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(Inter Part – II) **(Session 2020-22 to 2022-24)** **Sig. of Student ----------**

Mathematics (Objective) **(Group 1st)** **Paper (II)** SGD-I-24

Time Allowed:- 30 minutes **PAPER CODE 4197** **Maximum Marks:- 20**

Note:- You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question. Write **PAPER CODE, which is printed on this question paper,** on the both sides of the Answer Sheet and fill bubbles accordingly, otherwise the student will be responsible for the situation. Use of Ink Remover or white correcting fluid is not allowed. **Q. 1**

1) If $f(x) = e^{\sqrt{x}-1}$, then $f'(0) =$

(A) e (B) $\frac{1}{e}$ (C) $\frac{1}{2}$ (D) ∞

2) $\int e^x(\sin x + \cos x)dx =$

(A) $e^x \sin x + c$ (B) $e^x \cos x + c$ (C) $-e^x \sin x + c$ (D) $-e^x \cos x + c$

3) $\int \frac{dx}{x(\ln 2x)^3} =$

(A) $\ln(\ln 2x)^3 + c$ (B) $\frac{(\ln 2x)^4}{4} + c$ (C) $\frac{1}{(\ln 2x)^3} + c$ (D) $-\frac{1}{2(\ln 2x)^2} + c$

4) If $f(x) = x^2$, then range of f is

(A) $[0, \infty[$ (B) $]-\infty, 0]$ (C) $]0, \infty[$ (D) R

5) If $f(x) = x \sec x$, then $f(\pi) =$

(A) π (B) 2π (C) $-\pi$ (D) -2π

6) If $y = e^{-ax}$, then $y\frac{dy}{dx} =$

(A) ae^{-2ax} (B) $-ae^{-ax}$ (C) a^2e^{-ax} (D) $-ae^{-ax}$

7) $f(x) = 4 - x^2$ decreases in the interval

(A) $]-\infty, 0[$ (B) $]0, \infty[$ (C) $(-2, 2)$ (D) $(-\infty, +\infty)$

8) $\frac{1}{1+x^2}$ is the derivative of

(A) $\sin^{-1} x$ (B) $\cos^{-1} x$ (C) $\tan^{-1} x$ (D) $\cot^{-1} x$

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9) A vector perpendicular to both $2\hat{i}$ and $\hat{k}$ is

(A) $\hat{i}$ (B) $-2\hat{j}$ (C) $\hat{k}$ (D) $2i+k$

10) The angle between the vectors $2\hat{i}+3\hat{j}+\hat{k}$ and $2\hat{i}-\hat{j}-\hat{k}$ is

(A) 30° (B) 45° (C) 60° (D) 90°

11) $\int_0^{\pi/4} \sec^2 x \, dx =$

(A) 0 (B) 1 (C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

12) $\int_{-1}^{3} x^3 dx =$

(A) 20 (B) 40 (C) 60 (D) 80

13) The lines represented by $ax^2+2hxy+by^2=0$ are perpendicular if

(A) $a=b$ (B) $a=-b$ (C) $a\neq b$ (D) $a\geq b$

14) The equation of y-axis is

(A) $x=0$ (B) $y=0$ (C) $y=x$ (D) $x+y=0$

15) Slope of the line perpendicular to $3x-4y+5=0$ is

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

16) The graph of the Inequality y < b is a / an

(A) Upper half plane (B) Lower half plane (C) Right half plane (D) Left half plane

17) Angle Inscribed in a semi-circle is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) 0

18) Equation of normal to the circle $x^2+y^2=25$ at point (4 , 3) is

(A) $4x+3y=5$ (B) $4x+3y=25$ (C) $4x+3y=0$ (D) $3x-4y=0$

19) If $c=\sqrt{65}$, $b=7$ and $a=4$, then eccentricity of hyperbola is

(A) $\frac{7}{4}$ (B) $\frac{65}{16}$ (C) $\frac{\sqrt{65}}{7}$ (D) $\frac{\sqrt{65}}{4}$

20) If $P(2,3)$ and $Q(6,-2)$ are two points in the plane, then vector $\overrightarrow{PQ}$ is

(A) $4i-5j$ (B) $-4i+5j$ (C) $4i+5j$ (D) $8i+j$

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Mathematics (Subjective) **(Group 1st)** **(Inter Part – II)** **Paper (II)** SGD-I-24

Time Allowed: 2.30 hours **(Session 2020-22 to 2022-24)** **Maximum Marks: 80**

Section ---------- I

2. Answer briefly any Eight parts from the followings:- **8 × 2 = 16**

(i) Define exponential function. **(ii)** Prove the identity $\sec h^2 x = 1 - \tanh^2 x$

(iii) For real valued functions f and defined as

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

(iv) Evaluate the limit by algebraic techniques $\lim_{h \to 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}$

(v) Find by definition, the derivative of $x^{\frac{5}{2}}$ with respect to 'x' **(vi)** Differentiate with respect to x of $\frac{(x^2+1)^2}{x^2-1}$

(vii) Find $\frac{dy}{dx}$ if $x^2 - 4xy - 5y = 0$ **(viii)** Differentiate with respect to 'θ' of $\tan^3\theta \sec^2\theta$

(ix) Find $\frac{dy}{dx}$ if $y = x^2 \ln\sqrt{x}$ **(x)** Find y_4 if $y = \sin 3x$

(xi) Prove that $e^{x+h} = e^x\{1 + h + \frac{h^2}{2!} + \frac{h^3}{3!} + ...\}$

(xii) Find interval in which 'f' is increasing or decreasing if $f(x) = x^2 + 3x + 2$, $x \in (-4, 1)$

3. Answer briefly any Eight parts from the followings:- **8 × 2 = 16**

(i) Using differentials, find $\frac{dx}{dy}$ when $xy - \ln x = c$ **(ii)** Evaluate $\int \frac{3 - \cos 2x}{1 + \cos 2x}\, dx$

(iii) Find the area between the $x-axis$ and the curve $y = \sin 2x$ from $x = 0$ to $x = \frac{\pi}{3}$

(iv) Solve the differential equation $\sec x + \tan y \frac{dy}{dx} = 0$ **(v)** Evaluate $\int_0^{\pi/6} x \cos x\, dx$

(vi) Evaluate $\int x^2 \ln x\, dx$ **(vii)** Find $\int \frac{x^2}{4 + x^2}\, dx$

(viii) Find the point three fifth of the way along the line-segment from A(-5 , 8) to B(5 , 3).

(ix) Write down an equation of straight line passing through (5 , 1) and parallel to line passing through points (0 , -1) , (7 , -15)

(x) The xy – coordinate axes are translated through point O' whose coordinates are given in xy – coordinate system. The coordinates of P are given in XY-coordinate system. Find coordinates of P in xy – coordinate system, here P(-5 , -3) , O'(-2 , -6).

(xi) Find area of the triangular region whose vertices are A(5 , 3) , B(-2 , 2) , C(4 , 2).

(xii) Find an equation of each of the lines represented by $10x^2 - 23xy - 5y^2 = 0$

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 SGD-I-24

4. Answer briefly any Nine parts from the followings:- **9 × 2 = 18**

(i) What is an objective function?

(ii) Graph the solution set of $3x - 2y \geq 6$

(iii) Find centre and radius of circle $x^2 + y^2 + 12x - 10y = 0$

(iv) Write an equation of the circle with centre (-3 , 5) and radius 7.

(v) Find the focus and directrix of parabola $x^2 = 4(y-1)$

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

(vii) Find the foci and vertices of ellipse $9x^2 + y^2 = 18$

(viii) Find the eccentricity of hyperbola $25x^2 - 16y^2 = 400$

(ix) Find the direction cosines of vector $\underline{v} = 6\underline{i} - 2\underline{j} + \underline{k}$

(x) Find 'α' so that $|\alpha\, i + (\alpha+1)\underline{j} + 2\underline{k}| = 3$

(xi) Calculate the projection of $\underline{a} = 3\underline{i} + \underline{j} - \underline{k}$ along $\underline{b} = -2\underline{i} - \underline{j} + \underline{k}$

(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) Find the value of α, so that $\alpha i + \underline{j}$, $\underline{i} + \underline{j} + 3\underline{k}$ and $2\underline{i} + \underline{j} - 2\underline{k}$ are coplaner.

Section ---------- II

Note: Attempt any three questions. **(10 × 3 = 30)**

5 -(a) Evaluate the limit $\lim_{\theta \to 0} \dfrac{\tan\theta - \sin\theta}{\sin^3\theta}$

(b) If $y = \sqrt{\tan x + \sqrt{\tan x + \sqrt{\tan x + \ldots\ldots\ldots\infty}}}$, Prove that $(2y-1)\dfrac{dy}{dx} = \sec^2 x$

6 -(a) Show that $Y = X^X$ has minimum value at $X = \dfrac{1}{e}$

(b) Evaluate $\int \dfrac{x}{x^4 + 2x^2 + 5}\, dx$

7 -(a) Evaluate $\int_0^{\pi/4} \cos^4 t\, dt$

(b) Maximize $f(x, y) = 2x + 5y$ subject to the constraints $2y - x \leq 8$; $x - y \leq 4$; $x \geq 0$; $y \geq 0$

8 -(a) Find an equation of a circle of radius 'a' and lying in the second quadrant such that it is tangent to both the axes.

(b) Prove that the line segments joining the mid points of the sides of a quadrilateral taken in order form a parallelogram.

9 -(a) Find centre, foci and directrices of the ellipse $x^2 + 16x + 4y^2 - 16y + 76 = 0$

(b) Find a joint equation of lines through the origin and perpendicular to the lines $x^2 - 2xy\tan\alpha - y^2 = 0$

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(Inter Part – II) (Session 2020-22 to 2022-24) Sig. of Student ----------

Mathematics (Objective) **(Group 2nd)** SGD-2-24 **Paper (II)**

Time Allowed:- 30 minutes **PAPER CODE 4196** Maximum Marks:- 20

Note:- You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question. Write **PAPER CODE, which is printed on this question paper,** on the both sides of the Answer Sheet and fill bubbles accordingly, otherwise the student will be responsible for the situation. Use of Ink Remover or white correcting fluid is not allowed. **Q. 1**

1) $\int \ln a \cdot a^x \, dx =$

(A) $a^x + c$ (B) $\frac{a^x}{\ln a} + c$ (C) $\ln a^x + c$ (D) $2a^x + c$

2) $\int \frac{e^x}{e^x - 1} \, dx =$

(A) $\ln|1 - e^x| + c$ (B) $\ln|1 + e^{-x}| + c$ (C) $\ln|e^x - 1| + c$ (D) $\ln|1 - e^{-x}| + c$

3) $\lim_{x \to 0}(1 + 3x)^{\frac{2}{x}} =$

(A) e^2 (B) e^8 (C) e^6 (D) e^4

4) The perimeter P of a square as a function of its area A is

(A) $P = \sqrt{A}$ (B) $P = 4\sqrt{A}$ (C) $P = 4A$ (D) $P = \frac{1}{4}\sqrt{A}$

5) If $f(x) = \cot x$ then $f'\left(\frac{\pi}{6}\right) =$

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

6) $\frac{d}{dx}\left[\ln(e^x + e^{-x})\right] =$

(A) $\frac{e^x - e^{-x}}{e^x - e^{-x}}$ (B) $\frac{e^x - e^{-x}}{e^x + e^{-x}}$ (C) $\frac{e^x - e^{-x}}{-e^x + e^{-x}}$ (D) $\frac{-e^x + e^{-x}}{e^x + e^{-x}}$

7) If $y = Sin\, h^{-1}(x^3)$ then $\frac{dy}{dx} =$

(A) $\frac{x^3}{\sqrt{1 + x^6}}$ (B) $\frac{-3x^2}{\sqrt{1 + x^6}}$ (C) $\frac{1}{\sqrt{1 + x^6}}$ (D) $\frac{3x^2}{\sqrt{1 + x^6}}$

8) The derivative of $y = \sec^{-1}\frac{x}{a}$ is

(A) $\frac{a}{x}(a^2 - x^2)^{\frac{-1}{2}}$ (B) $-x(a^2 - x^2)^{\frac{1}{2}}$ (C) $x(a^2 - x^2)^{\frac{-1}{2}}$ (D) $x(a^2 - x^2)^{3/2}$

SGD-2-24

The lines joining the mid points of any two sides of a triangle is always _____ to the third side.

(A) Equal (B) Parallel (C) Perpendicular (D) Base

10) If $\underline{u}$ and $\underline{v}$ be any vectors, then $\underline{u} \times \underline{v}$ is

(A) parallel to $\underline{u}$ and $\underline{v}$ (B) parallel to $\underline{u}$ (C) perpendicular to $\underline{u}$ and $\underline{v}$ (D) orthogonal to $\underline{u}$

11) $\int_a^b f(x)\,dx =$

(A) $\int_b^a f(x)\,dx$ (B) $-\int_b^a f(x)\,dx$ (C) $[f(x)]_a^b$ (D) $f(b) - f(a)$

12) $\int_0^4 x\,dx =$

(A) 0 (B) 6 (C) 8 (D) 16

13) The slope of the line $2x + 3y - 1 = 0$ is

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

14) The lines lying in the same plane are called

(A) Collinear (B) Coplanar (C) Concurrent (D) Coincident

15) If the points $(a\ ,\ 0)$, $(0\ ,\ b)$ and $(x\ ,\ y)$ are collinear then

(A) $\frac{x}{a} + \frac{y}{b} = 0$ (B) $\frac{a}{x} + \frac{b}{y} = 1$ (C) $\frac{x}{a} + \frac{y}{b} = -1$ (D) $\frac{x}{a} + \frac{y}{b} = 1$

16) The graph of $x + 2y \leq 6$ is

(A) Open half plane (B) Closed half plane (C) Full plane (D) No any solution

17) The fixed line of the conic is known as

(A) x-axis (B) y-axis (C) directrix (D) latus rectum

18) The equation $a(x^2 + y^2) + 2gx + 2fy + c = 0$ represents a circle with centre

(A) $(-ag\ ,\ -af)$ (B) $\left(-\frac{g}{a}\ ,\ -\frac{f}{a}\right)$ (C) $\left(\frac{g}{a}\ ,\ \frac{f}{a}\right)$ (D) $(ag\ ,\ af)$

19) Equation of latus rectum of the parabola $x^2 = -4ay$ is

(A) $x = a$ (B) $x = -a$ (C) $y = a$ (D) $y = -a$

20) $(\underline{a} - \underline{b}) \cdot (\underline{a} + \underline{b}) =$

(A) $|\underline{a}|^2 - |\underline{b}|^2$ (B) $|\underline{a}|^2 + |\underline{b}|^2$ (C) $2(\underline{a} + \underline{b})$ (D) 0

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Mathematics (Subjective) **(Group 2nd)** (Inter Part – II) Paper (II) SGD-2-24

Time Allowed: 2.30 hours (Session 2020-22 to 2022-24) Maximum Marks: 80

Section ---------- I

2. Answer briefly any Eight parts from the followings:- **8 × 2 = 16**

(i) Evaluate $\lim_{x\to -1}\left(\frac{x^3+x^2}{x^2-1}\right)$ **(ii)** Define inverse of a function f.

(iii) Show that $x = a\sec\theta$, $y = b\tan\theta$ represent the equation of hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$

(iv) Evaluate $\lim_{n\to\infty}\left(1-\frac{1}{n}\right)^n$ **(v)** Find $f'(x)$, if $y = x^2\ln\sqrt{x}$

(vi) Show that $\cos(x+h) = \cos x - h\sin x - \frac{h^2}{\lfloor 2}\cos x + \frac{h^3}{\lfloor 3}\sin x + \ldots\ldots$

(vii) Determine the interval in which f is decreasing , here $f(x) = \cos x$, $x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$

(viii) If $x = y\sin y$, Find $\frac{dy}{dx}$ **(ix)** Differentiate $\sin^3 x$ $w.r.t$ $\cos^2 x$

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

(xi) Write the Quotient rule for derivative of two functions. **(xii)** Find $\frac{dy}{dx}$, if $\begin{matrix} x = at^2 \\ y = 2at \end{matrix}$

3. Answer briefly any Eight parts from the followings:- **8 × 2 = 16**

(i) Find dy and δy of $y = \sqrt{x}$ x changes from 4 to 4.41

(ii) Evaluate $\int\frac{3-\cos 2x}{1+\cos 2x}\,dx$ $\cos 2x \neq -1$ **(iii)** Evaluate $\int\frac{1}{x\ell nx}\,dx$

(iv) Evaluate $\int(\ell nx)^2\,dx$ **(v)** Evaluate $\int\frac{3x+1}{x^2-x+6}\,dx$ **(vi)** Evaluate $\int_0^{\frac{\pi}{3}}\cos^2 x\sin x\,dx$

(vii) Find the area between x-axis and curve $y = \sin 2x$ from $x = 0$ *to* $x = \frac{\pi}{3}$

(viii) Find 'h' such that A(-1 , h) , B(3 , 2) and C(7 , 3) are collinear

(ix) Find 'k' so that the lines joining A(7 , 3) , B(k , -6) and line joining C(-4 , 5) , D(-6 , 4) are perpendicular.

(x) Find point of intersection of lines $3x + y + 12 = 0$, $x + 2y - 1 = 0$

(xi) Find equation of lines represented by $20x^2 + 17xy - 24y^2 = 0$

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

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4. Answer briefly any Nine parts from the followings:- **9 × 2 = 18**

(i) Graph the solution set of the linear inequality $3x+7y \geq 21$ in $xy-$plane.

(ii) Define feasible region and feasible solution.

(iii) Find an equation of the circle with ends of diameter at (-3 , 2) and (5 , -6)

(iv) Find centre and radius of the circle $4x^2+4y^2-8x+12y-25=0$

(v) Find equation of Normal to the circle $x^2+y^2=25$ at $(5\cos\theta\ ,\ 5\sin\theta)$

(vi) Write equation of parabola with directrix $x=-2$ and focus (2 , 2).

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

(viii) Find equation of Hyperbola with foci $(\pm 5,0)$ and vertex $(3,0)$

(ix) Find sum of the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ given A(1 , -1) , B(2 , 0) , C(-1 , 3) and D(-2 , 2).

(x) let $\underline{u}=\underline{i}+2\underline{j}-\underline{k}$, $\underline{v}=3\underline{i}-2\underline{j}+2\underline{k}$, $\underline{w}=5\underline{i}-\underline{j}+3\underline{k}$. Find $|3\underline{v}+\underline{w}|$.

(xi) Find $\underline{v}$ for which $\underline{v}\cdot\underline{i}=0$, $\underline{v}\cdot\underline{j}=0$, $\underline{v}\cdot\underline{k}=0$.

(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) Find α so that $\alpha\underline{i}+\underline{j}$, $\underline{i}+\underline{j}+3\underline{k}$ *and* $2\underline{i}+\underline{j}-2\underline{k}$ are coplaner.

Section ---------- II

Note: Attempt any three questions. **(10 × 3 = 30)**

5 -(a) If $f(x)=\begin{cases} 3x & if \quad x\leq -2 \\ x^2-1 & if \quad -2<x<2 \\ 3 & if \quad x\geq 2 \end{cases}$

Discuss continuity at $x=2$

(b) Differentiate $\dfrac{(\sqrt{x}+1)(x^{3/2}-1)}{x^{3/2}-x^{1/2}}$ *w.r.t. x*

6 -(a) Show that $\int \dfrac{1}{\sqrt{a^2+x^2}}\,dx = \ell n(x+\sqrt{a^2+x^2})+c$ here $a>0$.

(b) If $x=\sin\theta$, $y=\sin m\theta$, show that $(1-x^2)y_2-xy_1+m^2y=0$

7 -(a) Evaluate the definite integral $\int_{\pi/6}^{\pi/2} \dfrac{\cos x}{\sin x\,(2+\sin x)}\,dx$

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

8 -(a) Find the equation of the tangent drawn from $(-7,-2)$ to $(x+1)^2+(y-2)^2=26$

(b) Using vectors, prove that $\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$

9 -(a) Find area of region bounded by the triangle whose sides are

$7x-y-10=0$, $10x+y-41=0$, $3x+2y+3=0$

(b) Find the centre , foci eccentricity, vertices of ellipse whose equation is

$x^2+16x+4y^2-16y+76=0$