

(i) Printed Pages : 3

Roll No.

(ii) Questions : 9

Sub. Code :

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Exam. Code :

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Bachelor of Arts (FYUP) 2nd Semester

(2056)

MATHEMATICS

Paper : Calculus - I (Common with B.Sc. 2nd Sem. FYUP)

Time Allowed : 3 Hours]

[Maximum Marks : 80

Note :- Attempt **five** questions in all, by selecting **one** question from each unit. Question number **1** is compulsory.

Compulsory Question

1. (a) Using definition, show that $\lim_{x \rightarrow 2} x + 1 = 3$. 4
- (b) Find $\frac{dy}{dx}$, where $y = x \sinh x$. 4
- (c) Find the equation of the normal to the curve $y^2 = 4x$ at (1, 2). 4
- (d) Using L.M.V. theorem, show that the arithmetic mean of two real numbers lies between them. 4

UNIT—I

2. (a) Show that $\sqrt{17}$ is an irrational number. 6
- (b) Solve the equation $|x - 2| + |7 - x| = 5$. 6
- (c) Find g.l.b. and l.u.b. of the set $\{\sin x + \cos x \mid x \in \mathbb{R}\}$. 4
3. (a) Show that $\lim_{x \rightarrow 0} \frac{1}{x}$ does not exist. 8
- (b) Show that $\lim_{x \rightarrow 1} [x]$ does not exist. 8

UNIT—II

4. (a) Find a, b so that :

$$f(x) = \begin{cases} 3 & \text{if } x \leq 2 \\ ax^2 + bx + 1 & \text{if } 2 < x \leq 3 \\ 7 - ax & \text{if } x > 3 \end{cases}$$

is continuous for all x. 8

- (b) Examine the continuity of :

$$f(x) = \begin{cases} \frac{x-1}{|x-1|} & \text{if } x \neq 1 \\ 1 & \text{if } x = 1 \end{cases} \text{ at } x = 1 \quad 8$$

5. (a) Show that if f is continuous at c , then $|f|$ is also continuous at c , but the converse is false. 8
- (b) Using the delta method, find $\frac{dy}{dx}$, where $y = \sqrt{x+3}$. 8

UNIT—III

6. (a) State and prove Leibnitz theorem. 8

(b) If $y = (\sin^{-1} x)^2$, find $y_n(0)$. 8

7. (a) Find $\frac{d}{dx} \{x^{\sinh x} + x^{\cosh x}\}$. 8

(b) Evaluate $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^{\frac{1}{x^2}}$. 8

UNIT—IV

8. (a) Find the equation of the tangent to $y = x^2 - 2x + 7$ which is perpendicular to the line $5y - 15x = 13$. 6

(b) Use differentials to approximate $\sqrt{26}$. 6

(c) Deduce Lagrange's theorem of mean value from Cauchy's mean value theorem. 4

9. (a) If $f(x) = x^3 - 6x^2 + 7$, find $f\left(\frac{21}{20}\right)$ by Taylor's theorem. 8

(b) State and prove Rolle's theorem. 8