NC COMMUNITY COLLEGES
CREATING SUCCESS

NORTH CAROLINA COMMUNITY COLLEGE SYSTEM
James C. Williamson, Ph. D.
President

March 8, 2017

<u>MEMORANDUM</u>

To: Presidents
              Chief Academic Officers

From: Wesley Beddard, Associate Vice President
              Programs

Subject: Curriculum Review Committee Course Approvals

The Curriculum Review Committee (CRC) has the responsibility for maintaining the curriculum courses in the *Combined Course Library* (CCL). The approved course requests from the Spring 2017 CRC meeting, held on February 23, 2017, are attached for your information. *Course revisions may involve the removal of required prerequisites or corequisites. Please note that colleges may add local prerequisites and/or corequisites if they determine a need exists.*

Course Revision Impact to Curriculum Standards
The CRC approved requests to revise the **course description, prerequisite(s), corequisite(s), and/or class/lab hours** of core courses found on the curriculum standard listed below. Please note that the only change indicated on the printed standard will be the inclusion of the statement *"CRC Revised-Electronic Only 2/23/17",* since only the electronic version of the standard in Colleague will be revised.

Mechanical Engineering Technology (A40320)
Mechatronics Engineering Technology (A40350)
Nanotechnology (A20190)
Nuclear Technology (A50460)

The following curriculum standard will be submitted to the March 17, 2017, State Board of Community College meeting for additional action.

Chemical Technology (A20120)

The following curriculum standard will be submitted to the April 21, 2017, State Board of Community College meeting for additional action.

Cancer Information Management (A45130)

CC17-011
Email Copy

Please be aware that you must implement the attached revised courses and standards no later than one year after the effective term. You must update your college's electronic program of study and receive approval from the System Office *prior* to implementation of the revised courses and programs.

Curriculum standards, curriculum courses and procedures for submitting requests to the CRC are available on the Academic Programs home page at:

http://www.nccommunitycolleges.edu/academic-programs

If you need assistance or clarification, please contact Ms. Jennifer Frazelle, Director of Academic Programs at frazellej@nccommunitycolleges.edu or (919) 807-7120.

WB/dm

Attachments

c: Curriculum Review Committee
     Dr. Lisa M. Chapman
     Ms. Jennifer Frazelle
     Program Coordinators

Course Prefix #	Title	Approved Request	Effective Semester	Curriculum Standard Core Course
AQU 251	Hatchery Management I	Change prerequisites from "BIO 111 and CHM 151" to "BIO 111 and (CHM 151 or 131 and CHM 131A)"	Early Implement Summer 2017	NA
CIM 110	Registry Org & Management	Change prerequisite from "BIO 271" to "BIO 166"	Early Implement Fall 2017	Cancer Inforamtion Management (A45130)
CIM 125	Cancer Disease Management	Change prerequisite from "BIO 271" to "BIO 166"	Early Implement Fall 2017	Cancer Inforamtion Management (A45130)
CIM 211	Abstract Prin & Prac I	Change prerequisite from "BIO 271" to "BIO 166 "	Early Implement Fall 2017	Cancer Inforamtion Management (A45130)
CIM 220	CIM Technologies & Systems	New course	Summer 2017	NA
CTC 110	Chemical Safety & Technology	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 114	Wet Laboratory Techniques	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 115	Quality Control Laboratory	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 145	Advanced Laboratory Methods	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 150	Standards and Solutions	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 210	Forensic Laboratory	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 235	Food Chemistry	New course	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 260	Chemical Technology Capstone	New course	Early Implement Fall 2017	Chemical Technology (A20120)

Course Prefix #	Title	Approved Request	Effective Semester	Curriculum Standard Core Course
CTC 240	Instru I: Spectroscopy	Change hours from "2-6-0-5" to "2-8-0-6", Change prerequisite from "CTC 140" to "CTC 114 or CTC 115"	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 250	Instru 2: Chromatography	Change hours from "2-6-0-5" to "2-8-0-6", Change prerequisite from "CTC 140" to "CTC 114 or CTC 115"	Early Implement Fall 2017	Chemical Technology (A20120)
CTC 111	Basic Chemistry I	Archive	End Term Summer 2018	Chemical Technology (A20120)
CTC 112	Basic Chemistry II	Archive	End Term Summer 2018	Chemical Technology (A20120)
CTC 120	Organic Chemistry I	Archive	End Term Summer 2018	Chemical Technology (A20120)
CTC 140	Organic Processes	Archive	End Term Summer 2018	Chemical Technology (A20120)
CTC 220	Organic Chemistry II	Archive	End Term Summer 2018	Chemical Technology (A20120)
CTC 230	Biochemistry	Archive	End Term Summer 2018	Chemical Technology (A20120)
NMT 214	Radiobiology	Change prerequisite from "NMT 132" to "NMT 110", Change corequisite from "None" to "NMT 126"	Early Implement Fall 2017	NA
NMT 217	Radiobiology and Protection	Change prerequisite from "NMT 132" to "NMT 110", Change corequisite from "None" to "NMT 126"	Early Implement Fall 2017	NA
PHY 151	College Physics I	Change prerequisite from "MAT 171" to "MAT 171 or MAT 271"	Spring 2018	Mechanical Enginering Technology (A40320) Mechatronics Engineering Technology (A40350) Nanotechnology (A20190) Nuclear Technology (A50460)

Course Prefix #	Title	Approved Request	Effective Semester	Curriculum Standard Core Course
PLU 124	Plumbing Business Operations	New course	Summer 2017	NA
PLU 145	Plumbing Measure/Calculations	New course	Summer 2017	NA
PLU 212	Adv Commercial/Ind Plumbing	New course	Summer 2017	NA
PLU 214	Backflow Preventer Install	New course	Summer 2017	NA
PLU 220	Commercial Rough-In Plumbing	New course	Summer 2017	NA
PLU 225	Commercial Trim-Out Procedures	New course	Summer 2017	NA
PLU 230	Concrete Slab Plumb Rough-In	New course	Summer 2017	NA

Curriculum Standard for Engineering and Technology: Mechanical Engineering Technology

Career Cluster: Science, Technology, Engineering, Mathematics**

Cluster Description: Planning, managing, and providing scientific research and professional and technical services (e.g., physical science, social science, and engineering) including laboratory and testing services, and research and development services.

Pathway: Engineering and Technology	**Effective Term:** Fall 2013 (2013*03)

Program Majors Under Pathway

Program Major / Classification of Instruction Programs (CIP) Code		Credential Level(s) Offered	Program Major Code
Mechanical Engineering Technology	CIP Code: 15.0805	AAS/Diploma/Certificate	A40320

Pathway Description: These curriculums are designed to prepare students through the study and application of principles from mathematics, natural sciences, and technology and applied processes based on these subjects.

Course work includes mathematics, natural sciences, engineering sciences and technology.

Graduates should qualify to obtain occupations such as technical service providers, materials and technologies testing services, process improvement technicians, engineering technicians, industrial and technology managers, or research technicians.

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

Mechanical Engineering Technology: A course of study that prepares the students to use basic engineering principles and technical skills to design, develop, test, and troubleshoot projects involving mechanical systems. Includes instruction in principles of mechanics, applications to specific engineering systems, design testing procedures, prototype and operational testing and inspection procedures, manufacturing system-testing procedures, test equipment operation and maintenance, computer applications, critical thinking, planning and problem solving, and oral and written communications. Graduates of the curriculum will find employment opportunities in the manufacturing or service sectors of engineering technology. Engineering technicians may obtain professional certification by application to organizations such as ASQC, SME, and NICET.

I. General Education Academic Core

[*Curriculum Requirements for associate degree, diploma, and certificate programs in accordance with 1D SBCCC 400.97 (3)*]:
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.

Engineering and Technology: Mechanical Engineering Technology

General Education Academic Core	AAS	Diploma	Certificate
Minimum General Education Hours Required:	**15 SHC**	**6 SHC**	**0 SHC**

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.

*Recommended certificate and diploma level curriculum courses. These courses may <u>not</u> be included in associate degree programs.

					AAS	Diploma	Certificate
Communications:					**6 SHC**	**3-6 SHC**	**Optional**
*	COM	101	Workplace Communication	3 SHC			
	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			
Humanities/Fine Arts:					**3 SHC**	**0-3 SHC**	**Optional**
*	HUM	101	Values in the Workplace	2 SHC			
	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			
Social/Behavioral Sciences:					**3 SHC**	**0-3 SHC**	**Optional**
	ECO	151	Survey of Economics	3 SHC			
	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	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			
	SOC	210	Introduction to Sociology	3 SHC			
	SOC	215	Group Process	3 SHC			
Natural Sciences/Mathematics:					**3 SHC**	**0-3 SHC**	**Optional**
	MAT	120	Geometry and Trigonometry	3 SHC			
	MAT	121	Algebra/Trigonometry I	3 SHC			
	MAT	161	College Algebra	3 SHC			
	MAT	171	Precalculus Algebra	3 SHC			
	MAT	175	Precalculus	4 SHC			
	MAT	223	Applied Calculus	3 SHC			
	MAT	271	Calculus I	4 SHC			

Approved by the State Board of Community Colleges on August 16, 2012; Editorial Revision 09/05/12; Editorial Revision 12/14/12; Editorial Revision 08/21/13; Editorial Revision 03/11/14; Prefix Addition 08/01/15; CRC Revised—Electronic Only 02/23/17.

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.

Engineering and Technology: Mechanical Engineering Technology	AAS	Diploma	Certificate
Minimum Major Hours Required:	**49 SHC**	**30 SHC**	**12 SHC**
A. Technical Core:	**21-25 SHC**		

Engineering Fundamentals
Pick One Set:

EGR	250	Statics and Strength of Mat	5 SHC
		OR	
EGR	251	Statics	3 SHC *and*
EGR	252	Strength of Materials	3 SHC

Two-Dimensional Drawing
Choose one::

DFT	151	CAD I	3 SHC
DFT	170	Engineering Graphics	3 SHC
EGR	120	Eng and Design Graphics	3 SHC

Three-Dimensional Drawing
Choose one::

DFT	153	CAD III	3 SHC
DFT	154	Intro Solid Modeling	3 SHC

Fluid Mechanics
Choose one:

HYD	110	Hydraulics/Pneumatics I	3 SHC
HYD	180	Pneumatics in Automation	3 SHC
MEC	265	Fluid Mechanics	3 SHC

Manufacturing
Choose one set:

MEC	145	Mfg Materials I	3 SHC
		OR	
MEC	161	Manufacturing Processes I	3 SHC *and*
MEC	180	Engineering Materials	3 SHC

Physics
Choose one:

PHY	131	Physics – Mechanics	4 SHC
PHY	151	College Physics I	4 SHC

B. Program Major(s): Not applicable

C. Other Major Hours. *To be selected from the following prefixes:*

ALT, ARC, ATR, BAT, BMT, BPR, BTC, BUS, CEG, CET, CHM, CIS, CIV, CMT, CSC, CTI, CTS, DBA, DDF, DEA, DFT, EGR, ELC, ENV, ELN, EPP, FBG, FMW, GIS, HYD, IMS, ISC, ITN, LEO, LOG, MAC, MAT, MEC, MLG, MNT, NAN, NDE, NET, NOS, NUC, OMT, OSS, PCI, PHY, PLA, PMT, PPT, RCT, SST, TCT, TDP, TNE, 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.

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 or http://www.careertech.org.

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

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

Approved by the State Board of Community Colleges on August 16, 2012; Editorial Revision 09/05/12; Editorial Revision 12/14/12; Editorial Revision 08/21/13; Editorial Revision 03/11/14; Prefix Addition 08/01/15; CRC Revised—Electronic Only 02/23/17.

| **Curriculum Standard for Engineering and Technology:** |||
| **Applied, Automation, Mechatronics Engineering Technology** |||

Career Cluster: Science, Technology, Engineering, Mathematics**

Cluster Description: Planning, managing, and providing scientific research and professional and technical services (e.g., physical science, social science, and engineering) including laboratory and testing services, and research and development services.

Pathway: Engineering and Technology	**Effective Term:** Spring 2017 (2017*01)

Program Majors Under Pathway			
Program Major / Classification of Instruction Programs (CIP) Code		**Credential Level(s) Offered**	**Program Major Code**
Applied Engineering Technology	CIP Code: 15.0000	AAS/Diploma/Certificate	A40130
Automation Engineering Technology	CIP Code: 15.0406	AAS/Diploma/Certificate	A40120
Mechatronics Engineering Technology	CIP Code: 15.0403	AAS/Diploma/Certificate	A40350
Mission Critical Operations	CIP Code: 15.0406	AAS/Diploma/Certificate	A40430

Pathway Description: These curriculums are designed to prepare students through the study and application of principles from mathematics, natural sciences, and technology and applied processes based on these subjects.

Course work includes mathematics, natural sciences, engineering sciences and technology.

Graduates should qualify to obtain occupations such as technical service providers, materials and technologies testing services, process improvement technicians, engineering technicians, industrial and technology managers, or research technicians.

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

Applied Engineering Technology: A course of study that prepares the students to use basic engineering principles and technical skills to solve technical problems in various types of industry. The course work emphasizes analytical and problem-solving skills. The curriculum includes courses in safety, math, physics, electricity, engineering technology, and technology-specific specialty areas. Graduates should qualify for employment in a wide range of positions in research and development, manufacturing, sales, design, inspection, or maintenance. Employment opportunities exist in automation, computer, electrical, industrial, or mechanical engineering fields, where graduates will function as engineering technicians.

Automation Engineering Technology: A course of study that prepares the students to use basic engineering principles and technical skills to develop, install, calibrate, modify and maintain automated systems. Includes instruction in computer systems; electronics and instrumentation; programmable logic controllers (PLCs); electric, hydraulic and pneumatic control systems; actuator and sensor systems; process control; robotics; applications to specific industrial tasks. The graduates of this curriculum will be prepared for employment in industries that utilize control systems, computer hardware and software, electrical, mechanical and electromechanical devices in their automation systems.

Mechatronics Engineering Technology: A course of study that prepares the students to use basic engineering principles and technical skills in developing and testing automated, servomechanical, and other electromechanical systems. Includes instruction in prototype testing, manufacturing and operational testing, systems analysis and maintenance procedures. Graduates should be qualified for employment in industrial maintenance and manufacturing including assembly, testing, startup, troubleshooting, repair, process improvement, and control systems, and should qualify to sit for Packaging Machinery Manufacturers Institute (PMMI) mechatronics or similar industry examinations.

Mission Critical Operations: The Mission Critical Operations curriculum prepares graduates for employment in a wide range of positions in specific mission critical environments, operations technology, and maintenance. Course work includes the development of a student's ability to maintain technically sophisticated systems for business continuity and near continuous uptime using engineering, information technology, and industrial management and maintenance skills. The course work emphasizes analytical and problem-solving skills required to sustain high availability national security interests and includes instruction in electromechanical systems, networking, automation, cybersecurity, emergency management and systems integration. Graduates should qualify for employment as entry-level technicians with businesses, industries, educational systems, and governmental agencies in national critical infrastructure areas including, but not limited to, communications, emergency services, energy, financial services, healthcare, information technology, and transportation.

I. General Education Academic Core

[*Curriculum Requirements for associate degree, diploma, and certificate programs in accordance with 1D SBCCC 400.97 (3)*]: *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.*

Engineering and Technology: Applied, Automation and Mechatronics Engineering Technology

General Education Academic Core	AAS	Diploma	Certificate
Minimum General Education Hours Required:	**15 SHC**	**6 SHC**	**0 SHC**

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.

*Recommended certificate and diploma level curriculum courses. These courses may not be included in associate degree programs.

					AAS	Diploma	Certificate
Communications:					**6 SHC**	**3-6 SHC**	**Optional**
*	COM	101	Workplace Communication	3 SHC			
	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	Writing and Inquiry	3 SHC			
	ENG	114	Professional Research & Reporting	3 SHC			
	ENG	116	Technical Report Writing	3 SHC			
Humanities/Fine Arts:					**3 SHC**	**0-3 SHC**	**Optional**
*	HUM	101	Values in the Workplace	2 SHC			
	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			
Social/Behavioral Sciences:					**3 SHC**	**0-3 SHC**	**Optional**
	ECO	151	Survey of Economics	3 SHC			
	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			
	SOC	210	Introduction to Sociology	3 SHC			
	SOC	215	Group Process	3 SHC			

Natural Sciences/Mathematics:

					3 SHC	0-3 SHC	Optional
	MAT	120	Geometry and Trigonometry	3 SHC			
	MAT	121	Algebra/Trigonometry I	3 SHC			
	MAT	161	College Algebra	3 SHC			
	MAT	171	Precalculus Algebra	3 SHC			
	MAT	175	Precalculus	4 SHC			
	MAT	223	Applied Calculus	3 SHC			
	MAT	271	Calculus I	4 SHC			

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.

Engineering and Technology: Applied, Automation, Mechatronics Engineering Technology			AAS	Diploma	Certificate
Minimum Major Hours Required:			**49 SHC**	**30 SHC**	**12 SHC**
Courses required for a diploma are designated with *			**16-44 SHC**	**16-24 SHC**	

A. **Technical Core:**

* **Computer Applications**
Choose one:

CIS	110	Introduction to Computers	3 SHC	
EGR	111	Eng Comp and Careers	3 SHC	
EGR	125	Appl Software for Tech	2 SHC	
ELC	127	Software for Technicians	2 SHC	

* **Safety**
Choose one:

ISC	112	Industrial Safety	2 SHC	
ISC	115	Construction Safety	2 SHC	

B. **Program Major(s):**
For AAS Degree select one program major.

Applied Engineering Technology

* **Computers**
Choose one:

DFT	119	Basic CAD	2 SHC	
ELC	127	Software for Technicians	2 SHC	

* **Electricity**
Choose one:

ELC	131	Circuit Analysis I	4 SHC	
ELC	138	DC Circuit Analysis	4 SHC	
ELC	139	AC Circuit Analysis	4 SHC	

*	**Engineering**						
	Choose one:						
	HYD	110	Hydraulics/Pneumatics I	3 SHC			
	HYD	112	Hydraulics/Med/Heavy Duty	2 SHC			
	HYD	115	Industrial Hydraulics	3 SHC			
	MNT	165	Mechanical Industrial Sys	2 SHC			
*	**Motors and Controls**						
	Choose one:						
	ELC	117	Motors and Controls	4 SHC			
	ELC	128	Intro to PLC	3 SHC			
*	**Specialty**						
	Choose one:						
	ATR	112	Intro to Automation	3 SHC			
	CET	110	Intro to CET	1 SHC			
	ELN	131	Analog Electronics I	4 SHC			
	MEC	110	Intro to CAD/CAM	2 SHC			

Automation Engineering Technology

*	ATR	112	Intro to Automation	3 SHC			
*	ATR	215	Sensors and Transducers	3 SHC			
*	ELC	128	Intro to PLC	3 SHC			
	ELN	133	Digital Electronics	4 SHC			
	PCI	171	Fieldbus Systems	4 SHC			
*	**Basic Electricity**						
	Choose one set:						
	ELC	131	Circuit Analysis I	4 SHC			
	ELC	133	Circuit Analysis II	4 SHC			
		OR					
	ELC	138	DC Circuit Analysis	4 SHC			
	ELC	139	AC Circuit Analysis	4 SHC			
	Specialty						
	Choose one:						
	ATR	121	Intro to Machine Vision	4 SHC			
	BAT	111	Building Automation Systems	2 SHC			
	HYC	110	Hydraulics/Pneumatics I	3 SHC			
	MEC	130	Mechanisms	3 SHC			
	MNT	250	PLC Interfacing	4 SHC			

Mechatronics Engineering Technology

*	ATR	112	Intro to Automation	3 SHC			
*	ELC	213	Instrumentation	4 SHC			
*	**Basic Electricity**						
	Choose one course or set:						
	ELC	111	Intro to Electricity	3 SHC			
		OR					
	ELC	112	DC/AC Electricity	5 SHC			
		OR					
	ELC	131	Circuit Analysis I	4 SHC			
		OR					
	ELC	138	DC Circuit Analysis	4 SHC			
	ELC	139	AC Circuit Analysis	4 SHC			

Drawing
Choose one:

DFT	119	Basic CAD	2 SHC
DFT	151	CAD I	3 SHC
DFT	154	Intro Solid Modeling	3 SHC
DFT	170	Engineering Graphics	3 SHC
EGR	120	Eng and Design Graphics	3 SHC
ELC	132	Electrical Drawings	2 SHC

Fluid Mechanics
Choose one:

HYD	110	Hydraulics/Pneumatics I	3 SHC
HYD	180	Pneumatics in Automation	3 SHC
MEC	265	Fluid Mechanics	3 SHC

Mechanical Drives
Choose one:

MEC	130	Mechanisms	3 SHC
MEC	275	Engineering Mechanisms	3 SHC

Machines
Choose one course or set:

ELC	117	Motors and Controls	4 SHC
ELC	130	Advanced Motors/Controls	3 SHC
ELC	135	Electrical Machines I	3 SHC
	AND		
ELC	136	Electrical Machines II	4 SHC

Programmable Logic Controllers
Choose one:

ELC	128	Intro to PLC	3 SHC
ELN	260	Prog Logic Controllers	4 SHC

* **Physics**
Choose one:

PHY	131	Physics-Mechanics	4 SHC
PHY	151	College Physics I	4 SHC

Mission Critical Operations

*	MCO	110	Intro to MCO	3 SHC
*	MCO	115	MCO Infrastructure	3 SHC
	MCO	210	Critical Site Operations	3 SHC

Operations Technology

	ATR	112	Intro to Automation	3 SHC
*	MNT	222	Industrial Sys Schematics	2 SHC

C. Other Major Hours. *To be selected from the following prefixes:*

AHR, ALT, ATR, BAT, BPM, BPR, BTB, BTC, BUS, CCT, CEG, CET, CHM, CIS, CIV, CMT, CSC, CTI, CTS, DBA, DDF, DEA, DFT, EGR, ELC, ELN, EPP, EPT, FBG, GRA, HET, HPC, HYD, ISC, LOG, MAC, MAT, MCM, MCO, MEC, MKT, MLG, MNT, MPS, MSM, NET, NOS, NUC, OMT, PCI, PHY, PKG, PMT, RCT, RVM, SEC, SST, TCT, TDP, TEL, TNE, TRN, WAT, WBL, WEB 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.

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 or http://www.careertech.org.*

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

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

CURRICULUM STANDARD

Curriculum Program Title	**Nanotechnology**	Program Code	**A20190**
Concentration	**(not applicable)**	CIP Code	*15.1601*

Curriculum Description

The Nanotechnology curriculum prepares students to characterize and fabricate materials for biological, textile, chemical, and electrical applications at the atomic level.

Course work includes biology, chemistry, physics, mathematics, and an extensive array of very detailed nanotechnology-specific courses, using high-tech equipment and complying with high-precision quality control and clean-room protocols with a multidisciplinary focus.

Graduates should qualify for various positions in industry and government, including research and development, materials testing and processing, optics and sensors, electron microscopy, and emerging nanotechnology industries.

*Curriculum Requirements**
[for associate degree, diploma, and certificate programs in accordance with 1D SBCCC 400.97 (3)]

I.   **General Education.** 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.

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. *(See second page for additional information.)*

III. **Other Required Hours.** A college may include courses to meet graduation or local employer requirements in a certificate, diploma, or associate in applied science 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.

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

*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.

Major Hours

[ref. 1D SBCCC 400.97 (3)]

A. **Core.** The subject/course core is comprised of subject areas and/or specific courses which are required for each curriculum program. 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 subject/course core of the AAS program.

B. **Concentration** *(if applicable).* A concentration of study must include a minimum of 12 semester hours credit from required subjects and/or courses. The majority of the course credit hours are unique to the concentration. The required subjects and/or courses that make up the concentration of study are in addition to the required subject/course 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 or concentration. 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.

Nanotechnology A20190

	AAS	Diploma	Certificate
Minimum Major Hours Required	**49 SHC**	**30 SHC**	**12 SHC**
A. CORE	**41-42 SHC**	**12 SHC**	

Required Courses:

NAN	111	Introduction to Nanotechnology	3 SHC
NAN	112	Fundamentals of Nanoscience	3 SHC
NAN	131	Nano Safety Practices	2 SHC
NAN	132	Nano Regulations & Ethics	2 SHC
NAN	241	Nanofabrication	4 SHC
NAN	242	Nanofabrication of Thin Films	4 SHC
NAN	243	Nanocharacterization	4 SHC
NAN	244	Electron Microscopy	4 SHC

Required Subject Areas:

Biology: Select one course.

BIO	110	Principles of Biology	4 SHC
BIO	111	General Biology I	4 SHC

Chemistry: Select one set.

CHM	131	Introduction to Chemistry **&**	3 SHC	
CHM	131A	Introduction to Chemistry Lab	1 SHC	*or*
CHM	151	General Chemistry I	4 SHC	

Mathematics: Select one course.

MAT	122	Algebra/Trigonometry II	3 SHC
MAT	172	Precalculus Trigonometry	4 SHC

Physics: Select one course.

PHY	131	Physics – Mechanics	4 SHC
PHY	151	College Physics I	4 SHC

B.   CONCENTRATION *(Not applicable)*

C. OTHER MAJOR HOURS *To be selected from the following prefixes:* ATR, BIO, BPM, BTC, CET, CHM, CIS, CPT, CSC, CTC, CTR, CYT, EGR, ELC, ELN, ENV, HPC, ICT, ISC, LEO, MAC, MAT, MEC, MLG, NAN, NET, PHY, PLA, PTC, SGR, SUR, WAT, and WBL *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.*			

CURRICULUM STANDARD

Curriculum Program Title	**Nuclear Technology**	Program Code **A50460**
Concentration	**(not applicable)**	CIP Code *41.0205*

Curriculum Description

The Nuclear Technology curriculum prepares individuals to become qualified reactor field technicians who are employed by licensed nuclear reactor facilities.

Course work includes theory and application related to industrial and engineering technology disciplines including nuclear reactor theory, reactor systems, industrial and nuclear safety, instrumentation, electrical generation, automation and robotics, and may include quality control, welding, and various metallurgical inspection procedures.

Upon completion, graduates should qualify as entry-level nuclear reactor technicians and have academic preparations to advance into other industrial or engineering technician positions within the commercial nuclear power industry.

Curriculum Requirements*

[for associate degree, diploma, and certificate programs in accordance with 1D SBCCC 400.97(3)]

I. **General Education.** 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.

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. *(See second page for additional information.)*

III. **Other Required Hours.** A college may include courses to meet graduation or local employer requirements in a certificate, diploma, or associate in applied science 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.

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

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*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.

Major Hours

[ref. 1D SBCCC 400.97 (3)]

A. **Core.** The subject/course core is comprised of subject areas and/or specific courses which are required for each curriculum program. 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 subject/course core of the AAS program.

B. **Concentration** *(if applicable).* A concentration of study must include a minimum of 12 semester hours credit from required subjects and/or courses. The majority of the course credit hours are unique to the concentration. The required subjects and/or courses that make up the concentration of study are in addition to the required subject/course 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 or concentration. 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.

Nuclear Technology A50460

	AAS	Diploma	Certificate
Minimum Major Hours Required	**49 SHC**	**30 SHC**	**12 SHC**
A. **CORE**	**29-30 SHC**	**12 SHC**	

A. **CORE**
A diploma offered under this AAS degree requires a minimum of 12 SHC extracted from the required subject/course core of the AAS degree.

Required Courses:

NUC	110	Nuclear Reactor Systems	3 SHC
NUC	120	Nuclear Reactor Theory	4 SHC

Required Subject Areas:

Computers. Choose one:

CIS	110	Introduction to Computers	3 SHC
CIS	115	Intro to Prog & Logi	3 SHC
CSC	133	C Programming	3 SHC

Fluids/Hydraulics. Choose one:

HYD	110	Hydraulics/Pneumatics I	3 SHC
MEC	265	Fluid Mechanics	3 SHC

Physics. Choose one set:

PHY	131	Physics–Mechanics	4 SHC	*and*
PHY	132	Physics–Elec and Magnetism	4 SHC	
		OR		
PHY	151	College Physics	4 SHC	*and*
PHY	152	College Physics II	4 SHC	

Nuclear Systems/Operations. Choose a group (8 –9 shc):

NUC	210	Nuclear Steam Plant Systems	4 SHC	
NUC	220	Nuclear Primary Plant Systems	4 SHC	*or*
ISC	130	Intro to Quality Control	3 SHC	
NUC	130	Applied NDE-Nuclear	2 SHC	
WLD	112	Basic Welding Processes	2 SHC	
WLD	143	Welding Metallurgy	2 SHC	

B.	CONCENTRATION *(Not applicable)*			
C.	OTHER MAJOR HOURS *To be selected from the following prefixes:* ATR, CHM, CIS, CSC, ELC, ELN, HYD, ISC, MAT, MEC, NUC, PCI, PHY, 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.*			