| | **National University of Sciences and Technology** |
|---|---|
| | **Course Description** |

| Course Title | Course Code | Credit Hours |
|---|---|---|
| System Dynamics and Controls | ME-843 | 3 – 0 |

**Textbook:**

- Smith, C. A, Corripio, A. B, Principles and Practice of Automatic Process Control, John Wiley

**Reference Book:**

- Marlin, T.E., Process Control, McGraw Hill Book Co
- Ogunnaike, B. A., et al., Process Dynamics, Modeling, and Control, 96 Oxford University Press.

**Course Objectives:**

- This course is an introduction to the mathematical modeling and control of systems of electrical, mechanical, fluid, thermal, and inter-domain (e.g. electro-mechanical) elements.

**Course Outline:**

- Introduction to Process Control; Process Dynamics and Laplace Transform.
- First Order Systems; Second Order Systems.
- Inverse Response and Time Delay.
- Frequency Domain.
- Linearization and Nonlinear Systems.
- Stability; Process Identification.
- Feedback Control Systems; Conventional Design.
- Inverse Response and Time Delay.
- Feed forward, Inverse Response, and Time Delay.
- Model-based Control; Digital Control - Sampling; Z Transforms and Digital Block Diagrams.
- Digital Controller Design; Model Predictive Control.
- Multivariable Control; RGA and Modal Analysis; SVD and Decoupling.
- Multivariable Examples.
- **ASSESSMENTS**

| Description | Percentage Weightage (%) |
|---|---|
| Assignments | 05-10% |
| Quizzes | 10-15% |
| Mid Semester Exams | 30-40% |
| End Semester Exam | 40-50% |