

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2021

Instrumentation

INS 1B 01—APPLIED MATHEMATICS

(2019—2020 Admissions)

Time : Two Hours and a Half

Maximum : 80 Marks

Section A (Short Answer Type Questions)

Each question carries 2 marks.

All questions can be attended. Overall Ceiling 25.

1. Find $\lim_{x \rightarrow 3} (x^2 + 2x)$.
2. Find $\lim_{x \rightarrow 1} \frac{x(x-2)^2}{(x^2-4)}$.
3. Find $\lim_{x \rightarrow \infty} \tan^{-1}(x^4 - 6x + 6)$.
4. Find if the function $f(x) = x^3 - x + 3$ is continuous at $x = -1$.
5. Find the slope of the tangent to the curve $y = x^2 + 2x + 1$ at $x = 3$.
6. Find $\frac{dy}{dx}$ if $y = e^{\cos x}$.
7. Find $\frac{dy}{dx}$ if $y = a^x$.
8. Use L'Hôpital's rule to find $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta}$.

9. Find the rate of change of the function $f(x) = 5x^3 - 2x^2 + 30x + 50$ with respect to x and the instantaneous rate of change at $x = 2$.
10. Find $\int (\sin x + \cos x) dx$.
11. Find $\int_0^2 (10x^2 + 10) dx$.
12. Find the area enclosed by the curves $y = x^2$ and $y = \sqrt{x}$.
13. Find the geometric mean of 2, 4, 6, 8.
14. Find the harmonic mean of 2, 6, 7, 8, 9.
15. Find the median of : 2, 1, 2, 3, 5, 4, 4.

(Ceiling 25)

Section B (Paragraph Type Questions)

Each question carries 5 marks.

All questions can be attended. Overall Ceiling 35.

16. Find $\lim_{x \rightarrow 0} \frac{a^{mx} - b^{nx}}{\sin kx}$.

17. Find the value of the constant k such that the function $f(x) = \begin{cases} \frac{1 - \cos 4x}{8x^2}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at $x = 0$.

18. If $y = \sin^{-1} \left\{ x\sqrt{1-x} - \sqrt{x}\sqrt{1-x^2} \right\}$ and $0 < x < 1$, find $\frac{dy}{dx}$.

19. If $x = a \cdot \sec^3 \theta$ and $y = a \cdot \tan^3 \theta$, find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$.

20. Evaluate $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$.

21. Evaluate $\int_2^8 \frac{\sqrt{10-x}}{\sqrt{x} + \sqrt{10-x}} dx$.

22. Find the arithmetic mean and the mean deviation for the data values : 5, 3, 4, 7, 9, 8.

23. Find the arithmetic mean of a distribution if it has a co-efficient of variation = 40 and standard deviation = 6.

(Ceiling 35)

Section C

Answer any two questions.

Each question carries 10 marks.

24. (a) Verify Rolle's theorem for the function $y = x^2 + 2$, in $[-2, 2]$.

(b) Verify Mean Value Theorem for the function $f(x) = x^3 + 2x^2 - x$ in the interval $[-1, 2]$.

25. Find values of x for the local maxima and minima of the function f given by $f(x) = 2x^3 - 6x^2 + 6x + 5$. Find the local maximum and local minimum values at these values of x .

26. Find the area of the region bounded by $y = -x^2 + 6x$ and $y = x^2$.

27. Find the variance and standard deviation for the following data :

Item		3	4	7	8	9	11	12
Frequency	:	4	5	6	4	5	3	1

(2 × 10 = 20 marks)

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INS 1B 01—APPLIED MATHEMATICS

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Section A (Short Answer Tye Questions)

Answer at least ten questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 30.

1. Find $\lim_{x \rightarrow 1} \frac{(\sqrt{x} - 1)(2x - 3)}{2x^2 + x - 3}$.

2. Find $\int_{-\pi/4}^{3\pi/4} \frac{dx}{1 + \cos x}$.

3. Evaluate $\int_0^a \frac{x^2}{\sqrt{a^2 - x^2}} dx$.

4. Find $\frac{dy}{dx}$, if $y = \sqrt{x} + \cos(x) \sin(x)$.

5. Solve $\frac{dy}{dx} = 4x^3$ with $y(1) = -1$.

6. Write the frequency definition of probability.

7. The range of the real valued function $f(x) = \sqrt{9 - x^2}$ is ?

8. Find $\frac{dy}{dx}$, if $y = 2 \sec^2(x)$.
9. Find the mean of 21, 23, 28, 25, 35, 42, 39.
10. Does the function $f(x) = \cos(x)$ is continuous for every values of x ?
11. Does the curve $y = x^4 - 2x^2 + 2$ have any horizontal tangent? If so, where?
12. Evaluate $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$.
13. Find the absolute maximum and minimum values of $f(x) = \sin x + \cos x$ in $(0, \pi)$.
14. Find the slope of the curve $x^3 y^3 + y^2 = x + y$ at the point $(1, 1)$.
15. Find $\frac{dy}{dx}$, if $y^2 = x^2 + y \sin(x)$.

(10 × 3 = 30 marks)

Section B (Paragraph Type Questions)

Answer at least five questions.

Each question carries 6 marks.

All questions can be attended.

Overall Ceiling 30.

16. Evaluate $\lim_{x \rightarrow 0} \left(\frac{4 - \sqrt{16 + x}}{x} \right)$.

17. At what points the function $y = \frac{x + 3}{x^2 - 3x - 10}$ is continuous?

18. Does the graph of $f(x) = \begin{cases} 0, & x \leq 0 \\ 1, & x \geq 0 \end{cases}$ have a vertical tangent at the point $(0, 1)$? Give reason for your answer.

19. Find $\frac{dy}{dx}$ if $y = \frac{2x + 5}{3x - 2}$.
20. If $x = 2t + 3$ and $y = t^2 - 1$, find the value of $\frac{dy}{dx}$ at $t = 6$.
21. Find the probability of getting an even number with an ordinary six faced die.
22. State Rolle's Theorem.
23. If $y = e^{\cos x}$, find $\frac{dy}{dx}$.

(5 × 6 = 30 marks)

Section C*Answer any two questions.**Each question carries 10 marks.*

24. For what value of 'k' is $f(x) = \begin{cases} 3x - 8, & x \leq 5 \\ 2k, & x > 5 \end{cases}$ is continuous ..

25. Find $\lim_{x \rightarrow \infty} \frac{5x^2 + 8x - 3}{3x^2 + 2}$.

26. Find the area of the region enclosed by the parabola $y^2 = 4ax$ and the x -axis and the ordinates $x = 0$ and $x = a$.

27. Find the mean and standard deviation for the following data :

Size of item	6	7	8	9	10	11	12
Frequency	3	6	9	13	8	5	4

(2 × 10 = 20 marks)