DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITTY, LONERE

BTEEC 601 CONTROL SYSTEM [TY SEM VI]

Teaching Scheme	**Examination Scheme**
Lectures Theory: 03 hrs / Week	Internal Assessment: 20 Marks
Tutorial: 01 Hr / Week	Mid-Sem Exam Test : 20 Marks
Credit: 04	End Sem Exam: 60 Marks

Course Syllabus:

Prerequisite	Network analysis and synthesis, numerical methods and C programming	
Course outcome	To know different basic concepts and components of a control system To derive transfer functions of basic control system components. To perform stability analysis using time domain and frequency domain response on a given system To design and analyze PID controller. To understand and analyze state variable technique.	
Unit	**Contents**	**Contact Hrs.**
1	**Introduction:** Concept of open & closed loop control system, Transfer Function: a) Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system. b) Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series & parallel circuit) transfer function, Procedure of obtaining transfer function.	**6**
2	**Block diagrams and Signal flow graphs**: a) Block diagram, Block Diagram reduction, and Numerical examples. b) Signal flow graph; Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system: Concept of negative and positive feedback, Sensitivity of the system to parameter variation, using negative and positive feedback	**6**
3	**Time domain analysis**: Typical test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, Numerical examples, transient response, Numericals, Concept of stability, Determination of stability by Routh - Hurwitz criterion.	**6**
4	**Frequency domain analysis:** Introduction to frequency response, Advantages of frequency domain analysis, Polar plots, Numericals, Bode plots, Principle of argument, Nyquist criterion, Relative stability from Nyquist criterion, Numericals. Definition of Root Locus, Construction of root locus, and Stability from root locus plots, Root counters, Effect of addition of poles & zeros on root locus plots.	**6**
5	**PID controllers**: Introduction to Proportional (P), Integral (I) & Derivative (D) controller, individual effect on overall system performance, P-PI & PID control and effect on overall system performance, Numerical examples	**6**

6	**State Variable Technique**: Concept of state & state variable, State Variable Analysis: Different forms of state variable representations (Phase, physical & canonical form), Concept of diagonalization, Obtaining state equations from transfer function representation and vice versa, solution of state equations, State transition matrix (STM), Methods of finding STM, Power series method, Laplace transform method, Calay Hamilton method, Controllability & observability of linear system, Kalman's test.	**7**
	References: 1.Ogata K., 'Modem control Engineering', Prentice Hall 2.Kuo B. C., 'Automatic Control System' Prentice Hall 3. Nagarath I. J., Gopal M., 'Control System Engineering' Willey Eastern. 4. Gopal .M. – Control System.(Prentice Hall Of India).	