

**IIT ROPAR**  
**SEMESTER I 2021-22**  
**NUMERICAL SIMULATION LAB (CH230)**  
**Assignment 1      Max Marks: 10**

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**Q1.** The Maclaurin series expansion for  $\sin x$  is (4M)

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

Use the expansion to determine the value of  $\sin x$  for a value of  $x = \pi/3$ . Write a program in MATLAB to display the true and approximate percentage errors after the addition of each term in the series. Determine the number of terms required to approximate  $\sin x$  to 8 significant figures.

**Q2.** Evaluate  $e^{-5}$  using two approaches (4M)

$$e^{-x} = 1 - x + \frac{x^2}{2} - \frac{x^3}{3!} + \dots$$

$$e^{-x} = \frac{1}{e^x} = \frac{1}{1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \dots}$$

and compare with the true value of  $6.737947 \times 10^{-3}$ . Write a program in MATLAB and use 20 terms to evaluate each series and compute percentage true and approximate errors as terms are added.

**Q3.** Evaluate the following equation for a value of  $x = 0.577$  (2M)

$$\frac{6x}{(1 - 3x^2)^2}$$

What would be the percentage true error if only 3 and only 4 significant figures are utilised for the evaluation.

Note you would have to evaluate the individual terms in the expression in terms of the significant figures.