

Modeling and Simulation in Chemical Engineering

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|--------------------------|--------------------------------------|--|---------------------|------------------|---------------------------|---|
| Course Name | Course type (credit/hours) | Elective course(3/3) | | | Course code | D019 |
| | Target students Division/major/grade | Chemical Engineering/Senior | | | Opening semester | 2017 2ND SEMESTER |
| | Class time and classroom | Tue 5.5(WH540) Tue 6.5(WH540) Tue 7.5(WH540) | | | English Grade | A(100%English) |
| Reference to this course | Prerequisite courses | 프로그래밍 기초 | | | | |
| | Related basic courses | | | | | |
| | Recommended concurrent courses | 화공종합설계 및 실습 | | | | |
| | Related advanced courses | | | | | |
| Instructor | Name (title/division) | Chee Burm Shin(Professor, Energy Systems Research) | | | | |
| | Office Room Number | 서관 201 | Office phone Number | 2388 | e-mail | |
| | Office hours | Tue. & Thu. 1-3pm | | Homepage address | http://matproc.ajou.ac.kr | |
| Teaching Assistant | Name (title/division) | | | | | |
| | Office Room Number | 화공실험동 205-1 | Office phone Number | 2949 | e-mail | etaranger@ajou.ac.kr, kdy008@ajou.ac.kr |

1. Introduction

The purpose of this course is to introduce the modeling of diverse processes in chemical engineering and the numerical methods to obtain the solutions of mathematical models to undergraduate students. The students will learn how to analyse and design the chemical processes through the various examples on chemical process modeling and simulation provided in lectures, homeworks, and design projects.

2. Course Objectives

Course objectives

- Exemplification of the methodology of modeling and simulation for the analysis and design of chemical processes
- Instruction of numerical methods to obtain the solutions of mathematical models

Course outcomes

- Application of chemical engineering principles to the modeling and simulation of chemical processes
- Derivation of the equations of mathematical models of chemical processes
- Obtaining the solutions of mathematical models
- Use of the methodology of modeling and simulation for the analysis and design of chemical processes

3. Class types and activities

- Official language of this course is English.
- Methodologies of the modeling and simulation of chemical processes will be covered in lectures and the homeworks will be assigned to illustrate how to apply the methodologies in the analysis and design of chemical processes.
- Design projects will be performed in 5-person groups to develop design skills and teamwork. Each group will present design results and submit design report.
- Mid-term and final examinations will be given to evaluate the understanding of students on the main concepts of the course.

4. Teaching Method

- | | |
|---|---|
| <input checked="" type="checkbox"/> lecture | <input checked="" type="checkbox"/> discussion and debate |
| <input checked="" type="checkbox"/> team project(presentation and case studies) | <input type="checkbox"/> experiments(role-playing,etc) |
| <input checked="" type="checkbox"/> designing and production | <input type="checkbox"/> on-site learning(on-site training) |
| <input type="checkbox"/> others | |

5. Support Systems in Use

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> e-class / AjouBb | <input type="checkbox"/> automatic recording system | <input type="checkbox"/> web-based assignment |
| <input type="checkbox"/> cyber lecture | <input type="checkbox"/> online content | |
| <input type="checkbox"/> class behavior analyzing system | <input type="checkbox"/> others | |

6. Teaching Tools

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|--|---|---|
| <input type="checkbox"/> PBL(Problem Based Learning) | <input type="checkbox"/> CBL(Case Based Learning) | <input type="checkbox"/> TBL(Team Based Learning) |
| <input type="checkbox"/> UR(Undergraduate Research) | <input type="checkbox"/> FL(Flipped Learning) | <input type="checkbox"/> DSAL(Data Science Active Learning) |
| <input type="checkbox"/> others | | |

7. Knowledge and ability required for taking this course

- Basic knowledge in unit conversion and material & energy balances
- Basic principles in chemical engineering mathematics, reaction engineering, and transport phenomena
- Basic skills in computer use

8. Method of Evaluation

| Evaluation Item | The Number of Times | Evaluation Proportion | Remarks |
|-----------------|---------------------|-----------------------|----------------|
| Attendance | | | |
| midterm exam | 1 | 25 | Mid-Term Exam. |
| final exam | 1 | 25 | Final Exam. |
| quiz | | | |
| presentation | | | |
| discussion | | | |
| homework | Many | 10 | Homeworks |
| etc | 1 | 40 | Team Projects |
| study hours | | | |

9. Textbook and supplementary material

| Main/Sub | Title (Web-site) | Writer | Publisher | Publication year |
|----------|------------------|----------------|-----------|------------------|
| Main | Lecture note | Chee Burm Shin | N/A | - |

10. Class system and Class shedule

The course will proceed in the following order:

- 1) Application of chemical engineering principles to the modeling and simulation of chemical processes
- 2) Derivation of the equations of mathematical models of chemical processes
- 3) Use of the means and tools to obtain the solutions of mathematical models
- 4) Use of the methodology of modeling and simulation for the analysis and design of chemical processes

< Class Schedule >

* language : K-korean, E-English

| Weeks | Topics | language | Instructor | Teaching Method | Evaluation Method | Matter to be prepared |
|-------|--------------------------------|----------|----------------|-------------------------|--------------------|-----------------------|
| 1 | Model Formulation I | | Chee Burm Shin | Lecture, Design project | | |
| 2 | Model Formulation II | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 3 | Systems of Linear Equations | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 4 | Systems of Nonlinear Equations | | Chee Burm Shin | Lecture, Design project | Project evaluation | |

< Class Schedule >

* language : K-korean, E-English

| Weeks | Topics | language | Instructor | Teaching Method | Evaluation Method | Matter to be prepared |
|-------|------------------------------------|----------|----------------|--|---|-----------------------|
| 5 | Numerical Differentiation | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 6 | Numerical Integration | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 7 | Ordinary Differential Equations | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 8 | Design Project | | Chee Burm Shin | Design Project | Project evaluation | |
| 9 | Partial Differential Equations | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 10 | Regression | | Chee Burm Shin | Lecture, Design project | Project evaluation | |
| 11 | Presentation of Design Project I | | Chee Burm Shin | Presentation of design project and discussion | Project evaluation, discussion evaluation | |
| 12 | Presentation of Design Project II | | Chee Burm Shin | Presentation of design project and discussion | Project evaluation, discussion evaluation | |
| 13 | Presentation of Design Project III | | Chee Burm Shin | Presentation of design project and discussion | Project evaluation, discussion evaluation | |
| 14 | Presentation of Design Project IV | | Chee Burm Shin | Presentation of design project and discussionproject | Project evaluation, discussion evaluation | |
| 15 | Presentation of Design Project V | | Chee Burm Shin | Presentation of design project and discussion | Project evaluation, discussion evaluation | |
| 16 | Final Exam. | | Chee Burm Shin | | Evaluation of final exam. | |

11. Other items of notification