

Snead State Community College **Workforce Development**



Introduction to Manufacturing Materials

Self-Paced Online Training
Students will have six weeks to complete

\$100.00 per student

This training course introduces materials used in manufacturing processes. Learners are presented an overview of plastic mold design including injected mold sprues, runner systems, injection mold gates, and mold vents. Advanced concepts taught include mold material and construction, multi-cavity molds, unbalanced multi-cavity molds, inserts in injection molds, and undercuts in injection molds. Learners will cover additional concepts in part design and material selection, thermoplastic molding materials, and blow molding design including materials and advanced design. The course concludes with a detailed overview of materials, which includes ferrous metals, non-ferrous metals, plastics, composites, and ceramicist used in manufacturing systems.

- Basic Injection Mold Design
- Advanced Injection Mold Design
- Plastics: Part Design and Material Selection
- Basic Blow Molding Design
- Introduction to Injection Molding Operations
- Injection Molding Operations
- Plastics: Chemistry and Properties
- Introduction to Blow Molding Operations
- Introduction to Extrusion Operations
- Material Quality Control
- Tensile Strength Analysis
- Data Acquisition Systems
- Materials Design
- Compression Testing and Analysis
- Shear and Hardness Testing and Analysis
- Design Evaluation
- Properties of Ferrous Metals and Steel Production
- Principles of Non-Ferrous Metals
- Copper, Aluminum and Their Alloys
- Principles of Heat Treatment
- Principles Of Plastics
- Principles of Composites
- Principles of Ceramics

Register Here: www.snead.edu/tbiregistration

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Introduction to Manufacturing Materials

This training course introduces materials used in manufacturing processes. Learners are presented an overview of plastic mold design, including injected mold sprues, runner systems, injection mold gates and mold vents. Advanced concepts taught include mold material and construction, multi-cavity molds, unbalanced multi-cavity molds, inserts in injection molds and undercuts in injection molds. Learners will cover additional concepts in part design and material selection, thermoplastic molding materials, and blow molding design, including materials and advanced design. The course concludes with a detailed overview of materials, which includes ferrous metals, non-ferrous metals, plastics, composites and ceramicist used in manufacturing systems.

Outline

1. Basic Injection Mold Design

Segment 1 - Introduction to Injection Molds

Objective 1 - Describe the Function and Operation of an Injection Molding Process

Objective 2 - Describe the Functions of Seven Basic Components of an Injection Mold

Objective 3 - Describe the Function of Three Additional Components of an Injection Mold

Activity 1 - Identify Seven Components of an Injection Mold

Self Review 1

Segment 2 - Injection Mold Sprues and Runner Systems

Objective 4 - Describe the Operation of a Sprue Bushing in an Injection Mold

Objective 5 - Describe the Operation of a Runner in an Injection Mold

Objective 6 - Describe the Operation of a Cold-Slug Well in a Runner System

Objective 7 - Describe the Operation of Three Types of Runner Shapes

Objective 8 - Describe Two Methods of Determining the Size of a Runner

Skill 1 - Determine the Runner and Sprue Diameter Given a Specific Plastics Mold

Self Review 2

Segment 3 - Injection Mold Gates

Objective 9 - Describe the Operation of Three Types of Gates in an Injection Mold and Give an Application of Each

Objective 10 - Describe How Gate Size Is Determined for a Mold

Skill 2 - Determine the Gate Size and Location for an Injection Mold

Self Review 3

Segment 4 - Injection Mold Vents

Objective 11 - Describe the Operation of Two Types of Vents and Give an Application of Each

Objective 12 - Describe How a Vent Size Is Determined for an Injection Mold

Objective 13 - Describe How to Draw CAD/CAM Geometry for Runners, Gates, and Vents

Self Review 4

2. Advanced Injection Mold Design

Segment 1 - Mold Material and Construction

Objective 1 - Describe Three Methods of Creating a Mold

Objective 2 - Describe Six Common Materials Used to Create Molds

Skill 1 - Select a Mold Material Given a Mold Usage Scenario

Objective 3 - Describe How to Determine the Size of a Mold

Skill 2 - Determine the Size of a Mold Given a Mold Design

Self Review 1

Segment 2 - Multi-Cavity Molds

Objective 4 - Describe the Function of a Multi-Cavity Mold and Give an Application

Objective 5 - Describe the Functions of Primary Runners, Secondary Runners, and Tertiary Runners

Objective 6 - Describe How to Size Runners for a Multi-Cavity Mold

Self Review 2

Segment 3 - Unbalanced Multi-Cavity Molds

Objective 7 - Describe the Function of Balanced and Unbalanced Multi-Cavity Molds and Give an Application of Each

Objective 8 - Describe How to Size a Runner System for an Unbalanced Multi-Cavity Mold

Skill 3 - Determine Runner Sizes for an Unbalanced Multi-Cavity Mold

Self Review 3

Segment 4 - Inserts in Injection Molds

Objective 9 - Describe the Function of Mold Inserts

Objective 10 - Describe Three Methods Used to Add Inserts into a Plastics Part

Self Review 4

Segment 5 - Undercuts in Injection Molds

Objective 11 - Describe How to Design Undercuts into a Mold

Self Review 5

3. Plastics: Part Design and Material Selection

Segment 1 - Product Design

Objective 1 - Describe the Difference between a Product and a Part

Objective 2 - Describe Four Product Design Rules That Must Be Considered When Designing a New Product

Self Review 1

Segment 2 - Part Design-Shrinkage and Warpage

Objective 3 - Describe Four Part Design Rules That Must Be Considered When Designing a New Part or Mold

Objective 4 - Describe Material Shrinkage and How It Influences Mold Design

Self Review 2

Segment 3 - Thermoplastic Molding Materials

Objective 5 - Describe the Properties of Nine Commonly Used Thermoplastics and Give an Application of Each

Objective 6 - Define the Terms Crystalline and Amorphous Polymers and Give Four Examples of Each

Objective 7 - Describe the General Properties of Crystalline and Amorphous Polymers

Skill 1 - Select a Plastics Material for an Application Given an Example

Self Review 3

4. Basic Blow Molding Design

Segment 1 - Introduction to Blow Molds

Objective 1 - Describe the Function and Operation of a Blow Molding Operation

Objective 2 - Describe the Six Components of a Blow Mold

Self Review 1

Segment 2 - Blow Mold Design

Objective 3 - Describe Five Applications for a Blow Molding Operation

Objective 4 - Describe Four Guidelines of Blow Mold Design

Self Review 2

Segment 3 - Blow Molding: Materials and Advanced Design

Objective 5 - Describe Five Common Materials Used in the Blow Molding Process

Objective 6 - Describe the Function of Re grind in a Blow Molding Application

Objective 7 - Describe How Material Shrinkage Affects Mold Design

Objective 8 - Describe Three Advanced Design Features for a Blow Mold

Self Review 3

5. Introduction to Injection Molding Operations

Segment 1 - Injection Molding Process

- Objective 1 - Define the Terms Plastics and Plastic
- Objective 2 - Describe the Importance of Plastics
- Objective 3 - Describe the Operation of Two Types of Plastics Injection Molding Processes
- Objective 4 - Describe the Six Main Parts of an Injection Molding Machine
- Self Review 1

Segment 2 - Molding: Material and Machine Safety

- Objective 5 - Describe the Function of a Safety Data Sheet (SDS)
- Skill 1 - Read and Interpret a Safety Data Sheet
- Objective 6 - Describe How to Request a Safety Data Sheet
- Skill 2 - Write a Request for a Safety Data Sheet
- Objective 7 - Describe Eight Safety Rules to Follow When Working around Plastics Molding Machines
- Self Review 2

Segment 3 - Molding Operations

- Objective 8 - Describe the Functions of Seven Basic Components of an Injection Mold
- Objective 9 - Describe the Function of Three Additional Components of an Injection Mold
- Objective 10 - Describe the Importance of Correct Alignment between the Nozzle and the Mold
- Self Review 3

Segment 4 - Molding Problems and Solutions

- Objective 11 - Describe Five Causes of Non-Fill during an Injection Molding Process
- Objective 12 - Describe Three Causes of Weld Lines during an Injection Molding Process
- Objective 13 - Describe Three Causes of Burn Marks during an Injection Molding Process
- Objective 14 - Describe Four Causes of Flash during an Injection Molding Process
- Self Review 4

6. Injection Molding Operations

Segment 1 - Inserts

- Objective 1 - Describe the Function of Three Types of Inserts Used in Plastics Parts and Give an Application of Each
- Self Review 1

Segment 2 - Threads and Multiple Part Molds

- Objective 2 - Describe Three Methods Used to Create Internal Threaded Features in a Plastics Part
- Objective 3 - Describe Two Methods Used to Create External Threaded Features on a Plastics Part
- Objective 4 - Describe the Function and Operation of a Multi-Cavity Mold
- Objective 5 - Describe the Function of a Runner System
- Objective 6 - Describe the Function of a Gate in an Injection Molding Operation
- Self Review 2

Segment 3 - Integral Hinge

- Objective 7 - Describe the Function and Operation of a Hinge on a Plastics Part
- Self Review 3

Segment 4 - System Purging

- Objective 8 - Describe Two Methods Used to Purge a Plastics Machine
- Self Review 4

7. Plastics: Chemistry and Properties

Segment 1 - Basic Chemistry

- Objective 1 - Define an Atom
- Objective 2 - Describe the Arrangement of Electrons around the Nucleus
- Objective 3 - Describe the Operation of Valence Electrons
- Objective 4 - Define Elements, Compounds, and Molecules
- Objective 5 - Describe Two Types of Primary Bonds and Give an Example of Each
- Objective 6 - Describe Three Types of Secondary Bonds
- Objective 7 - Describe Two Types of Hydrocarbons: Aliphatic and Cyclic
- Self Review 1

Segment 2 - Polymers

Objective 8 - Define a Polymer and Polymerization

Objective 9 - Describe Two Types of Polymers, Elastomers and Plastics, and Give an Example of Each

Self Review 2

Segment 3 - Properties of Plastics

Objective 10 - Describe Six Types of Plastics Properties

Objective 11 - Describe the Properties of Two Types of Plastics, Thermoplastics and Thermosets

Objective 12 - Describe the Characteristics of Four Common Thermoplastics and Give an Application of Each

Objective 13 - Describe the Characteristics of Four Common Thermosets and Give an Application of Each

Skill 1 - Select a Plastics for an Application Based on Its Properties

Self Review 3

Segment 4 - Manufacturing Characteristics of Plastics

Objective 14 - Describe the Effect of Shrinkage on Plastics and Explain How It Is Measured

Objective 15 - Describe the Effect of Warpage on Plastics

Self Review 4

8. Introduction to Blow Molding Operations**Segment 1 - Blow Molding Process**

Objective 1 - Describe Two Types of Blow Molding Processes

Objective 2 - Describe Six Components of a Blow Molding Machine

Self Review 1

Segment 2 - Blow Molding Safety and Operation

Objective 3 - Describe Eight Safety Rules to Follow around a Blow Molding Machine

Objective 4 - Describe the Function and Operation of a Blow Mold

Self Review 2

Segment 3 - Blow Molding Troubleshooting

Objective 5 - Describe Seven Causes of an Incomplete Blow Molding Operation

Objective 6 - Describe the Importance of Wall Thickness in a Blow Molded Part

Objective 7 - Describe the Effect of Weld Strength on a Blow Molded Part

Self Review 3

9. Introduction to Extrusion Operations**Segment 1 - Extrusion Process**

Objective 1 - Describe Four Types of Extruded Products

Objective 2 - Describe Seven Components of an Extrusion Machine

Self Review 1

Segment 2 - Extrusion Safety and Operation

Objective 3 - Describe Eight Safety Rules to Follow around an Extrusion Machine

Objective 4 - Describe the Function and Operation of an Extrusion Die

Self Review 2

Segment 3 - Extrusion Troubleshooting

Objective 5 - Describe Three Causes of Uneven Surface Finish on an Extruded Part

Objective 6 - Describe Three Causes of Burns on an Extruded Part

Objective 7 - Describe Three Causes of Thin Part Diameter on an Extruded Part

Self Review 3

10. Material Quality Control**Segment 1 - Material Quality Concepts**

Objective 1 - Explain How Material Characteristics Are Maintained in a Process

Objective 2 - List and Describe Three Types of Component Failure

Objective 3 - Describe the Function of Component Failure Analysis and Prevention

Objective 4 - List and Describe the Four Steps Used to Analyze a Component Failure

Self Review 1

Segment 2 - The Cause and Effect Diagram

Objective 5 - Describe the Function and Construction of a Cause and Effect Diagram

Objective 6 - Describe How to Construct a C&E Diagram

Activity 1 - Create a Cause and Effect Diagram as Part of a Brainstorming Process
Self Review 2

Segment 3 - Non-Destructive Testing

Objective 7 - List and Describe the Application of Six Types of Non-Destructive Testing
Self Review 3

Segment 4 - Destructive Testing

Objective 8 - List and Describe the Application of Seven Types of Destructive Testing
Skill 1 - Select One or More Testing Methods Given a Description of Component Failure
Self Review 4

11. Tensile Strength Analysis

Segment 1 - Tensile Characteristics

Objective 1 - Define Stress and Explain Its Importance
Skill 1 - Calculate Stress Given a Set of Data
Objective 2 - Define Strain and Explain Its Importance
Skill 2 - Calculate Strain Given a Set of Data
Objective 3 - List and Describe the Five Components of a Stress/Strain Diagram for a Part under Tension
Self Review 1

Segment 2 - Tensile Testing

Objective 4 - List and Describe Two Types of Tensile Testing Machines
Objective 5 - List and Describe Two Methods of Collecting Data from a Tensile Test
Self Review 2

Segment 3 - Tensile Analysis

Objective 6 - Define Modulus of Elasticity and Explain Its Importance
Skill 3 - Use the Modulus of Elasticity to Calculate Stress, Strain, and Elongation
Self Review 3

12. Data Acquisition Systems

Segment 1 - Introduction to Data Acquisition Software

Objective 1 - Describe the Function of a Data Acquisition System and Give Two Advantages
Objective 2 - Describe the Function of Four Components of a Data Acquisition System
Self Review 1

Segment 2 - Transducers

Objective 3 - Define Sensitivity and Explain Its Importance
Skill 1 - Calculate Transducer Sensitivity Given Measurement Data
Objective 4 - Describe the Operation of a Linear Potentiometer
Objective 5 - Describe the Operation of a Pressure Transducer
Self Review 2

Segment 3 - Data Acquisition Operation

Objective 6 - List and Describe Two Types of Sampling Methods
Self Review 3

Segment 4 - Data Acquisition Analysis

Objective 7 - Describe the Function of a Data Acquisition Formula
Self Review 4

13. Materials Design

Segment 1 - Material Science Concepts

Objective 1 - Define a Metal and List Five Properties
Objective 2 - Define an Alloy and Explain Its Importance
Objective 3 - Describe the Properties of Four Common Alloys and Give an Application of Each
Self Review 1

Segment 2 - Identification Systems

Objective 4 - Describe an Identification System Used to Identify Steel
Objective 5 - Describe the AA Identification System Used to Identify Aluminum Alloys
Objective 6 - Describe the CDA Identification System Used to Identify Copper
Objective 7 - Describe the Unified Numbering System for Material Identification and Explain Its Purpose

Skill 1 - Identify the Composition of an Alloy Given Its UNS Number

Self Review 2

Segment 3 - Alloy Design

Objective 8 - List and Describe Three Mechanical Properties of a Material

Objective 9 - List and Describe Four Physical Properties of a Material

Objective 10 - List and Describe Seven Steel Alloying Elements and Give an Application of Each

Objective 11 - List and Describe Four Aluminum Alloying Elements and Give an Application of Each

Objective 12 - Describe the Function of Alloying Elements in Copper

Self Review 3

Segment 4 - Heat Treating

Objective 13 - Define Heat Treating and Explain Its Importance

Objective 14 - List and Describe Four Types of Heat Treating and Give an Application

Self Review 4

Segment 5 - Material Field Identification

Objective 15 - List Three Methods Used to Identify Materials

Objective 16 - List and Describe Four Types of Field Tests Used to Identify Materials

Self Review 5

14. Compression Testing and Analysis

Segment 1 - Compression Strength

Objective 1 - Define Compression Strength and Explain Its Importance

Objective 2 - Describe How Stress Is Determined for a Part under a Compression Load

Objective 3 - Describe How Strain Is Determined for a Part under a Compression Load

Skill 1 - Calculate the Compression Stress and Strain Given a Set of Data

Self Review 1

Segment 2 - Compression Testing

Objective 4 - List and Describe the Five Areas of a Stress/Strain Diagram for a Part under a Compression Load

Self Review 2

Segment 3 - Compression Analysis

Skill 2 - Use the Modulus of Elasticity to Calculate Stress, Strain, and Compression

Self Review 3

15. Shear and Hardness Testing and Analysis

Segment 1 - Shear Testing

Objective 1 - Define Shear Strength and Explain Its Importance

Objective 2 - Describe Two Applications of Shear Stress

Self Review 1

Segment 2 - Shear Analysis

Objective 3 - List Two Types of Shear Stresses and Give an Example of Each

Objective 4 - Describe How to Calculate Shear Stress

Skill 1 - Calculate Shear Stress Given a Set of Data

Self Review 2

Segment 3 - Hardness Testing

Objective 5 - Define Material Hardness and Explain Its Importance

Objective 6 - List and Describe Three Methods of Hardness Testing

Objective 7 - Describe Three Types of Indention Hardness Tests and Give an Advantage of Each

Self Review 3

Segment 4 - Hardness Analysis

Objective 8 - Describe How the Brinell Hardness Number Is Used to Determine Ultimate Tensile Strength

Skill 2 - Calculate Tensile Strength Given a Brinell Hardness Number

Self Review 4

16. Design Evaluation

Segment 1 - Design Considerations

Objective 1 - List and Describe Three Ways to Reduce Stress in the Design of a Part

Objective 2 - Define Safety Factor
Skill 1 - Calculate a Safety Factor for a Design
Self Review 1

Segment 2 - Models and Prototypes

Objective 3 - Describe the Function of a Model
Objective 4 - Describe the Function of a Prototype
Objective 5 - Describe How to Determine Testing Conditions for a Model
Skill 2 - Calculate the Force to Be Applied to a Model in Order to Test a Design
Self Review 2

Segment 3 - Introduction to the Polariscope

Objective 6 - Describe the Function and Operation of a Polariscope
Objective 7 - Explain Why Photoelastic Materials Are Used with a Polariscope
Objective 8 - Describe How to Obtain the Isoclinic and Isochromatic Patterns Used to Interpret Stress
Objective 9 - Define the Isochromatic Fringe Order
Self Review 3

Segment 4 - Polariscope Analysis

Objective 10 - Describe How to Calibrate a Model Material for a Polariscope
Skill 3 - Calibrate a Photoelastic Material
Objective 11 - Describe How to Calculate Stresses in a Model
Skill 4 - Calculate the Stress in the Photoelastic Tensile Specimen
Self Review 4

17. Properties of Ferrous Metals and Steel Production

Segment 1 - Introduction to Ferrous Metals

Objective 1 - Define Ferrous Metal and Describe Two Types
Objective 2 - Describe the Properties of Metals

Segment 2 - Steelmaking Process

Objective 3 - Define Iron Ore and Describe How It Is Mined and Processed
Objective 4 - Define Pig Iron and Describe How It Is Made
Objective 5 - Describe How Pig Iron Is Processed into Steel
Objective 6 - Describe Four Methods for Shaping Steel

Segment 3 - Properties of Ferrous Metals

Objective 7 - Identify Five Mechanical Properties of Metal
Objective 8 - Describe Metal Strength and Explain How It Is Tested
Objective 9 - Describe Metal Ductility and Explain How It Is Tested
Objective 10 - Describe Metal Machinability and Explain How It Is Tested
Objective 11 - Describe Metal Hardenability and Explain How It Is Tested
Objective 12 - Describe Corrosion Resistance and Explain How It Is Tested
Objective 13 - Describe How Steel Forming Processes Can Affect Its Properties

Segment 4 - Elements Used in Steel Production

Objective 14 - Describe the Alloying Elements Commonly Used in Steel Production
Objective 15 - Describe the Effects of 10 Elements on Steel Production

Segment 5 - Classes of Ferrous Metals

Objective 16 - Describe the Four Classes of Ferrous Metals
Objective 17 - Describe Four Groups of Carbon Steel
Objective 18 - Describe Four Groups of Alloy Steel
Objective 19 - Describe Four Common Grades of Tool Steel
Objective 20 - Describe Four Groups of Stainless Steel
Objective 21 - List the Five Groups of Cast Iron and Discuss Two Major Types

Segment 6 - Ferrous Metal Specifications

Objective 22 - Describe Steel Nomenclature and Specification Systems and List Five Types
Objective 23 - Describe the AISI/SAE Nomenclature System
Objective 24 - Describe the UNS Nomenclature System
Objective 25 - Describe How Ferrous Metals Are Specified

18. Principles of Non-ferrous Metals

Segment 1 - The Forming Processes of Non-Ferrous Metals

- Objective 1 - Describe the Importance of Non-Ferrous Metals in Manufacturing
- Objective 2 - Describe the Steps Necessary to Prepare Non-Ferrous Metals for Commercial Purposes
- Objective 3 - Describe the Processes for Extracting Aluminum and Copper
- Objective 4 - Describe Alloying and the Forming Process
- Objective 5 - Describe Four Common Casting Processes
- Objective 6 - Describe Four Common Wrought Treatment Processes
- Objective 7 - Describe Four Methods of Tempering

Segment 2 - Physical Properties of Non-Ferrous Metals

- Objective 8 - Describe the Physical Properties of Non-Ferrous Metals
- Objective 9 - Describe How to Test the Mechanical Properties of Non-Ferrous Metal
- Objective 10 - Describe How Forming Processes Can Affect Non-Ferrous Metals' Physical Properties

19. Copper, Aluminum and Their Alloys

Segment 1 - Elements of Aluminum and Aluminum Alloys

- Objective 1 - Describe How Alloys Affect the Physical Properties of Non-Ferrous Metal
- Objective 2 - Describe How Alloys Are Used to Change the Physical Properties of Aluminum
- Objective 3 - Describe Two Classes of Aluminum

Segment 2 - Elements of Copper and Copper Alloys

- Objective 4 - Describe How Alloys Are Used to Change the Physical Properties of Copper
- Objective 5 - Describe Two Classes of Copper
- Objective 6 - Describe the Unified Numbering System for Non-Ferrous Metal

Segment 3 - Copper and Aluminum Specifications

- Objective 7 - Describe the Aluminum Association (AA) Nomenclature
- Objective 8 - Describe Non-Ferrous Metal Specifications

20. Principles of Heat Treatment

Segment 1 - Introduction to Heat Treating

- Objective 1 - Define Heat Treating and Explain Its Importance
- Objective 2 - Describe Six Types of Heat Treating Processes
- Objective 3 - Describe the Hardening Heat Treating Processes
- Objective 4 - Describe the Quenching Processes
- Objective 5 - Describe the Annealing Process
- Objective 6 - Describe Tempering
- Objective 7 - Describe Normalizing
- Objective 8 - Describe Stress Relieving
- Objective 9 - Describe Characteristics Used to Select a Heat Treatment for an Application
- Objective 10 - Describe the History of the Heat Treating Process
- Self Review 1

Segment 2 - The Heat Treating Process

- Objective 11 - Describe the Chemical Changes of Ferrous Metal During Heat Treatment
- Objective 12 - Describe the Chemical Changes of Non-Ferrous Metal During Heat Treatment
- Self Review 2

Segment 3 - Manufacturing Heat Treating Processes

- Objective 13 - Describe Batch Production Heat Treating
- Objective 14 - Describe Continuous Production Heat Treating
- Self Review 3

Segment 4 - Heat Treat Hardness Classification

- Objective 15 - Describe Heat Treated Metal Testing
- Objective 16 - Describe the Types of Organizations that Govern Heat Treating Standards
- Objective 17 - Describe the Nomenclature System for Heat Treating Standards
- Self Review 4

21. Principles of Plastics

Segment 1 - Introduction to Plastics

Objective 1 - Define Plastics and Explain Their Importance
Objective 2 - Describe the Properties of Two Types of Plastics: Thermoplastics and Thermosets
Objective 3 - Describe the Characteristics of Four Common Thermoplastics
Objective 4 - Describe the Characteristics of Four Common Thermosets
Objective 5 - Describe the History of Plastics
Self Review 1

Segment 2 - Plastics Making Process

Objective 6 - Define a Polymer and Polymerization
Objective 7 - Describe How Ethylene and Propylene Are Obtained
Objective 8 - Describe the Basic Plastics-Making Process
Self Review 2

Segment 3 - Properties of Plastics

Objective 9 - Describe the Mechanical Properties of Plastics
Objective 10 - Describe the Physical Properties of Plastics
Objective 11 - Describe the Thermal Properties of Plastics
Objective 12 - Describe the Optical Properties of Plastics
Objective 13 - Describe the Electrical Properties of Plastics
Objective 14 - Describe the Environmental Properties of Plastics
Self Review 3

Segment 4 - Plastics Manufacturing Processes

Objective 15 - Describe the Injection Molding Process
Objective 16 - Describe the Blow Molding Process
Objective 17 - Describe the Extrusion Process
Objective 18 - Describe the Manufacturing Characteristics of Plastics
Objective 19 - Describe Post-Manufacturing Processes
Self Review 4

Segment 5 - Plastics Nomenclature

Objective 20 - Describe the ASTM Nomenclature System for Plastics
Objective 21 - Describe the ISO Nomenclature System for Plastics
Self Review 5

Segment 6 - Environmental Considerations

Objective 22 - Describe the Impact of Plastics on the Environment
Objective 23 - Describe How Recycling Reduces Environmental Impact
Objective 24 - Describe How the Plastics Industry Is Reducing Its Environmental Impact
Self Review 6

22. Principles of Composites

Segment 1 - Introduction to Composites

Objective 1 - Define Composites and Explain Their Importance
Objective 2 - Describe Types of Constituent Materials That Make up a Composite
Objective 3 - Describe Two Categories of Fiber-Reinforced Materials
Objective 4 - Describe the History of Composites
Self Review 1

Segment 2 - Properties of Composites

Objective 5 - Describe the Mechanical Properties of Composites
Objective 6 - Describe the Thermal Properties of Composites
Objective 7 - Describe the Electrical Properties of Composites
Objective 8 - Describe the Environmental Properties of Composites
Self Review 2

Segment 3 - Composite Manufacturing Process

Objective 9 - Describe the Two Main Manufacturing Steps of a Composite Product
Objective 10 - Describe the Hand Lay-up Process
Objective 11 - Describe the Spray-up Process
Objective 12 - Describe the Filament Winding Process
Objective 13 - Describe the Resin Transfer Molding Process

Objective 14 - Describe Three Types of Curing Processes for Composite Materials
Objective 15 - Describe Post-Curing Manufacturing Processes for Composites
Self Review 3

Segment 4 - Environmental Considerations for Composites

Objective 16 - Describe the Impact of Composites on the Environment
Objective 17 - Describe How the Composite Industry Is Reducing Its Environmental Impact
Self Review 4

23. Principles of Ceramics

Segment 1 - Introduction to Ceramics

Objective 1 - Define Ceramics and Explain Its Importance
Objective 2 - Describe the Characteristics of Four Types of Ceramics
Objective 3 - Describe the Characteristics of Two Types of Glass
Objective 4 - Describe the Characteristics of Four Common Categories of Clay Products
Objective 5 - Describe the Characteristics of Three Classes of Refractories
Objective 6 - Describe the Characteristics of Five Types of Advanced Ceramics
Objective 7 - Describe the History of Ceramics
Self Review 1

Segment 2 - Properties of Ceramics

Objective 8 - Describe the Mechanical Properties of Ceramics
Objective 9 - Describe the Physical Properties of Ceramics
Objective 10 - Describe the Thermal Properties of Ceramics
Objective 11 - Describe the Electrical Properties of Ceramics
Objective 12 - Describe the Environmental Properties of Ceramics
Self Review 2

Segment 3 - Ceramic Making Process

Objective 13 - Describe the Basic Ceramics Material Making Process
Objective 14 - Describe the Basic Operation of Milling
Objective 15 - Describe the Basic Operation of Batching
Objective 16 - Describe the Basic Operation of Mixing
Objective 17 - Describe the Basic Operation of Forming
Objective 18 - Describe the Basic Operation of Drying
Objective 19 - Describe the Basic Operation of Firing
Objective 20 - Describe the Advanced Ceramics Making Process
Self Review 3

Segment 4 - Ceramics Manufacturing Processes

Objective 21 - Describe Ceramic Forming Processes
Objective 22 - Describe the Pressing Process
Objective 23 - Describe the Extrusion Process
Objective 24 - Describe the Injection Molding Process
Objective 25 - Describe the Drain and Solid Casting Processes
Objective 26 - Describe the Manufacturing Characteristics of Ceramics
Objective 27 - Describe Post-Manufacturing Processes
Self Review 4