



# Nanofabrication Manufacturing Technology- Associate in Applied Science (2020-21 Catalog)

## SEMESTER-BY-SEMESTER PROGRAM MAP FOR FULL-TIME STUDENTS

Courses are listed in preferred order of completion

Plans can be modified to fit student needs by adding more semesters

**Choose your courses with your Advisor.**

Developmental Education Courses (if required)			
<input type="checkbox"/>	ACLS050	Introduction to Academic Literacy	<input type="checkbox"/>
<input type="checkbox"/>	ENGL027	Writing Skills Workshop	<input type="checkbox"/>

<input type="checkbox"/>	MATH020	Pre-Algebra
<input type="checkbox"/>	MATH022	Elementary Algebra
<input type="checkbox"/>	MATH026	Intermediate Algebra

Location: B= BETH, M= MROE, S=SBTH, E= ESTN, D= DIST \*subject to change

complete	Course #	Course Title	Credits	Applies to:	Gen Ed	Fall	Winter	Spring	Summer	Pre-requisites / Co-requisites	
Semester 1	<input type="checkbox"/>	COLS101	College Success	1	AAS, SD		B,M,D	----	B,M,D	D	
	<input type="checkbox"/>	ELEC101	DC/AC Circuit Analysis I	4	AAS, SD		B,M	----	----	----	PRE: MATH026 or Placement Policy
	<input type="checkbox"/>	ELEC121	Technical Computer Applications	2	AAS, SD		B	----	----	----	
	<input type="checkbox"/>	ELEC177	Electronics Manufacturing I	2	AAS, SD		B	----	----	----	
	<input type="checkbox"/>	ENGL101	English I	3	AAS	Comm.	B,M,D	----	B,M,D	B,M,D	PRE: English Placement Policy
	<input type="checkbox"/>	MATH140	College Algebra	3	AAS, SD	QL	B,M,D	----	B,M,D	B,M,D	PRE: MATH026 or MATH Placement
	<input type="checkbox"/>		AH, SIT, or SSHB General Ed. Elective	3	AAS		B,M,D	D	B,M,D	B,M,D	
		Total Semester Credits:	18								
Semester 2	<input type="checkbox"/>	CMTH102	Introduction to Communication	3	AAS	Comm.	B,M,D	----	B,M,D	B,M,D	
	<input type="checkbox"/>	ELEC126	Digital Electronics I	3	AAS,SD		----	----	B	----	PRE: ELEC101
	<input type="checkbox"/>	ELEC151	DC/AC Circuit Analysis II	4	AAS, SD		----	----	B	----	PRE: ELEC101 PRE or CO: MATH140
	<input type="checkbox"/>	ELEC155	Introduction to Solid State Devices	2	AAS, SD		----	----	B	----	PRE: ELEC101 PRE or CO: EMEC115
	<input type="checkbox"/>	EMEC115	Mechanical Skills for Technicians	1	AAS, SD		----	----	B	----	
	<input type="checkbox"/>	ENGL151T	English II (Technical Writing)	3	AAS	Comm.	B	----	B	----	PRE: ENGL101
		Total Semester Credits:	16								
Semester 3	<input type="checkbox"/>	ELEC207	Solid State Circuits	4	AAS		B	----	----	----	PRE: ELEC155 or instructor permission
	<input type="checkbox"/>	CHEM120	General Chemistry I	4	AAS		B,M		B,M	M	PRE: MATH022 or Placement policy; 1 yr of HS chemistry or CHEM011; ENGL101 eligibility.
	<input type="checkbox"/>	QUAL210	Statistical Quality Control	3	AAS		B	----	----	----	PRE: Evidence of score of 500 or higher on SAT Math exam or completion of MATH026 with C or better or appropriate competence in MATH 150 as determined by the MATH Placement test, and industrial experience or ENGG 125 or ELEC 177.
	<input type="checkbox"/>		AH, SIT, or SSHB General Ed. Elective	3	AAS	AH,SIT,SSHB	B,M,D	D	B,M,D	B,M,D	
	<input type="checkbox"/>		Elective	3	AAS		B,M,D	D	B,M,D	B,M,D	
		Total Semester Credits:	16/17								
Semester 4	<input type="checkbox"/>	NANF211	Materials, Safety, & Equipment Overview...	3	AAS						
	<input type="checkbox"/>	NANF212	Basic Nanofabrication Processes	3	AAS						
	<input type="checkbox"/>	NANF213	Thin Films in Nanofabrication	3	AAS						
	<input type="checkbox"/>	NANF214	Lithography for Nanofabrication	3	AAS						
	<input type="checkbox"/>	NANF215	Materials Modification in Nanofabrication	3	AAS						
	<input type="checkbox"/>	NANF216	Characterization, Packaging, & Testing...	3	AAS						
		Total Semester Credits:	18								
		Total Degree Credits	64/66								

Spring/Summer: Nanofabrication Facility of Pennsylvania State University, Main Campus

PRE: Permission of department

General Education Requirements		
<input type="checkbox"/>		Diversity
<input type="checkbox"/>		Writing Intensive

Notes: CHEM120 General Chemistry is required of students intending to participate in the PSU Nanofabrication capstone semester. Students must work closely with their advisor to complete the application process to attend the capstone semester at Pennsylvania State University, main campus. The student must have at least a 2.5 GPA and meet the course pre-requisites, and be recommended by NCC for the program. The AAS degree is awarded by NCC. Information about the national network of nanofabrication programs can be found at [www.nano4me.org](http://www.nano4me.org)

**\*It is the student's responsibility to be knowledgeable of NCC graduation requirements and to verify transfer requirements with the 4-year institution. Courses listed on the program map are based upon the assumption that prerequisites and courses taken in previous semesters will be successfully completed**

Arts & Humanities (AH)
ARTA 100 Art and Visual Thinking
ARTA 101 Art History Survey
CMTH 110 Introduction to the Theatre
CMTH 111 Acting I
CMTH 115 Technical Theatre
CMTH 117 Stagecraft
CMTH 126 The Communication Arts
CMTH 189 Stage Voice and Movement
CMTH 190 Stage Production
CMTH 206 Directing
CMTH 211 Plays: Classical to Contemp. (G-WI)
CMTH 212 Acting II
CMTH 218 Theatre Portfolio
CMTH 220 Introduction to Film
DANC 101 Dance History
DANC 110 Ballet I
DANC 120 Modern Dance I
DANC 130 Jazz I
DANC 210 Ballet II
DANC 220 Modern Dance II
DANC 230 Jazz II
ENGL 201 British Literature I (G-WI)
ENGL 203 Shakespeare (G-WI)
ENGL 205 American Literature I (G-WI)
ENGL 211 Plays: Classical to Contemp. (G-WI)
ENGL 215 Multicultural Adolescent Lit (G-WI)
ENGL 250 Latin American Literature (G-WI)
ENGL 251 British Literature II (G-WI)
ENGL 253 Creative Writing
ENGL 255 American Literature II (G-WI)
ENGL 256 Modern Poetry (G-WI)
ENGL 257 20th Century Lit by Women (G-WI)
ENGL258 Fiction Writing
ENGL 260 Contemporary Literature (G-WI)
ENGL 264 Irish Literature (G-WI)
ENGL 265 African-American Literature (G-WI)
ENGL 267 Poetry Writing
HUMA 121 The American Work Experience (G-WI)
HUMA 140 Intro to Women & Gender St. (G-WI)
HUMA 150 Nature of the Environment
HUMA210 Creativity and the Origin of Ideas
JOUR 101 Journalism and Society
Modern Language - All MDLA Courses
MUSC 101 Introduction to Music
PHIL 111 On Death and Dying (G-WI)
PHIL 121 World Religions
PHIL 201 Introduction to Philosophy
PHIL 202 Ethics and Moral Problems (G-WI)
PHIL 204 Asian Philosophies
PHIL 211 Ancient Philosophy
PHIL 215 Modern Philosophy
PHIL 225 What is Freedom?

Societies & Institutions Over Time (SIT)
CMTH 221 History of Broadcasting
GEOG 101 World Geography
GEOG 151 Geography of the U.S. and Canada (G-WI)
GLBL 130 Intro to Global Studies
GLBL 160 Field Experience & Acad Research in GS
GLBL 230 Global Studies Capstone
HIST 103 Ancient and Medieval History
HIST 113 American History I (G-WI)
HIST 121 The Black Experience (G-WI)
HIST 123 African Civilization
HIST 140 Modern Chinese History
HIST 153 Found of Mod Euro History, 1300-1815 (G-WI)
HIST 163 American History II
HIST 165 The American Experience of Warfare (G-WI)
HIST 166 Civil War and Reconstruction (G-WI)
HIST 168 History of the Middle East (G-WI)
HIST 173 Mod European History, 1815 to Present (G-WI)
HIST 183 Modern American History 1945-Present
HIST 210 History of Mod Science, 1859 to Present
HIST 211 History of Pennsylvania
INTS 201 Implementing Sustainable Energy System...
INTS 202 The Architecture of the City: Classic to Contemp.
POLS 101 Introduction to Political Science
POLS 105 American Constitutional Law (G-WI)
POLS 110 American National Government (G-WI)
POLS 150 Peace Studies & Conflict Res (Study Abroad)
POLS 170 Politics of Modern Turkey (Study Abroad)
POLS 202 International Relations
POLS 205 Women and Politics (G-WI)
POLS 251 State and Local Government (G-WI)
SOCA 102 Cultural Anthropology (G-WI)
SOCA 105 American Ethnicity
SOCA 160 Issues in Contemp.Genocide & Mass Violence

Scientific Study of Human Behavior (SSHB)
ECON 201 Macroeconomics
GEOG 121 Environmental Sustainability (G-WI)
GEOG 140 Investigating Climate Change )
GEOG 271 Intro to Geographic Info Systems
HUMA 250 Research Methods in Social Sci (G-WI)
INTS 250 Study Abroad
PSYC 103 Introduction to Psychology (G-WI)
PSYC 205 Research Methods
PSYC 230 Introduction to Health Psychology
PSYC 235 Dev Child Psychopathology
PSYC 245 Cognitive Psychology
PSYC 255 Abnormal Psychology
PSYC 258 Developmental Psychology (G-WI)
PSYC 265 Psychology of Sex and Gender
SOCA 103 Principles of Sociology (G-WI)
SOCA 125 Sociology of Families (G-WI)
SOCA 210 Sociology of Gender

Writing Intensive Gen Ed Courses (WI)
BIOS105G Contemporary Biology
CMTH 211G Plays: Classical to Cont
ENGL 201G British Literature I
ENGL 203G Shakespeare
ENGL 205G American Literature I
ENGL 211G Plays: Classical to Contemporary
ENGL 215G Multicultural Adolescent Literature
ENGL 250G Latin American Literature
ENGL 251G British Literature II
ENGL 255G American Literature II
ENGL 256G Modern Poetry
ENGL 257G 20th Century Lit by Women
ENGL 260G Contemporary Literature
ENGL 264G Irish Literature
ENGL 265G African-American Literature
GEOG 121G Environmental Sustainability
GEOG 151G Geography of the US & Canada
HIST 113G American History I
HIST 121G The Black Experience
HIST 153G Found of Mod Euro Hist (1300-1815)
HIST 166G Civil War and Reconstruction
HIST 168G History of the Middle East
HIST 173G Mod Euro History, 1815 to Present
HUMA 121G The American Work Experience
HUMA 140G Intro to Women & Gender Studies
HUMA250G Research Methods in the Social Sci
PHIL 111G On Death and Dying
PHIL 202G Ethics and Moral Problems
POLS 105G American Constitutional Law
POLS 110G American National Government
POLS 205G Women and Politics
POLS 251G State and Local Government
PSYC 103G Introduction to Psychology
PSYC 258G Developmental Psychology
SOCA 102G Cultural Anthropology
SOCA 103G Principles of Sociology
SOCA 125G Sociology of Families

Diversity (D) Electives
BIOS 126 Environmental Science
BIOS 210 Environmental Biology
BUSA 115 Intro to International Business
CJST 250 Contemporary Issues in Criminal Justice
CMTH 126 The Communication Arts
CMTH 211 Plays: Classical to Contemporary
CMTH 215 Intercultural Communication
DANC 101 Dance History
ENGL 151L English II (Literature)
ENGL 205 American Literature I
ENGL 211 Plays: Classical to Contemporary
ENGL 215 Multicultural Adolescent Literature
ENGL 250 Latin American Literature
ENGL 251 British Literature II
ENGL 253 Creative Writing
ENGL 255 American Literature II
ENGL 256 Modern Poetry
ENGL 257 20th Century Lit by Women
ENGL 260 Contemporary Literature
ENGL 264 Irish Literature
ENGL 265 African-American Literature
ENGL 267 Poetry Writing
GEOG 101 World Geography
GEOG 121 Environmental Sustainability
GEOG 151 Geography of the U.S. and Canada
GEOG 210 Weather and Climate
GLBL 130 Intro to Global Studies
GLBL 160 Field Experience & Acad Research in GS
GLBL 230 Global Studies Capstone
HIST 113 American History I
HIST 121 The Black Experience
HIST 140 Modern Chinese History
HIST 165 The American Experience of Warfare
HIST 166 Civil War & Reconstruction
HIST 168 History of the Middle East
HIST 173 Mod Euro History: 1815-Present
HIST 183 Modern American History 1945-Present
HUMA 121 American Work Experience
HUMA 140 Intro to Women and Gender Studies
HUMA 150 Nature of the Environment
HUMA210 Creativity and The Origin of Ideas
INTS 201 Implement Sustain Energy Sys in Dev Com
MATH 150 Introductory Statistics
Modern Language - All MDLA Courses
PHIL111 On Death and Dying
PHIL 121 World Religions
PHIL 204 Asian Philosophies
POLS 101 Introduction to Political Science
POLS 105G American Constitutional Law
POLS 150 Peace Studies & Conflict Res (Study Abroad)
POLS 202 International Relations
POLS205 Women & Politics
POLS 251 State & Local Government
PSYC 258 Developmental Psychology
SOCA 102 Cultural Anthropology
SOCA103 Principles of Sociology
SOCA 105 American Ethnicity
SOCA 150 Deviance
SOCA160 Issues in Cont Genocide & Mass Violence
SOCA204 Social Problems

Electives for A.A. & A.S. Degrees
All courses except: OXX-level courses; EARL221, 222

For the General Education Electives, students must select one course from the list of approved courses in two of the following areas:

- Arts & Humanities (AH),
- Societies & Institutions over Time (SIT);
- Scientific Study of Human Behavior (SSHB).

**One General Education course (AH, SIT, SSHB) must be a Writing Intensive (WI) section.**

WI sections end in G (e.g. PSYC103G).

**One course should be designated as Diversity and Global Awareness (D).**

These can be taken during the summer or winter terms to lighten fall and/or spring workload.

ENGL151T Technical Writing (Semester 2) is recommended but any ENGL151 option is

**Program Narrative:**

•Nanofabrication manufacturing involves making devices at the smallest dimensions. While it was first used in the semiconductor industry, the technologies are now used for a wide variety of applications. These include miniature sensor arrays for biology and medicine, miniature valves, turbines for fluidics, flat panel displays for computers, and integrated circuits. As the use of nanofabrication manufacturing technologies by high-tech industries increases, so will the need for trained individuals. Northampton's program prepares graduates for employment as entry-level technicians.

•The Nanofabrication Manufacturing Technology degree is a cooperative program between Northampton Community College and Pennsylvania State University. In this program, you will begin with three semesters of study at NCC that covers a broad range of electronics and scientific material. You will also complete your required General Education courses at Northampton. These courses help round out your education, preparing you to communicate in the workplace and setting the stage for potential career growth. The fourth semester of the program is an intensive "capstone" experience taught at Penn State University's Nanofabrication facility at the University Park campus. Students work in a clean room environment and gain experience in operating and troubleshooting nanofabrication processing equipment as well as using characterization tools. The capstone courses are taught by Penn State faculty using state-of-the-art equipment. Please note that the capstone semester is only offered during the spring and summer semesters. There are two options for the capstone: (1) it is offered in a traditional full-semester format that is held at the facility at University Park or (2) it is offered in a hybrid format where students will take courses online and then participate in a two week lab experience at University Park. Room and board are the responsibility of the student. An additional fee is also charged for the capstone (please refer to the fee schedule in the catalog). Students must have a minimum GPA of 2.5 and be recommended by NCC for the capstone semester. Northampton awards the associate in applied science degree.

**Program Learning Outcomes:**

- Describe the operation and application of commonly used electronic components and circuits.
- Prototype, test, troubleshoot, and repair electronic circuits.
- Demonstrate the proper use of test equipment including oscilloscopes, DC power supplies, function generators, and multi-meters.
- Collect, record, interpret, and analyze data.
- Interpret technical information in the form of schematics, specifications, graphs, and procedure.
- Record relevant and necessary project information in a working lab notebook.
- Apply the terminology, procedures, equipment to manufacture micro and nanoscale products; and processes used in nanofabrication.
- Apply quality control methodology typical of the industry.
- Demonstrate safe and effective use of nanofabrication processing equipment.
- Demonstrate safe and appropriate maintenance techniques for basic processing equipment used in nanofabrication.
- Identify material and physical hazards associated with basic processing equipment used in nanofabrication.
- Respond appropriately to safety hazards and environmental disposal issues.
- Work both independently and as part of a team.
- Demonstrate written and oral communication skills.
- Use the computer in reporting, analyzing, and researching technical information.
- Be prepared to adapt to changes in the field of nanofabrication.
- Identify industries using nanofabrication such as opto-electronics, biomedical, sensors, flat panel displays, information storage, micro-electromechanical devices (MEMs), micro-fluidics, solar cells, and microelectronics.

**Transfer Information:**

- Students in sending school districts who attend vocational institutes (BAVTS, MCTI, or CIT) should ask about articulation agreements.
- A list of Universal NMT Pathways (by state) for NMT Associate degree graduates is provided at <http://www.nano4me.org/alumni/learn>.
- Graduates of this program can transfer their coursework towards one of these online Bachelor's degrees:
- Bachelor of Science in Applied Management through Franklin University.
- Bachelor of Applied Science in Technical Leadership through Bloomsburg University. (All Bloomsburg courses are taught at NCC.)
- Students planning to transfer should consult with the program advisor and the 4-year institution for guidance in course selection.

**Career Information:**

- See <http://www.nano4me.org/>
- A list of employers that hired graduates of the PSU capstone for students with a background in ELECTRONICS/COMMUNICATIONS/OPTICS can be found at <http://www.nano4me.org/alumni/work>
- See <https://northampton.emsicc.com/programs/nanofabrication-manufacturing-technology-aas/214379> for related careers