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| Nanotechnology Curriculum ChecklistChemistry/Bioengineering Emphasis |
| **Title** | **Course** | **Cr.** | **Pre/Co-Requisites** | **Term** | **Grade** |
| Bioengineering |
| Bioengineering Elective | BIOENG | 3 |  |  |  |
| Bioengineering Elective | BIOENG | 3 |  |  |  |
|  |
| Chemistry |
| General Chemistry for Engineering 1 | CHEM 0960 | 3 |  |  |  |
| General Chemistry for Engineering 2 | CHEM 0970 | 3 | CHEM 0960 |  |  |
| Core Chemistry Course | CHEM | 3 |  |  |  |
| Core Chemistry Course | CHEM | 3 |  |  |  |
| Core Chemistry Course | CHEM | 3 |  |  |  |
|  |
| Electrical & Computer Engineering |
| Linear Circuits & Systems | ECE 0101 | 4 | PHYS 0175, ENGR 0012 *Math 0280, 0290* |  |  |
| Microelectronic Circuits & Lab | ECE 0102 | 4 | ECE 0101 |  |  |
| Problem Solving in C++ | ECE 0301 | 3 | ENGR 0012 |  |  |
|  |
| 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 |  |  |
|  |
| 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 |  |  |  |
|  |
| Life Sciences |
| Basic Life Science | LIFESCI | 3 |  |  |  |
| Basic Life Science | LIFESCI | 3 |  |  |  |
|  |
| 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 |  |  |
|  |
| Mechanical Engineering |
| Introduction to Thermodynamics | MEMS 0051 | 3 | PHYS 0175, CHEM 0960 |  |  |
| Structures of Crystals | MEMS 1053 | 3 | ENGR 0022 |  |  |
| Experimental Methods in MSE | MEMS 1010 | 3 | ENGR 0022 |  |  |
| Micro/Nano Manufacturing | MEMS 1057 | 3 |  |  |  |
|  |
| 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* |  |  |
|  |
| Program Specific |
| Nanotechnology Program Elective |  | 3 |  |  |  |
| Nanotechnology Program Elective |  | 3 |  |  |  |
| Nanotechnology Program Elective |  | 3 |  |  |  |
|  |
| Senior Design |
| Senior Design 1+ |  | 3 |  |  |  |
| Senior Design 2++ |  | 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:**

Bioengineering

BIOENG 1005 RF Medical Devices and Applications of Electromagnetism in Medicine

BIOENG 1810 Biomaterials and Biocompatibility

Biological Sciences

BIOSC 0057 Foundations of Biology Research Lab 1 (1 cr.)

BIOSC 0067 Foundations of Biology Research Lab 2 (1 cr.)

Chemistry

CHEM 0310 Organic Chemistry 1

CHEM 0320 Organic Chemistry 2

CHEM 1130 Inorganic Chemistry

CHEM 1410 Physical Chemistry 1

CHEM 1420 Physical Chemistry 2

CHEM 1480 Intermediate Physical Chemistry

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

Electrical & Computer Engineering

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

ECE 1238 Digital Electronics (3 units)

ECE 1247 Semiconductor Device Theory

General Engineering

ENGR 1066 Introduction to Solar Cells and Nanotechnology

Industrial Engineering

IE 1012 Manufacture of Structural Nanomaterials

Mechanical Engineering

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

Materials Science

MSE 2012 Computational Material Science

Physics

PHYS 0520 Modern Physical Measurements

PHYS 1370 Introduction to Quantum Mechanics 1

PHYS 1371 Introduction to Quantum Mechanics 2

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

BIOSC 1000 Biochemistry

BIOSC 1810 Macromolecular Structure & Function

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

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

Bioengineering

BIOENG 1070 Introduction to Cell Biology I

BIOENG 1071 Introduction to Cell Biology II

Biological Sciences

BIOSC 0150 Foundations of Biology I

BIOSC 0160 Foundations of Biology II

BIOSC 1070 Human Physiology - UHC

BIOSC 1250 Introduction to Human Physiology

Health & Rehabilitation Sciences

HRS 1023 Human Physiology

Neuroscience

NROSCI 1000 Introduction to Neuroscience

NROSCI 1003 UHC Introduction to Neuroscience

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

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 [Biotransport 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