**Lecture Schedule**

**Department of ELECTRICAL AND ELECTRONICS Engineering**

# Branch & Section : II B.Tech - II Sem & ECE Regulation : R16

**Subject : CONTROL SYSTEMS Academic Year : 2017 -18**

**Name of the Faculty : G.S.S.SRI HARSHA**

**Course Objectives**

1. To introduce the concepts of open loop and closed loop systems, mathematical models of mechanicaland electrical systems, and concepts of feedback

2. To study the characteristics of the given system in terms of the transfer function and introducing various

approaches to reduce the overall system for necessary analysis

3. To develop the acquaintance in analyzing the system response in time-domain and frequency domain in

terms of various performance indices

4. To analyze the system in terms of absolute stability and relative stability by different approaches

5. To design different control systems for different applications as per given specifications

6. To introduce the concepts of state variable analysis, design and also the concepts of controllability andobservability

**Course Outcomes**

1. This course introduces the concepts of feedback and its advantages to various control systems

2. The performance metrics to design the control system in time-domain and frequency domain are

introduced.

3. Control systems for various applications can be designed using time-domain and frequency domain

analysis.

4. In addition to the conventional approach, the state space approach for the analysis of control systems is

also introduced.

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| **UNIT** | **TOPIC** | **No. of Periods** |
| **I** | **Introduction** |  |
|  | Introduction to concepts of control systems | 1 |
| Open Loop & Closed Loop systems, examples | 1 |
| Classification of control systems | 1 |
| Feed-back systems and their characteristics | 1 |
|  | Effects of feedback on control systems. | 1 |
|  | Impulse response and its transfer function | 1 |
|  | Block diagram representation of electrical systems | 3 |
|  | Problems on electrical systems to find transfer function | **1** |
|  | Steps to reduce the given block diagram and problems | **1** |
|  | Mason’s Gain Formula | **1** |
|  | Problems to find T(s) using SFG | **1** |
|  | TOTAL | **13** |
| **II** | **Controller Components** |  |
|  | DC Servomotor and its Transfer function  | 1 |
| AC Servomotor and its Transfer function | 1 |
| Transfer Function of Synchro for data transmission system | 1 |
| Transfer function of Synchro for error detection and correction  | 1 |
| AC tachometer and ac position control systems | 1 |
| Standard test Signals | 1 |
| Time response of first and second order systems,  | 1 |
| steady state errors and error constants | 1 |
|  Effect of adding a zero to a system | 1 |
| Design specifications of second order systems | 1 |
| Performance indices | 1 |
|  | **13** |
| **III** | **Concepts of Stability and Algebraic Criteria** |  |
|  | Concept of stability, Routh Stability criterion | 2 |
| Limitations of Routh stability criterion and problems on that. | 2 |
| Root Locus concept, magnitude and angle criterion. | 2 |
| Steps to solve the problem by root locus | 1 |
| Problems on root locus | 2 |
| Effects of adding poles and zeros to root locus | **2** |
|  | Total periods | **11** |

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| **IV** | **Frequency response analysis** |  |
|  | Correlation between time and frequency response | 2 |
| Polar Plots | 3 |
| Bode Plots | 4 |
| Nyquist Stability | 4 |
|  | **total** | **13** |
| **V** | **Introduction to Design** |  |
|  | The design problem | 1 |
| Preliminary consideration of classical design | 2 |
| Realization of basic Compensators | 3 |
| Cascade compensation in time domain and frequency domain | 2 |
| Tuning of PID Controllers | **2** |
|  | TOTAL | **10** |
| **VI** | **State Variable Analysis and Design** |  |
|  | Introduction | 1 |
| Concepts of State | 1 |
| State Variables and State models | 2 |
| State models for linear continuous-time systems, | 1 |
| State variables and linear discrete-time systems | 2 |
| Solution of state equations | **2** |
|  | Concepts of Controllability and Observability | **3** |
|  |  | **12** |

**Total No. of Periods**: 13+13+11+13+10+12= 72

**BOOKS:**

I.J.Nagarath and M.Gopal, “ **Control System Engineering,”** New Age International Publishers, Fifth

Edition

**Reference Books**

1. Katsuhiko Ogata, “Modern Control Engineering,” Pearson, Fifth Edition

2. S. Salivahanan, R. Rengaraj, and G. R. Venkata Krishnan, “ Control Systems Engineering,” Pearson,

First Impression

3. Benjamin C. Kuo, Frarid Golnaraghi, “ Automatic Control Systems,” Wiley Student Edition, Eigth

Edition

4. PadmaRaju and Reddy , “ Instrumentation and Control Systems “, McGrawHill Education ,2016