Savitribai Phule Pune University
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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) Show thet every differential function is continuous.
b) State Cauchy's mean value theorem.
c) Define relative extremum function.
d) Find general solution of homogeneous differential equation $y' + 3x^2y = 0$.
e) Check whether following differential equation is exact or not
$$3x^2y^2\,dx + 6x^3y\,dy = 0.$$
f) Find nth derivative of the function $y = a^{3x}, a > 0$.
g) Evaluate $\lim_{x\to 0} \frac{e^x - 1 - x}{x^2}$.

Q2) A) Attempt any one of the following **[5]**

a) State and prove Rolle's theorem.
b) Find nth derivative of $\cos^4 x$.

B) Attempt any one of the following **[5]**

a) The function $f: \mathbb{R} \to \mathbb{R}$ defined by
$f(x) = \begin{cases} x^2, & if \ \ x \geq 0 \\ -x^2, & if \ \ x < 0 \end{cases}$ show that f is differential at $x = 0$.
b) Using Taylor series expansion find the approximate value of $\sqrt{25.15}$.

Q3) A) Attempt any one of the following **[5]**

a) If P(x) is continuous on (a,b) then the general solution of the homogeneous equation $\frac{dy}{dx} + P(x)y = 0$ on (a,b) is $y = ce^{-\phi(x)}$ where
$$\phi(x) = \int P(x)dx, \quad a < x < b.$$
b) Find integrating factor for
$$(5xy + 2y + 5)dx + (2x)dy = 0.$$

B) Attempt any one of the following **[5]**

a) Evaluate $\lim_{x\to 0} \frac{1}{x} - \frac{1}{\sin x}$.
b) Verify the Lagrange's mean value theorem for the function $f(x) = \sqrt{x}$ on [1,9].

Q4) **A) Attempt any one of the following** **[5]**

a) Explain method of variation of parameter.

b) Define exact differential equation. Explain the method of solving exact differential equation.

B) Attempt any one of the following **[5]**

a) Solve the Bernoulli's equation $y' + y = y^2$.

b) Find the general solution of following differential equation by method of variation of parameter $y' + (\tan x)\, y = \cos x$.