Introduction to Manufacturing

Course Number: 13002

Rational Statement:
This course will provide entry level exposure and career exploration in the Manufacturing industry. Students will be exposed to small business skills, manufacturing and engineering products, production systems, manufacturing and marketing of products, and performing financial activities.

Suggested Grade Level: 9 – 12

Topics Covered:

- **Career Exploration**
- **Manufacturing Business Process**
- **Manufacturing Technology Safety Practices**
- **Health and Environmental Practices**
- **Basic Tools & Equipment used in the Manufacturing Industry**
- **Manufacturing Technology Basics**
- **Product Development**

Indicator #1: Career exploration and development	
Bloom's Taxonomy Level	**Standard and Examples**
Understanding	**IM1.1 Explore career pathways in manufacturing** Examples: • Utilize Guidance software to research and report on career opportunities • Research the historical evolution of the various careers in manufacturing • Utilizing Guidance software identify education and training needed for a career in manufacturing ie (welding, machine tooling)
Indicator #2: Explore the business process in manufacturing.	
Bloom's Taxonomy Level	**Standard and Examples**
Creating	**IM2.1 Develop a business process model for manufacturing operations** Examples: • Define business process • Identify and explain the core business processes in manufacturing (e.g., product development, sourcing and planning, manufacturing and logistics) • Prepare a diagram, chart and/or model that illustrates the manufacturing business processes • Trace and evaluate the interrelated activities performed to produce a product and serve a customer

Analyzing	**IM2.2 Analyze the manufacturing industry** Examples: • Categorize manufactured goods by type (e.g., medical, petroleum, metal) • Identify and describe types of manufacturing systems • Identify the customers, suppliers and stakeholders, and describe their roles and how they relate • Explain the major competitive challenges faced by manufacturing businesses • Describe historical influences on manufacturing (e.g., the labor movement, foreign competition, quality)
Analyzing	**IM2.3 Analyze trends and issues in the manufacturing industry** Examples: • Explain economic, labor and environmental factors related to manufacturing • Explain quality assurance systems and how they contribute to effective work organizations • Research and report on foreign out-sourcing and its impact on the national economy • Identify technological advancements and describe how they have influenced manufacturing processes
Understanding	**IM2.4 Explain how planning and budgeting are used to accomplish manufacturing goals and objectives** Examples: • Explain how work plans and budgets are used to allocate people and resources • Identify reports used to track performance and resources and explain how they are used (e.g. Payroll data, Balance Sheets and Income statements) • Identify and describe the most critical performance problems that manufacturing businesses typically face
Understanding	**IM2.5 Explain material control and product inventories necessary to meet customer and business requirements** Examples: • Analyze the relationship of quality control to supply of materials • Identify inventory control systems used in manufacturing (e.g., just-in-time) • Analyze the impact of inventory control systems on productive and profit/loss
Understanding	**IM2.6 Explain how social and economic changes outside manufacturing impact the manufacturing process** Examples: • Explain the impact of economic, social and technology changes • Discuss the positive and negative impact of government regulation • Relate the impact of international events to manufacturing

Understanding	**IM2.7 Explain the role of risk management in reducing risks and improving performance in manufacturing businesses** Examples: • Explain the objectives of risk management programs • Describe the major types of loss exposure for manufacturing businesses • Summarize the approaches for managing organizational risks
Understanding	**IM2.8 Understand the roles and functions of government in regulating and supporting manufacturing business** Examples: • Describe the governmental roles in regulating domestic operations • Discuss the governmental roles in regulating international operations • Explain the governmental roles in health, safety, and environment management
Creating	**IM2.9 Develop a management plan for a manufacturing business** Examples: • Describe strategies to achieve company goals and objectives • Design an organizational chart with job and activity descriptions • Identify a product and develop a business and marketing plan for that product
Understanding	**IM2.10 Identify basic procedures in the accounting cycle** Examples: • Describe the basic application of internal and external accounting • Describe job costing with direct and indirect costs • Explain basic economic concepts (e.g., supply, demand, price, cost, profit, value, cash flow)
Indicator #3: Know Manufacturing technology safety practices	
Bloom's Taxonomy Level	**Standards and Examples**
Remembering	**IM3.1 Maintain general safety in accordance with government regulations, health standards, and company policy** Examples: • Research and report on regulations for use of personal protective equipment • Develop a lock out tag out procedure and explain the need for such a procedure. • Describe how to operate fire extinguishers and identify classes of fires • Develop a company safety policy following federal and state regulations

Evaluating	**IM3.2 Evaluate the ergonomic factors associated with the manufacturing industry** Examples: • Define ergonomics • Describe ergonomic factors in the workplace • Identify work associated with repetitive motion and with lifting or moving heavy objects • Demonstrate appropriate body mechanics in lifting and moving heavy objects
Understanding	**IM3.3 Identify state, federal and local worker safety, health and environmental regulations** Examples: • Examine the Occupational Safety and Health Administration (OSHA) regulations as they apply to the manufacturing industry • Discuss the Environmental Protection Agency (EPA) regulations • Interpret personal safety rights, according to employees right to know plans
Indicator #4: Understand health and environmental practices	
Bloom's Taxonomy Level	**Standard and Examples**
Understanding	**IM4.1 Identify practices that contribute to a healthy environment** Examples: • Discuss symptoms of exposure to health-threatening environments (e.g., temperature, chemical, noise, noise vibrations harshness, and biological hazards). • Describe the effects of hazardous activities (e.g., welding) • Describe the interactions of incompatible substances
Understanding	**IM4.2 Handle hazardous materials in accordance with government regulations and health standards** Examples: • Identify types of hazardous materials • Interpret container label precautions • Interpret material safety date sheets (MSDS) and use materials accordingly • Identify hazardous storage procedures in compliance with government regulations
Indicator #5: Understand basic tools and equipment used in the manufacturing industry	

Bloom's Taxonomy Level	Standard and Examples
Understanding	**IM5.1 Identify basic tools and equipment appropriate to manufacturing** Examples: • Identify the various types of tools and equipment applicable to a specified manufacturing application • Describe the primary functions of various types of hand and power tools
Indicator #6: Understand manufacturing technology basics	
Bloom's Taxonomy Level	**Standard and Examples**
Evaluating	**IM6.1 Evaluate products in relation to size, proportion and tolerances** Examples: • Demonstrate a command of the International Standards of Units (SI or metric) system • Demonstrate a command of the English measurement system • Utilize appropriate measurement equipment and techniques • Measure products using SI and English systems
Understanding	**IM6.2 Interpret drawings, prints and schematics** Examples: • Identify commonly used symbols and abbreviations • Interpret orthographic projections, including first and third angle projections • Describe tolerances and dimensioning • Identify machine, hydraulic, pneumatic, instrument and electrical drawings, prints and schematics
Applying	**IM6.3 Demonstrate basic drawing skills** Examples: • Identify and demonstrate line weights, types and uniformity techniques • Examine and describe orthographic views • Perform basic geometric constructions (e.g., line dividing, angles, tangents) • Develop drawings and specifications for identified product in business plan
Remembering	**IM6.4 Describe basic electrical and electronic theory** Examples: • Identify how electricity and electronic are used in manufacturing processes

	• Discuss the scientific laws related to electricity and differentiate between alternating current (AC) and direct current (DC) terms and applications • Describe the uses of series, parallel and combination circuits • Discuss schematic drawings and blueprints
Remembering	**IM6.5 Describe basic hydraulic and pneumatic systems** Examples: • Describe how hydraulic and pneumatic systems are used in manufacturing processes • Recognize basic hydraulic and pneumatic systems and components • Recognize circuit diagrams (e.g., hydraulic, pneumatic) • Recognize connectors (e.g., hoses, fittings, tubes)
Remembering	**IM6.6 Describe fluid flow concepts** Examples: • Describe how flow concepts are used in manufacturing processes • Identify types of fluids (e.g., air, water, oil) • Identify properties of fluid flow (e.g., pressure, flow) • Discuss scientific principles to fluid flow (e.g., Pascal's law, Boyle's law, Bernoulli's equation)
Remembering	**IM6.7 Describe welding procedures for metals and plastics** Examples: • Describe how welding procedures are used in manufacturing processes • Identify basic welding joints • Identify various welding processes • Interpret basic welding symbols and their components • Describe the welding procedures specified for a given job
Remembering	**IM6.8 Describe materials joining procedures** Examples: • Describe how material joining procedures are used in manufacturing processes • Identify compatibility of materials • Identify types of bonds (e.g., chemical, thermal, mechanical) • Identify types and grades of fasteners (e.g., nuts, bolts, rivets)
Understanding	**IM6.9 Identify machining procedures for metals and plastics** Examples: • Describe turning procedures used in manufacturing processes • Discuss milling procedures used in manufacturing processes • Describe computer numerical control (CNC) machine operations • Describe surface grinding procedures used in manufacturing processes • Identify types of tooling (e.g., high-speed steel, carbide, ceramic

Remembering	**IM6.10 Describe the application of basic mechanical physics** Examples: • Identify how mechanical physics is used in manufacturing processes • Differentiate between simple machines and their functions (e.g., pulleys and levers) • Analyze potential and kinetic energy • Describe scientific laws associated with mechanical physics • Identify variables that affect mechanical physics (e.g., temperature, vibrations, stresses, forces)
Remembering	**IM6.11 Describe plastic processing and compounding** Examples: • Describe how plastics processing and compounding are used in manufacturing processes • Identify materials (e.g., thermoset, thermoplastic) • Identify processes (e.g., injection-molding, blow-molding, extrusion) • Discuss applications and material appropriate for specified processes
Understanding	**IM6.12 Explain the impact of emerging technologies in manufacturing** Examples: • Identify various uses of technology in manufacturing (e.g., scheduling, bar coding, material management, material handling, equipment, robotics) • Analyze the impact of technology use for the manufacturing industry
Remembering	**IM6.13 Describe basic metallurgy and metal processing** Examples: • Differentiate between different metals used in the manufacturing processes • Identify processes used in metal forming (e.g., casting, metal forming, extrusion, stamping)
Indicator 7: Apply product development process	
Bloom's Taxonomy Level	**Standard and Examples**
Applying	**IM7.1 Develop identified product prototype** Examples: • Using drawings and specifications develop a 3D model/prototype of the product • Test prototype to see if there are any manufacturing flaws

	• Redesign product if necessary
Applying	**IM7.2 Manufacture identified product** Examples: • Using drawings and specifications manufacture product with chosen manufacturing process • Evaluate product and manufacturing process and make necessary adjustments
Applying	**IM7.3 Present final product** Examples: • Do oral presentation on marketing plan presenting (identified market segment, product competition, product pricing, product distribution, and product branding etc.) • Do oral presentation on business plan presenting (inventory requirements, revenue and expense projections, cash flow statements etc.) • Do oral presentation on engineering design and testing of prototype • Do oral presentation on final product