



# MANIPAL UNIVERSITY JAIPUR

School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering  
Course Hand-out

LINEAR AND DIGITAL CONTROL SYSTEM | EC 1603| 4 Credits

Session: July 14 – Dec. 14 | Faculty: Mr. C.P Gupta | Class: Core Course

**Course Outcomes:** At the end of the course, students will be able to

- [EC1603.1] The ability to perform system's time and frequency-domain analysis with response to test inputs. And able to find out the parameter which characterised the system performance.
- [EC1603.2] Students will be able to understand feedback concept and ability to apply Laplace transform, Modelling mechanical system and used reduction technique to obtain transfer function..
- [EC1603.3] To determine the (absolute) stability of a closed-loop control system and to analyse and design **control Systems by apply** technique communicate design results in written reports. which is also **useful in employability**
- [EC1603.4] Students will be able to analyse controlling mechanism its improve skill of student in robotics and embedded area and also help in providing employment in emerging field and analyse for research skills.

## A. SYLLABUS

Block Diagrams and Signal flow graph: Transfer function, Block Diagram, Simplification of systems, Signal flow graphs, Gain formula, State diagram, Transfer function of discrete data systems (PTF), Zero order hold; System modeling: Modeling of electrical and Mechanical Systems (translational & Rotational), System equations, its electrical equivalent (analogous) networks; Time domain analysis: Stability, Routh-Hurwitz criterion, time response for Continuous data systems, type and order of systems, Steady state error for linear Systems, Unit step response for second order systems, Root locus properties and construction; Frequency domain analysis: Introduction, second order prototype system, Bode diagram, Gain and Phase margins, Nyquist stability criterion; Compensators and controllers: Proportional, Integral, PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators; State space representation: Stability Analysis, State transition matrix, Eigen values, Controllability and observability; Digital control systems: Stability and its tests, time response, Mapping between s-and Z- plane, Steady state error; Process controls: Process and process control, model identification, feedback and feed forward controls and control strategies, actuators; Controllers: Z-transform based control algorithms, PID controllers – direct digital controllers.

## B. TEXT BOOKS

1. S. I. Ashon "Microprocessors with Applications in Process Control".
2. B. C. Kuo "Automatic Control Systems" 7th Edition, PHI.
3. Nagrath and Gopal "Control system engineering" PHI.
4. K. Ogata "Modern control engineering" 2nd Edition., PHI.

