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| **Semester:** | 5 | | | | |
| **Course Code:** | ME3010 | | | | |
| **Course Name:** | Control Systems | | | | |
| **Credits Value:** | 3 (Notional hours: 150) | | | | |
| **Pre-requisites:** | EM1030 | | | | |
| **Core/ Optional:** | Core | | | | |
| **Hourly Breakdown** | Lectures (hours) | Tutorials (hours) | Practical classes (hours) | Assignments (hours) | Independent Learning & Assessment (hours) |
| | 28 | 04 | | 26 | 92 |

**Course Aim:** To impart knowledge and skills in classical Control Engineering design of control systems 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.

**Course Content:**

- **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

**Teaching/ Learning Methods:**

Classroom lectures, tutorials and in-class exercises and assignments

**Assessment Strategy:**

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

**Recommended Reading:**


- Benjamin C Kuo (2003), *Automatic Control Systems* (8th Edition), John Wiley & Sons, USA.
- Katsushita Ogata (2009), *Modern Control Engineering* (5th Edition), Pearson.
- Dorf& Bishop (1998), *Modern Control Systems* (8th Edition) Addison Wesley Longman
- Dutton, Thompson & Barraclough (1997), *The Art of Control Engineering*, Addison Wesley.
- Longman Nise (2009). *Control Systems Engineering* (5th Edition), Wiley-India.