Course Type	Course Code	Name of Course	L	T	P	Credit
DP	NMEC505	Modelling and Simulation Lab	0	0	3	1.5

Course Objective
Objective of this course to train the students in the simulation of manufacturing process. Understanding the mechanism of the processes and create a realistic model of the process. Selection of the process analysis of the results.
Learning Outcomes
At the end students will be able to model most of the manufacturing process as well other structural process in a commercial FE software. They will be able to solve the problem efficiently and may be able to predict the results well matching with the experimental results.

Unit No.	Topics	Practical hours	Learning Outcome
1	Basics of Finite Element analysis	2	Basic methods of solving numerical problem by finite element methods, starting from simple structural to machining problems like forming (mechanical), solidification of metal casting and weld joints (thermal) and metal cutting operations (mechanical thermal combined) analysis.
2	Introduction to the commercial FE software	1	Mention names of different commercial software
3	Basic training of FE software-1	3+3	Introduction to GUI, use of tabs, buttons, creation of geometry, assigning sections and material properties, simple meshing, assigning element type. Running simulation with single processor. Post processing, reading data and visualization of simulation
4	Practice on previous learning	3	Hands-on learning of the software with simple 2D problems with material deformation under mechanical loading.
5	Basic training of FE software-2	3	Advance learning with import of complex geometries. Assembly with multiple materials of different nature. Type of interaction and application between surfaces. Complex meshing with user defined mesh size. Mechanical and thermal loading. Multiprocessor solvers. Post processing and plotting metltidata output. Predefined output visualization. Filtration of output.
6	Simulation of a forming problem in 2D	3	Extrusion, rolling, deep drawing or equivalent problem solving.
7	Simulation of a metal casting problem in 2D	3	Transient heat transfer problem. Solidification analysis of metal casting
8	Simulation of metal cutting operation in 2D	3+3+3	Chip formation in orthogonal machining, with mechanical properties
9	Project work	3+3+3	Simulate an experimental work and validate from the literature or with the help of a parallel running practical work like, forces/residual stresses/temperature in machining zone/chip size and shape in metal cutting, casting defects in sand casting, strength of welded joints or any equivalent manufacturing problem.
10	Advance learning of software process using simulate software.	3	Introduction and basic learning of how to use "User defined subroutine for simple problems in 2D in python"
	Total	**42**	

References:

1. A First Course in the Finite Element Method – Logan
2. Textbook of Finite Element Analysis P. Seshu, Prof. IITB, PHI Learning Pvt Ltd, New Delhi
3. Abaqus user manual version 6.6 documentation