INC 341 System Modelling and Analysis

Semester: 1/2021
Schedule: Wed 13.30–17.20 (A) Thu 13.30–17.20 (B) **Classroom:** CB40609
Instructors:

- Asst. Prof. Dr.-Ing. Sudchai Boonto
- **Email:** sudchai.boo@kmutt.ac.th **Office:** CB40601 **Tel.** 02-470-9091

Required pre-requisites:
Circuit Analysis, Differential Equations, Basic Programming Skill

Course Description:

Introduction to System Dynamics, Linear Models. Modelling of Mechanical, Electrical, Fluid, Thermal System and Inter-Domain Systems. Solution methods for dynamic models. Differential equation, Laplace transform. State-Variable Models and Simulation Methods. Transient response. Block diagram. Stability analysis. Steady state error analysis. Introduction to feedback control.

Course Objectives

- To teach students basic mathematical and computational tools for modelling and analysis of dynamic systems
- To train students to identify, model analyze, design, and simulate dynamic systems in various engineering disciplines using a unified approach.

Learning Outcomes:

- Students will demonstrate an ability to mathematically model system in various engineering disciplines including mixed systems.
- Students will demonstrate understanding of various mathematical models, such as ordinary differential equation (ODE) model, transfer function and state-space, for dynamic systems.
- Students will demonstrate the ability to simulate the transient and steady-state response of dynamic systems.
- Students will demonstrate that they can analyse transient, steady-state, and frequency response of linear dynamic systems.

- Apply the processes, procedures and techniques which are required for the successful execution of systems engineering methodology to resolve different types of complex problems faced by senior manager, at an earlier stage of system design. These problems may relate to systme specification, requirements allocation, maintenance concepts, and critical issue resolution.

Learning Activities: The courses activities include lectures, computer laboratory modelling tutorials, presentations, group discussions, assignments and reports on case studies.

Learning Resources: Website `https://staff.kmutt.ac.th/~sudchai.boo/Teaching/inc341s/inc341s.html`, and facebook group. This can include lecture material, supplementary course notes, problem sheets and solutions, and useful references.

Course text: Ramin S. Esfandiari, and Bei Lu, *Modeling and Analysis of Dynamic Systems*, 2nd Edition, CRC Press, 2014.

Reference:

- K. Ogata, *System Dynamics*, 4th Edition, Prentice-Hall, 2004.
- W. J. Plam III, *System Dynamics*, 3rd Edition, McGraw Hill, 2014

Project:
Each student is required to formulate a real mechanical system, to do analysis and design for the problem using the course material.

Grading scheme:
In class activities: 15% Midterm Exam: 35% Final Exam: 35% term assignment: 15%

- I reserve the right to modify the grading scheme.

Course Schedule (Tentative)

Week	Topic	Date	Lecturer
1	Introduction to System Modelling	18,19 Aug 21	Sudchai
2	Modelling of Rigid-Body Mechanical System I	25,26 Aug 21	Sudchai
3	Modelling of Rigid-Body Mechanical System II	1, 2 Sep 21	Sudchai
4	Spring and Damper Element	8,9 Sep 21	Sudchai
5	Continuous-Time System Analysis I	15, 16 Sep 21	Sudchai
6	Continuous-Time System Analysis II	22, 23 Sep 21	Sudchai
8	Midterm Exam	30 Sep 21	
7	Laplace Transform I	6, 7 Oct 21	Sudchai
9	Laplace Transform II	13, 14 Oct 21	Sudchai
10	Electrical and Electromechanical Systems I	20, 21 Oct 21	Sudchai
11	Electrical and Electromechanical Systems II	27, 28 Oct 21	Sudchai
12	Fluid Systems I	3, 4 Nov 21	Sudchai
13	Fluid Systems II	10, 11 Nov 21	Sudchai
14	Thermal Systems	17, 18 Nov 21	Sudchai
15	Transient Responses and Block Diagram Models	24, 25 Nov 21	Sudchai
16	Final Exam	2 Dec 21	Sudchai

Note: All topics and timetable may be changed!