SYLLABUS :-

Introduction to System Dynamics, Feedback and Feed-forward control, Model-based control, Lagrange's equations, Hamilton's principle, State space form, Port Hamiltonian systems, Multi-energy domain systems, Lumped parameter models, Bond graph modelling, Transducers, Active and passive interfaces, Concept of physical and computational causality, generation of state space equations from bond graph model for linear and non-linear systems, algebraic, causal and differential-algebraic loops, concept of activated bonds, sensors and actuators.Linearization, Model order reduction, Equivalence of systems, Transformer and gyrator equivalence, Model scaling, modelling of systems with two-force members, constraints and degrees of freedom, relaxed constraints, joints with clearance/flexibility, modelling planar multi-body mechanisms, robot manipulators and other systems.Active and passive control, Modelling of active electro-mechanical and mechatronic systems, Block diagram representation of causal linear and non-linear models, introduction to MATLAB-Simulink.Recall of Laplace transform, Definition of transfer function, System identification in the frequency domain, Time response to step, impulse and sinusoidal inputs, Response characteristics, transfer function from state space model, Signal flow graph for LTI systems, Masson's gain rule and transfer function generation.Stability of LTI systems, Steady state error, PID control and controller tuning, Routh-Hurwitz criterion, Absolute versus relative stability, Root loci technique, PI controller design, Lead and Lag compensator circuit design using root loci, Use of Op-amps as buffer, Nyquist plot and stability, Gain and phase margins, Lead and lag compensator circuit design using Nyquist plot, Phase minimal property, Passivity and robustness, M and N circles.Brief description on the concepts of controllability and observability, pole placement, sampling theorem, digital and optimal control, multi-variate and non-linear control, and fault tolerant control (just description).