Spring 2016

AME 505: ENGINEERING INFORMATION MODELING

Department of Aerospace & Mechanical Engineering

University of Southern California

COURSE SYLLABUS

Instructor: Prof. Yan Jin

Professor of Aerospace and Mechanical Engineering

Office: Room 400D, Olin Hall of Engineering

Email: yjin@usc.edu, Phone: 213-740-9574

SkypeID: Prof.Yan.Jin; http://bcf.usc.edu/~yjin

Course Section:	28864R (campus) 29035D (den)
Course Unit:	3 Units
Prerequisite:	Graduate Standing
Class Hours:	Thursdays 6:40pm – 9:20pm
Class Location:	RTH-109
Office Hours:	Thursdays, 11am-12pm
Teaching Assistant:	Xiongqing (Vincent) Liu (liuxiongqing@gmail.com)

AME505:

ENGINEERING INFORMATION MODELING

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Course Objectives

Understand information modeling principles and methodologies: We will study basic approaches of information modeling including symbolic logic, artificial intelligence (AI) techniques, object-oriented technologies, machine learning, and design theory and methodologies. We will investigate and develop specific representations for (1) entities such as engineering system components and engineering activities; (2) relationships such as functional & spatial constraints among system components; (3) system behaviors expressed both qualitatively and quantitatively; and (4) functions expressed as design intent.

Develop basic skills through building an object-oriented and knowledge-based engineering support system: Students will learn basic information modeling skills by using Java and other AI tools for their exercises and term projects. The hands-on experience will be useful for students to digest the principles and methodologies and to develop product and process models in their future engineering and research practice.

Understand the state of the art of model-based systems: We will review the state of the art models as case examples reported in the literature. We will examine specific representations and algorithms used to model engineering products and processes for improving design and manufacturing. In addition, we will hold discussion sessions to criticize these models.

Apply the learned knowledge and skills to solve engineering problems: Students will form term project teams. Each team will prepare a project proposal and develop a proof-of-concept model-based application system for solving their selected engineering problem. Along with the development of their application system, project teams will present their proposal, modeling approach, their completed application system and future extensions.

Prerequisite

Graduate standing. No restrictions on graduate students. Senior students may also take this class after receiving approval from the instructor.

Course Work

Homework: Each homework assignment usually has 2-3 short questions. One question is about the content of the previous lecture and the other is based on the reading assignment for the next lecture. The homework is intended to help students (1) digest key concepts learned from the lectures and (2) assimilate the reading materials and organize their thoughts about them for the class discussion and future practice. Clarity, conciseness and incisiveness are required.

Mid-term Exam: Mid-term exam will be open-book. Problems of the exam will be similar to, and more comprehensive than, the homework questions.

Term Project: For the term project, students will need to form teams of 3-4 people. Each team will work together to create a project topic by choosing a specific engineering application problem. Teams will need to develop specific information models, build system components, develop reasoning algorithms and compose a demonstrateable system as a solution to their selected project problem. The term project will give students the opportunity to review and apply the theory and methodologies they learned from the class.

Course Materials

Required: AME505 Course Reader (Will be available on the course website).

Optional: *Object-Oriented Modeling & Design*, J. Rumbaugh, M. Blaha, Premerlani, W. Eddy, W. Lorensen, Prentice Hall, 1991

Others (will be added).

Grading Requirements

Homework: 30%, Mid-term exam: 30%; Final project: 40%.

Course Schedule

Date	Lecture	Exercise	Readings	Work Due
1/14	Course introduction	Engineering applications that need models	(All reading materials will be available on the course website)	
1/21	Introduction to symbolic systems	Lecture continue	Chapter1 (p.21-68)	HW#1
1/28	Introduction to production systems	Build a rule-based System	Chapter2 (Production System)	HW#2
2/4	Entity relationship model & E-R model examples	**Teaming and project planning**	Chapter3 (E-R Model)	HW#3
2/11	Object-oriented modeling and system development	(lecture continue)	Chapter4 (p.1-46)	HW#4
2/18	Object-oriented analysis	HW#5Q2 Briefing	Chapter5 (p.144-189)	HW#5
2/25	Object-oriented modeling and UML	UML modeling tool	Chapter6 (UML)	**Project proposal**
3/3	**Midterm Exam**			
3/10	Java concepts & structure	Eclipse env exercise	Java & Eclipse book	
3/17	Spring Break. No class.			
3/24	Java programming 1	Programming exercise	Java & Eclipse book	
3/31	Java programming 2	**Project briefing**	Java & Eclipse book	**Progress Report**
4/7	Introduction to big data and machine learning	Project modeling Q&A	HO#1	
4/14	Genetic algorithm & genetic programming	Modeling products and processes	HO#2	
4/21	Artificial neural network	Reasoning and algorithms	HO#3	
4/28	Advanced modeling topics	**Project Presentation**	HO#4	
5/2	**PDF file due 5pm via email to yjin@usc.edu**			**Final Project Report**