



## Degree and Study Plan

College: Agricultural and Marine Sciences  
 Department: Soils, Water & Agricultural Engineering  
 Cohort: 2021  
 Degree: Bachelor of Science  
 Major: Soil Sciences

### Summary of Credits:

<b>University Requirements (UR)</b>	<b>6</b>
Arabic	2
Contemporary Omani State & People	2
Oman & Islamic Civilization or Islamic Culture	2
<b>University Electives (UE)</b>	<b>6</b>
See List A	
<b>College Requirements (CR)</b>	<b>29</b>
See list B	
<b>College Electives (CE)</b>	<b>9</b>
See list C	
<b>Departmental Requirements (DR)</b>	
See list D	
<b>Departmental Electives</b>	
See list E	
<b>Major Requirements (AR)</b>	<b>55</b>
See list F	
<b>Major Electives (AE)</b>	<b>21</b>
See list G	
<b>Specialization Requirements (SR)</b>	
See list H	
<b>Specialization Electives (SE)</b>	
See list I	
<b>Minor Requirements (IR)</b>	<b>3</b>
See list J	
<b>Minor Electives (IE)</b>	<b>15</b>
See list K	
<b>TOTAL</b>	<b>126</b>

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HoD: **Dr. Said Al-Ismaily**

Date: 27/7/2021

Dean's Office: **Prof. Abdullah Al-Sadi**

Date: 2-8-2021

Admission and Registration:

Date:



**DEPARTMENT OF SOIL, WATER AND AGRICULTURAL ENGINEERING**  
**SOIL SCIENCES**

**Study Plan: for Cohort 2021**

Sem.	Course	Course Title	Cr.	Pre-Requisite	Cat.
ONE FALL		Foundation Program	0		UR
	<b>TOTAL</b>		<b>0</b>		
TWO SPRING	ARAB1060	Arabic <sup>1</sup>	2		UR
	CAMS2000	Intro. CAMS	0		CR
	CAMS2003	Intro. to Food & Resource Economics	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	CR
	CHEM2101	General Chemistry I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604), FPMT(0105 or 0109)	CR
	LANC2145	Communication in Agricultural Sciences	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	CR
		University Elective	2		UE
	<b>TOTAL</b>		<b>14</b>		
THREE FALL	HIST1010	Oman & Islamic Civilization	2	=ISLM1010	UR
	LANC2146	Academic Writing in Science	3	LANC2145	CR
	PHYS2101	General Physics I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604), FPMT(0105 or 0109)	CR
		University Elective	2		UE
		University Elective	2		UE
		College Elective	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	CE
	<b>TOTAL</b>		<b>16</b>		
FOUR SPRING	SOCY1005	Contemporary Omani State & People <sup>2</sup>	2		UR
	BIOL2101	General Biology I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	CR
	CAMS3000	Seminar & Presentation Skills	2	CAMS2000, FPMT(0105 or 0109), LANC2146	CR
	CAMS3001	Biometry & Experimental Design in AMS	3	CAMS2000, FPMT(0105 or 0109), LANC2146	CR
		College Elective	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	CE
		College Elective	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	CE
	<b>TOTAL</b>		<b>17</b>		
FIVE FALL	MATH2107	Calculus I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604), FPMT(0105 or 0109)	AR
	SWAE3302	Environmental Soil Chemistry	3	CHEM2101, SWAE2201	AR
	SWAE3303	Elements of Hydrology	3	PHYS2101, SWAE(2001 or 2201)	AR
	SWAE3308	Instrumentation & Control Systems	3	PHYS2101	AR
	SWAEXXX	Major Elective	3	Check pre-requisites	AE
	<b>TOTAL</b>		<b>16</b>		
SIX SPRING	SWAE3001	GIS for Environmentalists	3	LANC 2146 or 2052 or 2058	AR
	SWAE3304	Soil & Water Conservation	3	PHYS2101, SWAE(2001 or 2201)	AR
	SWAE3315	Water Quality	3	CHEM2101, SWAE2201	AR
	SWAE3411	Environmental Soil Microbiology	3	BIOL2101	AR
	SWAEXXX	Major Elective	3	Check pre-requisites	AE
	<b>TOTAL</b>		<b>15</b>		

SEVEN FALL	ERSC2101	Introduction to Geology I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	AR
	SWAE3005	Land Surveying	3	MATH2107, PHYS2101	AR
	SWAE3311	Environmental Soil Physics	3	PHYS2101, SWAE(2001 or 2201)	AR
	SWAE3402	Irrigation Principles	3	PHYS2101, SWAE2201	AR
	SWAE4404	Soil Genesis & Classification	3	ERSC2101 or SWAE2201 + CR*	AR
	<b>TOTAL</b>		<b>16</b>		

EIGHT SPRING	CAMS4001	Management and Business Skills	3	CR*	CR
	SWAE4110	Soil & Water Tour	2	SWAE4404 + CR*	AR
	SWAE4111	Hydropedology for Soil-Water Landscape Interactions	3	SWAE(2201, 3303, 3311) + CR*	AR
	SWAEXXXX	Major Elective	3	Check pre-requisites	AE
	SWAEXXXX	Major Elective	3	Check pre-requisites	AE
	<b>TOTAL</b>		<b>14</b>		

SUMMER	SWAE4800	Soil, Water & Ag. Eng. Internship	3	After 87 Credits + CR*	AR
	<b>TOTAL</b>		<b>3</b>		

NINE FALL	SWAE4401	Water & Nutrients in Soil-Plant	3	SWAE2201 + CR*	AR
	SWAE4412	Management of Salt-Affected Soils	3	SWAE2201 + CR*	AR
	SWAE4325	Water Treatment	3	MATH2107, SWAE3315 + CR*	AE
	SWAEXXXX	Major Elective	3	Check pre-requisites	AE
	SWAEXXXX	Major Elective	3	Check pre-requisites	AE
	<b>TOTAL</b>		<b>15</b>		

\* CR - CAMS college requirements which are BIOL2101, CAMS2000, CAMS2003, CAMS3000, CAMS3001, CHEM2101, PHYS2101 or PHYS2107.

<sup>1</sup> Non-Arabic speakers should register for ARAB1019 (3 credits), offered only during fall semesters.

<sup>2</sup> Non-Omanis should register for SOCY1007 (2 credits)

# DEPARTMENT OF SOIL, WATER AND AGRICULTURAL ENGINEERING

## SOIL SCIENCES

### LIST B: College Requirements (29 Credits)

Course Code	Course Title	Cr.	Pre-Requisite	Equivalents
BIOL2101	General Biology I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	
CAMS2000	Introduction to Agricultural and Marine Sciences	0		
CAMS2003	Introduction to Food and Resource Economics	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	
CAMS3000	Seminar and Presentation Skills	2	CAMS2000, FPMT(0105 or 0109), LANC2146	
CAMS3001	Biometry and Experimental Design in AMS	3	CAMS2000, FPMT(0105 or 0109), LANC2146	
CAMS4001	Management and Business Skills	3	CR*	
CHEM2101	General Chemistry I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604), FPMT(0105 or 0109)	
LANC2145	Communication in Agricultural Sciences	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	
LANC2146	Academic Writing in Science	3	LANC2145	
PHYS2101	General Physics I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604), FPMT(0105 or 0109)	

### LIST C: College Electives (9 Credits)

Course Code	Course Title	Cr.	Pre-Requisite	Equivalents
ANVS2001	Principles of Animal Science	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)	
ANVS2002	Introduction to Veterinary Technology	3		
PLNT2515	Introduction to Plant Sciences	3		
FSHN2071	Principles of Food Science	3		
FSHN2301	Introduction to Human Nutrition and Dietetics	3		
MASF2003	Introduction to Marine Science and Fisheries	3		
SWAE2001	Introduction to Agricultural Engineering	3		
SWAE2201	Introduction to Soils and Water	3		

\* CR - CAMS college requirements which are BIOL2101, CAMS2000, CAMS2003, CAMS3000, CAMS3001, CHEM2101, PHYS2101 or PHYS2107.

# DEPARTMENT OF SOIL, WATER AND AGRICULTURAL ENGINEERING

## SOIL SCIENCES

### LIST F: Major Requirements (55 Credits)

Course Code	Course Title	Cr.	Pre-Requisite	Equivalents
ERSC2101	Introduction to Geology I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or	
MATH2107	Calculus I	4	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604), FPMT(0105 or 0109)	
SWAE3001	GIS for Environmentalists	3	LANC 2146 or 2052 or 2058	
SWAE3005	Land Surveying	3	MATH2107, PHYS2101	
SWAE3302	Environmental Soil Chemistry	3	CHEM2101, SWAE2201	
SWAE3303	Elements of Hydrology	3	PHYS2101, SWAE(2001 or 2201)	
SWAE3304	Soil & Water Conservation	3	PHYS2101, SWAE(2001 or 2201)	
SWAE3308	Instrumentation & Control Systems	3	PHYS 2101	
SWAE3311	Environmental Soil Physics	3	PHYS2101, SWAE(2001 or 2201)	
SWAE3315	Water Quality	3	CHEM2101, SWAE2201	
SWAE3402	Irrigation Principles	3	PHYS2101, SWAE2201	
SWAE3411	Environmental Soil Microbiology	3	BIOL2101	
SWAE4110	Soil & Water Tour	2	SWAE4404 + CR*	
SWAE4111	Hydropedology for Soil-Water-Landscape Interactions	3	SWAE(2201, 3303, 3311) + CR*	
SWAE4401	Water & Nutrients in Soil-Plant Environments	3	SWAE2201 + CR*	
SWAE4404	Soil Genesis & Classification	3	ERSC2101 or SWAE2201 + CR*	
SWAE4412	Management of Salt-Affected Soils	3	SWAE2201 + CR*	
SWAE4800	SWAE Internship	3	After 87 Credits + CR*	

### LIST G: Major Electives (21 Credits) \*\*

Course Code	Course Title	Cr.	Pre-Requisite	Equivalents
NREC3300	Natural Resource Economics	3	CAMS2003	
NREC4500	Agricultural Extension Methods & Techniques	3	CAMS(2003, 3000, 3001)	
SWAE3002	Desertification & Land Restoration	3	SWAE2201	
SWAE3305	Agro-climatology	3	PHYS2101	
SWAE3306	Computer Programming	3	MATH2107, PHYS(2101 or 2107)	
SWAE3310	Fundamentals of Fluid Mechanics	3	MATH2107, PHYS2101	
SWAE3325	Desalination and Membrane Technology	3	CHEM2101, MATH2107, PHYS2101	
SWAE4001	Remote Sensing of the Environment	3	SWAE3001 + CR*	
SWAE4006	Arid-zone Hydrology	3	SWAE(2001 or 2201) + CR*	
SWAE4217	Transport of Chemicals in Porous Media	3	SWAE(3303, 3311) + CR*	
SWAE4304	Modeling & Analysis of Biophysical Systems	3	PHYS2101 + CR*	
SWAE4325	Water Treatment	3	MATH2107, SWAE3315 + CR*	
SWAE4326	Modeling of Subsurface Water Resources	3	MATH2107, SWAE3311 + CR*	
SWAE4400	Ground Water Hydrology	3	SWAE3303 + CR*	
SWAE4402	Design & Management of Irrigation Systems	3	SWAE(3310, 3402) + CR*	
SWAE4902	Research Project in Soils, Water & Agricultural Engineering	3	Manual Registration, 87 credits, GPA≥2.3 + CR*	

\* CR - CAMS college requirements which are BIOL2101, CAMS2000, CAMS2003, CAMS3000, CAMS3001, CHEM2101, PHYS2101 or PHYS2107.

\*\* Courses from any Department (preferably related to a Minor) of the College of Agricultural and Marine Sciences or another College, may be selected with the approval of Academic Advisor, Head of Department and Assistant Dean of Undergraduate Studies. **No course will be approved without filling the substitution form and getting all necessary approvals prior registering any course not listed in the above degree plan.**

**DEPARTMENT OF SOIL, WATER AND AGRICULTURAL ENGINEERING****SOIL SCIENCES****LIST J: Minor Requirements (3 Credits)**

Course Code	Course Title	Cr.	Pre-Requisite
SWAE2201	Introduction to Soil and Water	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)

**LIST K: Minor Electives (15 Credits)**

Course Code	Course Title	Cr.	Pre-Requisite
SWAE3002	Desertification & Land Restoration	3	SWAE2201
SWAE3302	Environmental Soil Chemistry	3	CHEM2101, SWAE2201
SWAE3304	Soil and Water Conservation	3	PHYS2101, (SWAE2001or SWAE2201)
SWAE3311	Environmental Soil Physics	3	PHYS2101, (SWAE2001or SWAE2201)
SWAE3411	Environmental Soil Microbiology	3	BIOL2101
SWAE4111	Hydropedology for Soil-Water-Landscape Interactions	3	SWAE(2201, 3303, 3311) + CR*
SWAE4401	Water and Nutrients in Soil-Plant Environments	3	SWAE2201 + CR*
SWAE4404	Soil Genesis and Classification	3	ERSC2101 or SWAE2201 + CR*
SWAE4412	Management of Salt-Affected Soils	3	SWAE2201 + CR*

## LIST J: MINOR REQUIREMENTS

### Within CAMS (18 credits):

#### **J1. Minor in Animal Science (18 credits)**

Course Code	Course Title	Cr.	Pre-Requisite
ANVS2101	Introduction to Animal Science	3	FPOL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
<b>Five courses from the following</b>			
ANVS3208	Veterinary Immunology	3	ANVS(2101 or 2201), BIOL2101
ANVS3101	Genetics and Animal Breeding	3	ANVS(2101 or 2201), BIOL2101
ANVS3102	Animal Health	3	ANVS(2101 or 2201), BIOL2101
ANVS3104	Anatomy and Histology	3	ANVS(2101 or 2201), BIOL2101
ANVS3105	Fundamentals of Nutrition	3	(ANVS(2101 or 2201), BIOL2101
ANVS3106	Systemic Physiology	3	ANVS(2101 or 2201), BIOL2101
ANVS3107	Animal Reproductive Physiology	3	ANVS(2101 or 2201), BIOL2101
ANVS4124	Dairy and Beef Production	3	ANVS(2101 or 2201) + CR*
ANVS4102	Poultry Production	3	ANVS(2101 or 2201) + CR*
ANVS4104	Camel Physiology and Husbandry	3	ANVS(2101 or 2201) + CR*
ANVS4106	Sheep and Goat Production	3	ANVS(2101 or 2201) + CR*
ANVS4107	Animal Nutrition	3	ANVS3105 + CR*
ANVS4113	Animal Biotechnology	3	ANVS(2101 or 2201) + CR*
ANVS4111	Horse Management and Care	3	ANVS(2101 or 2201) + CR*

#### **J2. Minor in Plant Sciences (18 credits)**

Course Code	Course Title	Cr.	Pre-Requisite
PLNT2515	Introduction to Plant Sciences	3	FPOL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
PLNT3522	Plant Pathology	3	BIOL2101
PLNT3526	General Entomology	3	BIOL2101, PLNT2515
Course Code	Course Title	Cr.	Pre-Requisite
<b>CHOOSE 2 COURSES FROM FOLLOWING:</b>			
PLNT3006	Field Crop Production	3	BIOL2101, PLNT2515
PLNT3211	Ornamental Horticulture	3	BIOL2101, PLNT2515
PLNT3512	Vegetable Production	3	BIOL2101, PLNT2515
PLNT3514	Fruit Production	3	BIOL2101, PLNT2515
<b>CHOOSE 1 COURSE FROM FOLLOWING:</b>			
PLNT3006	Field Crop Production	3	BIOL2101, PLNT2515
PLNT3011	Plant Propagation	3	BIOL2101, PLNT2515
PLNT3121	Bee Keeping	3	BIOL2101, PLNT2515
PLNT3201	Agricultural Biotechnology	3	BIOL2101
PLNT3211	Ornamental Horticulture	3	BIOL2101, PLNT2515
PLNT3213	Floriculture	3	PLNT3211
PLNT3333	Plant Genetics	3	BIOL2101, PLNT2515
PLNT3512	Vegetable Production	3	BIOL2101, PLNT2515
PLNT3514	Fruit Production	3	BIOL2101, PLNT2515
PLNT3555	Mushroom Cultivation	3	PLNT3522 or FSHN3105
PLNT3666	Methods in Plant Pathology	3	PLNT3522
PLNT4115	Phytonematology	3	PLNT3522+ CR*
PLNT4444	Organic Agriculture	3	PLNT2515 + CR*
PLNT4515	Landscape Design and Management	3	PLNT3211+CR*
PLNT4523	Medical and Veterinary Entomology	3	PLNT3526+CR*
PLNT4524	Biological Control of Arthropod Crop Pests	3	PLNT3526 + CR*
PLNT4529	Pesticides in Agriculture	3	PLNT3522, PLNT3526 + CR*
PLNT4540	Arthropod Pests of Major Crops	3	PLNT3526 + CR*

PLNT4542	Diseases of Economic Crops	3	PLNT3522 + CR*
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### J3. Minor in Food Science (18 credits)

Course Code	Course Title	Cr.	Pre-Requisite
FSHN2101	Principles of Food Science	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
<b>Five courses from the following</b>			
FSHN3101	Properties of Food & Agricultural Materials	3	(FSHN2101 or SWAE2001), PHYS(2101 or 2107)
FSHN3103	Food Analysis	3	CHEM3324, FSHN2302
FSHN3104	Food Chemistry I	3	CHEM3324, FSHN2302
FSHN3105	Food Microbiology I	3	BIOL3441
FSHN3106	Food Processing I	3	FSHN2101 or SWAE2001
FSHN3107	Food Sanitation and Quality Control	3	BIOL3441, FSHN2101
FSHN3108	Food Packaging	3	FSHN3102 or PHYS2102
FSHN3109	Sensory Evaluation of Food	3	FSHN2101, CAMS3001
FSHN4107	Milk and Milk Products	3	FSHN(3104, 3105, 3106) + CR*

### J4. Minor in Human Nutrition (18 credits)

Course Code	Course Title	Cr.	Pre-Requisite
FSHN2301	Introduction to Human Nutrition and Dietetics	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
FSHN2302	Principles of Biochemistry	3	BIOL2101, CHEM2101
<b>Five courses from the following</b>			
FSHN3305	Macronutrients in Human Nutrition	3	FSHN2301, (BIOL2101 or CHEM2101)
FSHN3306	Micronutrients in Human Nutrition	3	FSHN (2302, 3305)
FSHN3307	Nutrition Assessment and Planning	3	FSHN (2301, 2302)
FSHN3111	Public Sanitation****	3	BIOL3441, FSHN2101
FSHN3309	Life Cycle Nutrition	3	FSHN (2301, 3307)
FSHN4306	Community Nutrition	3	FSHN(2301, 3307) + CR*

\*\*\*\* Students who pass FSHN3075 cannot take FSHN3111

### J5. Minor in Marine Science and Fisheries (18 credits)

Course Code	Course Title	Cr.	Pre-Requisite
MASF2003	Introduction to Marine Science and Fisheries	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
MASFXXXX	Any MASF2000/3000/4000 level courses (excluding University Electives)	15	Check pre-requisites

### J6. Minor in Natural Resource Economics (18 credits)

Course Code	Course Title	Cr.	Pre-Requisite
CAMS2003	Introduction to Food and Resource Economics	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
<b>Five courses from the following</b>			
NREC3011	Economics of Fisheries Management	3	CAMS2003
NREC3101	Marketing of Agricultural and Fisheries Products	3	CAMS2003
NREC3106	Social Survey Design and Analysis	3	CAMS(2003, 3001)
NREC3107	Food Service Systems- Operations Management	3	FSHN2072 or NREC3101
NREC3300	Natural Resource and Environmental Economics	3	CAMS2003
NREC4103	Agribusiness Entrepreneurships	3	CR*
NREC4230	Agricultural Finance	3	CR*
NREC4430	Benefit Cost Analysis	3	CR*



NREC4500	Extension Methods and Techniques	3	CR*
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### J7. Minor in Soil Sciences (18 credits)

Course Code	Course Title	Cr.	Pre-Requisite
SWAE2201	Introduction to Soil and Water	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
<b>Five courses from the following</b>			
SWAE3002	Desertification & Land Restoration	3	SWAE2201
SWAE3302	Environmental Soil Chemistry	3	CHEM2101, SWAE2201
SWAE3304	Soil and Water Conservation	3	PHYS2101, (SWAE2001or SWAE2201)
SWAE3311	Environmental Soil Physics	3	PHYS2101, (SWAE2001or SWAE2201)
SWAE3411	Environmental Soil Microbiology	3	BIOL2101
SWAE4111	Hydropedology for Soil-Water-Landscape Interactions Water-Landscape Interactions	3	SWAE(2201, 3303, 3311) + CR*
SWAE4401	Water and Nutrients in Soil-Plant Environments	3	SWAE2201 + CR*
SWAE4404	Soil Genesis and Classification	3	ERSC2101 or SWAE2201 + CR*
SWAE4412	Management of Salt-Affected Soils	3	SWAE2201 + CR*

### J8. Minor in Water Technology (18 credits)

Code	Title	Cr.	Pre-Requisite
SWAE2201	Introduction to Soil and Water	3	FPEL(0560 or 0600 or 0601 or 0602 or 0603 or 0604)
<b>Five courses from the following</b>			
SWAE3303	Elements of Hydrology	3	PHYS(2101 or 2107), SWAE(2201 or 2001)
SWAE3310	Fundamentals of Fluid Mechanics	3	MATH2107, PHYS(2101 or 2107)
SWAE3315	Water Quality	3	CHEM2101, SWAE2201
SWAE3402	Irrigation Principles	3	SWAE2201
SWAE4217	Transport of Chemicals in Porous Media	3	SWAE(3303, 3311) + CR
SWAE4305	Water Control and Supply	3	SWAE(2201, 3310)+ CR*
SWAE4325	Water Treatment	3	CHEM2101,MATH2107, SWAE3315 + CR*
SWAE4400	Ground Water Hydrology	3	SWAE3303 + CR*
SWAE4402	Design & Management of Irrigation Systems	3	SWAE(3310, 3402) + CR*

### Minors outside CAMS (18 credits):

### Minors from the College of Science

### J9. Minor in Biotechnology (18 credits)

Required Courses (7 Credits)			
Code	Course Title	Cr.	Prerequisite
BIOL2101	General Biology-I	4	FPEL 0560 or FPEL0600 or FPEL0603 or FPEL0604
BIOL3202	Molecular Biology	3	BIOL2101 + LANC2058
<b>Remaining credits from the following</b>			
BIOL3441	Introductory Microbiology	3	BIOL2101 + LANC2058
BIOL4034	Biochemistry	3	BIOL2101 & CHEM3322
BIOL4046	Fundamentals of Biotechnology	3	BIOL3202
BIOL4500	Cell Biology	3	BIOL2101
BIOL5120	Microbial Biotechnology	3	BIOL 4046 & BIOL3441
BIOL5132	Tissue Culture	3	BIOL 4046 & BIOL4500
BIOL5402	Immunology	3	BIOL4500
BIOL5040	Microbial Genetics and Genetic Engineering	3	BIOL3441

**J10. Minor in Environmental Biology (18 credits)**

Required Courses (8 Credits)			
Course Code	Course Title	Cr.	Prerequisite
BIOL2101	General Biology-I	4	FPEL 0560 or FPEL0600 or FPEL0603 or FPEL0604
BIOL2102	General Biology-II	4	BIOL2101+ LANC2058
Remaining credits from the following			
BIOL2600	Biodiversity	3	BIOL2101 + LANC2058
BIOL3005	Ecology	3	BIOL2102+ LANC2058
BIOL3205	Invertebrates	3	BIOL2102+ LANC2058
BIOL3009	Introduction to Environmental Science	3	BIOL2102+ LANC2058
BIOL3410	Angiosperm Biology	3	BIOL2102+ LANC2058
BIOL4009	Waste management	3	BIOL2102
BIOL4021	Vertebrate Zoology	3	BIOL2102
BIOL4023	Entomology	3	BIOL2102
BIOL5010	Ecotoxicology	3	BIOL3009
BIOL4054	Marine Biology	3	BIOL3005
BIOL5052	Fresh Water Biology	3	BIOL3005
BIOL5021	Desert Biology	3	BIOL3005
BIOL5610	Environmental impact assessment	3	BIOL3005

**J11. Chemistry (18 credits)**

Required Courses (12 Credits)			
Code	Title	Cr.	Pre-req./Co-req.*
CHEM2101	General Chemistry I	4	FPEL0560 or FPEL0600 or FPEL0601 or FPEL0602 FPEL0603 or FPEL0604 and (FPMT0105 or FPMT0109)
CHEM2102	General Chemistry II	4	CHEM2101 or CHEM1071
CHEM3322 or CHEM3324	Organic Chemistry I or Organic Chemistry	4 4	LANC2058 and CHEM2101 (LANC2058 or LANC2161) and (CHEM1071 or CHEM2101)
Remaining credits from the following			
Code	Title	Cr.	Pre-req./Co-req.*
CHEM2350	Chemical Safety: Protecting ourselves and the environment	3	CHEM2101 or CHEM1071 or CHEM2110
CHEM3311	Inorganic Chemistry I	3	LANC2058 and CHEM2102 and MATH2107
CHEM3328	Green Chemistry	3	LANC2058 and (CHEM3322 or CHEM3324)
CHEM3333	Physical Chemistry I	3	LANC2058 and CHEM2101 and PHYS2101 and MATH2107
CHEM3337	Fundamentals of the Corrosion of Metals	3	LANC2058 and (CHEM2101 or CHEM1071)
CHEM3348	Introduction to Chemical and Instrumental Analysis	3	CHEM2102
CHEM3350	Environmental Chemistry	3	LANC2058 and CHEM2102
CHEM3400	Introduction to Chemical Process Industries	3	LANC2058 and CHEM2101 and CHEM3333*
CHEM3420	Petroleum Chemistry	3	LANC2058 and (CHEM3322 or CHEM3324)
CHEM4412	Inorganic Materials	3	CHEM3311
CHEM4414	Fundamentals of X-ray Crystallography	3	CHEM3311
CHEM4424	Introduction to Natural Products	3	CHEM3324 or CHEM4422
CHEM4429	Fundamentals of Medicinal Chemistry and Drug Design	3	CHEM3324 or CHEM4422

CHEM4433	Physical Chemistry II	3	CHEM3333 and MATH2108
CHEM4437	Electrochemistry: Fundamentals and Applications	3	CHEM3333
CHEM4445	Forensic Chemistry	3	CHEM3341 or CHEM3348
CHEM4472	Fine Chemicals	3	CHEM3324 or CHEM4422
CHEM4477	Essentials of Biological Chemistry	3	CHEM3324 or CHEM4422
CHEM5537	Surfactants: Principles & Applications in the Petroleum Industry	3	CHEM3333 or CHPE3102
CHEM5539	Chemical Sensors	3	CHEM3333 and (CHEM3348 or CHEM4441)

## J12. Computer Science (18 credits)

Required Courses (7 Credits)			
Code	Title	Credits	Pre-Requisite / Co-Requisite*
COMP2101	Introduction to Computer Science	4	FPEL0560 or FPEL0600 or FPEL0603 or FPEL0604) and (FPCS0101 or PCS0102)
COMP2201	Fundamentals of Object Oriented Programming	3	COMP2101
Remaining credits from the following			
Code	Title	Credits	Pre-Requisite / Co-Requisite*
COMP2102	Problem Solving and Programming	3	COMP2101
COMP2105	Introduction to Problem Solving with Visual Basic	3	COMP2101
COMP3203	Introduction to Data Structures and Algorithms	3	COMP2201 and MATH3340 and LANC2058
COMP3204	Advanced Java Programming	3	COMP2201 and LANC2058
COMP3205	Database Systems	3	COMP3203 and LANC2058
COMP3302	Introduction to Multimedia	3	COMP2201 and LANC2058
COMP3401	Introduction to Software Engineering	4	COMP2201 and LANC2058
COMP3501	Computer Organization & Assembly Language	3	COMP2201 and ECCE3206 and LANC2058
COMP3502	Computer Networks	3	COMP3501 and LANC2058
COMP3600	Intelligent Systems	3	COMP3203 and LANC2058
COMP3601	Bioinformatics Algorithms	3	BIOL2101 and COMP2101
COMP3700	Introduction to Web Computing	3	COMP3203 and LANC2058 / COMP3205*
COMP4100	Ethics and Skills for Computing Professionals	2	COMP3401
COMP4202	Database Development	3	COMP3205
COMP4204	Advanced Data Structures and Algorithms	3	COMP3203 and MATH3340
COMP4205	Competitive Programming	3	COMP3203
COMP4212	Introduction to Information Retrieval	3	COMP3203
COMP4300	Computer Graphics I	3	COMP3203 and MATH2202
COMP4402	Software Testing	3	COMP3401
COMP4404	Software Project Management	3	COMP3401
COMP4471	Computational Methods	3	COMP2101 and MATH2108 and MATH2202
COMP4501	Fundamentals of Operating Systems	3	COMP3203 and COMP3501
COMP4504	Wireless Networks	3	COMP3502
COMP4506	Systems and Networks Programming	3	COMP4501 and COMP3502
COMP4603	Machine Learning	3	COMP3600 and STAT2103
COMP4604	Digital Image Processing	3	COMP3600
COMP4701	Web Application Development	3	COMP3700 and COMP3205
COMP4704	Mobile Application Development	3	COMP3700 and COMP3205
COMP5101	Comparative Programming Languages	3	COMP3203 and COMP3501
COMP5400	Software Architecture and Design	3	COMP3401
COMP5401	Requirement Engineering	3	COMP3401
COMP5504	Distributed Systems	3	COMP4506

Remaining credits from the following			
Code	Title	Credits	Pre-Requisite / Co-Requisite*
COMP5507	Cryptography and Network Security	3	COMP3203 and COMP3502
COMP5508	Interconnection Networks for Multiprocessor and Multicore Systems	3	COMP3502
COMP5509	Penetration Testing and Ethical Hacking	3	COMP4507
COMP5511	Computer Forensics	3	COMP4507
COMP5521	Finite Automata & Formal Languages	3	MATH3340
COMP5522	Compiler Construction	3	COMP3501 and COMP5521
COMP5603	Computer Vision	3	COMP4603
COMP5605	Mobile Robotics	3	COMP3600 and MATH2108
COMP5701	Web Services	3	COMP3700
COMP5702	Semantic Web	3	COMP4701
COMP5704	Web Data Mining and Knowledge Discovery	3	COMP3700 and STAT2103

### J13. Earth Science (18 credits)

Required Courses (8 Credits)			
Course Code	Course Title	Cr.	Prerequisite (Co-requisite*)
ERSC2101	Introduction to Geology I	4	FPEL0560 or FPEL0600 or FPEL0603 or FPEL0604
ERSC2102	Introduction to Geology II	4	ERSC2101
Remaining credits from the following			
ERSC2211	Palaeontology I	3	ERSC2101 and LANC2058
ERSC3000	Environmental Geology	3	ERSC2101 and LANC2058
ERSC3002	Environmental Site Assessment and Remediation	3	ERSC2102 and ERSC3000 and LANC2058
ERSC3010	Mineralogy	3	ERSC2102* and LANC2058
ERSC3021	Structural Geology	3	ERSC2102 and LANC2058
ERSC3041	Stratigraphy	3	ERSC2102 and LANC2058
ERSC3051	Igneous Petrology	3	ERSC3010 and LANC2058
ERSC3061	Introduction to Remote Sensing	3	ERSC2102 and LANC2058
ERSC3901	Sedimentary Petrology	3	ERSC2211 and ERSC3010
ERSC4012	Metamorphic Petrology	3	ERSC3051
ERSC4031	Geochemistry	3	ERSC2102 and CHEM2101
ERSC4032	Environmental Geochemistry	3	ERSC2101 and CHEM2101
ERSC4040	Geological Interpretation of Well-logs	3	ERSC3041
ERSC4051	Hydrogeology	3	ERSC3000
ERSC4071	Economic Geology	3	ERSC3051
ERSC4311	Sedimentary Environments and Facies	3	ERSC3901
ERSC4321	Structural Geology II	3	ERSC3021
ERSC5011	Basin Analysis	3	ERSC3021 and ERSC4311
ERSC5012	Techniques in Sequence Stratigraphy	3	ERSC4311
ERSC5031	Tectonics	3	ERSC3021
ERSC5051	Petroleum Geology	3	ERSC3041
ESRC5061	Exploration Geophysics	3	GEO3041
GEO3041	General Geophysics	3	ERSC2101 and PHYS2101 and MATH2107 and LANC2058

## J14. Mathematics (18 credits)

Required Courses (14 Credits)			
Code	Title	Cr	Pre-req./Co-req.*
MATH2107	Calculus I	4	FPEL0560 or FPEL0600 or FPEL 0601 or FPEL0602 or FPEL0603 or FPEL0604 and (FPMT0105 or FPMT0109)
MATH2108	Calculus II	3	MATH2107
MATH2202 <sup>†</sup>	Linear Algebra I <sup>†</sup>	3	FPEL0560 or FPEL0600 or FPEL 0601 or FPEL0602 or FPEL0603 or FPEL0604 and (FPMT0105 or FPMT0109)
MATH3110 <sup>†</sup>	Calculus III <sup>†</sup>	4	LANC2058 and MATH2108

<sup>†</sup> MATH 3171 Linear Algebra & Multivariate Calculus (3 credits; Pre-req.: MATH2108) can substitute both MATH2202 and MATH3110 above. *However, students who have passed MATH 3171 cannot take MATH 2202 or MATH 3110, and vice versa.*

Remaining credits from the following			
Code	Title	Cr	Pre-req./Co-req.*
MATH2350 or MATH3340	Foundations of Mathematic or Discrete Mathematics for Computer Sciences	3 3	MATH2107 MATH2107 and COMP2101
MATH3302 or MATH4174	Ordinary Differential Equations or Differential Equations and Applications for Engineers	3 3	LANC2058 and MATH2108 MATH2108
MATH3303	Linear Algebra II	3	LANC2058 and MATH2202
MATH3573	Graph theory	3	MATH2350 or MATH3360
MATH3744	Introduction to Mathematical Modelling	3	LANC2058 and MATH3110 and MATH3302
MATH4141	Numerical Analysis	3	MATH2202 and MATH3302
MATH4450	Real Analysis I	3	MATH2108 and (MATH2350 or MATH3340)
MATH4452	Introduction to Complex Variables	3	MATH3110 or MATH3171
MATH4453	Abstract Algebra I	3	MATH2202 and (MATH2350 or MATH3340)
MATH4473	Linear Programming	3	MATH2202 or MATH3171
MATH4474	Introduction to Partial Differential Equations	3	MATH3302
MATH4481	Introduction to Optimisation	3	MATH2108 and (MATH2202 or MATH3171)
MATH4599	Introduction to Topology	3	MATH2350
MATH5551	Fluid Dynamics	3	MATH4474
MATH5558	Introduction to Number Theory	3	MATH3340 and MATH3350 and MATH3357

**J15. Physics (18 credits)**

<b>Required Courses (14 Credits)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Cr.</b>	<b>Pre-Requisite/Co-Requisite*</b>
PHYS2101	General Physics I	<b>4</b>	FPEL0560 or FPEL0600 or FPEL0601 or
PHYS2102	General Physics II	<b>4</b>	PHYS2101 /MATH2017*
PHYS3103	Physics III	<b>3</b>	LANC2058 and PHYS2102 and MATH2107
PHYS3104	Modern Physics	<b>3</b>	LANC2058 and PHYS3103
<b>Electives (min 4 Credits)</b>			
Any other courses in Physics *		<b>4 (min)</b>	
*Excluding Physics courses offered as University Electives			

**J16. Statistics (18 credits)**

<b>Required Courses (10 Credits)</b>			
<b>Code</b>	<b>Title</b>	<b>Credits</b>	<b>Pre-Requisite / Co-Requisite*</b>
STAT2101	Introduction to Statistics	4	(FPE0560 or FPEL0600 or FPEL0601 or FPEL0602 or FPEL0603 or FPEL0604) and (FPMT0105 or PMT0109)
STAT2102	Introduction to Probability	3	STAT2101 and MATH2108*
STAT3334	Introduction to Inference	3	STAT2102 and LANC2058

<b>Remaining credits from the following</b>			
<b>Code</b>	<b>Title</b>	<b>Credits</b>	<b>Pre-Requisite / Co-Requisite*</b>
STAT3331	Operations Research I	3	STAT2101 and MATH2108 and LANC2058
STAT3335	Introduction to Sampling	3	STAT2102 and LANC2058
STAT3336	Computational Techniques in Statistics	3	STAT2102 and COMP2200 and LANC2058
STAT3338	Statistical Methods	3	STAT3334 and LANC2058
STAT4432	Regression Analysis	3	STAT3334
STAT4433	Design and Analysis of Experiments	3	STAT3338
STAT4434	Nonparametric Statistics	3	STAT3334
STAT4436	Survey Design	3	STAT3335
STAT4533	Quality Assurance and Reliability	3	STAT2102
STAT5521	Categorical Data Analysis	3	STAT3338
STAT5536	Time Series Analysis	3	STAT4432
STAT5537	Multivariate Techniques	3	STAT3334 and MATH2202 and MATH3110