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Paper Code: BPCM-103 A (SVSU:2024-25/S)

Enrollment No.													

B.Sc. (PCM) BPCM-103
I YEAR/I SEM EXAMINATION
Calculus -1

[Time : 3:00 Hours] **[Max. Marks : 100]**

I Long Question : Answer Any Three **[15×3=45]**

1. Prove that the function $f(x) = |\alpha|$ is continuous at $x = 0$ but not differentiable at $x = 0$.
2. $y = e^{\tan^{-1}x}$ prove that
$$(1+x)^2 y_{n+2} + [2(n+1)x - 1]y_{n+1} + n(n+1)y_n = 0$$
3. Find the all asymptotes of the curve
$$3x^2 + 2x^2y - 7xy^2 + 2y^3 - 14xy + 7x^2 + 4x + 5y = 0$$
4. Show that the pedal equation of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is
$$\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2} - \frac{r^2}{a^2 + b^2}$$
5. Expand $\log(1+x)$ by McLaurin theorem

II. Short Question: Answer any Five **[5×5=25]**

1. Find the right hand and left hand limits of $\lim_{x\to 2} \frac{2x^2-8}{x-2}$
2. If $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\frac{y}{x}$ show that $x\frac{du}{dx} + y\frac{du}{dy} = 0$
3. Find the equation of the tangent at the paint t to the eycolaid
$$x = a(t + \sin t)\ y = a(1 - \cos t)$$
4. Show that curve $r = a(1 + \sin\theta)$ and $r = a(1 - \sin\theta)$ cut orthogonally.
5. Find the radius of curvature at the point (x, y) on the curve $y^2 = 4ax$.
6. Find the asymptotes of the curve $\frac{a^2}{x^2} - \frac{b^2}{y^2} = 1$.
7. Find the c of the mean value theorem is
$$f(x) = x(x-1)(x-2): a = 0, b = {}^1/_2$$
8. Write the statement of ROLLE'S Theorem.
9. State and Prove Euler's theorem.
10. If $u = \log\frac{x^4+y^4}{x+y}$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$

III. Objectives Question: Answer All Question | 15×2=30 |

1. $\lim_{x\to 0} \frac{|x|}{x}$ is equal to :
   (a) 1 (b) -1 (c) 2 (d) does not exist
2. $\lim_{x\to 0} \frac{e^x-1}{x}$ is equal to :
   (a) 0 (b) 1 (c) -1 (d) 2
3. A function $f(x)$ is differentiable at $x = a$ if
   (a) $Rf'(a) = Lf'(a)$ (b) $Rf'(a) = 0$
   (c) $Lf'(a) = 0$ (d) $Rf'(a) \neq if'(a)$
4. The function $f(x) = |x - 1|$ not differentiable at
   (a) $x = 0$ (b) $x = -1$ (c) $x = 1$ (d) $x = 2$
5. By Leibnitz's theorem find the n^{th} differential of the ..... of two function
   (a) sum (b) difference (c) product (d) quotient
6. $y = \sin(ax + b)$ then $D^n \sin(ax + b)$
   (a) $a^n \sin\left(ax + b + \frac{n\pi}{2}\right)$ (b) $a^n \cos\left(ax + b + \frac{n\pi}{2}\right)$
   (c) $a^n \tan\left(ax + b + \frac{n\pi}{2}\right)$ (d) none of these
7. If u is a homogeneous function of x and y of degree n then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to:
   (a) n (b) nu (c) $\frac{n}{u}$ (d) u
8. By Tayler's theorem second term in the expansion of $\log \sin x$ power of $(x - a)$ is
   (a) $(x - a)\cot a$ (b) $(x - a)\text{cosec } a$
   (c) $(x - a)\cot a \text{ cosec } a$ (d) $(x - a)^2 \cot a$
9. For the cardioid$r = a(1 - \cos\theta)$ the value of $\emptyset$ is
   (a) θ (b) $\theta/2$ (c) $-\theta/2$ (d) $-\theta$
10. Two curve cut orthogonally if $\tan\emptyset_1 \tan\emptyset_2$ is equal to
    (a) 1 (b) 0 (c) -1 (d) none of these
11. Pedal formula for radius of curvature is
    (a) $\frac{1}{r}\frac{dr}{d\theta}$ (b) $\frac{1}{r}\frac{dr}{dp}$ (c) $\frac{1}{r}\frac{dp}{dr}$ (d) $r\frac{dp}{dr}$
12. The number of asymptotes of the curve $\frac{a^2}{x^2} - \frac{b^2}{y^2} = 1$ is
    (a) 2 (b) 3 (c) 4 (d) 1
13. The asymptotes of the curve $y^2(x^2 - a^2) = x$ which are parcellel to x-axix are :
    (a) $x = \pm a$ (b) $y = \pm a$ (c) $y = 0,\ y = 0$ (d) $x = 0$
14. If $x = r\cos\theta \quad y = r\sin\theta$ then $\frac{\partial y}{\partial x}$ is
    (a) $\tan\theta$ (b) $-\cot\theta$ (c) $\cos\theta$ (d) none of these
15. If $u = f(y/x)$ then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$:
    (a) 0 (b) 1 (c) 2 (d) -1