# ITT Technical Institute

# IE2515

# Facilities Design

# Onsite and Online Course

# SYLLABUS

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**Credit hours:** 4.5

**Contact/Instructional hours:** 56 (34 Theory Hours, 22 Lab Hours)

**Prerequisite(s) and/or Corequisite(s):**

Prerequisites: IE1215 Basic Industrial Engineering Graphics or equivalent, IE1310 Work Measurements or equivalent

**Course Description:**

This course explores the theory of facility design. Topics include the scope of facility planning, facility layout planning procedures, systematic layout planning, non-production activity, production activity, computer-aided layout design, selection evaluation and implementation, and group technology layout.

# COURSE SUMMARY

## COURSE DESCRIPTION

This course explores the theory of facility design. Topics include the scope of facility planning, facility layout planning procedures, systematic layout planning, non-production activity, production activity, computer-aided layout design, selection evaluation and implementation, and group technology layout.

## MAJOR INSTRUCTIONAL AREAS

1. Space and Activity Relationships
2. Systematic Layout Planning
3. Computer-Aided Facilities Layout
4. Warehouse Operations
5. Location Optimization Models

## COURSE LEARNING OBJECTIVES

By the end of this course, you should be able to:

1. Identify the facilities planning process steps using the traditional engineering design process.
2. Assess the product, process, and schedule design implications on the facilities plan.
3. Apply flow systems, activity relationships, and space requirements considerations to the development of the facilities plan.
4. Analyze personnel requirements and how they affect the facilities plan.
5. Assess material handling requirements and the influence on the facilities plan.
6. Assess warehouse operations in regard to the typical warehouse functions and flows.
7. Discuss various manufacturing systems and their effect on the facilities plan.
8. Identify the facilities systems that need to be included in the facilities plan.
9. Use quantitative models to analyze various facilities location problems.
10. Evaluate alternative facilities plans.

# COURSE OUTLINE

## MODULE 1: INTRODUCTION TO FACILITY DESIGN AND PLANNING

### COURSE LEARNING OBJECTIVES COVERED

- Identify the facilities planning process steps using the traditional engineering design process.
- Assess the product, process, and schedule design implications on the facilities plan.

### TOPICS COVERED

- Defining Facilities Planning
- Objectives of Facilities Planning
- Facilities Planning Process
- Product, Process, and Schedule Design

| MODULE LEARNING ACTIVITIES | GRADED | OUT-OF-CLASS TIME |
|---|---|---|
| **Reading:** Tompkins J.A., Chapters 1 and 2 | No | 6.0 hr |
| **Lesson:** Study the lesson for this module. | No | 1.0 hr |
| **Analysis:** Submit the analysis titled “Facility Designing Decisions.” | Yes | 2.0 hr |
| **Lab:** Complete the lab titled “Product, Process, and Schedule Designing.” | Yes | N/A |
| **Project:** Read and begin the course project. | No | 1.0 hr |

Total Out-Of-Class Activities: 10 Hours

## MODULE 2: DETERMINING FACILITY REQUIREMENTS

### COURSE LEARNING OBJECTIVES COVERED

- Apply flow systems, activity relationships, and space requirements considerations to the development of the facilities plan.
- Analyze personnel requirements and how they affect the facilities plan.

### TOPICS COVERED

- Flow Systems
- Activity Relationships
- Product Design
- Space Requirements
- Human Factor

| MODULE LEARNING ACTIVITIES | GRADED | OUT-OF-CLASS TIME |
|---|---|---|
| **Reading:** Tompkins J.A., Chapters 3 and 4 | No | 9.0 hr |
| **Lesson:** Study the lesson for this module. | No | 1.5 hr |
| **Analysis:** Submit the analysis titled "Material Flow Systems." | Yes | 2.0 hr |
| **Lab 1:** Complete the lab titled "Determining Space Requirements." | Yes | N/A |
| **Lab 2:** Complete the lab titled "Determining Personnel Requirements." | Yes | N/A |
| **Project:** Submit Project Part 1. | Yes | 3.0 hr |

Total Out-Of-Class Activities: 15.5 Hours

## MODULE 3: DESIGNING FOR SPACE LAYOUT AND MATERIAL FLOW

### COURSE LEARNING OBJECTIVES COVERED

- Assess material handling requirements and the influence on the facilities plan.

### TOPICS COVERED

- Material Handling Systems
- Material Handling Equipment
- Layout Planning Models

| MODULE LEARNING ACTIVITIES | GRADED | OUT-OF-CLASS TIME |
|---|---|---|
| **Reading:** Tompkins J.A., Chapters 5 and 6 | No | 13.0 hr |
| **Lesson:** Study the lesson for this module. | No | 2.0 hr |
| **Discussion:** Participate in the discussion titled "Work Principles versus Ergonomic Principles." | Yes | N/A |
| **Analysis:** Submit the analysis titled "Unit Load Designing." | Yes | 2.0 hr |
| **Lab 1:** Complete the lab titled "Solving Layout Problem Using Systematic Layout Planning." | Yes | N/A |
| **Lab 2:** Complete the lab titled "Solving Layout Problem Using From-To Charts and Strategic Layout Planning." | Yes | N/A |
| **Project:** Continue work on Project Part 2. | No | 2.0 hr |

Total Out-Of-Class Activities: 19 Hours

## MODULE 4: FACILITY PLANNING FOR MANUFACTRUING SET-UPS

### COURSE LEARNING OBJECTIVES COVERED

- Assess warehouse operations in regard to the typical warehouse functions and flows.
- Discuss various manufacturing systems and their effect on the facilities plan.

### TOPICS COVERED

- Storage and Shipping Operations
- Designing for Flexible Manufacturing Systems
- Designing for Single-Stage Multi-Machine Systems
- Designing for Just-in-Time Manufacturing Systems

| MODULE LEARNING ACTIVITIES | GRADED | OUT-OF-CLASS TIME |
|---|---|---|
| **Reading**: Tompkins J.A., Chapter 7 and 8 | No | 9.0 hr |
| **Lesson:** Study the lesson for this module. | No | 2.0 hr |
| **Discussion:** Participate in the discussion titled "Designing Atmospheric Systems." | Yes | N/A |
| **Lab 1:** Complete the lab titled "Designing Layout for Just-in-Time Manufacturing." | Yes | N/A |
| **Lab 2:** Complete the lab titled "Designing Layout for Warehouse Operations." | Yes | N/A |
| **Project:** Submit Project Part 2. | Yes | 3.0 hr |

Total Out-Of-Class Activities: 14 Hours

## MODULE 5: PLANNING FACILITY SYSTEMS

### COURSE LEARNING OBJECTIVES COVERED

- Identify the facilities systems that need to be included in the facilities plan.
- Use quantitative models to analyze various facilities location problems.

### TOPICS COVERED

- Types of Facilities Systems
- Facilities Systems Layout Design
- Methods for Facilities Planning
- Facility Location Models

| MODULE LEARNING ACTIVITIES | GRADED | OUT-OF-CLASS TIME |
|---|---|---|
| **Reading:** Tompkins J.A., Chapter 9 and Chapter 10 (pp. 517–577) | No | 11.5 hr |
| **Lesson:** Study the lesson for this module. | No | 2.0 hr |
| **Discussion:** Participate in the discussion titled "Assessing Structural System Performance." | Yes | N/A |
| **Analysis:** Submit the analysis titled "Designing Facilities Systems." | Yes | 2.0 hr |
| **Lab 1:** Complete the lab titled "Solving Facilities Location Problem Using Contour Lines and Minisum Planar Method." | Yes | N/A |
| **Lab 2:** Complete the lab titled "Solving Facilities Location Problem Using a Tree Network Diagram." | Yes | N/A |
| **Final Exam:** Prepare for Final Exam. | No | 5.0 hr |

Total Out-Of-Class Activities: 20.5 Hours

## MODULE 6: APPRAISING FACILITY PLANS

### COURSE LEARNING OBJECTIVES COVERED

- Evaluate alternative facilities plans.

### TOPICS COVERED

- Evaluating and Selecting Facilities Plan
- Preparing and Presenting Facilities Plan
- Maintaining Facilities Plan

| MODULE LEARNING ACTIVITIES | GRADED | OUT-OF-CLASS TIME |
|---|---|---|
| **Reading:** Tompkins J.A., Chapter 11 and 12 | No | 8.5 hr |
| **Lesson:** Study the lesson for this module. | No | 1.5 hr |
| **Lab:** Complete the lab titled "Facility Evaluation." | Yes | N/A |
| **Final Exam:** Take the exam. | Yes | N/A |

Total Out-Of-Class Activities: 10 Hours

# EVALUATION AND GRADING

## EVALUATION CRITERIA

The graded assignments will be evaluated using the following weighted categories:

| Category | Weight |
|---|---|
| Analysis | 15% |
| Lab | 30% |
| Project | 20% |
| Discussion | 10% |
| Exam | 25% |
| TOTAL | 100% |

## GRADE CONVERSION

The final grades will be calculated from the percentages earned in the course, as follows:

| Grade | | Percentage |
|---|---|---|
| A | (4.0) | 90–100% |
| B+ | (3.5) | 85–89% |
| B | (3.0) | 80–84% |
| C+ | (2.5) | 75–79% |
| C | (2.0) | 70–74% |
| D+ | (1.5) | 65–69% |
| D | (1.0) | 60–64% |
| F | (0.0 | <60% |

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|---|---|
| ) | |

## LEARNING MATERIALS AND REFERENCES

### REQUIRED RESOURCES

COMPLETE TEXTBOOK PACKAGE

- Tompkins, J. A. (2010). *Facilities Planning (4th ed.). Hoboken, NJ: John Wiley & Sons,* Inc.

### RECOMMENDED RESOURCES

- ITT Tech Virtual Library (accessed via Student Portal | https://studentportal.itt-tech.edu)
  - ITT Tech Virtual Library>Basic Search
    - Bittencourt, R. S., & de M.Guimarães, L. B. (2012). A Conceptual model for barrier free facilities planning. *Work, 411394-1402.*
    - Farhan, B., & Murray, A. T. (2006). Distance decay and coverage in facility location planning. *Annals of Regional Science, 40(2), 279-295. doi: 10.1007/s00168-005-0041-7.*
    - Henschen, P. A., & De Vos, H. (1967). Facilities Planning. *Journal of Accountancy, 124(2), 81-83.*
    - Kim, J., & Kim, Y. (2000). Layout planning for facilities with fixed shapes and input and output points. *International Journal of Production Research, 38(18), 4635-4653. doi:10.1080/00207540050205550.*
    - Kowalski, T. (n.d). *Planning and managing school facilities [electronic resource] Theodore J. Kowalski. Westport, Conn. Bergin & Garvey 2002.*
    - McKendall, A. R., & Liu, W. (2012). New Tabu search heuristics for the dynamic facility layout problem. *International Journal of Production Research, 50(3), 867-878. doi:10.1080/00207543.2010.545446.*
    - Mewborn, A. (2013). Engineering better healthcare facilities. *Industrial Engineer: IE, 45(3), 22.*
    - Owens, R. (2011). Advancing facility planning. *Industrial Engineer: IE, 43(11), 45.*
    - Riedel, R. (2011). Facilities planning-4th edition by J.A. Tompkins, J.A. White, Y.A. Bozer and J.M.A. Tanchoco. *International Journal of Production Research, 49(24), 7519-7520. doi:10.1080/00207543.2011.563164.*

- Ritzman, L., Bradford, J., & Jacobs, R. (1979). *A Multiple Objective Approach to Space Planning for Academic Facilities. Management Science, 25(9), 895-906.*
- Wong, C. K., Fung, I. H., & Tam, C. M. (2010). Comparison of Using Mixed-Integer Programming and Genetic Algorithms for Construction Site Facility Layout Planning. *Journal of Construction Engineering & Management, 136(10), 1116-1128. doi:10.1061/ (ASCE)CO.1943-7862.0000214.*

## INSTRUCTIONAL METHODS AND TEACHING STRATEGIES

The curriculum employs a variety of instructional methods that support the course objectives while fostering higher cognitive skills. These methods are designed to encourage and engage you in the learning process in order to maximize learning opportunities. The instructional methods include but are not limited to lectures, collaborative learning options, use of technology, and hands-on activities.

To implement the above-mentioned instructional methods, this course uses several teaching strategies, such as scenario based analysis and practice exercises. Your progress will be regularly assessed through a variety of assessment tools including lab assignments, project, analysis, discussions, and an exam.

## OUT-OF-CLASS WORK

For purposes of defining an academic credit hour for Title IV funding purposes, ITT Technical Institute considers a quarter credit hour to be the equivalent of: (a) at least 10 clock hours of classroom activities and at least 20 clock hours of outside preparation; (b) at least 20 clock hours of laboratory activities; or (c) at least 30 clock hours of externship, practicum or clinical activities. ITT Technical Institute utilizes a “time-based option” for establishing out-of-class activities which would equate to two hours of out-of-class activities for every one hour of classroom time. The procedure for determining credit hours for Title IV funding purposes is to divide the total number of classroom, laboratory, externship, practicum and clinical hours by the conversion ratios specified above. A clock hour is 50 minutes.

A credit hour is an artificial measurement of the amount of learning that can occur in a program course based on a specified amount of time spent on class activities and student preparation during the program course. In conformity with commonly accepted practice in higher education, ITT Technical Institute has institutionally established and determined that credit hours awarded for coursework in this program course (including out-of-class assignments and learning activities described in the “Course Outline” section of this syllabus) are in accordance with the time-based option for awarding academic credit described in the immediately preceding paragraph.

## ACADEMIC INTEGRITY

All students must comply with the policies that regulate all forms of academic dishonesty or academic misconduct. For more information on the academic honesty policies, refer to the Student Handbook and the School Catalog.

## INSTRUCTOR DETAILS

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|---|---|
| Instructor Name | |
| Office Hours | |
| Contact Details | |

*(End of Syllabus)*