Semester VI

DISCIPLINE SPECIFIC ELECTIVE COURSE -4 (DSE-4)
VI.5.1. Mathematical modelling & Simulation

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Mathematical modeling & simulation# DSE-4, VI.5.1	**4**	**0**	**0**	**4**	**12th pass with Maths**	**Linear Algebra, Differential Equations**

 # This course will also be available to the students in semester IV

Learning Objectives

This interactive learning module intends to provide capabilities and basic understanding of system modelling and simulation performance. It will emphasis on analysis of dynamical behavior of physical, electrical, mechanical, social, biological, chemical, and financial systems along with applications in engineering and other applied sciences. The simulation will be done with the MATLAB software platform.

Learning outcomes

- After completing this course, student should be able to;
- Understand the mathematical and computational tools for modelling and simulation of various systems.
- Apply basic concepts of fractional calculus.
- Identify, model analyze, and simulate various systems using simulation tools.
- Know how the simulation help to analyze system graphically.
- Describe the behavior of different physical and virtual systems.

Syllabus

Practicals – (120 Hours)

- Modeling of integer and non-integer systems
- Introduction to basic simulation tools
- Simulation performance of integer and non-integer systems
- Chaotic behavior of integer and non-integer systems
- Parameter optimization to improve the efficiency of the system
- Model validation and performance analysis with data

● Innovation Project

Essential/recommended readings

- Theory of modeling and simulation, Zeigler B.P., Praehofer. H., Kim I. G., 2nd Edition. Academic press, 2000.
- Theory of Fractional Dynamic Systems, Lakshmikantham, V., Leela, S., Vasundhara Devi,
  J. Cambridge Academic Publishers, Cambridge, 2009.
- Fractional-order nonlinear systems: modeling, analysis and simulation, Petras, I., SpringerVerlag Berlin Heidelberg, Germany, 2011.
- Chaos: An Introduction to Dynamical Systems, K.T. Alligood, Sauer, Tim D., Yorke James
  Springer, 1996.
- Nonlinear Dynamics and Chaos, Strogatz, S. Reading, MA: Addison-Wesley, 1994.
- Optimization and Dynamical Systems, Helmke U., Moore J. B, SpringerVerlag, 1993.

DISCIPLINE SPECIFIC ELECTIVE COURSE -4 (DSE-4)
VI.5.2. Computational Fluid Dynamics (CFD)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Computational Fluid Dynamics# (CFD), DSE-4, VI.5.2	**4**	**0**	**0**	**4**	**12th Pass With Maths**	**Calculus, Linear Algebra & Differential Equations**

#This course will also be available to the students in semester IV

Learning Objectives

This interactive practical paper aims to enable the students to visualize different types of problems of flow and heat transfer in various fields. Blood flow within arteries, biological tissues, heat transfer within biological tissues, flow within circular pipes, flow within an aquifer are some of the important application of CFD. In this paper, students will visualize CFD models, mathematical analysis of these visualizations, simulate them numerically using mathematical softwares such as ANSYS, COMSOL and post process the obtained numerical results.