MFG 5311/SE 5347
Design for Manufacturability/System Engineering Processes
Course Syllabus

Instructor: Bill Tseng, Ph. D., CMfgE/ Md Fashiar Rahman, Ph. D.
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Office Hours: Friday 4 PM – 5 PM online via Blackboard or to make an appointment

TA: Honglun Xu
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Office Hours: TBA or to make an appointment

Class Time: 6 pm – 8:50 pm on Thursday

Text: Background material and Power Point slides available on the course website.
Andrew Kusiak, *Engineering Design: Products, Processes, and Systems*, Academic Press, San Diego, CA, 1999

Reference books:
D.W. Whitney, *Mechanical Assemblies*, Oxford University Press, New York, 2004.
M. Crawford and A. Di Benedetto, *New Product Management*, McGraw Hill, New York, 2003.
Y. Haik, *Engineering Design Process*, Thompson Books/Cole, Pacific Grove, CA, 2003.
M. Crawford and A. Di Benedetto, *New Product Management*, McGraw Hill, New York, 2003.
D.G. Ulman, *The Mechanical Design Process*, McGraw Hill, New York, 2000.
K.T. Urlich and S.D. Eppinger, *Product Design and Development*, McGraw-Hill, New York, 2000.

Prerequisite: Permission of instructor

Course description:
The course introduces a process approach to engineering design, manufacturing, and service applications. Models, modeling tools, solution approaches, and methodologies for analysis and improvement of processes, including the product development and manufacturing process are discussed. The science of process modeling and analysis is illustrated with case studies. In addition, to develop the skillset of future engineers, this course also includes the concept of and virtual reality (VR) and augmented reality (AR) where the students will learn the basic development VR/AR applications for modern manufacturing systems. Upon completion of this course students will:

- Have a clear understanding about the process modeling.
- Be able to analysis a reliability of any complex systems/ manufacturing processes
- Have a clear understanding of the quality functions and apply for real cases
- Understand how to form a function team based on the process/system requirements
- Be able to solve a part/product design problem under any given constraints
- Be able to design a 3D model using “Maya” software
- Be familiar with VR/AR toolkit used by the features of the Microsoft HoloLens device.
- Develop an application for target devices using the “Unity” game engine

Course Contents:

- Introduction to Virtual and Augmented Reality

- 3D design
- VR/AR application development
- Fundamentals of Process Modeling
- Analysis of Process Models and Problems
- Process Decomposition
- Quality Function Deployment and Process Models
- Reliability of Process Models
- Scheduling Design Activities
- Team Formation
- Requirements in Conceptual Design
- Design of Parts
- Design Problem Solving
- Data Warehousing

Midterm
Project Presentations
Final Exam

Course Grading Scheme:
Homeworks 20%
Midterm 20%
Quizzes 10%
Semester Project 25%
Final Exam 20%
Classroom participation 5%

Timelines:

Proposal	Feb. 17
Proposal Presentation	Feb. 24
Midterm	March 10 or March 24
Final Presentation Begin	April 28
Final Exam	May 05
Final Project Report	May 12

Homeworks: Regular homeworks are due by 6:00 pm on the day indicated on the assignment. Some homeworks that may be due in more than one week.

Quizzes: Numerous quizzes will be given in preparation for exams. The quizzes will not be announced in class.

Exams: Two in-class exams (midterm and final) will be given. All exams and quizzes will be open book and open notes.

Semester Project Guidelines

YOU MAY CHOOSE ONE OF THE FOLLOWING FIVE TYPES OF PROJECTS:
A. **Application Project** (Teaming of 2 students is encouraged)
You need to describe the problem considered for your project and propose a model and/or solution approach for solving the problem. Ideally, the project should be based on an industrial application. For industrial

projects the emphasis is normally given on the problem formulation and a model to be developed, as those might be relatively difficult to accomplish. The solution procedure for an industrial application project is likely to be an extension of one of the algorithms discussed in class or a combination of more than one algorithm. If you do not have industrial contacts, you may select for your project a problem from a journal (e.g., *Journal of Manufacturing Systems, IIE Transactions on Design and Manufacturing, International Journal of Production Research, Journal of Intelligent Manufacturing*), a magazine (e.g., *IE Solutions, Interfaces*) or a book (serf the web). In such case you will be expected to present a model (e.g., integer programming, neural network) of the problem and a solution procedure (e.g., heuristic, expert system). Writing computer codes (e.g., JAVA, C++, ASP) and using standard computer software (e.g., expert system shells, neural network software, and data mining software) to support the developments included in the project will be an asset. Make attempt to consider numerous alternatives (e.g., three layouts of a manufacturing facility) while proposing solutions, show the benefits and pitfalls of each alternative, and use visual tools to demonstrate the results (e.g., bar charts, virtual reality).

B. **Research Paper** (Teams of 2 students is encouraged, **highly recommended**)
You may choose a specific topic in the area of production, manufacturing, energy, systems engineering and explore it in greater detail. This type of a project should survey the existing literature, identify and summarize a research problem, present existing methods for solving the problem, and formulate a new solution approach.

C. **Technical Proposal** (Teams of 2 students is encouraged)
This project option involves preparing a proposal for a funding agency, e.g., Department of Commerce, Department of Defense, Company X. Each of you is likely to write numerous proposals in your professional career. In fact, most of non-routine tasked performed in any require proposal preparation. The project is then funded from an internal or external source.
Examples of websites of interest: nsf.gov, darpa.mil, nasa.gov, atp.nist.gov.

D. **Research Proposal** (Teams of 2 students is encouraged)
The research proposal option involves preparing a proposal to a funding agency, e.g., National Science Foundation, Defense Advance Project Agency. If you plan a research career, you are likely to write many proposal proposals. Examples of websites of interest: nsf.gov, darpa.mil, nasa.gov.

E. **Software Development Project** (Teams of 1 students)
The student(s) are responsible for the development of software for one of the algorithms discussed in class, e.g., grouping algorithm, machine layout algorithm, scheduling algorithm. The code should be written in a widely used programming language (e.g., JAVA, C, C++, Visual Basic, ASP.NET) with a user-friendly interface.

SEMESTER PROJECT REQUIREMENTS
The project prepared for this class can NOT be used to meet requirements of any other class. Each semester project (irrespectively of the type) must demonstrate some usage of software or computer programming skills, e.g., layout software, neural network software, C programming, etc.

SEMESTER PROJECT REPORT FORMAT
The project report should be prepared on a word processor and should contain figures and tables that are necessary to make the report easy to read. Be concise in your writing and consult technical writing references as needed (see below). The document should be double-space throughout and should use a standard font (Times 12). The first page should include the title of the project, project type (A, B, C, D, or E), student name(s), course title, and the date. The title page should be followed by an abstract (executive summary). Include also a table of contents, a list of figures, and a list of tables. All references must be

included at the end of the paper, followed by appendices, if any. All pages (with the exception of the title page) should be numbered.

The body of each semester project report should include the sections outlined next.
A. **Application Project**
1. Introduction
2. Problem definition
3. Project goals
4. Model formulation
5. Solution approach
6. Computational study
7. Conclusions
B. **Technical Proposal Project**
Requirements are determined by the selected funding agency.
C. **Research Paper**
1. Abstract (about one hundred word long)
2. Statement of the problem
3. Literature review
4. Existing models and solution approaches
5. Proposed model and/or solution approach
6. Examples
7. Conclusions
D. **Research Proposal**
Requirements are determined by the selected funding agency.
E. **Software Development Project**
1. Introduction
2. Algorithm description
3. User's manual
4. Example problems (2)
5. Computer code description

SEMESTER PROJECT PROPOSAL
The purpose of your project proposal is to outline the topic proposed and to receive feedback from the instructor. The proposal should be brief (less than 3 page long). You may attempt to prepare your project proposal in the format a project report (e.g., application project, software development project).
Each semester project proposal should contain a Gant chart of the proposed project activities prepared with MS Project.

PROJECT STATUS REPORT
Each project team (student) is to make a five-minute presentation in class to report on the project status.

REFERENCES ON TECHNICAL WRITING

[1] Olsen, L.A. and Huckin, T.N., *Principles of Communication for Science and Technology*, McGraw-Hill Book Company, New York, 1983.
[2] Sherlock, J., *A Guide to Technical Communication*, Allyn and Bacon, Inc., Newton, MA, 1985.

Project effort (time) estimate
It is expected that each student will spend about 45 hours on a project. Industrial or service application projects may take longer.

Project presentation time estimate

Each project has to be presented in class. A project team will be given about 15 minutes to present the results.

Project report submission requirements

Each team (student) should submit the following items (one per project):

- Hard copy of the project report should be dropped off at TA's office (E-113).
- Project report folder containing the project report file, the Power Point presentation slides, and software developed (when applicable) needs to be uploaded via Blackboard. Compress the folder with all files with Winzip before uploading. Label the compressed folder with your last name and the file content, e.g., Smith_5311_Sem_Project. Reference your email accordingly, e.g., RE: Smith_5311_Sem_Project.

COVID-19 PRECAUTIONS

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID 19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit
epstrong.org.