

NANOSCIENCE (NANO)

Administered jointly by the Department of Chemistry and the Department of Physics, College of Engineering and Physical Sciences

Major (Honours Program)

The major will require the completion of 20.00 credits as indicated below.

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: https://www.uoguelph.ca/bsc/revised_SS (https://www.uoguelph.ca/bsc/revised_SS/)

Code	Title	Credits
Semester 1		
BIOL*1090	Introduction to Molecular and Cellular Biology	0.50
CHEM*1040	General Chemistry I	0.50
IPS*1500	Integrated Mathematics and Physics I	1.00
NANO*1000	Introduction to Nanoscience	0.50
Semester 2		
CHEM*1050	General Chemistry II	0.50
IPS*1510	Integrated Mathematics and Physics II	1.00
MATH*1160	Linear Algebra I	0.50
BIOL*1070	Discovering Biodiversity	0.50
or BIOL*1080	Biological Concepts of Health	
Semester 3		
CHEM*2060	Structure and Bonding	0.50
MATH*2270	Applied Differential Equations	0.50
NANO*2000	Synthesis and Characterization of Nanomaterials I	0.50
PHYS*2330	Electricity and Magnetism I	0.50
CHEM*2820	Thermodynamics and Kinetics	0.50
or PHYS*2240	Thermal Physics	
Semester 4		
CHEM*2070	Structure and Spectroscopy	0.50
NANO*2100	Synthesis and Characterization of Nanomaterials II	0.50
PHYS*2310	Mechanics	0.50
1.00 electives ¹		1.00
Semester 5		
NANO*3200	Nanolithographic Techniques	0.50
NANO*3500	Thin Film Science	0.50
CHEM*3860	Quantum Chemistry	0.50
or PHYS*3230	Quantum Mechanics I	
1.00 electives		1.00
Semester 6		
NANO*3300	Spectroscopy of Nanomaterials	0.50
NANO*3600	Computational Methods in Materials Science	0.50
1.50 electives		1.50
Semester 7		

NANO*4100	Biological Nanomaterials	0.50
NANO*4700	Concepts in Quantum Computing	0.50
1.50 electives		1.50

Semester 8

NANO*4200	Topics in Nanomaterials	0.50
2.00 electives		2.00

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To take PHYS*3230 Quantum Mechanics I in semester 5, PHYS*2340 Electricity and Magnetism II must be selected as an elective in semester 4.

Note: In semesters 7 and 8, the student must select to do either NANO*4900 Advanced Studies in Nanoscience or NANO*4910 Nanoscience Research Project I.

Areas of Focus

In completing the science requirements for the degree, some suggested complementary areas of focus are:

Chemistry: Inorganic

- Semester 4: CHEM*2480 Analytical Chemistry I
- Semester 5: CHEM*3640 Chemistry of the Elements I
- Semester 6: CHEM*3650 Chemistry of the Elements II
- Semester 7: CHEM*4620 Advanced Topics in Inorganic Chemistry
- Semester 8: CHEM*2700 Organic Chemistry I

Chemistry: Organic

- Semester 4: CHEM*2700 Organic Chemistry I
- Semester 5: CHEM*3750 Organic Chemistry II
- Semester 6: CHEM*3760 Organic Chemistry III
- Semester 7: CHEM*4730 Synthetic Organic Chemistry
- Semester 8: CHEM*2480 Analytical Chemistry I, CHEM*4720 Organic Reactivity

Chemistry: Physical/Analytical

- Semester 4: CHEM*2480 Analytical Chemistry I
- Semester 5: CHEM*3860 Quantum Chemistry
- Semester 6: CHEM*3430 Analytical Chemistry II: Instrumental Analysis or CHEM*3870 Molecular Spectroscopy
- Semester 7: CHEM*3440 Analytical Chemistry III: Analytical Instrumentation
- Semester 8: CHEM*3430 Analytical Chemistry II: Instrumental Analysis or CHEM*3870 Molecular Spectroscopy

Engineering

- Semester 2: CIS*1500 Introduction to Programming
- Semester 4: ENGG*2450 Electric Circuits
- Semester 5: ENGG*2410 Digital Systems Design Using Descriptive Languages, ENGG*3450 Electronic Devices
- Semester 6: ENGG*4550 VLSI Digital Design
- Semester 7: ENGG*4080 Micro and Nano-Scale Electronics

Mathematics and Statistics

- Semester 4: STAT*2040 Statistics I
- Semester 5: STAT*3100 Introductory Mathematical Statistics I
- Semester 6: MATH*2130 Numerical Methods

- Semester 7: MATH*4240 Advanced Topics in Modeling and Optimization
- Semester 8: MATH*3160 Linear Algebra II

Physics

- Semester 4: PHYS*2340 Electricity and Magnetism II
- Semester 5: MATH*2200 Advanced Calculus I, PHYS*3130 Mathematical Physics
- Semester 6: PHYS*3000 Optics: Fundamentals and Applications
- Semester 7: PHYS*4180 Advanced Electromagnetic Theory, PHYS*4240 Statistical Physics II
- Semester 8: PHYS*4040 Quantum Mechanics II, PHYS*4150 Solid State Physics

Credit Summary

(20.00 Total Credits)

Code	Title	Credits
	First year science credits	4.50
	Required science courses semesters 3 – 8	8.00
	Restricted Electives ¹	0.50-1.00
	Approved Science Electives (depending on restricted elective chosen above)	2.50-3.00
	Liberal Education Electives	1.00
	Free electives - any approved elective for B.Sc. students. (could be less if restricted electives do not count as science)	3.00
	Total Credits	20

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Either NANO*4900 Advanced Studies in Nanoscience or NANO*4910 Nanoscience Research Project I

Of the total credits required, students are required to complete 16.00 credits in science of which 2.00 credits must be at the 4000 level and an additional 4.00 credits must be at the 3000 or 4000 level.