

**Curriculum Standard for Manufacturing Production and Process Development:  
Manufacturing and Industrial Engineering Technology**

**Career Cluster:** Manufacturing\*\*

**Cluster Description:** Planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.

**Pathway:** Manufacturing Production Process Development

**Effective Term:** Summer 2018 (2018\*02)

**Program Majors Under Pathway**

<b>Program Major / Classification of Instruction Programs (CIP) Code</b>	<b>Credentialed Level(s) Offered</b>	<b>Program Code</b>
Industrial Engineering Technology CIP Code: 15.0612	AAS/Diploma/Certificate	A40240
Industrial Management Technology CIP Code: 52.0205	AAS/Diploma/Certificate	A50260
Manufacturing Technology CIP Code: 15.0699	AAS/Diploma/Certificate	A50320

**Pathway Description:** These curriculums are designed to prepare students through the study and application of the principles for developing, implementing and improving integrated systems involving people, materials, equipment and information as leaders in an industrial or manufacturing setting.

Course work includes mathematics, systems analysis, leadership and management skills, quality and productivity improvement methods, cost analysis, facilities planning, manufacturing materials and processes, and computerized production methods.

Graduates should qualify as quality improvement technicians, quality assurance and control technicians, front-line supervisors, production planners, inventory supervisors, and manufacturing technicians.

*Program Description: Choose one of the following 4<sup>th</sup> paragraphs to use in conjunction with the first three paragraphs of the pathway description above for documentation used to identify each Program Major:*

**Industrial Engineering Technology:** A course of study that prepares the students to use basic engineering principles and technical skills to develop, implement, and improve industrial and service systems. Includes instruction in systems analysis, quality and productivity improvement techniques for process development, cost analysis, facilities planning, organizational behavior, industrial processes, industrial planning procedures, computer applications, and report and presentation preparation. Graduates should qualify for employment as industrial process technicians, quality assurance and control technicians, and facilities managers. Certification is available through organizations such as ASQC, SME, and APICS.

**Industrial Management Technology:** A course of study that prepares the students to use basic engineering principles and management skills to plan and manage operations of industrial and manufacturing processes. Includes instruction in financial management, industrial and human resources management, industrial psychology, management information systems, quality and productivity improvement, quality control, operations research, safety and health issues, and environmental program management. Graduates should be qualified to enter the workforce as front-line supervisor, engineering assistant, production planner, inventory supervisor, or as a quality control technician. With additional training and experience, graduates could become plant manager or production managers.

**Manufacturing Technology:** A course of study that prepares students to use basic engineering principles and technical skills to identify and resolve production problems in the manufacture of products. Includes instruction in machine operations and CNC principles, production line operations, instrumentation, computer-aided manufacturing (CAM) and other computerized production techniques, manufacturing planning, quality control, quality assurance and informational infrastructure. Graduates should qualify for employment as a manufacturing technician, quality assurance technician, CAD/CAM technician, team leader, or research and development technician.

*\*Within the degree program, the institution shall include opportunities for the achievement of competence in reading, writing, oral communication, fundamental mathematical skills, and basic use of computers.*

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<b>I. General Education Academic Core</b>					
<i>[Curriculum Requirements for associate degree, diploma, and certificate programs in accordance with 1D SBCCC 400.10]: Degree programs must contain a minimum of 15 semester hours including at least one course from each of the following areas: humanities/fine arts, social/behavioral sciences, and natural sciences/mathematics. Degree programs must contain a minimum of 6 semester hours of communications. Diploma programs must contain a minimum of 6 semester hours of general education; 3 semester hours must be in communications. General education is optional in certificate programs.</i>					
<b>Manufacturing Production Process Development: Manufacturing and Industrial Engineering Technology</b>					
<b>General Education Academic Core</b>	<b>AAS</b>	<b>Diploma</b>	<b>Certificate</b>		
<b>Minimum General Education Hours Required:</b>	<b>15 SHC</b>	<b>6 SHC</b>	<b>0 SHC</b>		
<i>Courses listed below are recommended general education courses for this curriculum standard. Colleges may choose to include additional or alternative general education courses to meet local curriculum needs.</i>					
<i>*Recommended certificate and diploma level curriculum courses. These courses may <u>not</u> be included in associate degree programs.</i>					
<b>Communications:</b>					
* COM 101	Workplace Communication	3 SHC	<b>6 SHC</b>	<b>3-6 SHC</b>	<b>Optional</b>
COM 110	Introduction to Communication	3 SHC			
COM 120	Intro Interpersonal Com	3 SHC			
COM 231	Public Speaking	3 SHC			
* ENG 101	Applied Communications I	3 SHC			
* ENG 102	Applied Communications II	3 SHC			
ENG 110	Freshman Composition	3 SHC			
ENG 111	Expository Writing	3 SHC			
ENG 114	Professional Research & Reporting	3 SHC			
ENG 116	Technical Report Writing	3 SHC			
<b>Humanities/Fine Arts:</b>					
* HUM 101	Values in the Workplace	2 SHC	<b>3 SHC</b>	<b>0-3 SHC</b>	<b>Optional</b>
HUM 110	Technology and Society	3 SHC			
HUM 115	Critical Thinking	3 SHC			
HUM 230	Leadership Development	3 SHC			
PHI 230	Introduction to Logic	3 SHC			
PHI 240	Introduction to Ethics	3 SHC			
<b>Social/Behavioral Sciences:</b>					
ECO 151	Survey of Economics	3 SHC	<b>3 SHC</b>	<b>0-3 SHC</b>	<b>Optional</b>
ECO 251	Prin of Microeconomics	3 SHC			
GEO 110	Introduction to Geography	3 SHC			
GEO 111	World Regional Geography	3 SHC			
GEO 131	Physical Geography I	4 SHC			
* PSY 101	Applied Psychology	3 SHC			
* PSY 102	Human Relations	2 SHC			
PSY 118	Interpersonal Psychology	3 SHC			
PSY 135	Group Processes	3 SHC			
PSY 150	General Psychology	3 SHC			
* SOC 105	Social Relationships	3 SHC	<b>3 SHC</b>	<b>0-3 SHC</b>	<b>Optional</b>
SOC 210	Introduction to Sociology	3 SHC			
SOC 215	Group Process	3 SHC			
<b>Natural Sciences/Mathematics:</b>					
MAT 110	Math Measurement & Literacy	3 SHC	<b>3 SHC</b>	<b>0-3 SHC</b>	<b>Optional</b>
MAT 121	Algebra/Trigonometry I	3 SHC			
MAT 143	Quantitative Literacy	3 SHC			
MAT 152	Statistical Methods I	4 SHC			
MAT 171	Precalculus Algebra	4 SHC			
MAT 223	Applied Calculus	3 SHC			
MAT 271	Calculus I	4 SHC			

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**II. Major Hours.** AAS, diploma, and certificate programs must include courses which offer specific job knowledge and skills. Work-based learning may be included in associate in applied science degrees up to a maximum of 8 semester hours of credit; in diploma programs up to a maximum of 4 semester hours of credit; and in certificate programs up to a maximum of 2 semester hours of credit. Below is a description of each section under Major Hours.

- A. Technical Core.** The technical core is comprised of specific courses which are required for all Program Majors under this Curriculum Standard. A diploma program offered under an approved AAS program standard or a certificate which is the highest credential level awarded under an approved AAS program standard must include a minimum of 12 semester hours credit derived from the curriculum core courses or core subject area of the AAS program.
- B. Program Major(s).** The Program Major must include a minimum of 12 semester hours credit from required subjects and/or courses. The Program Major is in addition to the technical core.
- C. Other Major Hours.** Other major hours must be selected from prefixes listed on the curriculum standard. A maximum of 9 semester hours of credit may be selected from any prefix listed, with the exception of prefixes listed in the core.

<b><i>Manufacturing Production Process Development: Manufacturing and Industrial Engineering Technology</i></b>	<b>AAS</b>	<b>Diploma</b>	<b>Certificate</b>
<b>Minimum Major Hours Required:</b>	<b>49 SHC</b>	<b>30 SHC</b>	<b>12 SHC</b>
<i>Courses required for a diploma are designated with *</i>	<b>19-22 SHC</b>	<b>12 SHC</b>	
<p><b>A. Technical Core:</b></p> <ul style="list-style-type: none"> <li>* ISC 132 Mfg Quality Control 3 SHC</li> <li>* <i>Choose one:</i></li> <li>BPR 111 Print Reading 2 SHC</li> <li>DFT 111 Technical Drafting I 2 SHC</li> <li>DFT 119 Basic CAD 2 SHC</li> <li>DFT 151 CAD I 3 SHC</li> <li>DFT 170 Engineering Graphics 3 SHC</li> <li>EGR 120 Eng and Design Graphics 3 SHC</li>   <li>ISC 112 Industrial Safety 2 SHC</li> <li><i>OR</i></li> <li>ISC 121 Envir Health &amp; Safety 3 SHC</li> </ul> <p><b>B. Program Major(s).</b> <i>For AAS Degree select one program major plus additional courses from the prefixes listed within the same program major for a minimum of (12) semester hours of credits.</i></p> <p><b><u>Industrial Engineering Technology</u></b></p> <ul style="list-style-type: none"> <li>ISC 135 Principles of Industrial Mgmt 4 SHC</li> <li>ISC 136 Productivity Analysis I 3 SHC</li> <li>ISC 243 Prod &amp; Oper Management I 3 SHC</li>   <li><i>Choose one:</i></li> <li>MEC 111 Machine Processes I 3 SHC</li> <li>MEC 145 Mfg Materials I 3 SHC</li> <li>MEC 161 Manufacturing Processes I 3 SHC</li>   <p><b><u>Industrial Management Technology</u></b></p> <ul style="list-style-type: none"> <li>* ISC 135 Principles of Industrial Mgmt 4 SHC</li> <li>* ISC 136 Productivity Analysis I 3 SHC</li> <li>ISC 233 Industrial Org &amp; Mgmt 3 SHC</li> </ul> </ul>			

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<p><b>Manufacturing Technology</b></p> <p>* Choose one:</p> <p>MEC 145 Mfg_Materials I 3 SHC</p> <p>MEC 180 Engineering Materials 3 SHC</p> <p>* Choose one:</p> <p>ISC 212 Metrology 2 SHC</p> <p>MAC 114 Intro to Metrology 2 SHC</p> <p>MEC 151 Mechanical Mfg Systems 2 SHC</p> <p>* Choose one:</p> <p>ATR 112 Intro to Automation 3 SHC</p> <p>BPR 111 Print Reading 2 SHC</p> <p>HYD 110 Hydraulics/Pneumatics I 3 SHC</p> <p>HYD 180 Pneumatics in Automation 3 SHC</p> <p>ISC 220 Lean Manufacturing 3 SHC</p>						
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**C. Other Major Hours. To be selected from the following prefixes:**

ACC, ALT, ATR, BAT, BIO, BPM, BPR, BTC, BUS, CEG, CET, CHM, CIS, CIV, CMT, CSC, CST, CTI, CTS, DBA, DDF, DFT, ECO, EGR, ELC, ELN, HYD, ISC, MAC, MAT, MEC, MNT, NOS, OMT, PHY, PLA, PTC, SRV, SST, WBL, and WLD

*Up to two semester hour credits may be selected from ACA.*

*Up to three semester hour credits may be selected from the following prefixes: ARA, ASL, CHI, FRE, GER, ITA, JPN, LAT, POR, RUS and SPA.*

**III. Other Required Hours**

*A college may include courses to meet graduation or local employer requirements in a certificate (0-1 SHC), diploma (0-4 SHC), or an associate in applied science (0-7 SHC) program. These curriculum courses shall be selected from the Combined Course Library and must be approved by the System Office prior to implementation. Restricted, unique, or free elective courses may not be included as other required hours.*

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#### IV. Employability Competencies

Fundamental competencies that address soft skills vital to employability, personal, and professional success are listed below. Colleges are encouraged to integrate these competencies into the curriculum by embedding appropriate student learning outcomes into one or more courses or through alternative methods.

- A. **Interpersonal Skills and Teamwork** – The ability to work effectively with others, especially to analyze situations, establish priorities, and apply resources for solving problems or accomplishing tasks.
- B. **Communication** – The ability to effectively exchange ideas and information with others through oral, written, or visual means.
- C. **Integrity and Professionalism** – Workplace behaviors that relate to ethical standards, honesty, fairness, respect, responsibility, self-control, criticism and demeanor.
- D. **Problem-solving** – The ability to identify problems and potential causes while developing and implementing practical action plans for solutions.
- E. **Initiative and Dependability** – Workplace behaviors that relate to seeking out new responsibilities, establishing and meeting goals, completing tasks, following directions, complying with rules, and consistent reliability.
- F. **Information processing** – The ability to acquire, evaluate, organize, manage, and interpret information.
- G. **Adaptability and Lifelong Learning** – The ability to learn and apply new knowledge and skills and adapt to changing technologies, methods, processes, work environments, organizational structures and management practices.
- H. **Entrepreneurship** – The knowledge and skills necessary to create opportunities and develop as an employee or self-employed business owner.

*\*An **Employability Skills Resource Toolkit** has been developed by NC-NET for the competencies listed above. Additional information is located at: <http://www.nc-net.info/employability.php>*

*\*\*The **North Carolina Career Clusters Guide** was developed by the North Carolina Department of Public Instruction and the North Carolina Community College system to link the academic and Career and Technical Education programs at the secondary and postsecondary levels to increase student achievement. Additional information about Career Clusters is located at: [http://www.nc-net.info/NC\\_career\\_clusters\\_guide.php](http://www.nc-net.info/NC_career_clusters_guide.php) or <http://www.careertech.org>.*

*Summary of Required Semester Hour Credits (SHC) for each credential:*

	<b>AAS</b>	<b>Diploma</b>	<b>Certificate</b>
Minimum General Education Hours	15	6	0
Minimum Major Hours	49	30	12
Other Required Hours	0-7	0-4	0-1
<b>Total Semester Hours Credit (SHC)</b>	<b>64-76</b>	<b>36-48</b>	<b>12-18</b>

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