



## Nanoscience 2014-2015

Nanoscience is a field based on principles related to the behavior of matter at the atomic level in chemical, biological and mechanical systems. Students completing this program will demonstrate proficiency in operating state-of-the-art materials characterization and nanofabrication equipment. They will also be able to apply the concepts of nanoscience to advanced emerging technology fields including clean energy technology, biomedical devices and high performance materials.

### Program Learning Outcomes:

- Students will apply foundational nanoscience principles to understanding and further learning about nanostructures, material properties, and engineering solutions, applying scientific literature, seminars, and webinars.
- Students will develop plausible approaches materials engineering solutions for industrial applications. These include applying characterization skills to elucidating structure, property relationships, process optimization and consistent material manufacturing.
- Students with internships and/or concurrent work experience will support fundamental Research and Development, process development, characterization (including Quality Assurance/Quality Control, Failure Analysis, etc.) and consistent/quality manufacturing practice in all sizes of high-technology firms.

### Career Opportunities:

The Nanoscience program will provide an entry point to nanotechnology related careers, foundational learning in chemistry, biology, physics, math and engineering. This program prepares students for three career paths: a two-year degree program for technicians interested in the science, engineering and manufacturing of nanotechnologies, traditional engineering transfer students desiring a concentration in nanoscience and career development for working professionals.

### Units required for Major: 50

### Units required for Certificate: 10-30

### Associate Degree Requirements:

- English proficiency: ENGL 1A, 1AH, 1S & 1T, ESLL 26 or equivalent.
- Mathematics proficiency: MATH 57, 105, 108 or equivalent.

A minimum of 90 units is required\* to include:

- Completion of one of the following general education patterns: Foothill General Education, CSU General Education Breadth Requirements or the Intersegmental General Education Transfer Curriculum (IGETC)
- Prerequisite (5 units)
- Core courses (10 units)
- Support Courses from one option (35-40 units)

\*Additional elective course work may be necessary to meet the 90-unit minimum requirement for the associate degree.

### Program Types:

**AS = Associate in Science Degree.**

**CA = Certificate of Achievement.**

**CP = Certificate of Proficiency.**

### Additional Information:

Prerequisite:

CHEM 1A General Chemistry (5 units)

### Core Courses: 10 Unit(s)

NANO 10 Introduction to Nanotechnology (5 units)

NANO 51 Applications of Nanotechnology (5 units)

### Support Courses: 35-40 Unit(s)

Select ONE option:

Nanoscience Transfer Option (40 units)

CHEM 1B General Chemistry (5 units)

CHEM 1C General Chemistry & Qualitative Analysis (5 units)

MATH 1A Calculus (5 units)

MATH 1B Calculus (5 units)

MATH 1C Calculus (5 units)

And 15 units from the following:

BIOL 1A Principles of Cell Biology (6 units)

BIOL 1D Molecular Genetics (4 units)

ENGR 45 Properties of Materials (5 units)

NANO 52 Nanomaterials & Nanostructures (5 units)

NANO 53 Nanomaterials Characterization (5 units)

NANO 54 Nanofabrication Tools & Process (5 units)

Nanoscience Workforce Option (35 units)

NANO 52 Nanomaterials & Nanostructures (5 units)

NANO 53 Nanomaterials Characterization (5 units)

NANO 54 Nanofabrication Tools & Process (5 units)

NANO 62 Nanomaterials Engineering: Structures, Processing & Characterization (5 units)

PHYS 2A\* General Physics (5 units)

PHYS 2B General Physics (5 units)

PHYS 2C General Physics (5 units)

\* PHYS 2A is recommended if the student is preparing to transfer to a four-year institution.

### Certificates:

#### Certificate of Achievement in Nanoscience

#### 30 Unit(s)

\*CHEM 1A General Chemistry (5 units) or equivalent

NANO 10 Introduction to Nanotechnology (5 units)

NANO 51 Applications of Nanotechnology (5 units)

NANO 52 Nanomaterials & Nanostructures (5 units)

NANO 53 Nanomaterials Characterization (5 units)

NANO 54 Nanofabrication Tools & Process (5 units)



\* Note: This course is a prerequisite for the remaining courses in this certificate.

Note: Minimum proficiency requirements for this certificate: ENGL 1A, ENGL 1AH, ENGL 1S & 1T or ESLL 26 and MATH 57 or 105 or 108 completed with a letter grade of "C" or better.

### **Nanocharacterization Certificate of Proficiency**

#### **15 Unit(s) [Non-Transcriptable]**

NANO 51 Applications of Nanotechnology (5 units)  
or NANO 10 Introduction to Nanotechnology (5 units)  
NANO 52 Nanomaterials & Nanostructures (5 units)  
NANO 53 Nanomaterials Characterization (5 units)

Note: Minimum proficiency requirements for this certificate: ENGL 1A, ENGL 1AH, ENGL 1S & 1T or ESLL 26 and MATH 57 or 105 or 108 completed with a letter grade of "C" or better.

### **Nanofabrication Certificate of Proficiency**

#### **15 Unit(s) [Non-Transcriptable]**

NANO 51 Applications of Nanotechnology (5 units)  
or NANO 10 Introduction to Nanotechnology (5 units)  
NANO 52 Nanomaterials & Nanostructures (5 units)  
NANO 54 Nanofabrication Tools & Process (5 units)

Note: Minimum proficiency requirements for this certificate: ENGL 1A, ENGL 1AH, ENGL 1S & 1T or ESLL 26 and MATH 57 or 105 or 108 completed with a letter grade of "C" or better.

### **Nanostructures Certificate of Proficiency**

#### **10 Unit(s) [Non-Transcriptable]**

NANO 51 Applications of Nanotechnology (5 units)  
or NANO 10 Introduction to Nanotechnology (5 units)  
NANO 62 Nanomaterials Engineering: Structures, Processing & Characterization (5 units)