Course Code	ME 321
Course Title	Control Systems
No. of Credits	3
Pre-requisites	EM 216 or EM 211
Compulsory/Optional	Compulsory for Mechanical Engineering stream

Aim(s):

To impart knowledge and skills in classical Control Engineering design of continuous controllers including using modern tools, the issues during design and an introduction to digital control so that all the students will be able to design control systems to solve stabilization and regulation related problems.

Intended Learning Outcomes:

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

- model a dynamic system, and analyze using transfer functions with respect to transient, steady state and stability requirements;
- design an automatic control system using PID control to meet given performance specifications, and use computer software in such a design;
- analyze and design compensators in the frequency domain and perform a simple system identification;
- realize a continuous controller in digital form.

Time Allocation (Hours) : Lectures 28, Tutorials 04, Assignments 26
(Notional Hours : 150)

Course content / Course description :

- **System Characterization:** Introduction, System modelling, Linearization, Transfer functions, Characteristic equation, Complex *s*-plane, Block diagram representation, First & Higher-order system characteristics, Stability criterion
- **Root Locus Based Controller Design:** Dominant-pole concept, Time-domain specifications, Root locus, PID, Lag & Lead compensator design.
- **Frequency-domain Based Controller Design:** Frequency response, Bode plots, Nyquist stability criterion, Frequency-domain specifications, Relative stability, Introduction to robust control, Sensitivity, Design considerations in the frequency-domain, Lag & Lead compensation.
- **System Identification:** System identification in the time and frequency domain
- **Digital Control:** Introduction, Effect of sampling, Ideal and zero-order hold sampler, Z-transforms, Digital realization of continuous-system Controller.

Recommended Texts (if any) :

- 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.

Assessment	Percentage Mark
In-course Tutorials/Assignments/Quizzes/Practicals Mid Semester Examination	 30 20
End-semester	50