

## **DEPARTMENT OF MATH and SCIENCE**

Co-Chairpersons: Stacy Phelps, M.S. Educational Technologies  
and Mike Fredenberg, M.S. Mathematics  
Deig Sandoval, Ph.D Chemistry  
A.J. Silva, PhD Environmental Science  
Ida Red Bear, M.S. Mathematics  
Merle "Misty" Brave, M.A. Science  
Charles Jason Tinant, M.S. Water Resources Engineering  
Alessandra Higa, M.S. Wildlife Biology  
Michel Melvin, M.S. Biology  
Leslie Heathershaw, Math/Science Office Manager  
Jay Roman, Technical Services Coordinator  
Misty Mousseaux, K-12 Math/Science Liaison  
Rhonda Little Boy, K-12 Outreach Liaison  
Pte Ska Poor Bear, Native Science Field Center Coordinator  
Alvin Eastman, Environmental Service Coordinator  
Alicia Provost, Secretary

Oglala Lakota College has become a regional leader in Environmental Science. Recent graduates of the baccalaureate program have entered careers with tribal agencies or entered graduate school. The construction of the new Lakota Center for Science and Technology (LCST) has allowed faculty to further expand strong undergraduate research and internship programs. The LCST hosts state of the art laboratories for Analytical Chemistry, GIS/Remote Sensing, and Wildlife Biology. At OLC, science is not just taught in a classroom setting, it incorporates extensive field experience with an emphasis on hands-on learning. All students have excellent opportunity to engage in research projects.

### **Department Mission/Purposes:**

To provide opportunities for learning Science, Math and Technology while incorporating practices that support traditional Lakota values.

### **Department Goals and Objectives:**

**Tribal:** Provide curriculum and academic experiences that infuse new knowledge to our stakeholders, and to create new and train existing professionals in science and math based positions.

**Community:** Offer formal and informal learning opportunities to our students and community members to positively influence their beliefs regarding science and math.

**Cultural:** Create an environment that supports, encourages, and respects Lakota values in all aspects of our academic, research, and outreach efforts.

**Academic:** Establish a foundation of academic excellence for our stakeholders in Science, Technology, Engineering and Math.

**Important Note to the prospective student:**

The needs and demands of the Pine Ridge reservation have evolved during the last eight years. As a result, the Math and Science Environmental Science program has undergone a series of changes to meet the changing needs of our students. We conducted an intensive program review in 2007 and reviewed our program again in 2008 to accommodate a departmental merger with the Agriculture and Natural Resources Department in 2008. As a result, we have made several important changes to our degree programs, which are summarized below. Our resulting degree programs take advantage of our faculty's diverse expertise in the fields of environmental science, water resources, agriculture, and wildlife biology, and GIS remote sensing by providing core requirements across several degree areas, and emphasis areas that allow a student to tailor a degree to his or her educational needs. Furthermore, all of our degree programs emphasize hands-on learning through student internship opportunities, bringing research into the classroom, and emphasizing geospatial understanding in resource management and protection.

**NATURAL SCIENCE AND NATURAL RESOURCES PHILOSOPHY STATEMENT**

The Lakota have always held their land base to be sacred. The land is something that must be protected and managed wisely and effectively. Consequently, OLC has developed strong programs in the areas of Natural Science and Natural Resources. The Lakota perspective is a vital component of our natural science and natural resources programs. All students enrolled in these programs are required to take specific courses that incorporate traditional Lakota concepts concerning language, land, plants, and animals.

Our departmental philosophy is to provide opportunities for learning Natural Science and Natural Resources while incorporating practices that support traditional Lakota values. Students will have the prerequisite skill set, foundation and knowledge necessary to succeed in a graduate program or in an environmental career.

***Bachelor of Science in Natural Science***

Our Bachelor of Science in Interdisciplinary Environmental Science is now called a Bachelor of Science in Natural Science to provide more wide-ranging employment opportunities for our graduates. The Bachelor of Science degree provides students with a solid foundation in the disciplines of mathematics, physical, and biological sciences needed to collaboratively solve multi-faceted environmental issues in conservation biology and earth science. The Natural Science degree provides students with necessary skills to succeed in a Master's or PhD program in the natural sciences. Furthermore, students in the Bachelor of Science in Natural Science program have abundant research internship opportunities in earth science, conservation biology, and GIS remote sensing. The degree program has two emphasis areas: conservation biology and earth science. The conservation biology option emphasizes conservation and sustainable use of wildlife and plant communities. The earth science option emphasizes GIS remote sensing, riparian ecosystems management and the appropriate development of water resources and waste management facilities.

### ***Bachelor of Science in Natural Resources***

Our Bachelor of Science in Natural Resources supports the growth of human resources on the Pine Ridge Reservation through academics, community service, and research with an emphasis on economic self-sufficiency and respect for cultural values. The Bachelor of Science in Natural Resources focuses on the holistic management of the natural resources of the Pine Ridge reservation. The Natural Resources degree has four emphasis areas: agriculture, agri-business management, and earth science and conservation biology.

#### *Learning Outcomes:*

Upon completion of the Bachelors of Science degree in Natural Science or Natural Resources students will:

- Demonstrate broad-based theoretical and technological knowledge of environmental and resource sciences.
- Demonstrate technical skills required in environmental measurement and monitoring within their emphasis area.
- Recognize a resource management, conservation biology or earth science issues and design a study using appropriate field and data analysis techniques.
- Use critical thinking skills and the scientific method in analyzing and responding to environmental and resource issues in conservation biology, earth science, or natural resources management.
- Record and communicate conservation biology, earth science or natural resources information to colleagues within the scientific community.
- Demonstrate cultural sensitivity and a knowledge base of the role of the natural world in tribal life, and develop an approach to environmental research and management that honors tribal cultural values.
- Apply techniques in communication and conflict resolution to build strong environmental policies and support among tribal and non-tribal members.
- Complete an individual research project or service-learning project related to an environmental or resource management issue.

#### *Assessment:*

The Math and Science department assesses student learning using a variety of assessment tools. These include:

- Pre/Post testing in selected courses
- Nationally normed exams (e.g. CAAP)
- Undergraduate portfolios containing written reports in the form of term papers, and research / service learning projects

### ***ASSOCIATE DEGREE PHILOSOPHY STATEMENT***

To provide opportunities for learning Science, Math and Technology while incorporating practices that support traditional Lakota values. Students will have the prerequisite skills, foundation and knowledge necessary to succeed in a four-year STEM program.

## **ASSOCIATE OF ARTS DEGREE, SCIENCE, ENGINEERING AND MATH (SEM)**

While environmental scientists can identify and help to remedy many of the ecological problems that exist on Pine Ridge Reservation, the solution, in many cases, will have to come from the engineering community. OLC has therefore developed a two-year Associate Degree in Science, Engineering and Math (SEM). Students who complete this program can then transfer to a four-year program. Recent studies have shown that Native American students who gain a strong math/science background at their local tribal college will then have a significantly higher chance of completing a four-year degree at an outside institution.

## **ASSOCIATE OF ARTS DEGREE, LIFE SCIENCE**

The same transfer concept that was used to structure the AA, SEM degree has been utilized to develop a new Associate degree in Life Science. The reasons for expanding into this area are two-fold. First, health issues are a major concern on the reservation. Students will be encouraged to explore the connection between health-related issues and the environment. Second, medical schools may be producing Native Americans to work in the health fields, but very few Native Americans actually teach in these medical/nursing programs. Our ultimate goal is to address this issue by having Native Americans complete their graduate degrees in the areas of biology, physiology, and other life science areas.

## **ASSOCIATE OF ARTS DEGREE NATURAL RESOURCES**

The Associate of Arts degree in Natural Resources provides opportunities for a new student to gain a foundational understanding and technical skills of the fields of natural resources and natural science. Graduates of the Associate of Arts in Natural Resources can seamlessly transition into either our Bachelors of Natural Science or our Bachelor of Natural Resources degrees.

### *Learning Outcomes:*

Students completing individual Associates of Arts programs will have the skills and knowledge to:

- Demonstrate theoretical and technological knowledge in their area of expertise.
- Apply mathematical and scientific concepts to real world situations and problems.
- Apply the scientific method in the field or in a laboratory setting in a professional and safe manner.
- Present information or findings in a professional manner.

### *Assessment:*

The Math and Science department assesses student learning using a variety of assessment tools. These include:

- Pre/Post testing in selected courses
- Nationally normed exams (i.e. CAAP)
- Undergraduate portfolios containing written reports in the form of term papers, and research / service learning projects

**Lakota Center for Science and Technology (LCST)**  
Dr. Deig Sandoval, Analytical Lab Manager  
Al Eastman, Environmental Services Coordinator  
Charles Jason Tinant, GIS Remote Sensing Lab Manager  
Kevin Ellis, BRIN Lab Technician

The National Science Foundation TCUP initiative has allowed OLC to build and equip three major laboratories the Lakota Center for Science and Technology. These are for GIS/Remote Sensing, Analytical Chemistry, and a Wet/Prep laboratory. The center also houses a mobile analytical laboratory and GeoProbe®. This infrastructure has significantly increased the usage of new technology at OLC.

The Analytic laboratory has received EPA certification for microbe analysis of water samples. This will allow the laboratory to analyze water samples for the Pine Ridge Rural Water agency. This will be the first commercial venture of the facility, and it will also lead to new research projects involving more undergraduate students. Several students have been trained in laboratory procedures and are employed as teaching assistants in OLC chemistry laboratory courses.

The GIS remote sensing laboratory has been a center for academic, research and community outreach programs. The GIS remote sensing has an extensive collection of geospatial imagery as well as the latest versions of ArcGIS and ERDAS IMAGINE that are available for student and community usage.

The GeoProbe® has been used to enhance Soils courses and other Earth Science classes and has been instrumental in several collaborations with other area universities. The completion of the mobile laboratory will increase the availability of many services.

The laboratories are also being used to supplement science courses. GIS is used in many of the upper level courses, and as the Analytical lab gets completed its services will be included in the curriculum as well.

## DEPARTMENT OF MATH AND SCIENCE BACHELOR OF SCIENCE IN NATURAL SCIENCE

1. Core Requirements: (30 Credits Total)	Where Taken	Date	Grade
CoSu 103 College Success	3	_____	
Engl 103 Freshman English I	3	_____	
Engl 103 Freshman English II	3	_____	
SpCm 103 Speech Communications	3	_____	
Math 163*Trigonometry*	3	_____	
MIS 113 Applied Information Processing	3	_____	
Bio 113 People and the Environment or	3	_____	
NaRs 123 Forest Principals or			
Rang 103 Range Plant Identification			
Social Science Elective	3	_____	
Humanities Elective	3	_____	
Literature Elective	3	_____	
<b>2. Lakota Studies (15 Credits):</b>			
Lak 103 Lakota Language I	3	_____	
Lak 233* Lakota Language II	3	_____	
LSoc 103 Lakota Culture (or LHist 203)	3	_____	
LSci 203 Traditional Plants, Herbs, and Foods	3	_____	
Lak Lakota Elective	3	_____	
<b>3. Natural Science Requirements (37 Credits)</b>			
Bio 154* Introductory Biology I	4	_____	
Bio 164* Introductory Biology II	4	_____	
Chem 233*		General Chemistry I	
3		_____	
Chem 231 General Chemistry I Lab	1	_____	
Chem 243*		General Chemistry II	
3		_____	
Chem 241 General Chemistry II Lab	1	_____	
Math 313*Introduction to Statistics	3	_____	
Phys 113* Survey of Physics	3	_____	
Geol 133* Environmental Geology	3	_____	
NaRs 113*		Watershed Principals	
3		_____	
Bio 223* Ecology	3	_____	
GIS 213* Introduction to GIS	3	_____	
Sci 273* Scientific Literature and Writing	3	_____	
PSc 213 Soils	3	_____	
<b>Conservation Biology Emphasis:</b>			
<b>Upper Division Core (21 Credits)</b>			
NSci 303* Integrated Environmental Science	3	_____	
Bio 303* Field Ecology	3	_____	
Bio 463* Conservation Biology	3	_____	
Biol 453* Advanced Ecology	3	_____	
Biol 463* Evolution	3	_____	
GIS 313* Applications of GIS	3	_____	
NSci 493* Senior Project	3	_____	
<b>Conservation Biology:</b>			
<b>Electives (Minimum of 18 Credits, 15 at or above 300 level)</b>			
NSci 393* Junior Research/Internship	3	_____	

Math 194*Calculus I	4
GIS 323* Remote Sensing	3
Bio 413* Mammology	3
Bio 423* Ornithology	3
Biol 413* Animal Behavior	3
Bio 453 / Rang 403* Environmental Conservation	3
Math 483*Advanced Statistics	3
Chem 423*	Laboratory Equipment
3	
NSci 483* Renewable Energy	3
NaRs 323*	Natural Resource Measurements
3	
NSci 473* Wetlands	3
Bio 443 / Rang 443 Range Ecology	3
Sci 393* Special Topics (needs approval)	3
NSci 363* Fluvial Processes and Stream Morphology	3
NSci 373* Watershed Assessment Techniques	3
	<b>Total Credits 125</b>

**Earth Science Emphasis:**

**Upper Division Core (27 Credits)**

NSci 323* Water and Wastewater Management	3
NSci 363* Fluvial Processes and Stream Morphology	3
NSci 373* Watershed Assessment Techniques	3
NSci 433* Waste Management	3
NSci 463* Groundwater	3
GIS 313* Applied GIS	3
NSci 253* Hydrology	3
Chem 423*	Laboratory Equipment
3	
NSci 493* Senior Project	3

**Earth Science:**

**Electives (Minimum of 12 Credits, 9 at or above 300 level)**

NSci 393* Junior Research/Internship	3
GIS 323* Remote Sensing	3
Math 194*Calculus I	4
NSci 303* Integrated Environmental Science	3
Chem 323 Environmental Chemistry	3
NSci 413* Air Pollution	3
Math 483*Advanced Statistics	3
NSci 483* Renewable Energy	3
NaRs 323*	Natural Resource Measurements
3	
NSci 473* Wetlands	3
Bio 303* Field Ecology	3
Bio 443 / Rang 443 Range Ecology	3
Sci 393* Special Topics (needs approval)	3
	<b>Total Credits 125</b>

\*Students must either pass an entrance exam for these courses or pass 100-level preparatory courses with a "C" or better. See catalog descriptions. Entrance exams are available from Math and Science Department members during the week of registration.

\*\*The following courses are typically offered in the fall semesters: College Algebra, Intro. Biology I, General Chemistry I & Lab and Organic Chemistry II & Lab. The following courses are typically offered in the spring semesters: Trigonometry, Survey of Physics, Intro. Biology II, General Chemistry II & Lab and Organic Chemistry I & Lab.

Science Course Sequencing:

Fall Semester 1 Math 154,	Spring Semester 2 Phys 113
Fall Semester 3 Chem 233, Chem 231, Bio 154	Spring Semester 4 Bio 164, Chem 253, Chem 251

## DEPARTMENT OF MATH AND SCIENCE BACHELOR OF SCIENCE IN NATURAL RESOURCES

	Where Taken	Date
<b>1. Core Requirements (27 Credits):</b>		
<b>Grade</b>		
CoSu 103 College Success	3	_____
Engl 103 Freshman English I	3	_____
Engl 103 Freshman English II	3	_____
SpCm 103 Speech Communications	3	_____
Math 313*Introduction to Statistics*	3	_____
MIS 113 Applied Information Processing	3	_____
Social Science Elective	3	_____
Humanities Elective	3	_____
Literature Elective	3	_____
<b>2. Lakota Studies (15 Credits):</b>		
Lak 103 Lakota Language I	3	_____
Lak 233* Lakota Language II	3	_____
LSoc 103 Lakota Culture or LHist 203, LHist 213	3	_____
LSci 203 Traditional Plants, Herbs, and Foods	3	_____
Lak Lakota Elective	3	_____
<b>3. Lower Division Core (26 Credits):</b>		
Chemistry 103 or above	3	_____
NaRs 123 Forest Principals	3	_____
Rang 103 Range Plant Identification or		
NaRs 133 Dendrology		
Psc 213 Soils	3	_____
GIS 213 Introduction to GIS	3	_____
NaRs 113 Watershed Principals	3	_____
Bio 154 Introductory Biology I	4	_____
Bio 164 Introductory Biology II	4	_____
Bio 223* Ecology	3	_____
<b>4. Lower Division Electives (15 Credits):</b>		
Natural Resources Emphasis:		
NaRs 143 Introduction to Natural Resources	3	_____
NaRs 103 Environmental Processes	3	_____
AnSc 103 Animal Science	3	_____
PSc 103 Crop Production	3	_____
Rang 113 Range Principals	3	_____
PSc 233 Weed Science	3	_____
AgEc 253 Reservation Land Use Planning	3	_____
NaRs 233 Bison Science	3	_____
Sci 273* Scientific Literature and Writing	3	_____
<b>Agri-business Electives:</b>		
AgEc 263 Farm and Ranch Management	3	_____
AgEc 243 / BAD 253 Principals of Management	3	_____
AgEc 323 / BAD 263 Principals of Marketing	3	_____
Econ 203 Principals of Macroeconomics	3	_____
BAd 133 Introduction to Business	3	_____
BAd 333 Business Letter & Report Writing	3	_____
<b>5. Upper Division Core (21 Credits):</b>		

NaRs 323 Natural Resource Measurements (SDSU Rang 325)	
3	
GIS 313 Applications of GIS	3
Bio 443 Range Ecology	3
AgEc 483 Tiospaye Practicum (Holistic Management)	
3	
NaRs 403 Environmental Conservation	3
NSci 303* Integrated Environmental Science	3
Bio 303* Field Ecology	3

**6. Upper Division Electives (21 Credits):**

Earth Science Emphasis:	
NSci 253* Hydrology	3
NSci 323* Water and Wastewater Management	3
NSci 363* Fluvial Processes and Stream Morphology	3
NSci 373* Watershed Assessment Techniques	3
GIS 323* Remote Sensing	3
NSci 483* Renewable Energy	3
NSci 473* Wetlands	3

**Conservation Biology Emphasis**

Bio 413* Mammology	3
Bio 423* Ornithology	3
Biol 413* Animal Behavior	3
Bio 463* Conservation Biology	3
Biol 453* Advanced Ecology	3
Biol 463* Evolution	3
NSci 393* Junior Research/Internship	3

**Agriculture Emphasis**

PSc 303 Forage Production	3
AnSc 403 Beef Science	3
AnSc 413 Equine (Horse) Science	3
Rang 413 Range Improvement (SDSU Rang 415)	3
NaRs 403 Introduction to Tourism	3

**Agri-business Management Emphasis**

AgEc 413 / BAD 363 Business Finance	3
Acct 213* Principles of Accounting II	3
BAd 373* Grant Proposal Writing & Management	3
BAd 363 Business Finance I	3

**Total Credits 125**

\*Students must either pass an entrance exam for these courses or pass 100-level preparatory courses with a "C" or better. See catalog descriptions. Entrance exams are available from Math and Science Department members during the week of registration.

\*\*The following courses are typically offered in the fall semesters: College Algebra, Intro. Biology I, General Chemistry I & Lab and Organic Chemistry II & Lab. The following courses are typically offered in the spring semesters: Trigonometry, Survey of Physics, Intro. Biology II, General Chemistry II & Lab and Organic Chemistry I & Lab.

## DEPARTMENT OF MATH AND SCIENCE ASSOCIATE OF ARTS IN NATURAL RESOURCES

1. Core Requirements: (21 Credits)	Where Taken	Date
<b>Grade</b>		
CoSu 103 College Success	3	_____
Engl 103 Freshman English I	3	_____
Engl 113 Freshman English II	3	_____
SpCm 103 Speech Communications	3	_____
MIS 113 Applied Information Processing	3	_____
Math 103 Elementary Algebra	3	_____
Social Science Elective	3	_____
Note: Science Elective is filled in Science Requirements		

<b>2. Lakota Studies Requirements: (9 Credits)</b>		
Lak 103 Lakota Language I	3	_____
LSoc 103 Lakota Culture or LHist 203, LHist 213	3	_____
LSci 203 Traditional Plants, Herbs, and Foods or AgEc 253 Reservation Land Use Planning	3	_____

<b>3. Science Core: (15 Credits)</b>		
Chem 1xx Chemistry 103 or above	3	_____
NaRs 123 Forest Principals	3	_____
Rang 103 Range Plant Identification or NaRs 133 Dendrology		
Psc 213 Soils	3	_____
GIS 213 Introduction to GIS	3	_____
NaRs 113 Watershed Principals	3	_____

**4. Departmental Electives: (15 Credits)**  
The departmental electives are designed to transfer into one of two emphasis areas: BS Natural Science or BS Natural Resources. Students who are looking for an agri-business education may wish to take the cross-listed business classes offered below.

BS Natural Science Emphasis:		
Geol 133 Environmental Geology	3	_____
Bio 154 Introductory to Biology I	4	_____
Bio 164 Introductory to Biology II	4	_____
Chem 233 General Chemistry I	3	_____
Chem 231 General Chemistry Lab I	1	_____

BS Natural Resources Emphasis:		
NaRs 143 Introduction to Natural Resources	3	_____
NaRs 103 Environmental Processes	3	_____
AnSc 103 Animal Science	3	_____
PSc 103 Crop Production	3	_____
Rang 113 Range Principals	3	_____
PSc 233 Weed Science	3	_____

Agri-Business Emphasis:		
AgEc 263 Farm and Ranch Management	3	_____
AgEc 243 / BAD 253 Principals of Management	3	_____
AgEc 323 / BAD 263 Principals of Marketing	3	_____
Econ 203 Principals of Macroeconomics	3	_____

Total Credits –60

**DEPARTMENT OF MATH AND SCIENCE**  
**ASSOCIATE OF ARTS IN SCIENCE, ENGINEERING AND MATH (SEM)**

	Where Taken	Date	Grade
<b>1. Core Requirements: (25 Credits)</b>			
CoSu 103 College Success	3	_____	_____
Engl 103 Freshman English I	3	_____	_____
Engl 113 Freshman English II	3	_____	_____
SpCm 103 Speech Communications	3	_____	_____
Math 154 College Algebra*	4	_____	_____
Social Science Elective	3	_____	_____
Humanities Elective	3	_____	_____
Technical Science Elective**	3	_____	_____
<b>2. Lakota Studies Requirements: (9 Credits)</b>			
Lak 103 Lakota Language I	3	_____	_____
LSoc 103 Lakota Culture or LHist 203, LHist 213	3	_____	_____
Lakota Elective	3	_____	_____
<b>3. Math and Science Requirements***: (31 Credits)</b>			
Math 163 Trigonometry	3	_____	_____
Math 194 Calculus I	4	_____	_____
Math 214 Calculus II	4	_____	_____
Math 224 Calculus III	4	_____	_____
Phys 214 Physics I*	4	_____	_____
Phys 223 Physics II	3	_____	_____
Phys 221 Physics II Lab	1	_____	_____
Chem 233 General Chemistry I*	3	_____	_____
Chem 231 General Chemistry Lab I	1	_____	_____
Chem 243 General Chemistry II	3	_____	_____
Chem 241 General Chemistry Lab II	1	_____	_____

**Total Credits – 65**

\*Students must either pass an entrance exam for these courses or pass 100-level preparatory courses with a “C” or better. See catalog descriptions. Entrance exams are available from Math and Science Department members during the week of registration.

\*\*Technical Science Elective should transfer into the student’s intended bachelor’s degree course of study. Must be approved by academic advisor and chair of the Department of Math and Science.

\*\*\*The following courses are typically offered in the fall semesters: Survey of Chemistry, Calculus I, Calculus III, Physics II & Lab and General Chemistry I & Lab. The following courses are only offered in the spring semesters: Survey of Physics, Trigonometry, Calculus II, Physics I and General Chemistry II.

Science Course Sequencing:

Fall Semester 1 Math 154 or Math 163	Spring Semester 2 Phys 113
Fall Semester 3 Chem 233, Chem 231	Spring Semester 4 Math 194, Chem 243, Chem 241
Fall Semester 5 Math 214, Phys 214,	Spring Semester 6 Tech. Sci. Elect, Math 224, Phys 223, Phys 221

## DEPARTMENT OF MATH AND SCIENCE ASSOCIATE OF ARTS IN LIFE SCIENCES

### 1. Core Requirements (22 Credits):

Grade	Where Taken	Date
CoSu 103 College Success	3	_____
Engl 103 Freshman English I	3	_____
Engl 113 Freshman English II	3	_____
SpCm 103 Speech Communications	3	_____
Math 154 College Algebra*	4	_____
Psy 103 General Psychology	3	_____
Humanities Elective	3	_____

Note: Science Elective is filled in Science Requirements

### 2. Lakota Studies Requirements (9 Credits):

Lak 103 Lakota Language I	3	_____
LSoc 103 Lakota Culture	3	_____
Lak Lakota Elective	3	_____

### 3. Math and Science Requirements\*\* (35 Credits):

Math 163 Trigonometry	3	_____
Math 194 Calculus I	4	_____
Phys 214 Physics I*	4	_____
Bio 154 Introductory to Biology I	4	_____
Bio 164 Introductory to Biology II	4	_____
Chem 233 General Chemistry I*	3	_____
Chem 231 General Chemistry Lab I	1	_____
Chem 243 General Chemistry II	3	_____
Chem 241 General Chemistry Lab II	1	_____
Chem 253 Organic Chemistry I	3	_____
Chem 251 Organic Chemistry Lab I	1	_____
Chem 263 Organic Chemistry II	3	_____
Chem 261 Organic Chemistry Lab II	1	_____

**Total Credits – 66**

\*Students must either pass an entrance exam for these courses or pass 100-level preparatory courses with a “C” or better. See catalog descriptions. Entrance exams are available from Math and Science Department members during the week of registration.

\*\*The following courses are typically offered in the fall semesters: Calculus I, Intro. Biology I, General Chemistry I & Lab and Organic Chemistry II & Lab. The following courses are typically offered in the spring semesters: Survey of Physics, Trigonometry, Physics I, Intro. Biology II, General Chemistry II & Lab and Organic Chemistry II & Lab.

## CHEMISTRY COURSES

Chem 103 Survey of General Chemistry

Prerequisite: Math 134 and CoSu 103.

An introduction to inorganic chemistry stressing basic concepts and the language of chemistry.

3 Credits.

Chem 113 Chemistry for the Health Sciences

Prerequisites: Math 134 completed with a grade of "C" or better.

Introduces the basic concepts of general and organic chemistry helpful for nursing students. Lecture topics will include, but not be limited to Scientific Measurements, Chemical (Inorganic and Organic) Nomenclature, Molar and Percentage Mathematics, Reactions, and a study of Solutions (including pH) as well as discussions of aliphatic and aromatic organic compounds. The instructional approach of Chem 113 will emphasize how these differing chemical concepts affect the human body. Chem 113 does not satisfy the requirements for Chem 233.

3 credits

Chem 111 Chemistry for Health Sciences I Laboratory

Prerequisites: Concurrent registration in Chem 113

Reinforces, in a practical format, the concepts and ideas introduced in Chem 113. Topics will include, but not be limited to, scientific concepts of weights and measures, gas law equations and calculations, solution calculations (including molar and pH), percentage mathematics, and thermodynamic predictions and calculations.

1 credit

Chem 123 Chemistry for Health Sciences II

Prerequisites: Chem 113 and Chem 111 completed with a grade of "C" or better.

Introduces and analyzes concepts of organic and biochemistry helpful for nursing students. Lecture topics will include, but not be limited to, alkyl and functional groups of organic compounds, macromolecules (including enzymes), heredity, metabolism and nutrition. The approach of Chem 123 will emphasize how these differing chemical concepts affect human body, specifically human anatomy, physiology and health. Chem 123 cannot be used as a substitute for Chem 233.

3 credits

Chem 231 Experimental General Chemistry Lab I

Prerequisite: Must be taken concurrently with Chem 233, or permission of instructor.

The fundamentals of chemical laboratory techniques and practice, the behavior of chemical compounds and quantitative measurements illustrating the laws of chemical combinations.

1 credit

Chem 233 General Chemistry I

Prerequisite: Math 154 or above, Chem 103 or an acceptable score on the chemistry placement examination, all courses with a grade of "C" or better, or permission of instructor.

An in-depth survey of inorganic chemistry. This course stresses the concepts and language of chemistry, including periodic properties, reactions, mathematics and algebraic manipulation of existing formulas, physical chemistry, and environmental issues dealing with the topic of atmospheric gases and surface groundwater. Chem 231 must be taken concurrently.  
3 credits

Chem 241 Experimental General Chemistry Lab II

Prerequisites: Must be taken concurrently with Chem 243, or permission of instructor.

Laboratory work will complement the topics covered in Chem 243.

1 credit

Chem 243 General Chemistry II

Prerequisite: Chem 233 and Chem 231 both completed with a grade of "C" or better, or permission of instructor. An advanced study of inorganic chemistry.

Topics include: in-depth mathematical formulas of chemistry and their manipulation, acid-base chemistry, complex reactions and their prediction, thermodynamics, nuclear chemistry, metallurgy, and an introduction to organic chemistry. Chem 241 must be taken concurrently. 3 credits

Chem 251 Organic Chemistry Lab I

Prerequisite: Must be taken concurrently with Chem 253, or permission of instructor.

Laboratory work will complement the topics covered in Chem 253.

1 credit

Chem 253 Organic Chemistry I

Prerequisites: Chem 233 and Chem 231, both with a grade of "C" or better, or permission of instructor.

This is an introduction to organic chemistry. Topics will include nomenclature of aliphatic and basic aromatic compounds and their derivatives, reaction predictions with industrial and environmental applications, chemical properties and synthesis, and an introduction to biochemistry. Chem 251 must be taken concurrently. 3 credits

Chem 261 Experimental Organic Chemistry Lab II

Prerequisite: Must be taken concurrently with Chem 263, or permission of instructor.

Laboratory work will complement the topics covered in Chem 263.

1 credit

Chem 263 Organic Chemistry II

Prerequisite: Chem 253 and Chem 251 both completed with a grade of "C" or better, or permission of instructor. Designed to be sequential with Chem 253,

topics will include: chemistry of carbon compounds, isomerism, an introduction to nucleophilic substitution and elimination reactions, and a further examination of certain biochemistry principles such as the study of carbohydrates, lipids and proteins, including their role in metabolic reactions. Chem 261 must be taken concurrently.

3 credits

Chem 323 Environmental Chemistry

Prerequisite: Chem 243 and Math 154, both completed with a grade of "C" or better, or permission of instructor. A study of the chemical nature of air, water, and earth. Some of the specific topics will include ozone layer, greenhouse effect, radioactivity, acid rain, nutrient cycles, and ecosystems.  
3 credits

The following Chemistry courses are required in the Physical Science Secondary Education degree program:

Chem 351 Organic Chemistry for Educators Lab I

Prerequisite: Must be taken concurrently with Chem 353, or permission of instructor.

Laboratory work will complement the topics covered in Chem 353. A methodology component is included.

1 credit

Chem 353 Organic Chemistry for Educators I

Prerequisites: Chem 233 and Chem 231, both with a grade of "C" or better, or permission of instructor.

This is an introduction to organic chemistry. Topics will include nomenclature of aliphatic and basic aromatic compounds and their derivatives, reaction predictions with industrial and environmental applications, chemical properties and synthesis, and an introduction to biochemistry. Chem 351 must be taken concurrently. A methodology component is included.

3 credits

Chem 361 Organic Chemistry for Educators Lab II

Prerequisite: Must be taken concurrently with Chem 363, or permission of instructor.

Laboratory work will complement the topics covered in Chem 263. A methodology component is included 1 credit

Chem 363 Organic Chemistry for Educators II

Prerequisite: Chem 353 and Chem 351 both completed with a grade of "C" or better, or permission of instructor. Designed to be sequential with Chem 353, topics will include: chemistry of carbon compounds, isomerism, an introduction to nucleophilic substitution and elimination reactions, and a further examination of certain biochemistry principles such as the study of carbohydrates, lipids and proteins, including their role in metabolic reactions. Chem 361 must be taken concurrently. A methodology component is included. 3 credits

Chem 423 Laboratory Equipment

Prerequisites: Phys 113, Chem 243, Chem 241, Math 154 all completed with a grade of "C" or better, or permission of instructor

This course gives students exposure to analytical laboratory equipment used in the environmental sciences. Students will have opportunities to analyze soil, and water samples for contaminants using analytical instrumentation at the Lakota Center for Science and Technology, which may include: mass-spectrometer with gas chromatograph (GC-MS), ion chromatograph (IC), x-ray diffraction (XRD), x-ray fluorescence (XRF), atomic absorption (AA) flame and/or furnace.

3 credits

## **LIFE SCIENCE COURSES**

### Bio 103 Human Biology

Prerequisite: CoSu 103. This course provides an introduction to human biology, including the evolution, natural history, and ecology of humans. Emphasis is placed on what the biological sciences have to say about maintaining human health. Native American views of health are also discussed. 3 credits

### Bio 113 People and the Environment

Prerequisite: CoSu 103

This course focuses on the role of people in ecosystems and the global effects of their alterations of those ecosystems. The influence of European and Native American cultures on people's activities in the ecosystem will be discussed. Alternatives for human survival and the well being and sustainability of the biosphere will be explored. 3 credits

### Bio 154 Introductory Biology I

Prerequisite: Engl 113, SpCm 103

This course begins with basic chemistry of life and proceeds through cell structure and function to animal embryology, plant life cycles, hormonal and environmental influenced growth processes, structure of roots, stems, leaves and animal physiology are studied. The laboratory covers use of the microscope and other elementary lab equipment. Students will conduct experiments that demonstrate principles discussed in lecture. Slides of structures and organisms, as well as preserved specimens, will be used to illustrate comparative morphology and function in plants and animals. (3,2)

4 credits

### Bio 164 Introductory Biology II

Prerequisite: Engl 113, SpCm 103 completed with a grade of "C" or better.

The second semester emphasizes ecological and evolutionary concepts, including genetics and plant and animal diversity. The lab allows students to conduct experiments that demonstrate principles covered in lecture. Dissections of representative invertebrate and vertebrate organisms will be used to illustrate comparative anatomy within the animal kingdom. (3,2)

4 credits

### Bio 204 Basic Microbiology

Prerequisite: Bio 154, Chem 113 (or above)

A survey course of bacteriology and immunology for allied health students. Emphasis is on bacterial anatomy, physiology and genetics; immune response and medical applications. The laboratory demonstrates common clinical procedures involved in the isolation and identification of the bacteria. (3,2)

4 credits

### Bio 223 Ecology

Prerequisite: Bio 164 and Chem 103 (or above), both completed with a grade of "C" or better, or permission of instructor.

The study of the interrelationship of living organisms and the environment. Topics include interactions at the population, community, and ecosystem levels; the study of energy flow, and nutrient cycling within these systems. Included also is the study of the geologic, hydrologic, and atmospheric processes involved in the maintenance of life on earth, with emphasis on the importance of human actions to promote sustainability and health of natural processes.

3 credits

### Bio 224 Human Anatomy and Physiology I

Prerequisite: A 100-level biology course and Engl 113 are recommended. Chem 113, and Chem 111 must be taken concurrently (if necessary).

Systematic study of gross anatomy and normal homeostasis functions of the human body. Systems studies include the skeletal, muscular and nervous systems. The laboratory is used to demonstrate these concepts through dissection and physiological experiments and demonstrations. (3,2)

4 credits

### Bio 234 Human Anatomy and Physiology II

Prerequisite: Bio 224 completed with a grade of "C" or better.

A continuation of Bio 224. Systems studied will include cardiovascular, respiratory, digestive, urinary, reproductive and endocrine systems. (3,2)

4 credits

### Bio 303 Field Ecology

Prerequisite: Bio 154, Bio 164, Math 313, with a grade of "C" or better, or permission of instructor.

This is a field course surveying the basic research methods used in sampling, and describing characteristics of plant and animal populations and communities. Emphasis will be placed on grassland, forest, wetland, and riparian systems in Southwest South Dakota.

3 credits

### Bio 413 Mammalogy

Prerequisite: Math 313, Bio 223 and Bio 303, all completed with a grade of "C" or better, or permission of instructor. A study of the classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of mammals. Emphasis is placed on species of the Great Plains ecosystem.

3 credits

### Bio 423 Ornithology

Prerequisite: Math 313, Bio 233, Bio 333, all completed with a grade of "C" or better, or permission of instructor. A study of the classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. Emphasis is placed on species of the Great Plains ecosystem.

3 credits

### Bio 443 Range Ecology (Co-listed as Rang 443)

Prerequisite: Bio 333, all completed with a grade of "C" or better, or permission of instructor.

A study of the dynamics and structure of range plants and animals upon each other, and the area on which they are living including the effects of human-related activities. Special emphasis is given to the role of herbivores on species composition and distribution of plant communities.

3 credits

### Bio 453 Environmental Conservation (Co-listed as NaRs 403 - previously NaRs 203)

Prerequisite: Permission of instructor.

An ecological approach to conservation that considers man's present and past impact on world environments; wise use of natural resources, including soil, water, air, forest, rangelands, energy, wildlife, and fisheries.

3 credits

#### Bio 463 Conservation Biology

Prerequisite: Math 314, and Bio 413, Bio 423 or Bio 443, all completed with a grade of "C" or better, or permission of instructor. A study of the principles and practices associated with the maintenance of maximum biodiversity and stability of ecosystems throughout the world. The importance of retaining genetic variability in wild populations is examined.

3 credits

#### Biol 413 Animal Behavior

Prerequisites: Bio 223, Math 313, or permission of the instructor

This course will present a biological perspective on the behavior of organisms from invertebrates through humans. Environmental and innate components of behavior will be discussed. Emphasis will be placed on social systems and the understanding of human behavior through comparative analyses with related social vertebrate species.

3 Credits

#### Biol 453 Advanced Ecology

Prerequisites: Bio 223, Bio 303, Math 313, or permission of the instructor

This course will build on information presented in general ecology, focusing on the ecology of South Dakota, with discussion of status and threats to those ecosystems. A research project will be undertaken in which the student designs a study investigating some aspect of wildlife or ecosystem interactions. Research may involve study of a local plant or animal population to better understand its ecological requirements or the investigation of a habitat and the interactions of plant and animal populations in that ecosystem.

3 Credits

#### Biol 463 Evolution

Prerequisites: Bio 223, or permission of the instructor

This course will present the history of the development of the theory of natural selection and evolution as first elucidated by Charles Darwin and Alfred Wallace. The concurrent work of Mendel will be discussed as well as more modern developments in areas of genetics, molecular biology, sociobiology, paleontology, and anthropology.

3 Credits

## **Science**

#### Sci 204 Integrated Science for the Elementary Teacher I

Prerequisite: Math 134 and a core science class.

A course designed to acquaint the pre-service elementary teacher with the scientific method and basic processes and concepts of science through the use of published articles in addition to the text. The latest scientific discoveries and current thinking in science education will be discussed. A writing component will consist of reacting to the assigned articles. A completed science fair project is required.

4 credits

Sci 214 Integrated Science for the Elementary Teacher II

Prerequisite: Sci 204 completed with a grade of "C" or better.

This course is a continuation of Sci 204 and will further stress the scientific method and basic processes of science through the study of specific concepts of physical and biological sciences. A writing component will consist of reacting to recent scientific and science education articles followed by class discussion. The display of a science fair project is required.

4 credits

Sci 273 Scientific Literature and Writing

This course will have two foci: 1) reading and interpreting current scientific literature selected from a cross section of mainstream journals, and (2) presentation, written and orally, of research results in accepted scientific style. Research data will be either original student work or supplied by the instructor. Students will write one technical manuscript suitable for submission to a refereed journal.

3 credits

Sci 290/490 Special Topics in Science

A study of selected topics in science. Topics will change each semester and may be repeated for credit. Credit may vary from one (1) to (4) credits. When taken at the 200 level, it is expected that the student will do sophomore level work. A 400 level implies a senior level course with extensive work expected.

## **NATURAL SCIENCE**

NSci 253 Hydrology

Prerequisite: Chem 231, Geol 133, and NaRs 113 completed with a grade of "C" or better, or permission of instructor.

This course introduces the hydrologic cycle and focuses on precipitation and surface flow. The following topics will be covered and quantitative techniques applied to: precipitation, including causes, duration and measurement; infiltration and soil-water processes; evapotranspiration; surface runoff; and flow systems, including rivers, channels and impoundments. Basic concepts in fluid mechanics such as pressure, friction and pressure head will also be addressed.

3 credits

NSci 303 Integrated Environmental Science

Prerequisite: Completion of LSci 203 and Engl 113 with grades of "C" or better, or permission of instructor.

This course will cover an interdisciplinary approach to the study of environmental sciences. The Western science of ecology and earth sciences, traditional Lakota and other indigenous knowledge and perspectives are examined. These topics are presented with consideration of the social, economic and political aspects of environmental issues.

3 credits

NSci 323 Water and Wastewater Management

Prerequisite: Math 154, Chem 233 and Chem 231, all completed with a grade of "C" or better, or permission of instructor.

A study in the biological treatment of sewage and wastewater. Students will be introduced to water treatment techniques and processes, including water and wastewater sampling and analysis techniques. Students will learn how to perform basic process balances to determine adequacy of system components. 3 credits

#### NSci 373 Watershed Assessment Techniques

Prerequisites: Math 154, Chem 233 and Chem 231, EnS 253 and EnS 363, all completed with a grade of "C" or better, or permission of instructor.

Students will use various watershed and stream evaluation techniques to characterize and quantify stream health and stream morphology. This is an extensive field course that includes taking and analyzing measurements and recording field data.

3 credits

#### NSci 393 Junior Research/Internship

Prerequisite: Junior status in the Environmental Science Program and approval of advising instructor and Department Chairperson.

Closely supervised research project or work at an approved site where experience will be gained directly related to environmental science.

3 credits

#### NSci 413 Air Pollution

Prerequisite: Chem 253 and Chem 251, and EnS 243, all completed with a grade of "C" or better, or permission of instructor.

This course explores the causes of natural and anthropogenic causes of air pollution. Topics covered will include the chemistry of air pollution, dispersion of pollutants in the atmosphere, and the effects of air pollution on biota and the environment. An overview of laws and the regulations used to regulate emissions from stationary as well as mobile sources will be presented. Indoor air pollution and noise pollution will be discussed. Finally, the course will address the effects of pollution on the atmosphere itself.

3 credits

#### NSci 433 Waste Management

Prerequisites: NSci323, Geol 113, Chem 323, Math 163 all completed with a grade of "C" or better, or permission of instructor

Waste management discusses the proper treatment and/or storage of solid waste, industrial and municipal wastewater, and water quality issues in rivers and lakes. Students will use mass balance approaches and other analytical techniques to find steady-state solutions to contamination, solid waste, and wastewater problems. 3 credits

#### NSci 463 Groundwater

Prerequisite: Chem 233 and Chem 231, Math 154, EnS 253, and Geol 133, all completed with a grade of "C" or better, or permission of instructor.

This course involves a study of subsurface water quality and water flow. Topics will include migration of water through the vadose zone, soil moisture, ground water recharge, flow through aquifers, methods of measuring flow direction and velocity. Chemical interaction between the ground water aquifer and ground water will be discussed, along with the factors effecting the rate of contaminate migration in ground water and soils. A laboratory portion of the class may include the use of the Geoprobe® to drill and complete monitoring wells.

3 credits

### NSci 473 Wetlands

Prerequisites: NSci363, Geol 113, Chem 323, Math 163 all completed with a grade of "C" or better, or permission of instructor

Wetlands are critical in the life cycles of avian, amphibian and rare floral species on the Pine Ridge Reservation and northern Great Plains. Furthermore, wetlands are protected under federal law. Wetlands covers the fundamental processes contributing to the unique nature of wetland ecosystems; as well as the various functions and values associated with wetlands. This class focuses on the hydrologic, geochemical, microbial processes, and delineation of wetlands.

3 credits

### NSci 483 Renewable Energy Technologies

Prerequisite: Completion of Math 154 and Phys 113 with grades of "C" or better, or permission of instructor.

This course will provide an introduction to renewable energy technologies, primarily solar photovoltaic, wind power generation, efficient building design and materials, and passive solar heating. Renewable energy system design and installation will be covered, including load analysis, system sizing and location, and installation and monitoring. Stand-alone and grid- systems will be covered.

3 credits

### NSci 493 Senior Project

Prerequisite: Senior status and approval of advising instructor and Department Chairperson.

Senior Thesis involving experimental design, field or lab implementation, data analysis, and conclusions.

3 credits

## **GEOLOGY**

### Geol 133 Environmental Geology

Prerequisite: CoSu 103 (or test-out, or permission of instructor)

A study of the earth's processes involved in the shaping of the earth. Topics include rocks and minerals, landforms, plate tectonic theory, and a survey of geological processes acting at the surface of the Earth such as wind, rivers, glaciers, ground water and the sea. This course will also allow students to examine how human activities influence the Earth's physical environment. A laboratory component will be included. (2,2). 3 credits

## **GIS/GPS**

### GIS 213 Introduction to GIS

Prerequisite: none

Geographic Information Systems (GIS) are essential to the solution of many types of management, planning, environmental and applied research problems. This online course is designed to provide dedicated students, instructors/tribal members or teachers with a basic understanding of current mapping technology. Course participants will learn how to independently understand, analyze, and present spatial data. Participants will gain knowledge to apply simple geospatial techniques for their own work. The core of the class will be an online ESRI certification for Basic ArcView8. ESRI is the leading maker of GIS software. 3 credits

### GIS 313/513 Applications of GIS

Prerequisite: none

Students will create maps and study local South Dakota areas. Geographic Information Systems (GIS) and Global Positioning Systems (GPS) are important for a variety of fields, such as management, Lakota leadership, planning, environmental and applied research. This course is designed to provide dedicated students, instructors/tribal members or teachers with a hand-on understanding of current mapping technology. Course participants will learn how to obtain, understand, analyze, and present spatial data. Participants will gain project oriented knowledge to apply simple geospatial techniques for their own work or personal projects.

3 credits

### GIS 323 Remote Sensing - Viewing our land from space

Prerequisite: none

Satellite data and image classifications are an important part in many segments of today's society. This challenging course rewards the student with an insight on current remote sensing systems, focusing in on the digital image processing techniques utilized to analyze remotely sensed imagery. Students will study classification methods of multi-spectral remotely sensed data including Landsat TM, orthophoto, and Digital Globe imagery. The course emphasizes the use of ERDAS IMAGINE, ArcGIS, and Google Earth applications to view, classify, create and update GIS and remote sensed data applicable to the Pine Ridge reservation.

3 credits

## **MATHEMATICS COURSES**

### Math 083 Basic Mathematics I

Prerequisite: None

This course is intended for those students who need a review of basic computational skills as indicated by the Math placement test. Topics include addition, subtraction, multiplication, and division with whole numbers, decimals, and fractions. Also covered are order of operations and problem solving.

3 credits

### Math 093 Basic Mathematics II

Prerequisite: An acceptable score on the math placement examination or a grade of "pass" in Math 083

This course is intended for those students who need a review of more advanced computational skills as indicated by the Math placement test. Topics include ratio/percent, measurement, unit conversion, introduction to algebra and geometry.

3 credits

### Math 103 Elementary Algebra

Prerequisite: An acceptable score on the math placement examination or a grade of "pass" in Math 093

This course prepares students for Intermediate Algebra. Topics covered include the Real number system, solving linear equations, formulas, graphing, exponents and polynomials.

3 credits

### Math 134 Intermediate Algebra

Prerequisite: Math 103 with a grade of "C" or better, or an acceptable score on the mathematics placement examination. This course prepares the student for College Algebra. Topics covered in this course are the basic rules of algebra, properties of real numbers, order and absolute value, integer exponents, radicals and rational exponents, polynomials and special products, factoring, the graphs of lines on the Cartesian plane and fractional expressions.

4 credits

### Math 154 College Algebra

Prerequisite: Math 134 with a grade of "C" or better, or an acceptable score on the mathematics placement examination, or permission of instructor. Topics include functions and their graphs, including polynomial and rational functions, exponential and logarithmic functions. Absolute value equations and inequalities; compounds inequalities; complex numbers; systems of second degree equations and inequalities; conic sections; matrices and determinants as well as mathematical induction and the Binomial Theorem are included.

4 credits

### Math 163 Trigonometry

Prerequisite: Math 154 with a grade of "C" or better, or an acceptable score on the mathematics placement examination. Math 154 may be taken concurrently but only with permission of instructor.

Topics include trigonometric functions of real numbers and their graphs; inverse trigonometric functions; solutions of triangles and applications thereof; trigonometric identities and equations; polar coordinate system, graphing in polar coordinates, complex numbers and DeMoivre's Theorem.

3 credits

### Math 194 Calculus I

Prerequisites: Math 163 completed with a grade of "C" or better, or an acceptable score on the calculus qualifying examination, or permission of instructor.

A study of plane analytic geometry, limits, derivatives of algebraic and elementary transcendental functions, differentiation, anti-differentiation, and integration of algebraic and trigonometric functions with applications in each area. 4 credits

### Math 214 Calculus II

Prerequisites: Math 194 completed with a grade of "C" or better, or an acceptable score on the calculus qualifying examination, or permission of instructor.

Continuation of Math 194 for transcendental functions, integration techniques, infinite series and sequences, indeterminate forms, improper integrals, parametric equations, and polar coordinates.

4 credits

### Math 224 Calculus III

Prerequisite: Math 214, with a grade of "C" or better, or permission of instructor.

A continuation of Math 214. Study includes polar coordinates, parametric equations, vector-valued functions, functions of multiple variables, multiple integrals and line and surface integrals. Topics also covered are level curves, gradients, cylindrical and spherical coordinates.

4 credits

### Math 263 Discrete Structures

Prerequisite: Math 154 completed with a grade of "C" or better, IT 203, permission of instructor.

This course covers fundamental topics in data structures and discrete mathematics. The topics are presented in an integrated manner that provides the discrete math foundations for data structures and computing applications of discrete mathematics concepts. Topics covered include stacks, queues, linked lists, trees, algorithms for searching and sorting, finite state automata, and concepts of computability and decidability. Topics from discrete math include sets and various types of relations (functions, graphs, trees, lattices), recursion and inductive proofs, Boolean logic, relational algebra, predicate calculus, series and limits, and asymptotic behavior of searching and sorting algorithms. Programming exercises are assigned throughout the course.

3 Credits

#### Math 313 Introduction to Statistics

Prerequisite: Math 134 completed with a grade of "C" or better, or permission of instructor.

Topics include samples and populations, distributions, descriptive statistics, probability and statistical inference, experimental design, correlation and linear regression, and questionnaire methods. A lab portion of the course will introduce students to the use of computer-based statistical programs to solve problems in elementary statistics.

4 credits

#### Math 324 Geometry for Educators

Prerequisite: Math 163 completed with a grade of "C" or better, or permission of instructor

A formal approach to Euclidean Geometry involving points, lines, planes, basic constructions, polygons, circles and three-dimensional figures. Logic, reasoning, direct and indirect proofs in two-column and paragraph form will be integrated where appropriate. A methodology component is included. 4 credits

#### Math 323 Math for Elementary Teachers I

Prerequisite: Math 134 completed with a grade of "C" or better.

This course covers the first part of the mathematics content taught in elementary schools. This course - along with Math 333 - is required for all bachelor degree education majors. Topics include problem solving, sets and functions, the study of numeration systems, basic operations (properties and algorithms) and whole numbers, integers and rational numbers; and elementary number theory.

3 credits

#### Math 333 Math for Elementary Teachers II

Prerequisite: Math 323 completed with a grade of "C" or better.

This course covers the second part of the mathematics content taught in elementary schools. Topics include probability and statistics, problem solving, measurement, properties of geometric shapes, coordinate geometry, and transformational geometry.

3 credits

#### Math 343 Matrix Theory and Linear Algebra

Prerequisite: Math 214 with a grade of "C" or better.

Matrix algebra, systems of linear equations, determinants, vector algebra and geometry in Euclidean 3-space, eigenvalues, eigenvectors. Vector spaces,

subspaces, bases, and dimension. Linear transformations, representation by matrices, nullity, rank, isomorphism.  
3 credits

#### Math 483 Advanced Statistics

Prerequisites: Math 154, Math 313, both passes with a 'C' or better

This course builds upon basic statistical concepts, including: numerical descriptions of quantitative data, probability distributions, and inferences about data parameters. Correlation and regression analyses, analysis of variance, and experimental design will be treated, as will non-parametric statistical methods. Examples will be drawn from various research data sets. Hypothesis testing will be emphasized.

3 credits

#### Math 290/490 Special Topics in Math

A study in selected topics in mathematics. Topics may change each semester and may be repeated for credit. Credits may vary from one (1) to four (4) credits. When taken at the 200 level, it is expected that the student will do sophomore level work. A 400 level implies a senior level course with extensive work expected.

### **PHYSICS COURSES**

#### Phys 113 Survey of Physics

Prerequisites: Math 163 completed with a grade of "C" or better, or permission of instructor.

This course is designed to cover broad topics such as mechanics, states of matter, wave motion, electricity and magnetism. Focus will be given to development of students critical thinking skills. Students will be challenged to apply these skills to conceptual type situations as well as problems that require a fundamental knowledge of college level algebra.

3 credits

#### Phys 214 Physics I

Prerequisites: Phys 113 completed with a "C" or better or an acceptable score on a Physics I qualifying examination and prior/concurrent registration in Math 214.

The basic physics principles of Newton's laws of motion and the conservation laws concerning momentum, energy and angular momentum are applied to the linear and curvilinear motion of particles, simple harmonic motion and the rotation of rigid bodies. An introduction to relativity and quantum concepts will also be included.

4 credits

#### Phys 223 Physics II

Prerequisite: Phys 214, completed with a grade of "C" or better, and at least concurrent registration in Math 224, or permission of instructor.

This is a continuation of the basic physical principles covered in Physics I, which extends to magnetic fields, and electric fields. Charged particles and electrical current are covered as well as basic DC and AC circuits. Gaussian surfaces, resistance, capacitance, and magnetic induction are studied. Extensive calculus is used.

3 credits

#### Phys 221 Physics II Laboratory

Prerequisites: Physics 223 is to be taken concurrently.

A hands on introduction to physical phenomena. Experiments will be performed in kinematics, force, freefall, projectile motion, friction, rotational motion, electrostatics and magnetic fields, simple ac/dc circuits, and optics. The experiments supplement the work in Phys 214, and Phys 223.

1 credit

Physics 253 Astronomy

Prerequisite: Phys 113 completed with a "C" or better.

Covers topics in contemporary astronomy that explores the nature, methods, and limitations of scientific inquiry to understand the structure and evolution of the Universe. This includes the history of astronomy, motions of the night sky, the solar system, stellar evolution, galaxies, and cosmology.

3 credits

Physics 434 Modern Physics

Prerequisite: Physics 224 with a grade of 'C' or better.

Covers topics in thermodynamics (such as temperature, heat, laws of thermodynamics, and the kinetic theory of gases) and modern physics (such as relativity; models of the atom; quantum mechanics; and atomic, molecular, solid state, nuclear, and particle physics).

4 credits

The following Physics courses are required in the Physical Science Secondary Education degree program:

Phys 324 Physics II for Educators

Prerequisite: Phys 214, completed with a grade of "C" or better, and at least concurrent registration in Math 224, or permission of instructor.

This is a continuation of the basic physical principles covered in Physics I, which extends to magnetic fields, and electric fields, light and optics. A methodology component is included. Extensive calculus is used.

4 credits

Phys 321 Physics for Educators Lab

Prerequisites: Physics 324 is to be taken concurrently.

A hands-on introduction to physical phenomena. Experiments will be performed in kinematics, force, freefall, projectile motion, friction, rotational motion, electrostatics and magnetic fields, simple ac/dc circuits, and optics. The experiments supplement the work in Phys 214, and Phys 323.

1 credit