1.	Title of the course	Nonlinear Dynamical Systems
2.	Course number	ME701L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To ME7021/10
6.	To be offered by	Department of Mechanical Engineering
7.	To take effect from	January 2022
8.	Prerequisite	CoT for PG
9.	**Course Objective(s):** To introduce the behaviours of different nonlinearities existing in dynamical systems. To mathematically model the system and learn some of the commonly used analytical, semi-analytical and numerical techniques to solve the nonlinear differential equations of motion. To introduce some important concepts of nonlinear systems such as stability, bifurcations and chaos.	
10.	**Course Content:** Linearization, qualitative analysis of linear systems, phase plane, stability; Nonlinear system basics, fixed points, stability, hysteresis, qualitative theory, bifurcations, logistic map (Choas), Instabilities (buckling); Stability in infinite dimensions; Lyapunov functions and stability; limit cycles (isolated periodic orbits); Poincare maps; Forced periodic systems, floquet multipliers, hopf bifurcation, fast-slow systems and singular perturbations, parametric excitation, forced oscillations (frequency response), numerical continuation of solutions (including obtaining frequency responses without simulating); Hamiltonian systems, non-smooth systems; Perturbation techniques, dependence on initial conditions, Lyapunov exponents, adjoint equation; Random vibrations; Numerical and semi-analytical methods, jacobians.	
11.	**Textbook(s):** 1. Nayfeh A H and Mook D T, *Nonlinear oscillations*, Wiley (1995). 2. Strogatz S H, *Nonlinear Dynamics and Chaos with Applications to Physics, Biology, Chemistry and Engineering*, CRC press (2000).	
12.	**Reference(s):** 1. Jordan D W and Smith P, *Nonlinear Ordinary Differential Equations: An Introduction to Dynamical Systems*, Oxford University Press (1999).	