COLLEGE OF ENGINEERING
Civil & Architectural
Engineering & Mechanics

Catalog Description: (3 units) Develop an enhanced understanding of construction project planning, scheduling, execution, and control in preparation to contribute to construction firms, project management consultants, and owners upon graduation. Topics include network scheduling, critical path method, resource allocation, cost control, software applications to scheduling, and contract documents.

Prerequisite(s): Advanced Standing in Engineering; MATH 129 or MATH 250B; CE381 or equivalent experience; or with consent of instructor.

Learning outcomes:
Students should be able to:
1. Explain the impact of project objectives and strategies on the project schedule.
2. Interpret contractual aspects related to project schedules (contract time, liquidated damages, incentives, weather, force majeure, differing site conditions, change orders, submittal and request for information times, float and ownership of float, extension of time, material order lead times, notice of delays, project phasing, schedule submissions, dispute resolution, etc.).
3. Identify project risks and analyze scheduling impacts.
4. Develop work breakdown structure for construction activities.
5. Prepare and analyze network schedules using software.
6. Identify and analyze the critical path of a schedule.
7. Perform resource loading and leveling.
8. Explain the use of preliminary, detailed, and look-ahead schedules.
9. Update schedules and write descriptive narratives of schedules.
10. Analyze schedules for project control of schedules and budgets, including acceleration, recovery, daily cost control tracking that considers method of measurement and payment, and cost control methods and intervention.
11. Prepare for the scheduling portion of the EIT and PE exams.

Graduate students should be able to:
12. Translate plans and specifications into a schedule and explain the schedule in written reports and oral presentations.
13. Develop alternatives to manage schedule risks.

Learning outcomes support ABET program outcomes:
Primary
    A. Apply mathematics, science and engineering principles
    K. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
    M. Be proficient in the major areas of civil engineering.
Secondary
    E. Ability to identify, formulate, and solve engineering problems
    F. Understanding of professional and ethical responsibility
    G. Ability to communicate effectively
    L. Pass the FE exam as the first step towards professional registration.

Instructor: Dean Papajohn
Class time & place: TuTh 2:00-3:15 PM, Harvill, Room 107
Computer Lab: Room CE203
Office Hours: Tu,Th 3:15-4:00 and by appointment
Office: CE 214B
e-mail: dpapajohn@email.arizona.edu

Textbooks:
- Required: Construction project scheduling and control, 3rd Edition, Saleh Mubarak, Wiley, 2010. (ISBN 978-0-470-50533-5).
- Recommended: Oracle Primavera P6 (software) User's Manual
- Other materials will be supplied through the course D2L website.

Evaluation for CE482

Homework, quizzes, and participation	19%
Computer project	36%
Tests (2)	30%
Final Exam	15%

Evaluation for CE582

Homework (additional problems for graduate students), quizzes, and participation	19%
Computer project	36%
Tests (2) (additional or alternate problems for graduate students)	30%
Final Exam (additional or alternate problems for graduate students)	15%

Graduate students will be expected to complete additional or alternate problems throughout the semester and present content and problem solutions in class.

Homework assignments will be announced in class and must be submitted **at the start of class** on the assigned due date. No late assignments will be accepted, including assignments turned in during or at the end of the class, unless special arrangements have been made.

Your semester grade will be determined as follows:

90-100% = A;   80-89% = B;   70-79% = C;   60-69% = D;   0-59% = E.

Homework Illuminators
During the semester you will be a "Homework Illuminator." Your job as a HW Illuminator is to project your homework with the Elmo on the screen and explain to the class what was involved in answering the homework problem. Therefore, you will want to complete the assignment professionally - neat and organized - so that it is easy to follow. As you explain the homework, you can highlight any assumptions you made, point out any difficulties you

ran into, share any insights you gained, etc. You should be prepared to answer any questions from the class as well.

Before each of you explains the homework, you should briefly introduce yourself to the class. In your introduction, you can share your major and emphasis of study, your career goals, where you grew up, and something interesting you enjoy doing.

Make it interesting and have fun. If you have any questions about the specific homework problems or about the "illumination" you will provide in class, do not hesitate to ask me.

Attendance
Students are expected to attend all class meetings and site visits. If a late arrival or an early departure is anticipated, check with the instructor to be sure that it is done without disturbing the class. The instructor, at his discretion, may decide to consider late arrivals or early departures as full absences. A two week absence may result in administrative withdrawal. If a student misses a class, he/she is responsible for all announcements and subjects covered in that class. If in doubt, contact the instructor.
•Absences for any sincerely held religious belief, observance, or practice will be accommodated where reasonable: policy.arizona.edu/human-resources/religious-accommodation-policy.
•Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.

Accessibility and Accommodations
"It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations. Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable."
http://drc.arizona.edu/instructors/syllabus-statement

Academic Integrity
Principle Integrity and ethical behavior are expected of every student in all academic work. This Academic Integrity principle stands for honesty in all class work, and ethical conduct in all labs and clinical assignments. This principle is furthered by the student Code of Conduct and disciplinary procedures established by ABOR Policies 5-308 through 5-404, all provisions of which apply to all University of Arizona students.
This Code of Academic Integrity (hereinafter "this Code") is intended to fulfill the requirement imposed by ABOR Policy 5-403.A.4 and otherwise to supplement the Student Code of Conduct as permitted by ABOR Policy 5-308.C.1.
Failure to follow this code of academic integrity will result in failing the course and be reported to the Dean of Students' office.

Prohibited Conduct
Conduct prohibited by this Code consists of all forms of academic dishonesty, including, but not limited to:

1. Cheating, fabrication, facilitating academic dishonesty, and plagiarism as set out and defined in the Student Code of Conduct, ABOR Policy 5-308-E.6, E.10, and F.1
2. Submitting an item of academic work that has previously been submitted without fair citation of the original work or authorization by the faculty member supervising the work.
3. Violating required professional ethics rules contained or referenced in the student handbooks (hardcopy or online) of undergraduate or graduate programs, or professional colleges.
4. Violating health, safety or ethical requirements to gain any unfair advantage in lab(s) or clinical assignments.
5. Failing to observe rules of academic integrity established by a faculty member for a particular course.
6. Attempting to commit an act prohibited by this Code. Any attempt to commit an act prohibited by these rules shall be subject to sanctions to the same extent as completed acts.

Student Responsibility

Students are expected to promote a positive learning environments for themselves and their peers, this includes responsible use of computers, cell phones and mobile devices.

Students engaging in academic dishonesty diminish their education and bring discredit to the academic community. Students shall not violate the Code of Academic Integrity and shall avoid situations likely to compromise academic integrity. Students shall observe the generally applicable provisions of this Code whether or not faculty members establish special rules of academic integrity for particular classes. Students are not excused from complying with this Code because of faculty members' failure to prevent cheating.

Prohibited Behavior

A. Nondiscrimination and Anti-harassment policy
"The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. The University encourages anyone who believes he or she has been the subject of discrimination to report the matter immediately as described in the section below, "Reporting Discrimination, Harassment, or Retaliation." All members of the University community are responsible for participating in creating a campus environment free from all forms of prohibited discrimination and for cooperating with University officials who investigate allegations of policy violations." http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

B. Threatening Behavior is Prohibited.
"Threatening behavior" means any statement communication, conduct or gesture, including those in written form, directed toward any member of the University community that causes a reasonable apprehension of physical harm to a person or property. A student can be guilty of threatening behavior even if the person who is the object of the threat does

not observe or receive it, so long as a reasonable person would interpret the maker's statement, communication, conduct or gesture as a serious expression of intent to physically harm.

C. Procedures for Mandatory Reporting of Threatening Behavior
If threatened by any student's conduct to the point of reasonable fear of immediate physical harm to self, others or property:

1. Leave the area immediately.
2. Call the Police by dialing 9-1-1 to request that an officer come to the location. Inform the Police if it is a repeat occurrence.
3. Anyone who observes what appears to be threatening behavior must report it to The Dean of Students Office and in the appropriate case file a Student Code of Conduct Complaint (see ABOR 5-403).

TENTATIVE SCHEDULE

(The instructor may change this schedule to accommodate class needs.)

Date	Topics	Readings due (from Mubarak unless otherwise noted)	Homework due
1/11/18	Introduction, Scheduling and project management	Ch.1 Intro	Obtain textbook
1/16/18	Scheduling and project management, Bar charts	Ch. 2 Bar charts	Ch. 1 Quiz HW 1.3
1/18/18	Arrow and node networks	Ch. 3 Basic networks	Ch. 2 Quiz HW 2.3
1/23/18	Lab: Intro to P6 Begin Project Assignment 1	Assignment 1 (p.421-425)	Ch. 3 Quiz
1/25/18	Arrow and node networks, CPM (WBS, durations, resources, float, forward & backward pass, logic & constraints)	Ch. 4 CPM	HW 3.14(arrow & node), 3.18(node), 3.19(node)
1/30/18	CPM (WBS, durations, resources, float, forward & backward pass, logic & constraints)		Ch. 4 Quiz Assignment 1
2/1/18	Lab Begin Project Assignment 2	Assignment 2 (p.426-427)	
2/6/18	Precedence networks (interruptible and contiguous activities)	Ch. 5 Precedence networks	HW 4.3, 4.7, 4.11
2/8/18	ASC Competition in Reno No class Begin Assignment 3	Assignment 3 (p.428)	
2/13/18	Precedence networks		Assignment 2 Ch. 5 Quiz
2/15/18	Lab Assignment 3 Review for Exam 1		HW 5.3. 5.4, 5.5, 5.6, 5.7, 5.11, 5.14, 5.16
2/20/18	Exam 1		
2/22/18	Lab Begin Assignment 4	Assignment 4 (p.429-430)	Assignment 3
2/27/18	Precast concrete construction Resource allocation and leveling	Ch. 6 Resource allocation and resource leveling (Coreslab)	Ch. 6 Quiz
3/1/18	Resource allocation and leveling		HW 6.4, 6.10, 6.14, 6.18, 6.24
	Spring Break: March 5-9		
3/13/18	Lab	Assignment 5 (p.430)	Assignment 4

	Begin Assignment 5		
3/15/18	Schedule updating & project control	Ch. 7 Scheduling updating and project control	Ch. 7 Quiz
3/20/18	Schedule updating & project control	Adam Sedgeman, KE&G	HW 7.16, 7.32.7.34, 7.35
3/22/18	Lab Begin Assignment 6	Assignment 6 (p.431-432)	Assignment 5
3/27/18	Schedule compression & time-cost trade-off	Ch. 8 Schedule compression and time-cost trade-off	Ch. 8 Quiz
3/29/18	Pull Planning and lean construction	Chase Farnworth and Blake Gleason, Mortenson	Assignment 6
4/3/18	Review for Exam 2		HW 8.10, 8.11, 8.12, 8.21
4/5/18	Lab Begin Assignment 7	Assignment 7 (p.433)	
4/10/18	Exam 2 (new date)		
4/12/18	ASCE Pacific South West Conference April 12 (No class)		
4/17/18	Lab Begin Assignment 8	Assignment 8 (p.433)	
4/19/18	Schedule risk management	Ch. 14 Schedule risk management	Assignment 7 Ch. 14 Quiz
4/24/18	Lab Begin Assignment 9	Assignment 9 (p.433-434)	Assignment 8 HW 14.3, 14.8, 14.10, 14.11
4/26/18	Construction delays & other claims	Ch. 13 Construction delay and other claims David Weber, PMA Consultants	Ch. 13 Quiz
5/1/18	Review for Final Exam		HW 13.2, 13.5, 13.13 Assignment 9
5/3/18	Reading Day		
5/7/18 3:30-5:30 PM	Final Exam Harvill, Room 107		