

Savitribai Phule Pune University
Hutatama Rajguru Mahavidyalaya, Rajgurunagar
F.Y.B.Sc.
MT-122: Calculus II
(2019 Pattern) (Semester-II) (Paper-II) (12112)

Time: 2 Hours

Max. Marks: 35

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.

- Q1) Attempt any five of the following:** [5]
- a) Whether every differential function is continuous? Justify.
 - b) State interior extremum theorem.
 - c) Show that absolute value function $f(x) = |x|$ is not differential at $x = 0$.
 - d) Find general solution of $\frac{dy}{dx} = -\frac{x}{y}$.
 - e) Evaluate $\lim_{x \rightarrow 1} \frac{\ln x}{x-1}$.
 - f) Find n^{th} derivative of the function $y = (ax + b)^m$
 - g) Use the definition to find the derivative of $f(x) = 2x^3 + 3x + 1$ for $x \in \mathbb{R}$.
- Q2) A) Attempt any one of the following** [5]
- a) State and prove Lagrange's mean value theorem.
 - b) Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$.
- B) Attempt any one of the following** [5]
- a) The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by
$$f(x) = \begin{cases} x^2, & \text{if } x \geq 0 \\ -x^2, & \text{if } x < 0 \end{cases}$$
 show that f is differential at $x = 0$.
 - b) Find Taylor series for the function $f(x) = \sin x$ at $x = 0$.
- Q3) A) Attempt any one of the following** [5]
- a) Verify Rolle's theorem for the function $f(x) = x^2 - 6x + 8$ on $[2,4]$ and find value of c .
 - b) Find integrating factor for
$$(5xy + 2y + 5)dx + (2x)dy = 0.$$
- B) Attempt any one of the following** [5]
- a) State and prove Cauchy's mean value theorem.
 - b) Solve Bernoulli equation $y' - y = xy^2$.
- Q4) A) Attempt any one of the following** [5]
- a) Evaluate $\lim_{x \rightarrow 0} \frac{1}{x} - \frac{1}{\sin x}$.
 - b) Find the general solution of the homogeneous differential equation
$$y' + 3x^2y = 0.$$

B) Attempt any one of the following

[5]

a) Find n^{th} derivative of $\frac{x^4}{(x-1)(x-2)}$.

b) Calculate $\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, \frac{\partial^2 z}{\partial x^2}, \frac{\partial^2 z}{\partial y^2}, \frac{\partial^2 z}{\partial x \partial y}$ when $z = x^2 + 3xy + 2y - 7$.