Semester:	6				
Course Code:	ME5050				
Course Name:	Advanced Controls				
Credits Value:	3 (Notional hours: 150)				
Pre-requisites:	ME3010				
Core/ Optional:	Optional				
Hourly Breakdown	Lectures (hours)	Tutorials (hours)	Practical classes (hours)	Assignments (hours)	Independent Learning & Assessment (hours)
	20	08	16	18	88

Course Aim: To make the students understand the basics of Modern Control Engineering and for them to be able to do a State Variable Feedback Design using state space control methods.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

- **model** a control system in state space and transform to canonical forms
- **determine** controllability, observability, sterilizability and detectability of a state space system
- **design** a full-order and reduced-order observer
- **design** a control system using state variable feedback by pole placement, optimal control/Linear Quadratic Regulator

Course Content:

- **State-space representation of dynamic systems**: Introduction to state-space: State-space representation of dynamic systems, State-transition matrix, time response, characteristic values.
- **Design of State-variable feedback systems:** Controllability, observability, stabilizability and detectability; controllable canonical form, design of control systems through pole placement, Ackerman's formula, design considerations, feed-forward control.
- **Observers:** Observable canonical form, design of full-order observers and reduced-order observers, optimal observer.
- **Optimal Control**: Introduction to Optimum Control and generalized derivation, finite and infinite horizon problem, linear quadratic regulator, Kalman Filter.

Teaching/ Learning Methods:

Classroom lectures, tutorials and in-class exercises and assignments

Assessment Strategy:

Continuous Assessment 50%		**Final Assessment** 50%		
Details:		Theory (%)	Practical (%)	Other (%) (Project)
Labs/Assignments/Quizzes	30%	50%		
Mid semester examination	20%			

Recommended Reading:

- Kuo, B.C. (2009). *Automatic Control Systems* (9th Edition). Addison Wesley Longman, New Jersey, United States.
- Ogata, K. (2009). *Modern Control Engineering*, (5th Edition). Pearson Publications, London, UK.
- Dorf, R.C. and Bishop, R.H. (1998). *Modern Control Systems* (8th Edition). Addison Wesley Longman, New Jersey, United States.
- Dutton, T. and Barracloughm B. (1997). *The Art of Control Engineering.* Addison Wesley Longman, New Jersey, United States.