Course Type	Course Code	Name of the Course	L	T	P	Credits
DP	NFMC516	Computer Applications in Metallurgical Engineering	0	0	3	1.5

Course Objective

Equip students with practical skills in applying numerical methods using MATLAB for solving engineering problems in metallurgy. The course aims to provide hands-on experience in mathematical modeling and algorithmic solutions relevant to metallurgical processes.

Learning Outcomes

- Develop numerical algorithms to solve various mathematical models.
- Develop and implement computer-based programs to solve mathematical models pertinent to Metallurgical Engineering problems.
- Gain hands-on experience in using software such as MATLAB, ANSYS, etc.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Getting Started with MATLAB: Basic Operations and Scripting	3	Acquire foundational skills in programming with MATLAB and understand script execution.
2.	Computational Error Analysis in Numerical Methods	3	Learn to identify and quantify errors in numerical computation to enhance the accuracy of mathematical models.
3.	Implementing Gauss Siedel and Gauss Elimination for Linear Systems	3	Develop the ability to formulate and solve linear equations using MATLAB
4.	Solving Single and Multivariable Nonlinear Equations Using Newton-Raphson method	3	Learn to find the roots of linear and non-linear equations using the Newton-Raphson method.
5.	Data Interpolation with Piecewise Linear and Quadratic Interpolation	3	Learn methods of data interpolation to predict unknown values, useful for data analysis and engineering design.
6.	Numerical Integration using Simpson's 1/3rd rule and Trapezoidal Rule	3	Understand numerical integration concepts to approximate the area under curves, applicable in various engineering calculations.
7.	Solving First-Order ODEs in MATLAB	3	Learn tonumerically solve ordinary differential equations, which are fundamental to modeling dynamic systems and processes.
8.	Non-Linear Regression for Curve Fitting of Multi-variate Data	3	Acquire skills in data-fitting techniques to model real-world phenomena/ experimental outcomes with high accuracy.
9.	Simulating Heat Conduction in Solids using MATLAB and ANSYS	3	Understand the principles of heat transfer and apply simulation tools to predict thermal responses in materials.
10.	Simulation of Laminar Flow and Heat Transfer in Pipes using ANSYS	3	Learn fluid dynamics and heat transfer principles in pipe systems through simulation, important for process engineering
11.	Simulation of Carburization hardening of Steel using ANSYS	3	Learn to simulate the carburization process using ANSYS and predict its effects on steel properties
12.	Simulation of Stress Analysis in a Metal Component using ANSYS	3	Learn to apply fundamentals of mechanical metallurgy to perform structural analysis on metal components.
	Total	**36**	

Reference Books:

1. Numerical Methods for Engineers and Scientists: An introduction with applications using Matlab; Gilat & Subramaniam, Wiley.
2. Applied Numerical Methods for Engineering using Matlab and C; R. J. Schilling & S. L. Harris, Cengage.
3. Applied Numerical Methods with MATLAB for Engineers and Scientists, Steven C. Chapra, McGraw-Hill.