Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech. Mid Semester Examination December 2022

(Delayed Autumn Semester)

Branch	**: CSE, ECE, EEE**	**Semester**	**: 1st**
Title of the Course	**: Advanced Calculus / Engineering Mathematics I**	**Course Code**	**: MAL101 /MAL103**

Time: One and Half Hours **Maximum Marks: 25**

Note : All sections are compulsory.

Section A

Section A contains 03 MCQ's (Question number 1 to 3) of 01 Mark each.

Multiple options may be correct.

Q.1. The inflection points on the curve $y = x^4 - 4x^3 + 10$ are

(A). (0, 10) (B). (2, -6) (C). (3, -17) (D). (1, 7)

Q.2. Which of the following functions do not satisfy the hypothesis of mean value theorem

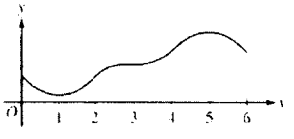
(A). $f(x) = x^{2/3}$, $[-1,8]$ (B). $f(x) = x^{4/5}$, $[0,1]$

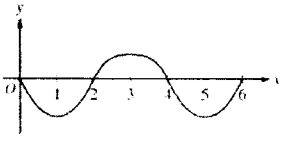
(C). $f(x) = sinx$, $[0,\pi]$ (D). $f(x) = \begin{cases} \frac{sinx}{x}, & -\pi \le x < 0 \\ 0, & x = 0 \end{cases}$

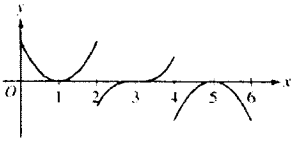
Q.3. The graph of f' the derivative of the function f is given below:

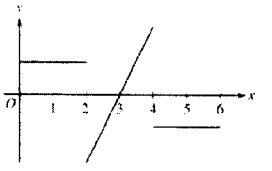
Graph of f'

Which of the following could be graph of f?

A. 

B. 

C. 

D. 

Section B

Section B contains 04 theoretical question (Question number 4 - 7) of 04 Marks each.

Q.4. Find the interval where function is increasing or decreasing and locate the extreme values for the function $f(x) = x^{2/3}(x + 5)$.

Q.5. Find the value of constants a, b and c so that the graph of $y = \frac{x^2 + a}{bx + c}$ has a local minimum at x=3 and a local maximum at $(-1, -2)$.

Q.6. Sketch a smooth connected curve $y = f(x)$ with the following data:

$f(-2) = 8,\ f(0) = 4,\ f(2) = 0,$ and $f'(-2) = 0,\ f'(2) = 0,$

$f'(x) > 0$ for $|x| > 2,$ and $f'(x) < 0$ for $|x| < 2,$

$f''(x) < 0$ for $|x| < 0,$ and $f''(x) > 0$ for $|x| > 0.$

Q.7. Find the asymptotes of the function

(A) $f(x) = \frac{x^2 + x - 6}{x^2 + 2x - 8}$ (B) $f(x) = \frac{\sqrt{x} + 4}{\sqrt{x + 4}}$

Section C

Section C contains 1 theoretical question (Question number 8) of 06 Marks.

Q.8. (A) Define convergence of a sequence and show that the sequence $\{\frac{lnn}{n}\}$ is convergent.

(B) Find the sum of the series $\sum_{n=0}^{\inf} (\frac{5}{2^n} + \frac{1}{3^n})$

(C) Find the sum of the series $\sum_{n=1}^{\inf} (\frac{3}{n^2} - \frac{3}{(n+1)^2})$

OR

Find the critical points for the function $f(x, y) = xy + 2x - ln(x^2y)$ in the open first quadrant (x>0, y>0) and find out if these represent local maxima, local minima or saddle points.