MATHEMATICS (Fresh) Part-II	Paper Code	Roll No. of the Student
Time: 20 Minutes Marks: 20	①	
Multiple Choice Questions 01 Mark for each	② ●	Serial No. Of the Answer Book ________

Note:

1) Attempting all MCQs is compulsory. This paper along with the OMR sheet must be returned to the superintendent after due time.
2) Fill the circle Ⓐ Ⓑ Ⓒ Ⓓ, which one is correct with blue or black ball point, in this sheet as well as in separate OMR Sheet like ●
3) If more than one circle in the OMR sheet is filled then no credit will be given to such answer.

SECTION-A

1. $\frac{d}{dt}(\cot x) =$ ________.

   Ⓐ $\tan x \sec x$ Ⓑ $-\cot x \operatorname{cosec} x$ ● $-\operatorname{cosec}^2 x$ Ⓓ $\sec^2 x$

2. If $f(x,y)=\sin(x^2)\cos y$, then $\frac{\partial f}{\partial y}=$ ________

   Ⓐ $2x\cos(x^2)\cos y$ Ⓑ $\sin(x^2)\sin y$ Ⓒ $2x\cos(x^2)\sin y$ ● $-\sin(x^2)\sin y$

3. The differential equation $\frac{dy}{dx}=\frac{f(x,y)}{g(x,y)}$ is homogenous if its degree is ________

   ● Positive Ⓑ Negative Ⓒ Zero Ⓓ Constant

4. The order and degree of $\frac{d^2y}{dx^2}+2x\frac{dy}{dx}+y=3$ is ________

   Ⓐ 1, 1 Ⓑ 1, 2 ● 2, 1 Ⓓ 2, 2

5. $\int_3^4 5dx =$ ________

   ● 5 Ⓑ 10 Ⓒ 15 Ⓓ 20

6. $\int \frac{1}{x\sqrt{x^2-a^2}}dx =$ ________

   ● $\frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right)+c$ Ⓑ $\frac{1}{a}\left|\sec^{-1}\left(\frac{a}{x}\right)\right|+c$ Ⓒ $\frac{1}{a}\sec^{-1}\left|\frac{x}{a}\right|+c$ Ⓓ $\frac{1}{a}\sec^{-1}\left|\frac{a}{x}\right|+c$

7. $\frac{d}{dt}(\vec{F}\times\vec{G})=$ ________.

   Ⓐ $\frac{dG}{dt}\times F+\frac{dF}{dt}\times G$ Ⓑ $\frac{dF}{dt}\times G+\frac{dG}{dt}\times F$ ● $\frac{dF}{dt}\times G+F\times\frac{dG}{dt}$ Ⓓ $F\times\frac{dF}{dt}+G\times\frac{dG}{dt}$

8. The function $F(t)=(\sin t, (1-t)^{-1}, \ln t)$ is continous when ________

   ● $t>0$ and $t\neq 1$ Ⓑ $t\geq 0$ or $t\neq 1$ Ⓒ $t\geq 0$ or $t=1$ Ⓓ $t\geq 0$ and $t\neq 1$

9. The point $P(c, f(c))$ for the function $f(x)$ is called critical point if ________.

   Ⓐ $f'(c)=0$ or $f'(c)$ does not exist Ⓑ $f'(c)=0$ or $f'(c)$ exist ● $f'(c)=0$ Ⓓ $f'(c)\neq 0$

10. If $f(x)=\cos(ax+b)$ then $f^n(x)=$ ________.

    Ⓐ $a^n\cos(ax+b)$ ● $a^n\cos\left(ax+b+\frac{n\pi}{2}\right)$ Ⓒ $a^n\cos\left(ax+b\frac{n\pi}{2}\right)$ Ⓓ $a^n\cos\left(ax+\frac{n\pi}{2}\right)$

11. $\frac{d}{dx}(\operatorname{sech}^{-1}x)=$ ________.

    Ⓐ $\frac{-1}{x\sqrt{1-x^2}}$ Ⓑ $\frac{1}{x\sqrt{1-x^2}}$ Ⓒ $\frac{-1}{x\sqrt{x^2-1}}$ ● $\frac{1}{x\sqrt{x^2-1}}$

12. If $y=\sqrt{15x^2+1}$ then $\frac{dy}{dx}=$ ________.

    Ⓐ $\frac{x}{\sqrt{15x^2+1}}$ ● $\frac{15x}{\sqrt{15x^2+1}}$ Ⓒ $\frac{\sqrt{15x^2+1}}{x}$ Ⓓ $\frac{\sqrt{15x^2+1}}{15x}$

13. $\lim_{x\to 4}\left(\frac{\sqrt{x}-2}{x-4}\right)=$ ________.

    Ⓐ 4 ● $\frac{1}{4}$ Ⓒ $\frac{1}{2}$ Ⓓ 2

14. The function $f(x) = b^x$ decreases as x increases if ________.

Ⓐ $b > 1$ Ⓑ $1 < b < 2$ Ⓒ $0 < b < 1$ Ⓓ $0 > b > 1$

15. The direction cosines of the line perpendiculer to $x - 5y + 3 = 0$ are ________

Ⓐ $\frac{-1}{\sqrt{26}}, \frac{5}{\sqrt{26}}$ Ⓑ $\frac{1}{\sqrt{26}}, \frac{-5}{\sqrt{26}}$ Ⓒ $\frac{-1}{\sqrt{26}}, \frac{-5}{\sqrt{26}}$ Ⓓ $\frac{1}{\sqrt{26}}, \frac{5}{\sqrt{26}}$

16. The homogeneous equation $ax^2 + 2hxy + by^2 = 0$ represent lines, which are real and distinct, if

Ⓐ $h = \sqrt{ab}$ Ⓑ $h \neq \sqrt{ab}$ Ⓒ $h > \sqrt{ab}$ Ⓓ $h < \sqrt{ab}$

17. The equation of the circle passes through $(0, 0)$, whose intercepts on axes are 3 and 4 is ________

Ⓐ $x^2 + y^2 - 3x - 4y = 0$ Ⓑ $x^2 + y^2 + 3x + 4y = 0$ Ⓒ $x^2 + y^2 + 3x - 4y = 0$ Ⓓ $x^2 + y^2 - 3x + 4y = 0$

18. The foci of ellipse $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1,\ a > b$ are ________

Ⓐ $F(h \pm c, k)$ Ⓑ $F(h \pm c, -k)$ Ⓒ $F(h + c, \pm k)$ Ⓓ $F(h - c, \pm k)$

19. $x^2 + y = 0$ is a parabola which opens ________

Ⓐ Upward Ⓑ Downward Ⓒ To the right Ⓓ To the left

20. Equation of tangent to the circle $x^2 + y^2 = 25$ at point (3, 4) is ________

Ⓐ $3x + 4y = 5$ Ⓑ $4x + 3y = 5$ Ⓒ $3x + 4y = 25$ Ⓓ $4x + 3y = 25$

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MATHEMATICS (Fresh) P-II

Note: Time allowed for section B and C is 2 hours and 40 minutes.

SECTION "B" — Marks: 40

II. Attempt any TEN Parts out of the following. Each Part carries equal marks.

i. Evaluate the definite integral $\int_1^2 \frac{4}{t^3+4t}\,dt$

ii. Find the equation of straight line passing through the intersection of $2x-3y+4=0$ and $3x+4y-5=0$ and is perpendicular to the line $6x-7y+18=0$

iii. Evaluate $\lim_{x\to 5}\left(\frac{\sqrt{x}-\sqrt{5}}{x-5}\right)$.

iv. Differentiate $y=\ln\sqrt{\frac{x+1}{x-1}}$.

v. Find the critical value of the function $f(x)=2x^4-3x^2-72x+15$.

vi. If $\vec{v}=2i-j+5k$ and $\vec{w}=i+2j-3k$ are two vector functions, then find the value of $\frac{d}{dt}(\vec{v}+t\,\vec{w})$.

vii. Evaluate $\int\frac{dx}{4-x^2}$.

viii. Find the angle between the lines represented by $x^2+xy+y^2=0$.

ix. Find the equation of tangents to the circle $x^2+y^2=25$ which are parallel to the straight line $3x+4y+3=0$.

x. Find the equation of parabola with line of symmetry is vertical, passes through (-3, 4) and vertex at v(5, 1).

xi. Solve the homogenous differential equation given by $\frac{dy}{dx}=\frac{xy-y^2}{x^2}$.

xii. Compute four iterates of the bisection method for $f(x)=x^2-10x+23$, using intervals [3.2, 4].

xiii. Find the partial derivative's $f_x(x,y)$ and $f_y(x,y)$, where $f(x)=\sin^{-1}(xy)$.

SECTION "C" — Marks: 27

Note: Attempt any THREE questions of the following. Each question carries equal Marks.

III. (a) Use parametric differentiation to find $\frac{d^2y}{dx^2}$, where $x=a\,Cos\,2t$ and $y=b\,Sin\,2t$

(b) Write the equation of the hyperbola with vertices (2, -2) and (-4, -2) and passes through (5, 1).

IV. (a) Evaluate the integral $\int Sin\,(2x)\,\ln(Cos\,x)\,dx$.

(b) Find the equation of the circle that passes through (0, 4), (2, 6) and the line $x+y-4=0$ is tangent to it at (0, 4).

V. (a) Use the first principle rules to find $\frac{d}{dx}\left(a^x\right)$.

(b) Indicate the centre, foci, ends of major and minor axes of $9(x-1)^2+16(y-2)^2=144$.

VI. (a) Solve the initial value problem $y\frac{dy}{dx}+xy^2-x=0$

(b) If $u=\tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$, then show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\tan u$