| ***SEMESTER*** | ***DEPARTMENT*** | ***COURSE TITLE*** |
|---|---|---|
| *Fifth* | *Control Engineering* | *Control Theory I* |
| ***COURSE CODE*** | ***HOURS*** 3 | ***COURSE SPECIFICATIONS*** |
| *EC505* | ***UNITS*** 3 | *Theoretical Content* |

1. ***Introduction to Control Systems:***
   - Introduction to a control system and its components.
   - Open-loop and closed-loop systems.
   - Definition of the automatic control system.
   - Basic functions of control valves, electric motors, sensors and transducers in a control system.
2. ***Transfer Function of Control Systems:***
   - Mathematical foundation (Complex variables, function of complex variables, analytic of function, etc).
   - Laplace Transform.
   - Important theorem in Laplace transformation.
   - Inverse Laplace transformation.
   - Differential equations.
   - Transfer function concept.
3. ***Block Diagrams and Signal Flow:***
   - Typical elements of block diagram in control systems.
   - Block diagram reduction.
   - Signal flow graph.
   - Mason's rule.
4. ***Stability of Linear Control Systems:***
   - Characteristic equations.
   - Location of poles.
   - Routh Hurwitz Criterion.

***5. Modeling of Dynamic Systems:***

- Modeling of passive electrical elements
- Modeling of electrical networks.
- Modeling of active elements.
- Modeling of mechanical systems.
- DC motor in Control systems.

***6. Time- Domain Analysis in Control Systems:***

- Time response of first order control systems.
- Time response of second order control systems.
- Typical test signals for the time response of control systems.
- Steady state error.

***7. Root Locus:***

- Definition of Root Locus.
- Properties of Root Locus.
- Sketching Root Locus.
- Pole sensitivity.
- Root Locus compensations.

***8. Frequency Response:***

- Bode plots.
- Nyquist criterion.
- Stability via Nyquist diagrams.
- Gain margin and phase margin via Nyquist diagrams.

***References:***

1. ***Modern Control Engineering***, K. Ogatta, Prentice Hall, 1994.
2. ***Modern Control Systems***, R. C. Dorf, Eddison Wesley, 1990.