1.	Title of the course	Non-Linear Control Systems
2.	Course number	EE504L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To EE5104/2
6.	To be offered by	Department of Electrical Engineering
7.	To take effect from	July 2022
8.	Prerequisite	Nil
9.	**Course Objective(s):** This course presents mathematical tools for analysis and control of nonlinear systems, with emphasis on Lyapunov methods	
10.	**Course Content:** Mathematical preliminaries: Open and closed sets, compact set, dense set, Continuity of functions, Lipschitz condition, smooth functions, Vector space, norm of a vector, normed linear space, inner product space. Notion of equilibrium points and operating points, Second-order nonlinear systems, vector field, trajectories, vector field plot, phase-plane portrait and positively invariant sets, classification of equilibrium points based on the eigenvalues of the linearized system and special cases, Periodic solutions and the notion of limit cycles, Bendix son's theorem and Poincare -Bendixson criteria, approximate solutions of periodic solutions. Stability notions such as Lagrange stability, Lyapunov stability, asymptotic stability, global asymptotic stability, exponential stability, relative stability and instability, Lyapunov's direct and indirect method, La Salle's invariance property and singular perturbations, Sum of Squares for construction of Lyapunov functions. Design methods, design of control laws based on Lyapunov function and Sliding mode control and illustration of methodology on a few benchmark examples.	
11.	**Textbook(s):** 1. Hassan K K, *Nonlinear Systems*, 3rd Edition, Pearson Education (2002).	
12.	**Reference(s):** 1. Shankar S, *Nonlinear System Analysis - Analysis, Stability and Control*, Springer (2013). 2. Vidyasagar M, *Nonlinear System Analysis*, Society for Industrial and Applied Mathematics (2002).	