AP5091 DIGITAL CONTROL ENGINEERING

DETAILED SYLLABUS

OBJECTIVES:

- The student learns the principles of PI, PD, PID controllers.
- The student analyses time and frequency response discrete time control system.
- The student is familiar with digital control algorithms.
- The student has the knowledge to implement PID control algorithms.

UNIT I CONTROLLERS IN FEEDBACK SYSTEMS

Review of frequency and time response analysis and specifications of first order and second order feedback control systems, need for controllers, continuous time compensations, continuous time PI, PD, PID controllers, digital PID controllers.

UNIT II BASIC DIGITAL SIGNAL PROCESSING IN CONTROL SYSTEMS

Sampling theorem, quantization, aliasing and quantization error, hold operation, mathematical model of sample and hold, zero and first order hold, factors limiting the choice of sampling rate, reconstruction.

UNIT III MODELING OF SAMPLED DATA CONTROL SYSTEM

Difference equation description, Z-transform method of description, pulse transfer function, time and frequency response of discrete time control systems, stability of digital control systems, Jury's stability test, state space description, first companion, second companion, Jordan canonical models, discrete state variable models (elementary principles only).

UNIT IV DESIGN OF DIGITAL CONTROL ALGORITHMS

Review of principle of compensator design, Z-plane specifications, digital compensator design using frequency response plots, discrete integrator, discrete differentiator, development of digital PID controller, transfer function, design in the Z-plane.

UNIT V PRACTICAL ASPECTS OF DIGITAL CONTROL ALGORITHMS

Algorithm development of PID control algorithms, standard programmes for microcontroller implementation, finite word length effects, choice of data acquisition systems, microcontroller-based temperature control systems, microcontroller-based motor speed control systems, DSP implementation of motor control system.

REFERENCES:

1. John J. D'Azzo, "Constantive Houpios, Linear Control System Analysis and Design", Mc Graw Hill,1995.

2. Kenneth J. Ayala, "The 8051 Microcontroller- Architecture, Programming and Applications", Penram International, 2nd Edition, 1996.

3. M. Gopal, "Digital Control and Static Variable Methods", Tata McGraw Hill, New Delhi, 1997.