

**SAN JOSE STATE UNIVERSITY**  
**Charles W. Davidson College of Engineering**  
**Department of Aviation & Technology**  
**Tech 45: Sustainable Facilities Design & Planning, Section 1, Spring 2018**

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**Course and Contact Information**

<b>Instructor:</b>	Dr. Samuel C. Obi
<b>Office Room:</b>	IS 105
<b>Office Phone:</b>	(408) 924-3218
<b>E-mail Address:</b>	Samuel.obi@sjsu.edu
<b>Office Hours:</b>	M 11:00 AM – 1:00 PM
<b>Class Days and Time:</b>	W 6:00 PM-8:45 PM
<b>Class Location:</b>	E 103
<b>Prerequisites:</b>	ME/TECH 020, CE 020 or equivalent

**Course Materials**

Copies of the course materials including the syllabus, lecture slides, projects, etc. may be found at <http://www.sjsu.edu/people/samuel.obi/>

**I. Course Description**

Construction, planning, and maintenance of physical facilities and equipment for sustainable manufacturing operations. Green and sustainable practices and standards, plant facilities layout/design, regulatory and environmental compliance, safety/security, energy conservation, and process improvement. Production line planning. OSHA and NIOSH standards. Prerequisite: ME 020/TECH 020/CE 020 or equiv.

**II. Purpose of the Course**

The purpose of this course is to develop an understanding and the skills needed to design and implement practical, sustainable and safe manufacturing facilities. It includes an array of systematic tools and techniques for planning and designing safe and green layouts, workstations, office space, and operations facilities for production of goods or services. To this end, areas of study will include: physical facilities design and layout, green design principles, plant and equipment layout, regulatory and environmental compliance, safety and security issues, energy conservation, green audits, process improvement, production capacity planning, and design cost analysis. Comprehensive facilities planning projects will be undertaken and a strong emphasis will be placed upon the role of teamwork in establishing the goals and achieving the objectives of the project. Green design philosophy will be emphasized.

Tech 45 is divided into five (5) main instructional units. Each unit has associated objectives, assigned readings, and assignments related to those objectives. There are

also three (3) projects designed to augment those assignments and objectives.

### **III. Course Student Learning Outcomes (SLOs)**

1. Use skills in team development, dynamics, and management to work as team players
2. Demonstrate leadership skills for a technology professional
3. Design and plan industrial facilities
4. Apply the theory of computer-integrated manufacturing (CIM), including the computer-aided design/computer-aided manufacturing (CAD/CAM) interface to industrial problems and settings
5. Use the principles of production scheduling & planning in an industrial environment
6. Demonstrate an understanding of materials management including Just-in-Time (JIT) and Materials Resource Planning (MRP)
7. Apply OSHA and NIOSH principles to facilities design and management

### **IV. General Course Goals**

- a) Develop an understanding and skills needed to design and implement green, efficient and safe manufacturing facilities.
- b) Analyze layout problems and systematically develop a plant layout by the use of related analytical tools available.
- c) Analyze and implement the 12 green design principles.
- d) Apply green audit principles to facility design and analysis.
- e) Describe the importance of systematic approach to facilities planning and material handling decisions.
- f) Develop a plant layout and material handling term project.
- g) Develop computer skills needed in facilities planning and analysis simulation.

### **V. Textbook/ Lab Materials**

- 1) Meyers, Fred E. & Stephens, Matthew P. (2013). Manufacturing Facilities Design and Material Handling. (5th. Ed) Prentice Hall. **(Required)**
- 2) Obi, Samuel C. (2013). Introduction to Manufacturing Systems. **(Required)** Available from: a) Spartan Bookstore, and b) <http://www.amazon.com/Introduction-Manufacturing-Systems-Dr-Samuel/dp/1481701118>
- 3) Kibert, Charles J. (2008). Sustainable Construction: Green Building Design and Delivery. (2<sup>nd</sup> Ed) Wiley. (Recommended)
- 4) Fluke (2011). Energy Auditing for Industrial Facilities. American Technical Publishers. (Recommended)
- 5) Handouts and outside materials on green and sustainability design and manufacturing.
- 6) Safety Glasses
- 7) Suitable storage device, e.g. Jump Drive etc.
- 8) Hand calculator with trig and square root functions
- 9) Laptop computer (recommended)
- 10) Final projects may require a payment for material or the student may bring in material.

## **VI. Outline of Course Content and Unit Objectives**

### **Unit 1: Introduction to Manufacturing Facilities, Design, and Processes; Green Design Principles and Applications**

#### **Objectives**

- a) Describe manufacturing facilities and components of manufacturing facilities
- b) Familiarize with manufacturing machine tools, tools and tooling
- c) Define and familiarize with different manufacturing processes
- d) Comprehend various safety rules and security implications of manufacturing facilities design
- e) Describe nature, goals, and importance of manufacturing facilities
- f) Delineate the components of manufacturing facilities
- g) Describe manufacturing facilities design procedure
- h) Analyze the safety and security implications of manufacturing facilities design
- i) Define and describe green design technology
- j) Explore green principles
- k) Apply green technology in facility design

#### **Reading List for Unit 1:**

- 1) Obi, Chapters: 4, 5 & 6; Meyers & Stephens, Chapters: 1 & 16
- 2) Facilities layout safety-related allowances handout
- 3) OSHA materials and guidelines
- 4) Handout materials on green technology

### **Unit 2: Manufacturing Facilities Design Procedures and Analysis Tools**

#### **Objectives**

- a) Examine the importance of planning in manufacturing facilities design
- b) Investigate different planning tools in manufacturing facilities design
- c) Employ appropriate planning tools for manufacturing facilities design
- d) Describe the use and importance of time study in facility design
- e) Investigate analysis techniques in manufacturing facilities planning and design
- f) Apply green auditing principles in facility design and planning analysis

#### **Reading List for Unit 2:**

- 1) Meyers & Stephens, Chapters: 2, 3, 4, & 5; Obi, Chapter 3
- 2) Related Handouts

### **Unit 3: Green and Sustainable Manufacturing Facilities Design and Analysis: Workstation and Material Handling Equipment**

#### **Objectives**

- a) Describe the goal of material handling in manufacturing facility design
- b) Describe the importance of ergonomics in facilities design
- c) Integrate ergonomic and green principles in workstation design
- d) Integrate ergonomic and green principles in material handling systems
- e) Determine facility plan and space requirements for workstation and material handling equipment

- f) Analyze facility plan and space requirements for workstation and material handling equipment

### **Reading List for Unit 3:**

- 1) Meyers & Stephens, Chapters: 7, 10, & 11; Obi, Chapter 7
- 2) Related Handouts

## **Unit 4: Manufacturing Facilities Design and Analysis: Employee Office Layout and Auxiliary Services**

### **Objectives**

- a) Determine facility plan and space requirements for personnel services
- b) Analyze facility plan and space requirements for personnel services
- c) Determine facility plan and space requirements for auxiliary services
- d) Analyze facility plan and space requirements for auxiliary services
- e) Integrate sustainability principles to employees and auxiliary services space design

### **Reading List for Unit 4:**

- 1) Meyers & Stephens, Chapters: 8, 9, & 12; Obi Chapter 11
- 2) Related Handouts

## **Unit 5: Manufacturing Facilities Design and Analysis: Management and Applications of Computer Simulation and Modeling**

### **Objectives**

- a) Determine facility plan and space requirements for entire plant
- b) Analyze facility plan and space requirements for entire plant
- c) Utilize various management tools in controlling manufacturing facility
- d) Employ computer simulation to determine appropriate facility plans for the entire plant
- e) Determine advantages and disadvantages of computer simulation in manufacturing facilities design and analysis
- f) Employ computer simulation systems to produce and analyze master layout of entire plant
- g) Determine ways to improve manufacturing facility design

### **Reading List for Unit 5:**

- 1) Meyers & Stephens, Chapters: 14 & 15; Obi, Chapter 12
- 2) Related Handouts
- 3) Video (Layout Improvements for JIT XS2762)

## **VII. Attendance**

In order to benefit from the lecture and laboratory activities and to complete assignments on time, students are encouraged to attend every class meeting.

## **VIII. Written Assignments**

All assignments are due as scheduled and must be typewritten (pc word processor) or they will not be accepted. NO PAPERS WILL BE ACCEPTED LATE UNLESS PRIOR

PERMISSION HAS BEEN OBTAINED. Assignments are due at the BEGINNING of the class period on the designated due date.

### **IX. Examinations, Assignments and Quizzes**

No make-up exams, assignments or quizzes will be given unless prior permission was obtained from the instructor. No exams will be rescheduled due to student perceived overloads (e.g. two mid-terms, finals, back-to-back)

**Refer to the SJSU General Catalog, Undergraduate Studies, for policies on absences, incompletes, withdrawals, and plagiarism.**

### **Note on Academic Dishonesty**

*The Academic Integrity Policy for SJSU is available on the SJSU web site at <http://www.sjsu.edu/senate/docs/F15-7.pdf>. You, the student, are responsible for following the rules that preserve academic integrity and abide by them at all times. This includes learning and following the particular rules associated with specific classes, exams and/or course assignments. Ignorance of these rules is not a defense to the charge of violating the Academic Integrity Policy.*

*Cheating of any kind is not acceptable, and will be reported to the campus student affairs office. It will result in loss of credit for the assignment, which cannot be made up, and it MAY result in an "F" in the class or even expulsion from the University.*

### **X. Required Projects and Assignments**

This course has been carefully planned to provide the opportunity for students to develop an understanding of sustainable facilities design, planning and development. To this end, a variety of laboratory activities are required as practical exercises.

#### **Projects and Reports (170 points)**

There are three required projects, which will provide each student with the opportunity to demonstrate his/her knowledge and understanding of facilities design and development. The first project (which may also serve as your term paper) will emphasize the student's ability to understand, interpret and use appropriate tools and principles to perform analysis and reporting undertakings related to safe and appropriate facility layout and design. The second one will emphasize layout and design of equipment, material handling peripherals, personnel offices, and related analysis. The third project will be a group assignment designed to include layout and design of an entire plant and its related analysis. The actual assignments for the projects will be handed out in the form of detailed assignment sheets.

#### **Class Assignments (100)**

There are five class assignments designed to help students understand the various aspects of Sustainable Facilities Design and Planning. These assignments will be issued in class at various scheduled times during class discussions.

#### **Outside Readings (45 Points)**

There are three (3) out-of-class reading assignments. The readings are to be from a

magazine or professional journal **no more than three years old**. The subjects to be read and reported on must be concerned with facilities design and development in the following areas and sequence:

- 1) the first should be on planning, design and/or construction of physical facilities and equipment as related to plant layout/design,
- 2) the second one should be on maintenance and/or management of physical facilities and equipment as related to plant layout/design, and
- 3) the third one should be on regulatory and environmental compliance, safety/security, energy conservation, and process improvement etc.

Each of the three should discuss a different area of facility design and development. Be prepared to discuss your paper in class on the day it is due. The assignments must be prepared with a computer in the "Outside Reading Assignment" format, which will be provided.

### **Course Examinations (150 points)**

There will be one midterm and one final examination, covering reading assignments, lectures, classroom discussions, field trips, and laboratory exercises. The midterm and final will be announced at least one week in advance, and will occur close to the dates scheduled in the course.

### **Pop Quizzes (30 points)**

Three pop quizzes will take place as scheduled during the semester.

### **Term Paper**

This assignment requires the student to undertake an in-depth study of one area of modern manufacturing facility design: construction, planning, and maintenance, physical facilities and equipment, regulatory and environmental compliance, safety/security, energy conservation, process improvement, related applications and trends etc.

The paper should be from 3 to 5 pages in length citing 5 or more references. The paper must be typewritten, double-spaced, and free of errors. Drawings or photocopies of drawings/pictures (not part of the 3-5 pages) may be included to show a unique feature of a process. Be sure to cite your references in a reference list on the last page of the paper, using APA format. A format for grading this paper will be provided.

There will be an oral presentation of this paper at the end of the semester.

### **XI. Grading**

**YOU, THE STUDENT**, will have the major role in determining the final grade you receive for this course. To be taken into consideration will be **objective** and **subjective** evaluations. **Objective** evaluations will include quizzes, mid-term and final exams.

**Subjective** evaluations will include outside reading assignments, individual exercises, projects that must be completed in the laboratory, and team projects.

An approximate numerical breakdown for grading is as follows and is subject to change:

<b>Assignment</b>	<b>Possible Points</b>
Quiz #1 _____	10
Quiz #2 _____	10
Quiz #3 _____	10
Outside Reading #1 _____	15
Outside Reading #2 _____	15
Outside Reading #3 _____	15
Class assignments (5 X 20) _____	100
Project #1- Individual (or term paper) _____	50
Project #2 - Individual _____	50
Project #3 - Small Team _____	70
Mid-Term Exam _____	50
Final Exam - Comprehensive _____	100
<b>TOTAL</b>	<b>495</b>

**Total/495 = % for final grade**

93% - 100% = A	73% - 76% = C
90% - 92% = A-	70% - 72% = C-
87% - 89% = B+	67% - 69% = D+
83% - 86% = B	63% - 66% = D
80% - 82% = B-	60% - 62% = D-
77% - 79% = C+	Below 60% = F

## **XII. University Policy Information**

a) Academic integrity statement (from Office of Judicial Affairs): “Your own commitment to learning, as evidenced by your enrollment at San José State University, and the University’s Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Judicial Affairs. The policy on academic integrity can be found at <http://www.sjsu.edu/senate/docs/F15-7.pdf>).

b) Campus policy in compliance with the Americans with Disabilities Act: If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with DRC to establish a record of their disability.

### XIII. Course Schedule

<b>TECH 045 SCHEDULE OF COURSE SEMESTER ACTIVITIES</b>				
<b>WEEK OF:</b>	<b>TOPICS TO BE DISCUSSED</b>	<b>ASSIGNMENTS</b>	<b>LAB DUTIES</b>	<b>DUE</b>
JAN. 24	ORIENTATION/UNIT 1	BUY MATERIALS		
JAN. 31	UNIT 1: INTRODUCTION TO MANUFACTURING FACILITIES, DESIGN, AND PROCESSES; GREEN DESIGN PRINCIPLES AND APPLICATIONS	OBI 4, 5 & 6; MEYERS & STEPHENS 1 & 16  <b>Assignment 1 Issued</b>	ALL	
FEB. 7	UNIT 1: INTRODUCTION TO MANUFACTURING FACILITIES, DESIGN, AND PROCESSES; GREEN DESIGN PRINCIPLES AND APPLICATIONS	<b>PROJECT 1 BEGINS</b>	ALL	<b>QUIZ I</b>
FEB. 14	UNIT 2: MANUFACTURING FACILITIES DESIGN AND ANALYSIS TOOLS	MEYERS & STEPHENS 2,3,4&5; OBI 3	ALL	<b>Assignment 1 Due</b>
FEB. 21	UNIT 2: MANUFACTURING FACILITIES DESIGN AND ANALYSIS TOOLS	MEYERS & STEPHENS 2,3,4&5; OBI 3  <b>Assignment 2 Issued</b>	ALL	<b>1ST. OR</b>
FEB. 28	UNIT 3: MANUFACTURING FACILITIES DESIGN AND ANALYSIS: WORKSTATION & MATERIAL HANDLING EQUIPMENT	MEYERS & STEPHENS 7,10&11; OBI 7	ALL	<b>PROJECT 1 DUE</b>
MAR. 7	UNIT 3: MANUFACTURING FACILITIES DESIGN AND ANALYSIS: WORKSTATION & MATERIAL HANDLING EQUIPMENT	<b>PROECT 2 BEGINS</b>	ALL	<b>Assignment 2 Due</b>
MAR. 14	<b>MID-TERM EXAM</b>	<b>Assignment 3 Issued</b>	ALL	<b>QUIZ 2</b>
MAR. 21	UNIT 4: MANUFACTURING FACILITIES DESIGN AND ANALYSIS: EMPLOYEE OFFICE LAYOUT & AUXILIARY SERVICES	MEYERS & STEPHENS 8,9&12; OBI 11  <b>Assignment 4 Issued</b>	ALL	<b>2ND. OR</b>  <b>Assignment 3 Due</b>
<b>MAR. 28</b>	<b>SPRING BREAK</b>	<b>SPRING BREAK</b>	<b>SPRING BREAK</b>	<b>SPRING BREAK</b>
APR. 4	UNIT 4: MANUFACTURING FACILITIES DESIGN AND ANALYSIS: EMPLOYEE OFFICE LAYOUT & AUXILIARY SERVICES	<b>TEAM PROJECT BEGINS</b>	ALL	<b>PROJECT 2 DUE</b>
APR. 11	UNIT 5: MANUFACTURING FACILITIES DESIGN AND ANALYSIS: MANAGEMENT AND APPLICATIONS OF COMPUTER SIMULATION & MODELING	MEYERS & STEPHENS 14 & 15; OBI 12	ALL	<b>QUIZ 3</b>  <b>Assignment 4 Due</b>



		Assignment 5 Issued		
APR. 18	UNIT 5: MANUFACTURING FACILITIES DESIGN AND ANALYSIS: MANAGEMENT AND APPLICATIONS OF COMPUTER SIMULATION & MODELING	TEAM PROJECT	ALL	Assignment 5 Due
APR. 25	REVIEW/ADJUSTMENT, ETC.	TEAM PROJECT	ALL	3RD. OR
MAY 2	1 <sup>ST</sup> GROUP PRESENTATIONS	1 <sup>ST</sup> GROUP PRESENTATIONS	ALL	1 <sup>ST</sup> GROUP REP/PRES
May 9	2 <sup>ND</sup> GROUP PRESENTATIONS  LAST DAY OF CLASS	2 <sup>ND</sup> GROUP PRESENTATIONS  Final Exam Review	ALL	2 <sup>ND</sup> GROUP REP/PRES
May 16	FINAL EXAMINATION	WEDNESDAY, MAY 16, FROM 5:15 - 7:30 PM.		
THIS SCHEDULE IS SUBJECT TO CHANGES DUE TO CIRCUMSTANCES DURING THE SEMESTER				
Monday - Friday, March 26 – March 30 is Spring Recess - No Classes Friday March 30 is Cesar Chavez Day - Campus will be Closed.				