DIT UNIVERSITY DEHRADUN
B.TECH. (ALL)   MID TERM EXAMINATION, EVEN SEM 2020-21 (SEM I)

Roll No.

Subject Name: Engineering Mathematics-I

Time: 2 Hours   **Total Marks: 50**

Note: All questions are compulsory. No student is allowed to leave the examination hall before the completion of the exam.

Q.1)   **Attempt all Parts:**

(a)   Evaluate $\lim\limits_{x \to 0} \dfrac{1 - \cos x}{x^2}$.

(b)   Determine n^{th}- order derivative of function $y = \sin(3x - 5)$.

(c)   Show that $\lim\limits_{x \to 0} \dfrac{e^{1/x} + 1}{e^{1/x} - 1}$ doesn't exist at $x = 0$.

(d)   Discuss the continuity of function $f(x) = \begin{cases} \dfrac{|x|}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$,   at $x = 0$.

$\hfill$ **[4 x 2.5= 10]**

Q.2)   **Attempt all Parts:**

(a)   Show that the function $f(x) = \begin{cases} px + 1, & x \geq 1 \\ x^2 + p, & x < 1 \end{cases}$ is continuous for all p.

(b)   Evaluate $\lim\limits_{x \to 0} \dfrac{1 - \sqrt{1 - x^2}}{x^2}$.

(c)   If $y = (x - 1/7)^{10}$ then find its 8th derivative.

(d)   Evaluate $\lim\limits_{x \to \infty} \dfrac{e^x}{x^3}$.

$\hfill$ **[4 x 2.5= 10]**

Q.3)   **Attempt any Two Parts:**

(a)   For what value of m the function $f(x) = \begin{cases} x^m \cos(1/x), & x \neq 0 \\ 0, & x = 0 \end{cases}$ is differentiable at $x = 0$.

(b)   Find n^{th}- order derivative of function $f(x) = \dfrac{1}{x^2 - 5x + 6}$.

(c)   Obtain fourth degree Taylor's polynomial expansion of $f(x) = \log x$ about point $x = 1$.

$\hfill$ **[2 x 5= 10]**

Q.4)   **Attempt any Two Parts:**

(a)   Evaluate $\lim\limits_{x \to 1} x^{\frac{1}{(1-x)}}$.

(b)   If $f(x) = x^2 \sin\left(\dfrac{1}{x}\right)$, $for\ x \neq 0$ and $f(0) = 0$. Then show that $f(x)$ is differentiable at $x = 0$.

(c)   Use Taylor's theorem to show that $\sin x = x - \dfrac{x^3}{3!} + \dfrac{x^5}{5!} - \dfrac{x^7}{7!} + \cdots$

$\hfill$ **[2 x 5= 10]**

Q.5)   **Attempt any Two Parts:**

(a)   Use Taylor's theorem to approximate the function $f(x) = \tan^{-1} x$ upto degree five.

(b)   If $y = \sin 2x . \cos^2 4x$ then determine y_n.

(c)   Evaluate $\lim\limits_{x \to 0} \dfrac{\sin x - x - \frac{1}{6}x^3}{x^5}$.

$\hfill$ **[2 x 5= 10]**

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