Course Title	**Mechanical Design Simulation**	Course Code				
Dept./ Specialization	Mechanical Engineering	Structure (LTPC)	2	0	4	4
To be offered for	B.Tech. Mechanical Engineering / Smart Manufacturing	Status	Core ☐		Elective ▪	
Faculty Proposing the course	Venkata Timmaraju Mallina	Type	New ▪		Modification ▪	
Recommendation from the DAC		Date of DAC	9-1-2023			
External Expert(s)	Prof. Ratnakumar Annabattula, Professor, Mechanical Engineering, IIT Madras					
Pre-requisite	Mechanics of Materials	Submitted for approval		50th Senate		
Learning Objectives	This course is proposed to offer • the connection between mechanical design and finite element analysis • the process of creating simulation models of various mechanical elements • an understanding of behavior of various mechanical components and structures subjected to static and dynamic forces • the process of evaluating the performance of new mechanical components / products / structures					
Learning Outcomes	After the completion of the course, students will be able • create 1D, 2D and 3D simulation models of mechanical systems. • understand the solution techniques available in computer aided engineering tools. • evaluate the designs of mechanical systems by performing appropriate engineering simulations.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Engineering design and analysis: Engineering design - Archer, Pahl and Beitz, Shigley and concurrent design processes, Engineering analysis – methods applied at various stages of design, Approximations for engineering analysis. (L4+P4) Application of finite element method: Basic concepts and approximations, typical procedures and applications using commercial or open source codes. (L2+P4) Creation of engineering simulation models and evaluation of displacements, stresses and reaction forces and moments of prismatic member structures (bars, trusses, beams and frames) subjected to steady state forces and moments. (L8+P16) Creation of engineering simulation models of thin and thick plate or disc structures subjected to in-pane forces, pressure vessels and brackets to study stress concentration and distribution. (L8+P16) Creation of 1D and 2D engineering simulation models of composite walls or panels and chimney structures, respectively to study the steady state temperature distribution. Analysis of potential flows. (L4+P8) Evaluation of natural frequencies and mode shapes of machine structures. (L2+P8)					
Text Book	1. S. Moaveni, Finite Element Analysis: Theory and Application with ANSYS, Pearson 2020, ISBN: 978-0135212103. 2. G. R. Liu and S .S. Quek, The finite element method – A practice course, Butterworth-Heinemann, 2013.					
Reference Books	1. Nigel Cross, Engineering Design Methods – Strategies for Product Design, Wiley, ISBN: 978-1-119-72440-7. 2. Tai-Ran Hsu, Applied Engineering Analysis, Wiley, 2018, ISBN: 978-1-119-07120-4. 3. Tirupathi R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite Elements in Engineering, Cambridge University Press, 2021. 4. Erdogan Madenci and Ibrahim Guven, The Finite Element Method and Applications in Engineering Using ANSYS, Springer, 2015.					