedron with the vertices A ( 2, 1, 8 ) , B ( 3, 2, 9 ) , C ( 2, 1, 4 ) and D ( 3, 3, 10 ) 5

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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 | $\frac{d}{dx}\ell og_a x =$ : <br> (A) $\frac{1}{x}$ (B) $x\ell nx - x$ (C) $\frac{1}{x}\ell na$ (D) $\frac{1}{x\ell na}$ |
| 2 | $\int \sin x \cos x dx$ : <br> (A) $\frac{1}{2}\cos 2x$ (B) $-\frac{1}{2}\cos 2x$ (C) $\frac{\sin^2 x}{2}$ (D) $\frac{\cos^2 x}{2}$ |
| 3 | $\int \frac{1}{x\sqrt{x^2-1}} dx$ : <br> (A) $\sin^{-1} x$ (B) $\tan^{-1} x$ (C) $\sec^{-1} x$ (D) $\cos ec^{-1} x$ |
| 4 | If $x = f(\theta), y = g(\theta)$ then $\frac{dy}{dx}$ : <br> (A) $\frac{dy}{d\theta}\frac{d\theta}{dx}$ (B) $\frac{dx}{d\theta}\frac{d\theta}{dy}$ (C) $\frac{d\theta}{dy}\frac{dx}{d\theta}$ (D) $\frac{dy}{d\theta}\frac{dx}{d\theta}$ |
| 5 | $\frac{d}{dx}\sec hx =$ : <br> (A) $\sec hx \tanh x$ (B) $-\sec hx \tanh x$ (C) $\tan h^2 x$ (D) $\sec h^2 x$ |
| 6 | If at least one vertical line meets the curve at more than two points then curve is : <br> (A) A function (B) Not a function <br> (C) One – to – one function (D) Onto function |
| 7 | $\frac{d}{dx}\cosh x =$ : <br> (A) $-\sin hx$ (B) $\sec hx$ (C) $-\sec hx$ (D) $\sin hx$ |
| 8 | $\int \sec^2 x dx$ : <br> (A) $\tan x$ (B) $\frac{\sec^3 x}{3}$ (C) $\tan^2 x$ (D) $\sec x \tan x$ |
| 9 | Solution of $\frac{dy}{dx} = \frac{-y}{x}$ is : <br> (A) $\frac{x}{y} = c$ (B) $\frac{y}{x} = c$ (C) $y = cx$ (D) $xy = c$ |

| | |
|---|---|
| 1-10 | Domain of $f(x) = x^2 + 1$ :<br>(A) R (B) $R - \{1\}$ (C) $R - \{-1\}$ (D) $[1, \infty)$ |
| 11 | Equation of line bisecting II and IV quadrant :<br>(A) $y = x$ (B) $y = -x$ (C) $y = \frac{1}{x}$ (D) $x + y = 1$ |
| 12 | Set of all points equidistant from a fixed point form :<br>(A) Ellipse (B) Parabola (C) Hyperbola (D) Circle |
| 13 | Joint equation of two lines is $ax^2 + 2hxy + by^2 = 0$ , if $\theta$ is angle between them, then $\tan\theta =$ :<br>(A) $\frac{2\sqrt{h^2 + ab}}{a + b}$ (B) $\frac{2\sqrt{h^2 - ab}}{a + b}$ (C) $\frac{\sqrt{h^2 + ab}}{a + b}$ (D) $\frac{\sqrt{h^2 - ab}}{a + b}$ |
| 14 | Focal chord perpendicular to axis of parabola is called :<br>(A) Latus Rectum (B) Eccentricity (C) Vertex (D) Axis |
| 15 | Horizontal line through $(7, -9)$ is :<br>(A) $x = 7$ (B) $x = -9$ (C) $y = 7$ (D) $y = -9$ |
| 16 | Projection of vector $\vec{u}$ on vector $\vec{v}$ is :<br>(A) $\frac{\vec{u} \cdot \vec{v}}{\lvert v \rvert}$ (B) $\frac{\vec{u} \cdot \vec{v}}{\lvert u \rvert}$ (C) $\frac{\vec{u} \times \vec{v}}{\lvert v \rvert}$ (D) $\frac{\vec{u} \times \vec{v}}{\lvert u \rvert}$ |
| 17 | Distance of $(x_1, y_1)$ from line $ax + by + c = 0$ is :<br>(A) $\frac{\lvert ax_1 + by_1 + c \rvert}{\sqrt{a^2 + b^2}}$ (B) $\frac{\lvert ax_1 + by_1 - c \rvert}{\sqrt{a^2 + b^2}}$ (C) $\frac{\lvert ax_1 + by_1 + c \rvert}{\sqrt{a + b}}$ (D) $\frac{\lvert ax_1 + by_1 - c \rvert}{\sqrt{a + b}}$ |
| 18 | For ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , $(a > b)$ then eccentricity $e =$ :<br>(A) $\frac{\sqrt{a^2 - b^2}}{a}$ (B) $\frac{\sqrt{a^2 + b^2}}{a}$ (C) $\frac{\sqrt{b^2 - a^2}}{a}$ (D) $\frac{\sqrt{b^2 - a^2}}{b}$ |
| 19 | If $\vec{v}$ is any vector then vector of magnitude 5 opposite to $\vec{v}$ is :<br>(A) $5\vec{v}$ (B) $-5\vec{v}$ (C) $5\frac{\vec{v}}{\lvert v \rvert}$ (D) $-5\frac{\vec{v}}{\lvert v \rvert}$ |
| 20 | System of linear inequalities involved in the problem is called :<br>(A) Coefficients (B) Solution (C) Problem constraints (D) Boundaries |

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

**SECTION – I**

LHR-G2-12-18

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

(i) Prove that $\cosh^2 x + \sinh^2 x = \cosh 2x$

(ii) Determine whether function $f(x) = \dfrac{x^3 - x}{x^2 + 1}$ is even or odd.

(iii) Evaluate $\underset{x \to 0}{Lim} \dfrac{\sec x - \cos x}{x}$

(iv) Find $\dfrac{dy}{dx}$ if $y = \dfrac{a + x}{a - x}$

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

(vi) Differentiate $x^2 - \dfrac{1}{x^2}$ *w.r.t* $x^4$

(vii) Differentiate $\sin^{-1}\sqrt{1 - x^2}$ *w.r.t* $x$

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

(ix) Find $\dfrac{dy}{dx}$ if $y = e^{-2x}\sin 2x$

(x) Find $\dfrac{d^2y}{dx^2}$ if $y^3 + 3ax^2 + x^3 = 0$

(xi) Find $y_2$ if $y = \cos^3 x$

(xii) Find $\dfrac{dy}{dx}$ if $y = \ell n\left(\dfrac{x^2 - 1}{x^2 + 1}\right)^{\frac{1}{2}}$

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

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

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

(iii) Evaluate $\int (a - 2x)^{3/2} dx$

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

(v) Evaluate $\int xe^x dx$

(vi) Evaluate $\int e^x \left(\dfrac{1}{x} + \ell nx\right) dx$

(vii) Evaluate $\int_{-1}^{3} (x^3 + 3x^2) dx$

(viii) Evaluate $\int_{0}^{\pi/3} \cos^2\theta \sin\theta \, d\theta$

3. (ix) Find the area between the x-axis and the curve $y = 4x - x^2$ from $x = 0$ to $x = 4$

(x) Define differential equation.

(xi) Solve $\frac{dy}{dx} = \frac{y^2+1}{e^{-x}}$

(xii) Solve $\frac{dy}{dx} = 2x$

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

(i) Write down equation of straight line with x-intercept ( 2 , 0 ) and y-intercept ( 0 , – 4 )

(ii) Find an equation of a line bisecting 2nd and 4th quadrants.

(iii) Find an equation of a line with x-intercept : – 9 and slope : – 4 .

(iv) Prove that if the lines are perpendicular, then product of their slopes = – 1

(v) Find the measure of angle between the lines represented by $x^2 - xy - 6y^2 = 0$

(vi) Find focus and vertex of the parabola $y = 6x^2 - 1$

(vii) Find equation of latus rectum of parabola $y^2 = -8(x - 3)$

(viii) Find an equation of an ellipse with foci ( ± 3 , 0 ) and minor axis of length 10.

(ix) Find the foci and length of the latus rectum of the ellipse $9x^2 + y^2 = 18$

(x) Define direction angles and direction cosines of a vector.

(xi) Find the projection of vector $\underline{a}$ along vector $\underline{b}$ and projection of vector $\underline{b}$ along $\underline{a}$ when $\underline{a} = \hat{i} - \hat{k}$ , $\underline{b} = \hat{j} + \hat{k}$

(xii) Find a vector perpendicular to each of the vectors $\underline{a} = 2\hat{i} + \hat{j} + \hat{k}$ and $\underline{b} = 4\hat{i} + 2\hat{j} - \hat{k}$

(xiii) Convert $2x - 4y + 11 = 0$ into slope intercept form.

## SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e a$ 5

(b) Prove that $y\frac{dy}{dx} + x = 0$ if $x = \frac{1-t^2}{1+t^2}$ , $y = \frac{2t}{1+t^2}$ 5

6. (a) Show that $\int \frac{dx}{\sqrt{x^2 - a^2}} = \ell n(x + \sqrt{x^2 - a^2}) + c$ 5

(b) The points A ( – 1 , 2 ) , B ( 6 , 3 ) and C ( 2 , – 4 ) are vertices of a triangle, then show that the line joining the mid-point " D " of $\overline{AB}$ and mid-point " E " of $\overline{AC}$ is parallel to $\overline{BC}$ and $\overline{DE} = \frac{1}{2}\overline{BC}$. 5

7. (a) Evaluate $\int_0^{\frac{\pi}{4}} \cos^4 t \, dt$ 5

(b) Graph the feasible region of system of linear inequalities and find the corner points
$2x + 3y \leq 18, x + 4y \leq 12$ , $3x + y \leq 12$ $x \geq 0, y \geq 0$ 5

8. (a) Find an equation of parabola having its focus at the origin and directrix parallel to y-axis. 5

(b) Prove that the line segment joining the mid-points of two sides of a triangle is parallel to the third side and half as long. 5

9. (a) Find the centre, foci, eccentricity, vertices and equations of directices of $\frac{y^2}{4} - x^2 = 1$ 5

(b) Find the value of $\alpha$, in the coplanar vectors $\alpha\hat{i} + \hat{j}$ , $\hat{i} + \hat{j} + 3\hat{k}$ , $2\hat{i} + \hat{j} - 2\hat{k}$ 5