North Gauhati College

Department of Mathematics

Semester I (Generic/Regular)
Home Assignment 2022

MAT-HG-1026/MAT-RC-1026
Calculus

January 2022 Total Marks: 30

INSTRUCTIONS TO CANDIDATES

1. This assignment paper contains **seven(7)** questions and comprises of **two(2)** printed pages.
2. Mark against each question is indicated at right hand side of concerned question.
3. Submit the assignment as a single **PDF** file through the online portal of our college website under section "Assignments" and submit a hard copy in the Department of Mathematics.
4. Write your **Name** and **Class Roll No.** in the assignment.
5. Submission **Due Date** is on or before **30th January, 2022**.

Answer the following questions (Any six) 5×6=30

1. Define continuity and derivability of a function f at a point $x = a$ of its domain. Discuss the continuity and derivability of the function

$$f(x) = \begin{cases} 3 + x, & \text{if } x \leq 1 \\ 5 - x, & \text{if } x > 1 \end{cases}$$

at $x = 1$.

2. Find successive differentiation y_n of the following functions:
   (a) $y = e^{ax}$.
   (b) $y = \frac{1}{(ax+b)^m}$.

3. State Rolle's Theorem. Verify Rolle's Theorem for the function

$$f(x) = (x-1)(x-2)(x-3)$$

in the interval $[0, 4]$.

4. State Lagranges Mean Value Theorem(LMVT). Using LMVT in $[a, b]$, prove that-

$$\frac{b-a}{1+b^2} < tan^{-1}b - tan^{-1}a < \frac{b-a}{1+a^2}$$

for positive values of a, b.

5. Using Maclaurin's Theorem, expand $cosx$ in ascending powers of x.

6. Find the values of the following:
   (a) $lim_{x\to 0}\frac{xcosx-log(1+x)}{x^2}$.
   (b) $lim_{x\to b}\frac{x^b-b^x}{x^x-b^b}$.

7. If $f(x) = \frac{1}{1+x}$ and $f(h) = f(0) + hf'(0) + \frac{h^2}{2!}f''(\theta h)$, $0 < \theta < 1$, then find the value of θ when $h = 7$.

End of assignment paper