VM384 Fall 2016-2017 Engineering Project Management
UM-SJTU JI SYLLABUS Prof. Thomas A. Hamade
(Class Meeting: 10:00-11:40 T,Th Room: E1-104 东中院)

Course Description:

Introduction to **TQM** & approaches to managing engineering projects from inception stages to production, including setting objectives & goals, feasibility (mainly based on science, technology & economics), project manager skills, project structure, project synthesis, project stages, design strategy and the algorithm method (degrees of freedom, strategy to solve multivariable multi-unknown equations), part-process-plant design, optimization of design & operation using **Taguchi** method, allocating the use of resources (time, money, people, materials, energy, space, etc.), planning & scheduling using **CPM & PERT** tools for managing activities & resources with minimum delays, contract & licensing procedures. Algorithm method strategy will be introduced to solve & optimize multi-design variables. Considerations to other important factors limiting the design such as laws and regulations, licensing, safety, hazardous waste, **OSHA/EPA/DEQ**, community rights-to-know laws, pollution & environmental protection (soil, water & air), and intellectual rights protection (patents, copy rights, trademarks & trade secrets). Maturity management models such as **CMMI, SPICE, ISO's** for supervising & monitoring projects introduced. Plenty of case studies presented using actual projects and showing how create projects from inception to prototyping/production. Guide to writing technical communication, reports & project proposals introduced through successful engineering selective project case studies related to discipline and submitted as a final report. Consideration of economic feasibility analysis (total capital investment, total manufacturing costs, & measure of profitability) based on all aspects considered while managing engineering projects from design to plant erection & production.

Course Category: Elective ***Pre-requisite:*** Advised Junior standing
Course Objectives:

1. Students will learn tools for total quality management (TQM) and implementation to management of engineering projects.
2. To teach integration of TQM throughout project organization and from inception to production.
3. To expose the students to a variety of management techniques through carefully balancing time for project inception & synthesis, R&D, project development, design, optimization, budgeting, planning scheduling, monitoring, supervising, recruiting, procurement, process & plant construction, validation and modification.
4. Teach the main tools to evaluate feasibility (accept/reject) of projects based on science, technology, common practice, common sense, and economical benefits such as determining total manufacturing costs, capital investments, breakeven point (using industrial indexes, charts & calculations to predict costs).
5. To teach the importance of effective technical communication throughout project stages, transmittal letters, proposals, interim & final reports, publications, presentations and intellectual property protection.
6. Teach the algorithm method to solve design variables and the optimization for simple and complex processes of multiple loops, setting the stages for proto-typing and eventual plant design.
7. To teach the technical aspects of using CPM/PERT for effective planning & scheduling and using CMMI/SPICE for supervising and monitoring projects.
8. To provide a technical understanding of other important considerations in selecting and approving projects such as government regulations, safety aspects, environmental protection & intellectual property protection.
9. Assigned projects motivate students to integrate the technical knowledge and practical considerations into the entire stages of engineering project from inception to production.

Course Outcome: After completing VM384 students will be able to:

1. Integrate and implement total quality management (TQM) tools during management of engineering projects from inception to production stages and apply to organizations' management.
2. Carefully balance theory with practice and apply knowledge on project inception, feasibility evaluation (accept/reject/modify), & synthesis based on science, technology, common practice, common sense, and on economy.
3. Convert inceptions, into sketch, design loops and final design using various case studies examples and how to finalize design specifications relying on theory & practice. They are able to effectively apply strategies they learnt in creating analytical and correlation equations describing the design variables that are needed to complete design specifications. Through the algorithm method they will learn to sift through multiple equations and unknowns that very often impossible to determine via computers without facilitation from project leaders and managers. Then identify which variables are most important to yield least iterative steps in finding solution of the design.
4. Provide a technical understanding of various factors in selecting, optimizing and approving projects based on design (science, technology), economics, social needs, government rules & regulations, company policy, green manufacturing, environmental & pollutions, control, safety, ethics & intellectual property protection.
5. Apply their knowledge in economics to determine budgets for projects and to determine total capital investment and total manufacturing costs for mass production of their prototypes (involving industrial indexes, charts & calculations to predict costs and break-even point).
6. Identify important stages of project activities from inception to production (or prototyping). This include the technical aspects of using CPM/PERT for effective planning & scheduling (Gantt's Chart) and using CMMI/SPICE & SCADA for supervising, monitoring projects, recruiting, procurement, process validation and modification.
7. Apply effective technical communication throughout project stages, transmittal letters, proposals, interim & final reports, publications, presentations and intellectual property protection.
8. Engage in industrial and research projects with minimum training since they were taught how to start and manage engineering projects from scratch and the stages/tools required to successfully complete projects (from inception to production). They students have the knowledge on how to be entrepreneur, innovator, and start own company (via many case studies covered during the course).

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Grading for Course: Homework assignments (**must do to pass tests and final exam**)

MIDTERM TEST (30% of final grade, 300 points each)	**300 points**
Homework (20% of final grade)	**200 points**
Final Project Report & PPT (20% of final grade)	**200 points**
FINAL EXAM (30% of final grade)	**300 points**
TOTAL COURSE POINTS:	**1000 points**

Internet Resources:

This class will use the CANVAS Internet service extensively. All class handouts, extra reading materials, lecture notes, homework and project assignments, announcements, etc. will be posted in CANVAS. In order not to miss any important class announcement, students are advised to check CANVAS at least once per day. Posting

solutions by any student to any of the class assignment on CANVAS is prohibited and is considered as a violation of the Honor Code of the UM-SJTU Joint Institute.

Honor Policies:

All students in the class are presumed to be decent and honorable, and all students in the class are bound by the Honor Code of the UM-SJTU Joint Institute (visit http://umji.sjtu.edu.cn/honorcode for more details). You may not seek to gain an unfair advantage over your fellow students; you may not consult, look at, or possess the unpublished work of another without their permission; and you must appropriately acknowledge your use of another's work. Any violation of the honor policies appropriate to each piece of course work will be reported to the Honor Council, and if guilt is established penalties may be imposed. Such penalties can include, but are not limited to, letter grade deductions, disciplinary sanctions, or expulsion from the Institute and the University. **If you have any questions about this course policy, please consult the course instructors and the undergraduate student handbook.**

Following are specific policies for different types of course assignments:

● Exams:

Each student must complete the exam solely by her or his own efforts. Questions can be asked only of the course instructors. The exam must be completed within the specified time.

● Individual Assignments:

You may discuss individual assignments with your fellow students at the conceptual level, but must complete all calculations and write-up, from scrap to final form, on your own. Verbatim copying of another student's work is forbidden. You may not consult homework solutions from a previous term unless they are made available in a publicly accessible form (no unfair advantage can be sought). Use of other people's work, including materials publically available on the Internet should be acknowledged with proper citations.

● Team Assignments:

All group work is to be completed only within your own group. You may receive help from the course instructors and you may consult with members of other groups in the course, but you must complete your group's calculation and project write-up on your own in collaboration with your team members.

● Plagiarism:

You **must** refer to the 2015 JI Undergraduate Student Handbook, Section 9, for a description of what acceptable academic conduct is. Section 9 of the Handbook contains the Honor Code. In particular for this course:

▶ "it is dishonorable for students to receive credit for work that is not the result of their own efforts" (2013 USH, 19).
▶ "It is a violation of the Honor Code for students to submit, as their own, work that is not the result of their own labor and thoughts. This applies, in particular, to ideas, expressions or work obtained from other students as well as from books, the internet, and other sources [**including lab manuals**]. The failure to properly credit ideas, expressions or work from others is considered plagiarism. Plagiarism is taken extremely seriously at JI. A student is required to follow the rules of citation and attribution as set down by the instructor." (2013 USH, 20).
▶ "Plagiarism is taken extremely seriously at JI. A student is required to follow the rules of citation and attribution as set down by the instructor. The following list includes some specific examples of plagiarism:

- Use of any passage of three words or longer from another source without proper attribution. Use of any phrase of three words or more must be enclosed in quotation marks ("example, example, example").

- Use of material from an uncredited source, making very minor changes (like word order or verb tense) to avoid the three-word rule.
- Inclusion of facts, data, ideas or theories originally thought of by someone else, without giving that person (organization, etc.) credit.
- Paraphrasing of ideas or theories without crediting the original thinker." " (2013 USH, 21).

► Please read carefully the following document:
http://umji.sjtu.edu.cn/academics/student-handbook/ >
http://umji.sjtu.edu.cn/wp-content/uploads/2013/04/2013-Undergraduate-Student-Handbook.pdf

Disability Policy:

If you have any disability that might interfere with your ability to turn in assignments on time or in the form required, contact the instructors and the Academic & Student Affairs Office at the start of the term so that arrangements may be made to accommodate you.

Selective Project Guidelines: Assigned engineering projects motivate students to integrate the technical knowledge (encouraged to integrate smart technology of robotics & mechatronics), practical considerations, and total quality management (TQM) into the entire stages of the engineering project from inception creation to prototyping and eventual plant erection & mass production. The class will be divided into groups of 2-4 students per group, depending on class size and the assigned case study. Each group and each student will engage actively in one different project and the detailed descriptions, requirements and guidelines are posted on CANVAS under "Resources". As a group and for each selected topic you are required to give a **15 minutes final presentation (PPT)** and a **final written report** (**one report & 1 PPT due per group as shown by the Course Schedule)**.

The **PPT & the final report** should start with introduction to the project with discussion of the inception stages based on logical science, technology, common sense and preliminary economic feasibility to be used as the compelling evidences to proceed or reject and then modify the project. Then proceed with detailed discussion of the design of the components & optimization, the processes & control for mass production and the plant design to house the entire project and operations, detailed economic analysis to estimate the fixed capital investment required to build the plant, the total manufacturing (production) costs and the break-even point (profit = loss). The report should be total between 10-20 pages.

In addition, students must integrate the additional project management stages required to achieve a successful completion of the project (projects typically closes when smooth steady production stage can be achieved without major design changes and severe technical disruptions such significant recalls and erratic product specifications). Project stages to include discussion of **CPM & PERT** planning, scheduling, monitoring, procurement, R&D, plant erection, validation, modification, product **SCADA** (Supervisory Control And Data Acquisition) control & monitoring stations, supervision, integrating pollution & environmental control, occupational safety and hazardous waste management, communications (with managers, sales people, customers, colleagues, workers, workshops, conference, etc.), transmittal letters, proposals, technical & advertising publications, and the final reports (closing projects) with PPT's The final report & PPT guidelines and schedule of presentations will be posted on CANVAS. Check CANVAS very often for additional announcements & instructions.

To ensure the implementation of the projects leading to the completion of the final reports and the PPTs, students and groups are required to submit several progress reports in stages according to instructions given during lecture and on CANVAS.

Each Group may select one of the following engineering projects and give a final PPT & one written report per group according to the class schedule listed on this syllabus. Each group must integrate with their PPT's and reports the above instructions and any other additional instructions given on CANVAS:

Midterm Report Project 1: Computer Manufacturing Assembly Plant: Economic Analysis – Manufacturing Cost & Capital Investment. No PPT presentation required from this Case Study 1. **All groups must complete this case study no later than 1 week after Midterm Exam.**

Final Report Projects: Each group must complete one Project Report of an approved case study by the instructor due one week before the Final Exam

Project 2: Plant Design & Management - Retrofit Vehicle Throttle Positioning Valve Sensor Into Vehicles.
Project 3: Plant Design & Management - Retrofit Hamade's 1994 Invention of Self Service Vehicle Tire Changer into Vehicles (Thomas A. Hamade and Fahad Alkuwaliet, "Automotive Flat Tire Repair System Improvement", U.S.A. Patent 5876526, Mar. 2, 1999.)
Project 4: Plant Design & Management - Retrofit Hamade's 2013 Invention of Enhanced Catalytic Converter System Using High-Voltage Into Vehicles (Thomas A. Hamade, "Electrically Stimulated Catalytic Converter Apparatus, and Method of Using Same", USA Patent 8544257, Oct. 1, 2013.)
Project 5: Plant Design & Management – Design Manufacturing Plant for any of Hamade's Prior Inventions Related to High-Voltage Electrostatics Applications to Clean Room and HVAC Systems (Electrically Stimulated Filtration ESF), Bacteriological & Virus Infection Control, Disinfection, etc.

a. T. Hamade, "Electrostatic Charging Apparatus and Method", USA Patent # 5,012,094, April 30, 1991.
b. T. Hamade, "Electrostatic Charging Apparatus and Method", USA Patent # 5,077,468, Dec. 31, 1991.
c. T. Hamade, "Electrostatic Charging Apparatus and Method", USA Patent # 5,118,942, June 2, 1992.
d. R. Jaisinghani and T. Hamade, "Effect of Relative Humidity on Electrostatic Filter Performance", APCA, Vol. 37, No. 7, July 1987.
e. R. Jaisinghani and T. Hamade, "Electrically Stimulated Filter Method and Apparatus", USA Patent No. 4,853,005; Aug. 1, 1989. European Patent Appl. No. 86905658.0-, 1987.

Project 6: Plant Design & Management - *Solar Powered* Electric Hybrid Vehicle with Smart Retractable Solar Panels.
Project 7: Plant Design & Management - Investigate Roof & Building Coatings to Clean the City of Shanghai Auto Exhaust Emission.
Other self-selected case studies: Plant Design & Management - Groups can also engage in other case study projects when approved by Prof. Hamade. But details of each self-selected case study should be submitted to Dr. Hamade during the third week of classes.

COURSE SCHEDULE (see CANVAS for any changes in schedule)

Wk	Day	Date	Topic	HW DUE
1	T	**May 16**	**CH1 Overall Course Introduction**	
1	Th	18	**CH2 Introduction Eng'g Project Management (EPM) & Total Quality Management (TQM) Integration**	
2	T	23	**CONTINUE CH2**: Project Management Skills, Achieve Total Quality Management (TQM), Manager's Role	
2	Th	25	**CONTINUE CH2:**, Benefits-Results & Obstacles of TQM, Achieving TQM, Integration of TQM into Eng'g Project Management **CH3** Project Management Growth (by **Kirzner**): Concepts and Definitions	
3	T	30	**Holliday: No Class**	
3	Th	Jun 1	**CH4 Engineering Project Synthesis - Inception to Production**: Project Overview, Synthesis, Procedure, Inception, Creating Plausible Alternatives & Assessment, & feasibility (**Hamade-Johnson**)	
4	T	6	**CH5 Case Studies Inception to Prototyping-Production:** Keys to Creative Projects **(**Sketch vs. Design Approach) Case Study Projects from Inception to Prototyping (**Hamade's Patents**), Project Maturity, Prototyping & Validation,	
4	Th	8	**CONTINUE CH5:** Proposal Structure, Objectives & Goals, Managing Design Projects, Introduction to Plant Design, General Design Considerations, Project Stages**,** Role of Technical Know-How & Commonsense, Best vs. Optimum Case Studies (Nuclear Car, Electric Motor). **Concept Generation & Selection (Xu)**	**HW1 DUE**
5	T	13	**CH6 Eng'g Design Strategy & Opt.:** Inception Conversion Strategy**,** Design Degrees of Freedom & case studies, Generating & Solving Design Equations & Variables via Algorithm Method, Examples: Hypothetical System Loop	
5	Th	15	**CONTINUE CH6**: Optimization (Taguchi Method, case studies Tank & Catalytic Converter), Design Solution Using Algorithm Method, Simple Mixer Specific Alternatives: Design Solution via Algorithm Method	**HW2 DUE**
6	T	20	**CONTINUE CH6,** Double –Pipe Heat Exchanger Case Study: Define Design Variables, Solution & Optimization Using Algorithm Method & Iteration. Double-Pipe Heat Exchanger Case Study Practice Algorithm Analysis.	
6	Th	22	**CH7 Eng'g Economics & Project Optimization (case studies)**: Introduction, Cost Indexes, Estimation, Capital Investment, Manufacturing Costs.	**DUE Final Project Progress Report 1**
7	T	27	**CONTINUE CH7:** Measurement of Profitability, Plant/ Project Costs, Design Costs Factors & Data. Midterm exam review.	
7	Th	29	**MIDTERM EXAM CH1-CH7**	**HW3 DUE: HE**
8	**T**	**Jul 4**	**CH8 Introduction to Technical Communication & Report Writing:** Technical Reports & Project Reports, Report Criteria & Communication in Engineering	
8	Th	6	**CH9 Project Planning, Scheduling, Supervising, SCADA Control & Quality Assurance:** Planning Tools, Critical Path Method (**CPM**), Program Evaluation and Review Technique (**PERT**), Capability Maturity Model Integration (**CMMI**), Software Process Improvement and Capability **dEtermination** (**SPICE**)	**DUE Final Project Progress Report 2**
9	T	11	**CONTINUE CH9: SCADA** (Supervisory Control And Data Acquisition), CPM Case Studies, Quality Function Deployment (**QFD**), Planning & Scheduling by Kirzner book	**HW4 DUE: Proj.1**
9	Th	13	**CH10 Intellectual Property, Patents & Plagiarism**: Patents, Trade Marks, Trade Secrets, and Copyrights. Ethics & Plagiarism	
10	T	18	**CH11 Promoting Environmental, Health, & Safety Practices in Eng & Green Manuf:** Brief Introduction to Air Water & Soil Pollution, Health & Occupational Safety, Government Rules & Regulations, Hazardous Solid/Liquid Waste Management, MSDS Glossary	
10	Th	20	**CONTINUE CH11:** Green Manufacturing, Safety in Engineering & Science	
11	T	25	**STUDENTS FINAL PROJECTS PPT, Group (Project): ?, ?, ?, ?**	**HW5 DUE** **Project PPT DUE**
11	Th	27	**FINAL PROJECTS PPT, Group (Project): ?, ?, ?** **FINAL PROJECT REPORT DUE – See CANVAS**	**Project PPT DUE** **Final Report DUE**
12	T	**Aug 1**	**FINAL EXAM (CHECK CANVAS FOR EXAM SCHEDULE) CH1-CH11**	