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BBA in TM, 3rd Sem. Date: October 11, 2023 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF BUSINESS AND TECHNOLOGY MANAGEMENT

Mid-Semester Examination		Winter Semester, A. Y. 2022-2023	
Course No.	: Math 4361	Time	: 1.5 hours
Course Title	: Mathematics	Full Marks	: 75

Answer **all 3 (three)** questions. All questions carry equal marks. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1. a) Define limit of $f(x)$ at x_0. Evaluate $\lim_{x\to\infty}\left(\sqrt{x^6+5x^3}-x^3\right)$. 5 (CO1) (PO1)

   b) Define continuity of $f(x)$ at x_0. For what value of k and m the following function is continuous everywhere? 7 (CO1) (PO1)

$$f(x)=\begin{cases} x^2+5, & x>2 \\ m(x+1)+k, & -1<x\le 2 \\ 2x^3+x+7, & x\le -1 \end{cases}$$

   c) Find the derivative of (i) $y=\dfrac{\sin x\cos x\tan^3 x}{\sqrt{x}}$ (ii) $y=\left(2x^2-1\right)^{\sin x}$ 13 ((CO1) (PO1)

2. a) Show that $f(x)=\sin x\,(1+\cos x)$ has a relative maxima at $x=\dfrac{\pi}{3}$. 10 (CO1) (PO1)

   b) State L Hospital's rule. Evaluate (i) $\lim_{x\to\infty}\left(1-\dfrac{3}{x}\right)^x$ (ii) $\lim_{x\to 0}\left(1+\sin x\right)^{\frac{1}{x}}$ 7 (CO1) (PO1)

   c) State Taylor's theorem. Expand $f(x)=\sin x$ in power of $\left(x-\dfrac{\pi}{2}\right)$ with remainder term. 8 (CO1) (PO1)

3. a) Define successive differentiation. Find the nth derivative of $f(x)=(ax+b)^m$. 8 (CO1) (PO1)

   b) State and prove Leibnitz theorem. 7 (CO1) (PO1)

   c) If $y=\left(\sin^{-1}x\right)^2$, the by Leibnitz's theorem show that 10 (CO1) (PO1)

$$\left(1-x^2\right)y_{n+2}-(2n+1)xy_{n+1}-n^2y_n=0$$