

ITT Technical Institute

DT1410T

Materials and Processes in Design

Onsite and Online Course

SYLLABUS

Credit hours: 4.5

Contact/Instructional hours: 67 (41 Theory Hours, 26 Lab Hours)

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

None.

Course Description:

This course emphasizes the materials and processes used in manufacturing and construction. Students are introduced to a variety of construction and manufacturing materials, machine tools and tooling used in a variety of processes. Emphasis is placed on terminology and function.

COURSE DESCRIPTION

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MAJOR INSTRUCTIONAL AREAS

1. Materials of Manufacturing and Construction
2. Survey of Manufacturing and Construction Processes
3. Tolerancing
4. Measurement and Quality Assurance
5. Manufacturing Systems
6. Manufacturing and Design Process
7. Sustainable Manufacturing and Construction

COURSE LEARNING OBJECTIVES

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

1. Identify the basic mechanical behavior and properties of materials.
2. Select materials based on their mechanical and physical properties and its application.
3. Explain how molten steel is formed into industrial shapes.
4. Describe how metal powders are produced.
5. Define the principles of material removal and the basic mechanics of machining.
6. Choose a joining technology that is best suited to a given application.
7. Identify common methods of processing plastics and composites.
8. Define the purpose and intent of quality control and quality assurance.
9. Describe the relationships among tolerance, precision, and resolution and select inspection methods and equipment.
10. Select appropriate materials and processes for manufacturing and construction projects.
11. Describe the basic practices and impact of green manufacturing.

MODULE 1: METALS AND THEIR PROPERTIES
COURSE LEARNING OBJECTIVES COVERED

- Identify the basic mechanical behavior and properties of materials.
- Select materials based on their mechanical and physical properties and its application.

TOPICS COVERED

- The Nature of Materials
- Chemical Properties of Materials
- Physical Properties of Materials

MODULE LEARNING ACTIVITIES	GRADED	OUT-OF-CLASS TIME
Reading: Budinski, K. & Budinski, M., <i>Chapters 1, 2, 3, and 4 (pp. 60, 74-76, 83-89)</i>	No	8 hrs
Lesson: Study the lesson for this module.	No	1 hr
Discussion: Participate in the discussion titled "Evolution of Metals and Materials."	Yes	N/A
Analysis: Submit the analysis titled "Chair Design."	Yes	2 hrs

Total Out-Of-Class Activities: 11 Hours

MODULE 2: MATERIAL SELECTION AND CASTING PROCESS

COURSE LEARNING OBJECTIVES COVERED

- Choose a joining technology that is best suited to a given application.
- Identify common methods of processing plastics and composites.
- Define the purpose and intent of quality control and quality assurance.
- Select appropriate materials and processes for manufacturing and construction projects.
- Describe the basic practices and impact of green manufacturing.

TOPICS COVERED

- Polymer Types and Families
- Composite Fabrication
- Selection of Polymeric Materials

MODULE LEARNING ACTIVITIES	GRAD ED	OUT-OF- CLASS TIME
Reading: Budinski, K. & Budinski, M., <i>Chapter 7, Chapter 8 (pp. 191-192, 227-228), Chapter 9 (pp. 241-255, 261-262), Chapter 10</i>	No	12 hrs
Lesson: Study the lesson for this module.	No	2 hrs
Discussion: Participate in the discussion titled "ATV Design Improvement Project."	Yes	1 hr
Lab: Complete the lab titled "Airplane Crashes."	Yes	N/A
Analysis: Submit the analysis titled "Thermal Properties of Materials."	Yes	2 hrs
Quiz: Prepare for Quiz 1.	No	1 hr
Quiz: Take Quiz 1.	Yes	N/A

Total Out-Of-Class Activities: 18 Hours

MODULE 3: PROCESSING METALS

COURSE LEARNING OBJECTIVES COVERED

- Identify the basic mechanical behavior and properties of materials.
- Select materials based on their mechanical and physical properties and its application.
- Explain how molten steel is formed into industrial shapes.
- Describe how metal powders are produced.
- Define the principles of material removal and the basic mechanics of machining.
- Select appropriate materials and processes for manufacturing and construction projects.

TOPICS COVERED

- Steel Products
- Heat Treatment of Steel
- Carbon and Alloy Steels
- Tool Steels
- Stainless Steels

MODULE LEARNING ACTIVITIES	GRADED	OUT-OF-CLASS TIME
Reading: Budinski, K. & Budinski, M., <i>Chapter 12 (pp. 365-368), Chapter 13 (pp. 389, 397-405, 417-419, 427), Chapter 14 (pp. 433, 51-453, 458-461), Chapter 15, Chapter 16 (pp. 501, 513, 523-527, 1, 532)</i>	No	8.5 hrs
Reading: ITT Tech Virtual Library> Basic Search> <ul style="list-style-type: none"> • “Damascus steels from powder metal.” • “Feature: Lost treasures: Miraculous Damascus steel” 	No	1.5 hrs
Lesson: Study the lesson for this module.	No	2 hrs
Discussion: Participate in the discussion titled “Most Efficient Fabricating Method.”	Yes	N/A
Analysis 1: Submit the analysis titled “Stiffening Sheet Metal.”	Yes	2 hrs
Analysis 2: Submit the analysis titled “Steel Knife.”	Yes	2 hrs
Quiz: Prepare for Quiz 2.	No	1 hr
Quiz: Take Quiz 2.	Yes	N/A

Total Out-Of-Class Activities: 17 Hours

MODULE 4: MACHINING PROCESSES

COURSE LEARNING OBJECTIVES COVERED

- Select materials based on their mechanical and physical properties and its application.
- Select appropriate materials and processes for manufacturing and construction projects.

TOPICS COVERED

- Casting
- Powdered Metals
- Alloys
- Corrosion

MODULE LEARNING ACTIVITIES	GRADE D	OUT-OF- CLASS TIME
Reading: Budinski, K. & Budinski, M., <i>Chapters 6, Chapter 17 (pp. 537-552, 559-569), Chapter 18 (pp. 573, 578-582, 589-592), Chapter 9 (pp. 597-601, 607-615), and Chapter 20</i>	No	13 hrs
Lesson: Study the lesson for this module.	No	2 hrs
Discussion: Participate in the discussion titled "Corrosion Abatement Measures for Metals."	Yes	N/A
Analysis: Submit the analysis titled "Working with Materials."	Yes	2 hrs
Quiz: Prepare for Quiz 3.	No	1 hr
Quiz: Take Quiz 3.	Yes	N/A

Total Out-Of-Class Activities: 18 Hours

MODULE 5: SURFACE ENGINEERING

COURSE LEARNING OBJECTIVES COVERED

- Select materials based on their mechanical and physical properties and its application.
- Select appropriate materials and processes for manufacturing and construction projects.

TOPICS COVERED

- Ceramics, Glass, and Carbon Products
- Surface Engineering
- Nanomaterials
- Wear and Product Failure Prevention
- Sustainable Manufacturing

MODULE LEARNING ACTIVITIES	GRADED	OUT-OF-CLASS TIME
Reading: Budinski, K. & Budinski, M., <i>Chapter 5 (pp. 95-113, 123-127), Chapter 11 (pp. 323, 331-341, 361-362), Chapter 21 (pp. 45-647, 673-687), Chapter 22</i>	No	10 hrs
Reading: ITT Tech Virtual Library> Basic Search> “Sustainable manufacturing: a case study of the forklift painting process”	No	2 hrs
Lesson: Study the lesson for this module.	No	2 hrs
Discussion: Participate in the discussion titled “Museum Mystery.”	Yes	N/A
Lab 1: Complete the lab titled “Abrasion Resistance.”	Yes	N/A
Lab 2: Complete the lab titled “Concrete Beam Calculation.”	Yes	N/A
Quiz: Prepare for Quiz 4.	No	1 hr
Quiz: Take Quiz 4.	Yes	N/A

Total Out-Of-Class Activities: 15 Hours

MODULE 6: DESIGN AND MANUFACTURING

COURSE LEARNING OBJECTIVES COVERED

- Identify the basic mechanical behavior and properties of materials.
- Select materials based on their mechanical and physical properties and its application.
- Explain how molten steel is formed into industrial shapes.
- Describe how metal powders are produced.
- Define the principles of material removal and the basic mechanics of machining.
- Choose a joining technology that is best suited to a given application.
- Identify common methods of processing plastics and composites.
- Define the purpose and intent of quality control and quality assurance.
- Describe the relationships among tolerance, precision, and resolution and select inspection methods and equipment.
- Select appropriate materials and processes for manufacturing and construction projects.
- Describe the basic practices and impact of green manufacturing.

TOPICS COVERED

- Material Selection
- Tolerances and Measuring Tools
- Quality Control

MODULE LEARNING ACTIVITIES	GRADED	OUT-OF-CLASS TIME
Reading: Budinski, K. & Budinski, M., <i>Chapter 23</i>	No	4 hrs
Reading: ITT Tech Virtual Library> Basic Search> <ul style="list-style-type: none"> • “Caliper” by Yang, Jen-Yung • “QC of Sampling Processes--A First Overview: From Field to Test Portion.” (pp. 282-287) 	No	1 hr
Lesson: Study the lesson for this module.	No	2 hrs
Lab: Complete the lab titled “Tolerances.”	Yes	N/A
Analysis: Submit the analysis titled “Green Manufacturing.”	Yes	2 hrs
Final Exam: Prepare for the final exam.	No	5 hrs
Final Exam: Take the final exam.	Yes	N/A

Total Out-Of-Class Activities: 14 Hours

EVALUATION CRITERIA

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

CATEGORY	WEIGHT
Analysis	20%
Lab	25%
Discussion	15%
Quiz	15%
Final 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%

LEARNING MATERIALS AND REFERENCES

REQUIRED RESOURCES

COMPLETE TEXTBOOK PACKAGE

- Budinski, K. & Budinski, M. (2010). *Engineering Materials: Properties and Selection (9th ed.)*. Upper Saddle River, NJ: Prentice Hall.

RECOMMENDED RESOURCES

- Periodic and Professional Journals
 - Journal for Manufacturing Processes
 - Journal for Manufacturing Systems
 - Journal of Materials Processing Technology
 - International Journal of Cast Metals Research
 - International Journal of Manufacturing Technology and Management
- Professional Associations
 - National Association of Manufacturers
 - United States Advanced Ceramic Association
 - Society for Manufacturing Engineers
 - Fabricators & Manufacturers Association
 - Precision Metalforming Association
- ITT Tech Virtual Library (accessed via Student Portal | <https://studentportal.itt-tech.edu>)
 - Basic Search>
 - “Sustainable manufacturing: a case study of the forklift painting process”
 - “Caliper” by Yang, Jen-Yung
 - “QC of Sampling Processes--A First Overview: From Field to Test Portion.”

- Additional Reading from ITT Tech Virtual Library:
 - Henzold, G. (2006). *Geometrical Dimensioning and Tolerancing for Design, Manufacturing and Inspection: A Handbook for Geometrical Product Specifications Using ISO and ASME Standards*. Oxford: Butterworth-Heinemann.

- Other References
 - Society of Manufacturing Engineers: <http://sme.org> (Accessed 10/27/15)
 - American National Standards Institute: www.ansi.org (Accessed 10/27/15)
 - International Organization for Standardization: www.iso.org (Accessed 10/27/15)
 - U.S. Department of Commerce Sustainable Manufacturing Initiative: www.trade.gov/competitiveness/sustainablemanufacturing/index.asp (Accessed 10/27/15)
 - Green Manufacturing News: www.greenmfgnews.com (Accessed 10/27/15)
 - U.S. EPA Green Engineering: www.epa.gov/oppt/greenengineering/index.html (Accessed 10/27/15)

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INSTRUCTIONAL METHODS AND TEACHING STRATEGIES

This 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 opinion-based discussions, lessons and hands-on labs. Your progress will be regularly assessed through a variety of assessment tools including discussions, analysis, quizzes, labs, and final 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

Instructor Name	
Office Hours	
Contact Details	

(End of Syllabus)