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B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
CONTROL ENGINEERING

Course Code	18ME71	CIE Marks	40
Teaching Hours / Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To develop comprehensive knowledge and understanding of modern control theory, industrial automation, and systems analysis.
- To model mechanical, hydraulic, pneumatic and electrical systems.
- To represent system elements by blocks and its reduction techniques.
- To understand transient and steady state response analysis of a system.
- To carry out frequency response analysis using polar plot, Bode plot.
- To analyse a system using root locus plots.
- To study different system compensators and characteristics of linear systems.

Module-1

Introduction: Components of a control system, Open loop and closed loop systems.
Types of controllers: Proportional, Integral, Differential, Proportional-Integral, and Proportional- Integral-Differential controllers.
Modeling of Physical Systems: Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic Systems.

Module-2

Time domain performance of control systems: Typical test signal, Unit step response and time domain specifications of first order, second order system. Steady state error, error constants.

Module-3

Block diagram algebra, Reduction of block diagram, Signal flow graphs, Gain formula for signal flow graphs, State diagram from differential equations.

Module-4

Stability of linear control systems: Routh's criterion, Root locus, Determination of phase margin and gain using root locus.

Module-5

Frequency analysis using Polar plot, Nyquist plot, Bode plot, Determination of phase margin and gain margin using Nyquist plot.

Assignment:

1. Study of On-Off Controller for Flow/ Temperature.
2. Study of Control Modes like P, PD, PI, PID for Pressure / Temperature / Flow.
3. Assignment on Root Locus, Bode Plots and Polar Plots.
4. Study of Software 'MATLAB' on the above topics.

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

- Identify the type of control and control actions.
- Develop the mathematical model of the physical systems.
- Estimate the response and error in response of first and second order systems subjected standard input signals.
- Represent the complex physical system using block diagram and signal flow graph and obtain transfer function.
- Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.

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Analyse the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots.
paper pattern: question paper will have ten full questions carrying equal marks. ch full question will be for 20 marks. re will be two full questions (with a maximum of four sub- questions) from each module. full question will have sub- question covering all the topics under a module. students will have to answer five full questions, selecting one full question from each module.

Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
k/s			
Automatic Control Systems	Farid G., Kuo B. C	McGraw Hill Education	10th Edition,2018
Control systems	Manik D. N	Cengage	2017
Books			
Modern control Engineering	K. Ogeta	Pearson	5th Edition, 2010
Control Systems Engineering	Norman S Nice		Fourth Edition, 2007
Modern control Systems	Richard C Dorf	Pearson	2017
Control Systems Engineering	IjNagrath, M Gopal	New Age International (P) Ltd	2018
Control Systems Engineering	S Palani	Tata McGraw Hill Publishing Co Ltd	ISBN-13 978007067193