



# SHILLONG GOVERNMENT COLLEGE OF ENGINEERING

Mawlai Kynton Massar, East Khasi Hills, Meghalaya, Shillong – 793022

## REPORT ON COMPACT COURSE IN MATHEMATICS

on “*NUMERICAL METHODS FOR ENGINEERS*”

The Compact Course in Mathematics on “*Numerical Methods for Engineers*” sponsored by Professor R. Balakrishnan Endowment Trust, Tiruchirappalli and The Indian Mathematics Consortium, Pune was conducted at Shillong Government College of Engineering, Shillong on the 9<sup>th</sup>-10<sup>th</sup> of March 2026 and was comprised of three lectures and tutorials/discussion sessions.

Prof. Saikat Mukherjee from the Department of Mathematics of National Institute of Technology, Meghalaya was the speaker. The course was attended by the second semester B. Tech students of the Shillong Government College of Engineering.

The topics covered in the course were:

1. Solving a system of linear equations
2. Interpolation
3. Numerical Integration and differentiation.

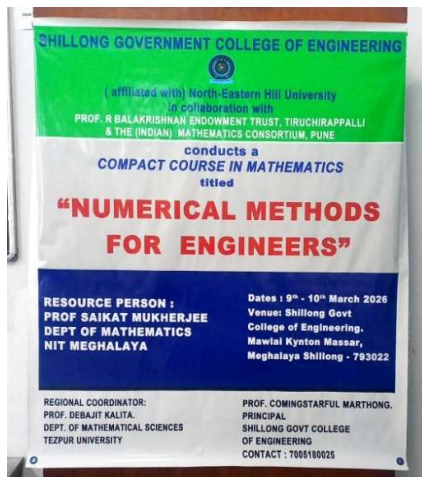
### **Lecture 1 (Morning Session, 9<sup>th</sup> March): Solving a system of linear equations (SLE)**

The first lecture began with an introduction to numerical analysis, approximations in numerical analysis and the different types of errors. After the introduction, a brief revision on dependent and independent vectors in a vector space, the conditions for existence and uniqueness of a solution for an SLE, and the direct methods of solving SLE's was done, and the motivation for iterative methods was given. The lecture then progressed to the iterative methods of solving SLE's, specifically the Jacobi and Gauss-Seidel methods. Using relevant examples, it was discussed that the two methods are not comparable, and that the convergence of any of the methods is not guaranteed. The definition of diagonally dominant was then given and the condition for convergence of the methods was discussed.



## Lecture 2 (Afternoon session 9<sup>th</sup> March): Interpolation

The second lecture began with the purposes of interpolation, the choices of interpolating function and the introduction of basis functions. Finding an interpolating polynomial using monomial basis, and using the interpolating polynomial to get new data points was discussed. The students solved exercises for better understanding and actively engaged in the discussion.



## Lecture 3 (10<sup>th</sup> March): Numerical Integration and Differentiation

During the third lecture, it was discussed how finite integrals can be evaluated using *n-point quadrature rules* based on interpolating polynomials. The first three Newton-Cotes quadrature rules i.e., the midpoint rule, the trapezoid rule and Simpson's rule were discussed along with exercises.

Motivation for the need for numerical differentiation was given, after which, finite difference approximations were discussed leading to the forward difference, backward difference and central difference expressions for the first derivative, and the central difference expression for the second derivative, along with examples for illustration. Applications in finding numerical solution for initial value problems were also discussed.

