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| Nanotechnology Curriculum ChecklistChemistry/Bioengineering Emphasis |
| **Title** | **Course** | **Cr.** | **Pre/Co-Requisites** | **Term** | **Grade** |
| Chemistry |
| General Chemistry for Engineering 1 | CHEM 0960 | 3 |  |  |  |
| General Chemistry for Engineering 2 | CHEM 0970 | 3 | CHEM 0960 |  |  |
| Organic Chemistry 1 | CHEM 0310 | 3 | CHEM 0970 |  |  |
| Organic Chemistry 2 | CHEM 3201 | 3 | CHEM 0310 |  |  |
|  |  |  |  |  |  |
| Life Sciences |
| Foundations of Biology 1 | BIOSCI 150 | 3 |  |  |  |
| Foundations of Biology 1 | BIOSCI 160 | 3 | BIOSCI 150 |  |  |
|  |  |  |  |  |  |
| Mathematics |
| Analytical Geometry & Calculus 1 | MATH 0220 | 4 |  |  |  |
| Analytical Geometry & Calculus 2 | MATH 0230 | 4 | MATH 0220 |  |  |
| Analytical Geometry & Calculus 3 | MATH 0240 | 4 | MATH 0230 |  |  |
| Matrices & Linear Algebra | MATH 0280 | 3 | MATH 0220 |  |  |
| Differential Equations | MATH 0290 | 3 | MATH 0230 |  |  |
|  |  |  |  |  |  |
| Physics |
| Physics for Science & Engineering 1 | PHYS 0174 | 4 | *MATH 0220* |  |  |
| Physics for Science & Engineering 2 | PHYS 0175 | 4 | PHYS 0174, *MATH 0230* |  |  |
| Lab Physics for Science & Engineering | PHYS 0219 | 2 | *PHYS 0175* |  |  |
|  |  |  |  |  |  |
| General Engineering |
| Introduction to Engineering Analysis | ENGR 0011 | 3 |  |  |  |
| Engineering Computing | ENGR 0012 | 3 | ENGR 0011 |  |  |
| Materials Structures & Properties | ENGR 0022 | 3 | PHYS 0175, MATH 0230 |  |  |
| Statics & Mechanics of Materials 1 | ENGR 0135 | 3 | MATH 0230, PHYS 0174 |  |  |
| Probability & Statistics | ENGR 0021 | 3 | MATH 0230 |  |  |
| Introduction to Nanotechnology & Nanoengineering | ENGR 0240 | 3 | MATH 0230, PHYS 0175 |  |  |
|  |  |  |  |  |  |
| Electrical & Computer Engineering |
| Linear Circuits & Systems | ECE 0101 | 4 | PHYS 0175, ENGR 0012 *Math 0280, 0290* |  |  |
| Problem Solving in C++ | ECE 0301 | 3 | ENGR 0012 |  |  |
|  |  |  |  |  |  |
| Mechanical Engineering |
| Experimental Methods in MSE | MEMS 1010 | 3 | ENGR 0022 |  |  |
| Micro/Nano Manufacturing | MEMS 1057 | 3 |  |  |  |
|  |  |  |  |  |  |
| Bioengineering |
| Introductory Cell Biology 1 | BIOENG 1070 | 3 | ENGR 0012, CHEM 0120, PHYS 0175 |  |  |
| Introductory Cell Biology 2 | BIOENG 1071 | 3 | BIOENG 1070 |  |  |
| Bioengineering Thermodynamics | BIOENG 1210 | 3 | MATH 0290, PHYS 0175, CHEM 0960 |  |  |
| BIOENG Elective |  |  |  |  |  |
| BIOENG Elective |  |  |  |  |  |
| BIOENG Workshop |  | 1 |  |  |  |
|  |  |  |  |  |  |
| Program Specific |
| Nanotechnology Program Elective |  | 3 |  |  |  |
| Nanotechnology Program Elective |  | 3 |  |  |  |
| Nanotechnology Program Elective |  | 3 |  |  |  |
|  |  |  |  |  |  |
| Senior Design |
| Senior Design 1+ |  | 3 |  |  |  |
| Senior Design 2++ |  | 3 |  |  |  |
|  |  |  |  |  |  |
| Humanities & Social Sciences |
| Humanities Elective\* |  | 3 |  |  |  |
| Social Sciences Elective\* |  | 3 |  |  |  |
| Humanities/Social Sciences Elective\* |  | 3 |  |  |  |
| Humanities/Social Sciences Elective\* |  | 3 |  |  |  |
| Humanities/Social Sciences Elective\* |  | 3 |  |  |  |
| Humanities/Social Sciences Elective \* ‡ |  | 3 |  |  |  |

Upper-Level Physics: Physics courses ≥ 3-credits with course numbers > 1000

+ A senior design course offered by one of the other SSOE engineering programs is required. Alternatively, may be ENGR 1050 Product Realization, or with preapproval, a senior design project arranged with a faculty mentor and taken as ENGSCI 1801.
++ A semester-long research experience under the supervision of a faculty advisor at Pitt, not necessarily within the Swanson School of Engineering. Note that this requirement may also be fulfilled by participation in an undergraduate research program like the MCSI URP or the SURI during the summer semester.

‡A University designated writing intensive course

\*All Humanities and Social Science electives must be from the SSOE approved list. Two courses need to be in single area (see SSOE guidelines).

Italicized courses indicate co-requisites; courses must be taken prior to or concurrently.

Nanotechnology Curriculum Program Electives
Core Chemistry, Life Science and Bioengineering Course Options

**Approved Nanotechnology Electives include:**

CHEM 0310 Organic Chemistry 1

CHEM 0320 Organic Chemistry 2

CHEM 3450 Molecular Modeling and Graphics

CHEM 1410 Physical Chemistry 1

CHEM 1420 Physical Chemistry 2

CHEM 1480 Intermediate Physical Chemistry

CHEM 1130 Inorganic Chemistry

CHEM 1620 Atoms, Molecules & Materials – ‘Introduction to Nanomaterials’

PHYS 0577 Modern Physical Measurements

PHYS 1370 Introduction to Quantum Physics 1

PHYS 1371 Introduction to Quantum Physics 2

PHYS 1363 Photonics 1

PHYS 1364 Photonics 2

BIOSC 0057 Foundations of Bio. Lab 1 (1 cr.)

BIOSC 0067 Foundations of Bio. Lab 2 (1 cr.)

BIOENG 1005 RF Medical Devices and Applications of Electromagnetism in Medicine

BIOENG 1810 Biomaterials and Biocompatibility

ECE 1232 Introduction to Lasers and Optical Electronics (3 units)

ECE 1238 Digital Electronics (3 units)

ECE 1247 Semiconductor Device Theory

ECE 2295 Nano sensors

ENGR 1066 Introduction to Solar Cells and Nanotechnology

IE 1012 Manufacture of Structural Nanomaterials

MEMS 1011 Structure and Properties Lab

MEMS 1048 Analysis and Characterization at the Nanoscale

MEMS 1063 Phase Transformation

MEMS 1082 Electromechanical Sensors and Actuators

MEMS 1101 Ferrous Physical Metallurgy

MEMS 1111 Materials for Energy Generation and Storage

MEMS 1477 Thin Film Processes and Characterization

**CHEM 1, 2, and 3 must be selected from the following:**

CHEM 0310 Organic Chemistry 1

CHEM 0320 Organic Chemistry 2

CHEM 0250 Analytic Chemistry

CHEM 1250 Instrument Analysis

CHEM 1410 Physical Chemistry 1

CHEM 1420 Physical Chemistry 2

CHEM 1130 Inorganic Chemistry

BIOSC 1000 Principles of Biochemistry

BIOSC 1810 Macromolecular Structure

**LIFESCI 1 and 2 must be selected from the following:**

BIOENG 1070 Cell Biology I

BIOENG 1071 Cell Biology II

BIOSC 0150 Foundations of Biology I

BIOSC 0160 Foundations of Biology II

BIOSC 1070 Human Physiology - UHC

BIOSC 1250 Introduction to Human Physiology

HRS 1023 Human Physiology

NROSCI 1000 Intro to Neuroscience

NROSCI 1003 UHC Introduction to Neuroscience

**BIOENG 1 and 2 must be selected from the following (prerequisites must be met):**

BIOENG 0050 Workshop in Bioengineering Design (Fundamentals of SolidWorks)

BIOENG 0051 Workshop in Medical Devices (The Basics)

BIOENG 0052 Workshop in OpenSim

BIOENG 0053 Workshop in statistical Design of Experiments

BIOENG 0054 Workshop in Design for Manufacturability

BIOENG 1005 Radiofrequency Medical Devices

BIOENG 1075 [Introductory Cell and Molecular Biology Laboratory Techniques](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1075.html)

BIOENG 1095 [Special Projects](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1095.html)

BIOENG 1150 [Bioengineering Methods and Applications](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1150.html)

BIOENG 1210 [Bioengineering Thermodynamics](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1210.html) – OR MEMS 0051 (Thermodynamics)

BIOENG 1220 [Bio transport Phenomena](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1220.html)

BIOENG 1310 Linear Systems and Electronics I – OR MEMS 0031 (Linear Circuits & Systems)

BIOENG 1320 Biological Signals and Systems

BIOENG 1330 [Biomedical Imaging](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1330.html)

BIOENG 1383 [Biomedical Optical Microscopy](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1383.html)

BIOENG 1620 [Introduction to Tissue Engineering](http://webster.engr.pitt.edu/bioengineering/main/undergraduate/courses/1620.html)

BIOENG 1630 Biomechanics 1