MICHIGAN STATE UNIVERSITY
University Committee on Curriculum

SUBCOMMITTEE A – AGENDA

Via Zoom
TUESDAY, April 16, 2024
1:30 p.m.

PART I – NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

1. Request to change the requirements for the **Bachelor of Science** degree in **Food Science** in the Department of Food Science and Human Nutrition.

   The concentrations in the Bachelor of Science degree in Food Science are noted on the student's academic record when the requirements for the degree have been completed.

   a. Under the heading **Requirements for the Bachelor of Science Degree in Food Science** make the following changes:

      (1) In the **Food Business and Industry** concentration, add the following courses in item (2):

HB	265	Hospitality Food Service Systems I	3
HB	347	Hospitality Supply Chain Process	3
HB	358	Hospitality Entrepreneurship	3
HB	365	Hospitality Foodservice Systems II	3
HB	409	Introduction to Wine	3
HB	411	Hospitality Beverages	3

      (2) In the **Food Technology** concentration, delete the following courses in item (2):

HB	100	Introduction to Hospitality Business	2
HB	267	Management of Food and Beverage Systems	3

      Add the following courses:

HB	100	Introduction to Hospitality Business	3
HB	347	Hospitality Supply Chain Process	3
HB	358	Hospitality Entrepreneurship	3
HB	365	Hospitality Foodservice Systems II	3
HB	411	Hospitality Beverages	3

   Effective Fall 2024.

COLLEGE OF ENGINEERING

1. Request to establish a **Minor** in **Smart Agricultural Systems** in the Department of Department of Biosystems and Agricultural Engineering. The University Committee on Undergraduate Education (UCUE) recommended approval of this request at its March 7, 2024 meeting.

   a. **Background Information**:

      The overall purpose of the Minor in Smart Agricultural Systems (SAS) is to provide students with an understanding of current digital and emerging technologies such as artificial intelligence, machine learning, Internet of Things (IoT), sensors and automation that support modern, sustainable, productive, and resilient agriculture. The SAS Minor is a crosscutting minor providing broader employment opportunities to students in
      engineering majors. Students completing the minor will have the ability to:
      identify current and emerging technologies that monitor, measure, and analyze agriculture, food, fiber, feed, and bioenergy systems; and identify, develop, and deploy technological solutions for agricultural systems to improve system efficiency, sustainability, and resiliency.

      Engineering technology and innovations have contributed to transforming agriculture into a highly productive and efficient sector of the U.S. economy. In 2021, the agrifood sector contributed roughly $1.264 trillion to the U.S. gross domestic product (GDP), a 5.4% share (USDA ERS). Total U.S. agricultural exports were valued at $177 billion in 2021, more than any other sector of the

economy. Innovations such as the diesel engine, rural electrification, and agricultural mechanization have played a significant role in transforming agriculture and increasing farm productivity. In the early 1900s, nearly 2/3 of the 135 million U.S. population was engaged in farming. Today, this number is less than 5% while creating more than 10% of total U.S. employment in the agrifood related industries. The National Academy of Engineers (NAE) has listed agricultural mechanization as the 7th most significant engineering achievement of the 20th Century.

Global agrifood system faces many challenges including population growth, climate change, rapid urbanization, and diet transformation. It is expected that by the year 2100 the global population will reach 10.9 billion with Africa and Asia comprising more than 80% of the population. It is also projected that by 2050 the global middle class will increase to 70% resulting in a significant increase in demand for animal protein. According to the Global Harvest Initiative 2014 Gap Report (GHI, 2014), by 2030 demand for poultry will increase by 63%, milk by 55% and meat by 44%. Producing this extra amount will require land, water, and energy resources that are already limited. For example, agricultural land will shrink to 0.17 ha/capita in 2025 from 0.44 ha/capita in1960. It is also expected that by 2030 energy demand will increase by 50% (IEA) and water by 30% (IFPRI). Clearly, to meet the growing demand, global agriculture will need to be productive, efficient, resilient, and sustainable. Emerging engineering technologies and innovations such as artificial intelligence, data analytics, sensors and sensing(including remote sensing), Internet of Things (IoT), automation, robotics and drone technologies hold much promise in meeting these challenges.

The objective of the proposed Minor in Smart Agricultural Systems is to prepare engineering majors in Applied Engineering Sciences, Biosystems Engineering, Computational Data Science, Computer Engineering, Computer Science, Electrical Engineering, and Mechanical Engineering for the rapidly evolving smart ag industry.

b. **Academic Programs Catalog Text**:

The Minor in Smart Agricultural Systems, which is administered by the Department of Biosystems and Agricultural Engineering, is designed to serve students with majors in Applied Engineering Sciences, Biosystems Engineering, Computational Data Science, Computer Engineering, Computer Science, Electrical Engineering, and Mechanical Engineering who are interested in smart technology for management decision support and who plan to pursue careers in agriculture or natural resources. The minor will provide an opportunity for students to gain a working knowledge of digital technologies necessary to monitor and manage aspects of agriculture, food, natural resources, and bioenergy systems.

With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. At least 10 unique credits counted towards the requirements for a student's minor must not be used to fulfill the requirements for that student's major.

Students who plan to complete the requirements of the minor should consult the Smart Agricultural Systems minor program coordinator in the Department of Biosystems Engineering and have their program of study approved in advance and in writing.

Requirements for the Minor in Smart Agricultural Systems

Students must complete a minimum of 16 credits from the following:

				CREDITS
1.	All of the following courses (10 credits):			
	BE`	221	Introduction to Smart Agriculture	1
	BE	321	Principles of Precision Agriculture	3
	BE	421	Sensors and Robotics for Agricultural Systems	3
	BE	422	Crop Modeling and Optimization	3
2.	Two of the following courses (6 or 7 credits):			
	BE	449	Human Health Risk Analysis for Engineering Controls	3
	BE	456	Electric Power and Control	3
	BE	481	Water Resources Systems Analysis and Modeling	3
	BE	482	Engineering Ecological Treatment Systems	3
	CSE	404	Introduction to Machine Learning	3
	CSE	440	Introduction to Artificial Intelligence	3
	CSE	480	Database Systems	3
	CSE	482	Big Data Analysis	3

CSS	467	Bioenergy Feedstock Production	3
ECE	416	Digital Control	3
ECE	417	Robotics	3
ECE	431	Smart Sensor Systems	3
ECE	434	Autonomous Vehicles	3
ECE	477	Microelectronic Fabrication	3
ME	417	Design of Alternative Energy Systems	3
ME	451	Control Systems	4
ME	456	Mechatronic System Design	3

Effective Fall 2024.

2. Request to change the requirements in the **Master of Science** degree in **Computer Science** in the Department of Computer Science and Engineering. The University Committee on Graduate Studies (UCGS) will consider this request at its April 15, 2024 meeting.

   a. Under the heading **Requirements for the Master of Science Degree in Computer Science** make the following changes:

      (1) Under the heading **System Design and Analysis**, add the following courses:

CSE	834	Advanced Topics in Automated Vehicles	3
CSE	893	Selected Topics in System Design and Analysis	3

      (2) Under the heading **Theory and Algorithms** add the following course:

CSE	894	Selected Topics in Theory and Algorithms	3

      Delete the following course:

CSE	836	Probabilistic Models and Algorithms in Computational Biology	3

      (3) Under the heading **Data Analysis and Applications** add the following courses:

CSE	850	Advanced Topics in Adversarial Machine Learning	3
CSE	851	Genetic Programming	3
CSE	895	Selected Topics in Data Analysis and Applications	3

      Delete the following courses:

CSE	843	Language and Interaction	3
CSE	872	Advanced Computer Graphics	3

Effective Spring 2025.

3. Request to change the requirements in the **Doctor of Philosophy** degree in **Computer Science** in the Department of Computer Science and Engineering. The University Committee on Graduate Studies (UCGS) will consider this request at its April 15, 2024 meeting.

   a. Under the heading **Requirements for the Doctor of Philosophy Degree in Computer Science** make the following changes:

      (1) Under the heading **System Design and Analysis**, add the following courses:

CSE	834	Advanced Topics in Automated Vehicles	3
CSE	893	Selected Topics in System Design and Analysis	3

      (2) Under the heading **Theory and Algorithms** add the following course:

CSE	894	Selected Topics in Theory and Algorithms	3

Delete the following course:

CSE	836	Probabilistic Models and Algorithms in Computational Biology	3

(3) Under the heading **Data Analysis and Applications** add the following courses:

CSE	850	Advanced Topics in Adversarial Machine Learning	3
CSE	851	Genetic Programming	3
CSE	895	Selected Topics in Data Analysis and Applications	3

Delete the following courses:

CSE	843	Language and Interaction	3
CSE	872	Advanced Computer Graphics	3

Effective Spring 2025.

COLLEGE OF HUMAN MEDICINE

1. Request to change the requirements for the **Master of Public Health** degree in **Public Health** in the College of Human Medicine. The University Committee on Graduate Studies (UCGS) will consider this request at its April 15, 2024 meeting.

The concentrations in the Master of Public Health degree in Public Health are noted on the student's academic record when the requirements for the degree have been completed.

a. Under the heading **Requirements for the Master of Public Health Degree in Public Health** make the following change:

(1) Change all 'HM' required courses to 'PH'.

(2) Add the following concentrations:

Data Management and Analytics Concentration
Provides students with the data management and analytic skillset needed to effectively utilize a variety of public health and health care data sources for applied public heath practice and research purposes, while integrating a data equity framework into all aspects of this work. Students completing this concentration will possess the skills to access, manage, assess, analyze, and report findings from a myriad of data sources commonly used in public health such as, vital records, surveys, surveillance, and in the healthcare delivery setting such as, administrative claims data, electronic medical records data. These concentration courses will prepare MPH students with the applied skills needed to pursue careers in public health positions which require skills in data management and analyses.

All the following courses (9 credits):

PH	826	Data Management in Public Health Practice	3
PH	878	Applied Biostatistics for Public Health Practitioners	3
PH	829	Public Health and Healthcare Delivery Data	3

Rural Public Health Concentration
Provides students with sufficient skills and knowledge to effectively work as public health leaders and practitioners in rural communities, both globally and domestically. Students completing this concentration will develop an understanding of how unique social, cultural, political, and environmental characteristics of rural communities, as well as structural, systemic, and historical influences, affect everything from rural health and well-being to public health and health care delivery, policy development, collaborative opportunities, and advocacy strategies. Courses in the concentration will prepare MPH students with a unique set of applied skills needed to pursue careers in rural public health.

All the following courses (9 credits):

PH	830	Foundations of Rural Public Health	3
PH	834	Drivers of Rural Health	3
PH	839	Rural Public Health Policy and Advocacy	3

Effective Fall 2024.

COLLEGE OF NATURAL SCIENCE

1. Request to change the requirements for the **Bachelor of Science** degree in **Neuroscience** in the College of Natural Science.

   a. Under the heading **Requirements for the Bachelor of Science Degree in Neuroscience** replace item 3. with the following:

a.	One of the following groups of courses (8 or 9 credits):				
	(1)	BS	161	Cell and Molecular Biology	3
		BS	162	Organismal and Population Biology	3
		BS	171	Cell and Molecular Biology Laboratory	2
	(2)	BS	181H	Honors Cell and Molecular Biology	3
		BS	182H	Honors Organismal and Population Biology	3
		BS	191H	Honors Cell and Molecular Biology Laboratory	2
	(3)	LB	144	Biology I: Organismal Biology	4
		LB	145	Biology II: Cellular and Molecular Biology	5
b.	One of the following groups of courses (7 or 8 credits):				
	(1)	CEM	141	General Chemistry	4
		CEM	142	General and Inorganic Chemistry	3
	(2)	CEM	151	General and Descriptive Chemistry	4
		CEM	152	Principles of Chemistry	3
	(3)	CEM	181H	Honors Chemistry I	4
		CEM	182H	Honors Chemistry II	4
	(4)	LB	171	Principles of Chemistry I	4
		LB	172	Principles of Chemistry II	3
c.	One of the following courses (1 credit):				
	CEM	161L		Chemistry Laboratory I	1
	LB	171L		Introductory Chemistry Laboratory	1
	CEM	185H		Honors Chemistry Laboratory I	2
d.	Both of the following courses (6 credits):				
	CEM	251		Organic Chemistry I	3
	CEM	252		Organic Chemistry II	3
e.	One of the following groups of courses (6 or 8 credits):				
	(1)	PHY	221	Studio Physics for Life Scientists I	4
		PHY	222	Studio Physics for Life Scientists II	4
	(2)	PHY	231	Introductory Physics I	3
		PHY	232	Introductory Physics II	3
	(3)	PHY	183	Physics for Scientists and Engineers I	4
		PHY	184	Physics for Scientists and Engineers II	4
	(4)	PHY	193H	Honors Physics I-Mechanics	4
		PHY	294H	Honors Physics II-Electromagnetism	4
	(5)	LB	273	Physics I	4
		LB	274	Physics II	4
f.	One of the following courses (3 or 4 credits):				
	MTH	124		Survey of Calculus I	3
	MTH	132		Calculus I	3
	MTH	152H		Honors Calculus I	3
	LB	118		Calculus I	4
g.	One of the following courses (3 or 4 credits):				
	STT	201		Statistical Methods	4
	STT	231		Statistics for Scientists	3
	STT	421		Statistics I	3
	STT	464		Statistics for Biologists	3

h.	Both of the following courses (8 credits):				
	BMB	401	Comprehensive Biochemistry		4
	PSY	101	Introductory Psychology		4
i.	One of the following groups of courses (4 or 8 credits):				
	(1)	PSL	310	Physiology for Pre-Health Professionals	4
	(2)	PSL	431	Human Physiology I	4
		PSL	432	Human Physiology II	4
k.	All of the following courses (15 credits):				
	NEU	101	Frontiers in Neuroscience		1
	NEU	301	Introduction to Neuroscience I		3
	NEU	302	Introduction to Neuroscience II		3
	NEU	311L	Neuroscience Laboratory (W)		2
	NEU	401	Cellular and Molecular Neuroscience		3
	NEU	402	Behavioral and Cognitive Neuroscience		3
l.	One of the following courses (3 or 4 credits):				
	NEU	403	Communication in Neuroscience (W)		3
	LB	492	Senior Seminar (W)		4
m.	Complete a minimum of 3 credits from the following:				
	NEU	310	Psychology and Biology of Human Sexuality		3
	NEU	416	Development of the Nervous System Through the Lifespan		3
	NEU	417	Instrumental Methods of Analysis in Neuroscience		3
	NEU	420	Neurobiology of Disease		3
	NEU	440	Synaptic Transmission		3
	NEU	450	The Autonomic Nervous System		3
	NEU	460	Current Approaches in Molecular and Cellular Neuroscience		3
	NEU	492	Special Topics in Neuroscience		1 to 3
	PHM	422	Fundamentals of Neuropharmacology		2
	PHM	431	Pharmacology of Drug Addiction		3
n.	One of the following courses (3 or 4 credits):				
	IBIO	341	Fundamental Genetics		4
	MMG	409	Eukaryotic Cell Biology		3

Effective Fall 2024.

2. Request to change the name of **the Bachelor of Arts** degree in **Computational Mathematics** to **Computational Mathematics and Applied Mathematics** in the Department of Mathematics.

   No new students are to be admitted to the Bachelor of Arts degree in Computational Mathematics effective Fall 2024. No students are to be readmitted to Bachelor of Arts degree in Computational Mathematics effective Fall 2024. Effective Fall 2029, coding for the Bachelor of Arts degree in Computational Mathematics will be discontinued and the program will no longer be available in the Department of Mathematics. Students admitted to the bachelor's degree prior to Fall 2024 will be awarded a Bachelor of Arts degree in Computational Mathematics in the Department of Mathematics. Students admitted to the bachelor's degree Fall 2024 and forward will be awarded a Bachelor of Arts degree in Computational Mathematics and Applied Mathematics in the Department of Mathematics.

3. Request to change the requirements for the **Bachelor of Arts** degree in **Computational Mathematics and Applied Mathematics** in the Department of Mathematics.

   a. Under the heading **Computational Mathematics and Applied Mathematics** make the following changes:

      (1) In item 1., delete the following statement:

      Students who are in the teacher certification program are required to complete Mathematics 330 or 432 and Statistics and Probability 430.

      (2) Replace item 3. with the following:

      a. The following courses outside the Department of Mathematics (27 credits):
         (1) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or integrative biology.
         (2) One of the following courses (4 credits):

	CEM	141	General Chemistry	4
	CEM	151	General and Descriptive Chemistry	4
	CEM	181H	Honors Chemistry I	4
	LB	171	Principles of Chemistry I	4

(3) One of the following courses (4 or 5 credits):

PHY	183	Physics for Scientists and Engineers I	4
LB	273	Physics I	4
PHY	173	Studio Physics for Scientists and Engineers I	5
PHY	193H	Honors Physics I – Mechanics	4

(4) At least 2 credits in laboratory in biological science, chemistry, entomology, microbiology, physiology, plant biology, or integrative biology from the following:

(5) A minimum of 6 credits beyond the university requirements in courses from the College of Arts and Letters or the College of Social Science approved by the student's academic advisor.

(6) One of the following groups of courses (8 credits):

(a)	CSE	231	Introduction to Programming I	4
	CSE	232	Introduction to Programming II	4
(b)	CMSE	201	Computational Modelling and Data Analysis I	4
	CMSE	202	Computational Modelling and Data Analysis II	4

b. The following courses from the Department of Mathematics:

(1) One course from each of the following groups (11 or 12 credits):

(a)	MTH	132	Calculus I	3
	MTH	152H	Honors Calculus I	3
	LB	118	Calculus I	4
(b)	MTH	133	Calculus II	4
	MTH	153H	Honors Calculus II	4
	LB	119	Calculus II	4
(c)	MTH	234	Multivariable Calculus	4
	MTH	254H	Honors Multivariable Calculus	4
	LB	220	Calculus III	4

(2) One of the following groups (4 or 7 credits):

(a)	MTH	299	Transitions	4
	MTH	309	Linear Algebra I	3
(b)	MTH	299	Transitions	4
	MTH	314	Matrix Algebra with Computational Applications	3
(c)	MTH	317H	Honors Linear Algebra	4

(3) Completion of one of the following groups of courses (12 credits):

(a) **Differential Equations and Numerical Methods**

(i) One of the following courses:

MTH	235	Differential Equations	3
MTH	340	Ordinary Differential Equations I	3
MTH	347H	Honors Ordinary Differential Equations	3

(ii) One of the following courses:

MTH	320	Analysis I	3
MTH	327H	Honors Introduction to Analysis	3

(iii) The following course:

MTH	451	Numerical Analysis I	3

(iv) One of the following courses:

MTH	441	Ordinary Differential Equations II	3
MTH	442	Partial Differential Equations	3
MTH	452	Numerical Analysis II	3

(b) **Probability and Discrete Mathematics**

(i) The following course:

STT	441	Probability and Statistics I: Probability	3

(ii) One of the following courses:

MTH	320	Analysis I	3
MTH	327H	Honors Introduction to Analysis	3

(iii) Both of the following courses:

MTH	481	Discrete Mathematics I	3
MTH	482	Discrete Mathematics II	3

(c) **Applied Algebra and Discrete Mathematics**

(i) One of the following courses:

MTH	310	Abstract Algebra I and Number Theory	3
MTH	418H	Honors Algebra I	3

(ii) All of the following courses:

MTH	416	Introduction to Algebraic Coding	3
MTH	481	Discrete Mathematics I	3
MTH	482	Discrete Mathematics II	3

(d) **Mathematical Machine Learning**

(i) One of the following courses:

MTH	320	Analysis I	3
MTH	327H	Honors Introduction to Analysis	3

(ii) All of the following courses:

MTH	483	Mathematical Machine Learning	3
STT	441	Probability and Statistics I: Probability	3
STT	442	Probability and Statistics II: Statistics	3

(4) Both of the following courses (6 credits):

MTH	415	Applied Linear Algebra	3
MTH	496	Capstone in Mathematics (W)	3

(5) Complete five elective courses from the following lists of electives with at least two from the ***Mathematics Electives*** list. All courses listed may only be used if not being used to meet a course requirement in requirement (3) above (15 to 20 credits):

Mathematics Electives

MTH	310	Abstract Algebra	3
Or			
MTH	418H	Honors Algebra I	3
MTH	320	Analysis I	3
or			
MTH	327H	Honors Introduction to Analysis	3
MTH	411	Abstract Algebra II	3
or			
MTH	419H	Honors Algebra II	3
MTH	416	Introduction to Algebraic Coding	3
MTH	417	Topics in Number Theory	3
MTH	421	Analysis II	3
or			
MTH	429H	Honors Real Analysis	3
MTH	425	Complex Analysis	3
MTH	441	Ordinary Differential Equations II	3
MTH	442	Partial Differential Equations	3
MTH	451	Numerical Analysis I	3
MTH	452	Numerical Analysis II	3
MTH	457	Introduction to Financial Mathematics	3
MTH	461	Metric and Topological Spaces	3
MTH	481	Discrete Mathematics I	3
MTH	482	Discrete Mathematics II	3
MTH	483	Mathematical Machine Learning	3

Other 400-level or above MTH courses approved by the Department of Mathematics.

Other Electives
Approval of the College of Engineering is required to enroll in all CSE or ECE courses listed.

CMSE	404	Introduction to Machine Learning	3
CSE	402	Biometrics and Pattern Recognition	3
CSE	404	Introduction to Machine Learning	3
CSE	425	Introduction to Computer Security	3
CSE	450	Translation of Programming Languages	3
CSE	460	Computability and Formal Language Theory	3
CSE	472	Computer Graphics	3
CSE	482	Big Data Analysis	3
ECE	305	Electromagnetic Fields and Waves I	4
ECE	366	Introduction to Signal Processing	3
ECE	405	Electromagnetic Fields and Waves II	4
ECE	446	Biomedical Signal Processing	3
ECE	447	Introduction to Biomedical Imaging	3
ECE	449	Fundamentals of Acoustics	3
ECE	457	Communication Systems	3
PHY	410	Thermal and Statistical Physics	3
PHY	415	Methods of Theoretical Physics	4
PHY	422	Classical Mechanics II	3
PHY	471	Quantum Physics I	3
PHY	472	Quantum Physics II	3
PHY	480	Computational Physics	3
PHY	481	Electricity and Magnetism I	3
PHY	482	Electricity and Magnetism II	3
STT	381	Fundamentals of Data Science Methods	4
STT	441	Probability and Statistics I: Probability	3
STT	442	Probability and Statistics II: Statistics	3
STT	455	Actuarial Models I	3
STT	461	Computations in Probability and Statistics	3
STT	465	Bayesian Statistical Methods	3

Other 400-level or above courses approved by the Department of Mathematics.

Effective Fall 2024.

4. Request to change the name of **the Bachelor of Science** degree in **Computational Mathematics** to **Computational Mathematics and Applied Mathematics** in the Department of Mathematics.

   No new students are to be admitted to the Bachelor of Science degree in Computational Mathematics effective Fall 2024. No students are to be readmitted to Bachelor of Science degree in Computational Mathematics effective Fall 2024. Effective Fall 2029, coding for the Bachelor of Science degree in Computational Mathematics will be discontinued and the program will no longer be available in the Department of Mathematics. Students admitted to the bachelor's degree prior to Fall 2024 will be awarded a Bachelor of Science degree in Computational Mathematics in the Department of Mathematics. Students admitted to the bachelor's degree Fall 2024 and forward will be awarded a Bachelor of Science degree in Computational Mathematics and Applied Mathematics in the Department of Mathematics.

5. Request to change the requirements for the **Bachelor of Science** degree in **Computational Mathematics and Applied Mathematics** in the Department of Mathematics.

   a. Under the heading **Computational Mathematics and Applied Mathematics** make the following changes:

      (1) In item 1., delete the following statement:

      Students who are in the teacher certification program are required to complete Mathematics 330 or 432 and Statistics and Probability 430.

      (2) Replace item 3. with the following:

      a. The following courses outside the Department of Mathematics (28 credits):

(1) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or integrative biology.

(2) One course from each of the following groups (8 or 10 credits):

(a)	CEM	141	General Chemistry	4
	CEM	151	General and Descriptive Chemistry	4
	CEM	181H	Honors Chemistry I	4
	LB	171	Principles of Chemistry I	4
(b)	CEM	142	General and Inorganic Chemistry	3
	CEM	152	Principles of Chemistry	3
	CEM	182H	Honors Chemistry II	4
	LB	172	Principles of Chemistry II	3
(c)	CEM	161	Chemistry Laboratory I	1
	CEM	185H	Honors Chemistry Laboratory	2
	LB	171L	Introductory Chemistry Laboratory I	1

(3) One course from each of the following groups (8 or 10 credits):

(a)	PHY	183	Physics for Scientists and Engineers I	4
	LB	273	Physics I	4
	PHY	173	Studio Physics for Scientists and Engineers I	5
	PHY	193H	Honors Physics I – Mechanics	4
(b)	LB	274	Physics II	4
	PHY	184	Physics for Scientists and Engineers I	4
	PHY	174	Physics II	5
	PHY	294H	Honors Physics II – Electromagnetism	4

(4) At least 1 credit in laboratory in biological science, chemistry, entomology, microbiology, physiology, plant biology, or integrative biology from the following:

(5) One of the following groups of courses (8 credits):

(a)	CSE	231	Introduction to Programming I	4
	CSE	232	Introduction to Programming II	4
(b)	CMSE	201	Computational Modelling and Data Analysis I	4
	CMSE	202	Computational Modelling and Data Analysis II	4

b. The following courses from the Department of Mathematics:

(1) One course from each of the following groups (11 or 12 credits):

(a)	MTH	132	Calculus I	3
	MTH	152H	Honors Calculus I	3
	LB	118	Calculus I	4
(b)	MTH	133	Calculus II	4
	MTH	153H	Honors Calculus II	4
	LB	119	Calculus II	4
(c)	MTH	234	Multivariable Calculus	4
	MTH	254H	Honors Multivariable Calculus	4
	LB	220	Calculus III	4

(2) One of the following groups (4 or 7 credits):

(a)	MTH	299	Transitions	4
	MTH	309	Linear Algebra I	3
(b)	MTH	299	Transitions	4
	MTH	314	Matrix Algebra with Computational Applications	3
(c)	MTH	317H	Honors Linear Algebra	4

(3) Completion of one of the following groups of courses (12 credits):

(a) **Differential Equations and Numerical Methods**

(i) One of the following courses:

MTH	235	Differential Equations	3
MTH	340	Ordinary Differential Equations I	3
MTH	347H	Honors Ordinary Differential Equations	3

(ii) One of the following courses:

		MTH	320	Analysis I 3
		MTH	327H	Honors Introduction to Analysis 3
	(iii)	The following course:		
		MTH	451	Numerical Analysis I 3
	(iv)	One of the following courses:		
		MTH	441	Ordinary Differential Equations II 3
		MTH	442	Partial Differential Equations 3
		MTH	452	Numerical Analysis II 3
(b)	**Probability and Discrete Mathematics**			
	(i)	The following course:		
		STT	441	Probability and Statistics I: Probability 3
	(ii)	One of the following courses:		
		MTH	320	Analysis I 3
		MTH	327H	Honors Introduction to Analysis 3
	(iii)	Both of the following courses:		
		MTH	481	Discrete Mathematics I 3
		MTH	482	Discrete Mathematics II 3
(c)	**Applied Algebra and Discrete Mathematics**			
	(i)	One of the following courses:		
		MTH	310	Abstract Algebra I and Number Theory 3
		MTH	418H	Honors Algebra I 3
	(ii)	All of the following courses:		
		MTH	416	Introduction to Algebraic Coding 3
		MTH	481	Discrete Mathematics I 3
		MTH	482	Discrete Mathematics II 3
(d)	**Mathematical Machine Learning**			
	(i)	One of the following courses:		
		MTH	320	Analysis I 3
		MTH	327H	Honors Introduction to Analysis 3
	(ii)	All of the following courses:		
		MTH	483	Mathematical Machine Learning 3
		STT	441	Probability and Statistics I: Probability 3
		STT	442	Probability and Statistics II: Statistics 3
(4)	Both of the following courses (6 credits):			
	MTH	415	Applied Linear Algebra 3	
	MTH	496	Capstone in Mathematics (W) 3	

(5) Complete five elective courses from the following lists of electives with at least two from the ***Mathematics Electives*** list. All courses listed may only be used if not being used to meet a course requirement in requirement (3) above (15 to 20 credits):

Mathematics Electives

MTH	310	Abstract Algebra	3
Or			
MTH	418H	Honors Algebra I	3
MTH	320	Analysis I	3
or			
MTH	327H	Honors Introduction to Analysis	3
MTH	411	Abstract Algebra II	3
or			
MTH	419H	Honors Algebra II	3
MTH	416	Introduction to Algebraic Coding	3
MTH	417	Topics in Number Theory	3
MTH	421	Analysis II	3
or			

MTH	429H	Honors Real Analysis	3
MTH	425	Complex Analysis	3
MTH	441	Ordinary Differential Equations II	3
MTH	442	Partial Differential Equations	3
MTH	451	Numerical Analysis I	3
MTH	452	Numerical Analysis II	3
MTH	457	Introduction to Financial Mathematics	3
MTH	461	Metric and Topological Spaces	3
MTH	481	Discrete Mathematics I	3
MTH	482	Discrete Mathematics II	3
MTH	483	Mathematical Machine Learning	3

Other 400-level or above MTH courses approved by the Department of Mathematics.

Other Electives

Approval of the College of Engineering is required to enroll in all CSE or ECE courses listed.

CMSE	404	Introduction to Machine Learning	3
CSE	402	Biometrics and Pattern Recognition	3
CSE	404	Introduction to Machine Learning	3
CSE	425	Introduction to Computer Security	3
CSE	450	Translation of Programming Languages	3
CSE	460	Computability and Formal Language Theory	3
CSE	472	Computer Graphics	3
CSE	482	Big Data Analysis	3
ECE	305	Electromagnetic Fields and Waves I	4
ECE	366	Introduction to Signal Processing	3
ECE	405	Electromagnetic Fields and Waves II	4
ECE	446	Biomedical Signal Processing	3
ECE	447	Introduction to Biomedical Imaging	3
ECE	449	Fundamentals of Acoustics	3
ECE	457	Communication Systems	3
PHY	410	Thermal and Statistical Physics	3
PHY	415	Methods of Theoretical Physics	4
PHY	422	Classical Mechanics II	3
PHY	471	Quantum Physics I	3
PHY	472	Quantum Physics II	3
PHY	480	Computational Physics	3
PHY	481	Electricity and Magnetism I	3
PHY	482	Electricity and Magnetism II	3
STT	381	Fundamentals of Data Science Methods	4
STT	441	Probability and Statistics I: Probability	3
STT	442	Probability and Statistics II: Statistics	3
STT	455	Actuarial Models I	3
STT	461	Computations in Probability and Statistics	3
STT	465	Bayesian Statistical Methods	3

Other 400-level or above courses approved by the Department of Mathematics.

Effective Fall 2024.

6. Request to change the requirements for the **Bachelor of Arts** degree in **Mathematics, Advanced** in the Department of Mathematics.

a. Under the heading **Requirements for the Bachelor of Arts Degree in Mathematics, Advanced** make the following changes:

(1) Replace item 3. a. (1) with the following:

One of the following courses (3 or 4 credits):

BS	161	Cell and Molecular Biology	3
IBIO	150	Integrating Biology: From DNA to Populations	3
PLB	105	Plant Biology	3
ENT	205	Pests, Society, and Environment	3
PSL	250	Introductory Physiology	4

(3) Delete item 3. b.

(4) Reletter item 3. c. to item 3. b. and make the following change in item (4):

(a) Change the total credits from '25' to '22'.

(b) Delete the following course:

MTH	428H	Honors Complex Analysis	3

(5) Reletter item 3. d. to item 3. c. and replace with the following:

A total of 15 credits in electives.

Three of the courses (9 credits) are to be selected from any MTH course at the 800-level or above, or any course approved by the Mathematics Advanced program for satisfying this requirement, or any course from the following list:

MTH	416	Introduction to Algebraic Coding	3
MTH	417	Topics in Number Theory	3
MTH	425	Complex Analysis	3
MTH	441	Ordinary Differential Equations II	3
MTH	442	Partial Differential Equations	3
MTH	451	Numerical Analysis I	3
MTH	452	Numerical Analysis II	3
MTH	461	Metric and Topological Spaces	3
MTH	481	Discrete Mathematics I	3
MTH	482	Discrete Mathematics II	3
MTH	492H	Undergraduate Thesis (W)	3

Two of the courses (6 credits) are to be selected from any MTH course at the 400 level or above (excluding MTH 411 and 421), or any course approved by the Mathematics Advanced program for satisfying this requirement, or any course from the following list:

CMSE	820	Mathematical Foundations of Data Science	3
CMSE	821	Numerical Methods for Differential Equations	3
CMSE	823	Numerical Linear Algebra	3
CSE	425	Introduction to Computer Security	3
CSE	450	Translation of Programming Languages	3
CSE	460	Computability and Formal Language Theory	3
CSE	472	Computer Graphics	3
CSE	802	Pattern Recognition and Analysis	3
CSE	803	Computer Vision	3
CSE	814	Computer Aided Verification	3
CSE	830	Design and Theory of Algorithms	3
CSE	835	Algorithmic Graph Theory	3
CSE	847	Machine Learning	3
CSE	860	Foundations of Computing	3
CSE	881	Data Mining	3
PHL	432	Logic and its Metatheory	4
PHY	410	Thermal and Statistical Physics	3

PHY	415	Methods of Theoretical Physics	4
PHY	422	Classical Mechanics II	3
PHY	471	Quantum Physics I	3
PHY	472	Quantum Physics II	3
PHY	480	Computational Physics	3
PHY	481	Electricity and Magnetism I	3
PHY	482	Electricity and Magnetism II	3
STT	861	Theory of Probability and Statistics I	3
STT	862	Theory of Probability and Statistics II	3
STT	881	Theory of Probability I	3
STT	882	Theory of Probability II	3
STT	886	Stochastic Processes and Applications	3

Effective Fall 2024.

7. Request to change the requirements for the **Bachelor of Science** degree in **Mathematics, Advanced** in the Department of Mathematics.

a. Under the heading **Requirements for the Bachelor of Science Degree in Mathematics, Advanced** make the following changes:

(1) In item 3. a., change the total credits from ’21 to 25’ to ’20 to 25’.

(2) Replace item 3. a. (1) with the following:

One of the following courses (3 or 4 credits):

BS	161	Cell and Molecular Biology	3
IBIO	150	Integrating Biology: From DNA to Populations	3
PLB	105	Plant Biology	3
ENT	205	Pests, Society, and Environment	3
PSL	250	Introductory Physiology	4

(3) In item 3. a. (4) change the credits from ‘2’ to ‘1’.

(4) Delete item 3. b.

(5) Reletter item 3. c. to item 3. b. and make the following change in item (4):

(a) Change the total credits from ‘25’ to ‘22’.

(b) Delete the following course:

MTH	428H	Honors Complex Analysis	3

(6) Reletter item 3. d. to item 3. c. and replace with the following:

A total of 15 credits in electives.

Three of the courses (9 credits) are to be selected from any MTH course at the 800-level or above, or any course approved by the Mathematics Advanced program for satisfying this requirement, or any course from the following list:

MTH	416	Introduction to Algebraic Coding	3
MTH	417	Topics in Number Theory	3
MTH	425	Complex Analysis	3
MTH	441	Ordinary Differential Equations II	3
MTH	442	Partial Differential Equations	3
MTH	451	Numerical Analysis I	3
MTH	452	Numerical Analysis II	3
MTH	461	Metric and Topological Spaces	3
MTH	481	Discrete Mathematics I	3
MTH	482	Discrete Mathematics II	3
MTH	492H	Undergraduate Thesis (W)	3

Two of the courses (6 credits) are to be selected from any MTH course at the 400 level or above (excluding MTH 411 and 421), or any course approved by the Mathematics Advanced program for satisfying this requirement, or any course from the following list:

CMSE	820	Mathematical Foundations of Data Science	3
CMSE	821	Numerical Methods for Differential Equations	3
CMSE	823	Numerical Linear Algebra	3
CSE	425	Introduction to Computer Security	3
CSE	450	Translation of Programming Languages	3
CSE	460	Computability and Formal Language Theory	3
CSE	472	Computer Graphics	3
CSE	802	Pattern Recognition and Analysis	3
CSE	803	Computer Vision	3
CSE	814	Computer Aided Verification	3
CSE	830	Design and Theory of Algorithms	3
CSE	835	Algorithmic Graph Theory	3
CSE	847	Machine Learning	3
CSE	860	Foundations of Computing	3
CSE	881	Data Mining	3
PHL	432	Logic and its Metatheory	4
PHY	410	Thermal and Statistical Physics	3
PHY	415	Methods of Theoretical Physics	4
PHY	422	Classical Mechanics II	3
PHY	471	Quantum Physics I	3
PHY	472	Quantum Physics II	3
PHY	480	Computational Physics	3
PHY	481	Electricity and Magnetism I	3
PHY	482	Electricity and Magnetism II	3
STT	861	Theory of Probability and Statistics I	3
STT	862	Theory of Probability and Statistics II	3
STT	881	Theory of Probability I	3
STT	882	Theory of Probability II	3
STT	886	Stochastic Processes and Applications	3

Effective Fall 2024.

COLLEGE OF OSTEOPATHIC MEDICINE

1. Request to change the requirement for the **Master of Science** degree in **Basic Medical Science** in the College of Osteopathic Medicine. The University Committee on Graduate Studies (UCGS) will consider this request at its April 15, 2024 meeting.

   a. Under the heading **Requirements for the Master of Science Degree in Basic Medical Science** make the following changes:

      (1) Add the option of Plan B (without thesis).

      (2) Delete item 3. and 4. and replace with the following:

      Additional Requirements for Plan A

      1. Complete the following course:

         OST 899 Master's Thesis Research 4

         This requirement must be completed within one full semester of entry into the program.
      2. Pass an oral defense of the thesis.

      Additional *Requirements* for Plan B

      1. Completion of a final examination or evaluation.

Effective Fall 2024.

PART II - NEW COURSES AND CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

AT 215 Agriculture Employee Management
On Demand. 3(3-0) R: Open to students in the Institute of Agricultural Technology.
NEW Key concepts, techniques, and issues in agricultural employee management and their impact on agricultural operations
Effective Summer Semester 2024

AT 221 Unmanned Aircraft Systems (UAS) in Agriculture
Spring of every year. 4(2-4) R: Open to students in the Institute of Agricultural Technology and open to undergraduate students in the College of Agriculture and Natural Resources. Approval of department; application required.
NEW Concepts and field work necessary to conduct safe operations with unmanned aerial systems used in agricultural operations. Field trips required. Field trips required.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 1 semester after the end of the semester of enrollment.
Effective Spring Semester 2025

CSS 860 Soil Health Concepts and Methodology
Fall of every year. 1(0-2) RB: One course in soil science and one course in plant science or ecosystem science
NEW A rigorous and quantitative assessment of chemical, physical, and biological components of soils in agroecosystems. Advanced techniques in field and laboratory settings. Soil health data verification and validation for informed interpretations and management recommendations. Field trip required. Offered first ten weeks of semester.
Effective Fall Semester 2024

COLLEGE OF ENGINEERING

BE 221 Introduction to Smart Agriculture
Spring of every year. 1(1-1) Interdepartmental with Engineering P: (MTH 114 or MTH 116 or LB 117) or ((MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently))
NEW Concepts of smart agriculture and its role in addressing global challenges. Sustainable agricultural systems management incorporating digital tools, AI, and machine learning.
Effective Fall Semester 2024

BE 321 Principles of Precision Agriculture
Fall of every year. 3(2-2) P: BE 221 or concurrently or approval of department
NEW Principles of precision agriculture utilizing GPS, GIS, data acquisition, analysis, and prescriptive application. Mapping, prescriptive software, and informed decision making for sustainable and resilient agriculture.
SA: TSM 343
Effective Fall Semester 2024

BE 421 Sensors & Robotics for Agricultural Systems
Fall of every year. 3(2-2) P: BE 321 or concurrently R: Open to juniors or seniors in the College of Engineering or approval of department.
NEW Comprehensive introduction to the fundamentals and applications of sensing and robotics technologies in agricultural systems.
Effective Fall Semester 2024

BE 422 Crop Modeling and Optimization
Spring of every year. 3(2-2) P: BE 321 or concurrently R: Open to juniors or seniors in the College of Engineering or approval of department.

NEW An in-depth exploration of the theory and practical applications of crop modeling in agriculture and agroecosystems.
Effective Fall Semester 2024

CSE 834 Advanced Topics in Automated Vehicles
Spring of every year. 3(3-0) Interdepartmental with Electrical and Computer Engineering RB: Algorithms, programming in Python or equivalent, basic knowledge of probability and statistics. R: Open to graduate students in the Department of Computer Science and Engineering or in the Department of Electrical and Computer Engineering or approval of department.

NEW This course will serve as an advanced course for graduate students interested in conducting hands-on research into automated and connected vehicles. It is a standalone course or may be considered a follow-on course to CSE434.
Effective Spring Semester 2025

CSE 850 Advanced Topics in Adversarial Machine Learning
Spring of every year. 3(3-0) P: CSE 840 R: Open to graduate students in the Department of Computer Science and Engineering.

NEW This course will serve as an advanced course for graduate students interested in conducting foundational and applied research regarding the robustness and trustworthiness of today's deep learning systems. It is a standalone course but with a preference to have certain backgrounds on Machine Learning (CSE 847), Deep Learning (CSE 849), or Computer Vision (CSE 803).
Effective Spring Semester 2025

CSE 851 Genetic Programming
Fall of every year. 3(3-0) R: Open to graduate students in the Department of Computer Science and Engineering or approval of department.

NEW Genetic Programming was originally conceptualized as a method to approach automatic programming of computers, by a method akin to breeding computer programs. It then developed a large body of work related to Machine Learning. This course will give an overview of current techniques and applications of genetic programming, with occasional excursions into the history of fields like Artificial Intelligence, Machine Learning and automatic programming in general. Students will learn to create their own genetic programming systems and apply them in projects of their choice.
Effective Spring Semester 2025

CSE 893 Selected Topics in System design and analysis
On Demand. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R: Open to graduate students in the Department of Computer Science and Engineering or approval of department. A student may earn a maximum of 9 credits Student may earn a maximum of 9 credits in 891, 893, 894 and 895 combined

NEW Selected topics in System design and analysis of current interest and importance but not covered in a regular course.
Effective Spring Semester 2025

CSE 894 Selected Topics in Theory and Algorithms
On Demand. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R: Open to graduate students in the Department of Computer Science and Engineering or approval of department. A student may earn a maximum of 9 credits Student may earn a maximum of 9 credits in 891, 893, 894 and 895 combined

NEW Selected topics in theory and algorithms of current interest and importance but not covered in a regular course.
Effective Spring Semester 2025

CSE 895 Selected Topics in Data Analysis and Applications
On Demand. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. P: CSE 840 R: Open to graduate students in the Department of Computer Science and Engineering or approval of department. A student may earn a maximum of 9 credits Student may earn a maximum of 9 credits in 891, 893, 894 and 895 combined

NEW Selected topics in data analysis and applications of current interest and importance but not covered in a regular course.
Effective Spring Semester 2025

COLLEGE OF HUMAN MEDICINE

PH 826 Data Management in Public Health Practice
Fall of every year. Spring of every year. Summer of every year. 3(3-0) R: Open to students in the Public Health Major or approval of department.

NEW Data management skills for using large data sets for public health related practice and research activities.
Effective Fall Semester 2024

PH 829 Public Health and Healthcare Delivery Data
Fall of every year. Spring of every year. Summer of every year. 3(3-0) P: PH 826 and PH 878 R: Open to students in the Public Health Major or approval of department.

NEW Public health and healthcare data sources, data systems and use requirements. Common data sources and data sets in public health and healthcare delivery. Application of data management, project management, study design, research methods, and statistical analysis skills.
Effective Fall Semester 2024

PH 830 Foundations of Rural Public Health
Fall of every year. Spring of every year. Summer of every year. 3(3-0) R: Open to students in the Public Health Major or approval of department.

NEW Unique historical, political, and social influences of rural health. Rural determinants of health, public health systems, health outcomes and disparities. Comparisons of domestic and global rural health.
Effective Fall Semester 2024

PH 834 Drivers of Rural Health
Fall of every year. Spring of every year. Summer of every year. 3(3-0) R: Open to students in the Public Health Major or approval of department.

NEW Analysis of social, cultural, commercial, and political systems, resource availability and their interactions that can be changed to improve domestic and global health outcomes.
Effective Fall Semester 2024

PH 839 Rural Public Health Policy and Advocacy
Fall of every year. Spring of every year. Summer of every year. 3(3-0) P: PH 830 and PH 834 R: Open to students in the Public Health Major or approval of department.

NEW Leadership and advocacy skills necessary for rural public health systems and policy-level change. Leadership theories, skills, and policy development processes. Exploration of political, social, and cultural drivers/determinants that influence policy, advocacy, and coalition building in rural communities. Advocacy plan creation specific to rural public health issues.
Effective Fall Semester 2024

COLLEGE OF NATURAL SCIENCE

BMB 470 Advanced Molecular Biology Laboratory
Fall of every year. 4(2-4) P: BMB 370 and BMB 461 RB: BMB 462 ~~R: Open to students in the Biochemistry and Molecular Biology/Biotechnology Major or in the Biochemistry and Molecular Biology major or in the Lyman Briggs Biochemistry and Molecular Biology Coordinate Major or in the Lyman Briggs-Biochemistry/Biotechnology Coordinate Major or approval of department.~~ R: Open to students or approval of department.

Methods of molecular biology and the underlying principles on which these methods are based.
SA: BCH 472, BMB 472
Effective Spring Semester 2024

BMB 825 Cell Structure and Function
~~Spring of every year.~~ Spring of every year. 3(3-0) ~~Interdepartmental with Microbiology and Molecular Genetics, Microbiology and Molecular Genetics, Microbiology and Molecular Genetics, Microbiology and Molecular Genetics, Physiology, Physiology, Physiology, Physiology~~ Interdepartmental with Microbiology, Genetics, and Immunology, Microbiology, Genetics, and Immunology, Microbiology, Genetics, and Immunology, Microbiology, Genetics, and Immunology, Physiology, Physiology, Physiology, Physiology, Physiology RB: BMB 401 or BMB 461.

Molecular basis of structure and function. Cell properties: reproduction, dynamic organization, integration, programmed and integrative information transfer. Original investigations in all five kingdoms.
SA: BCH 825
Effective Fall Semester 2025

MTH 116 College Algebra and Trigonometry
Fall of every year. Spring of every year. Summer of every year. 5(5-0) P: Designated score on Mathematics Placement test ~~Not open to students with credit in MTH 103.~~ Not open to students with credit in LB 117 or MTH 103.

Functions and graphs. Equations and inequalities. Exponential and logarithmic functions. Trigonometric functions. Systems of equations. Binomial theorem.
SA: LBS 117
Effective Summer Semester 2023

MTH 362 Mathematics of Contract Pricing in Sports Analytics
Fall of every year. Spring of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: MTH 360 RB: MTH 361

NEW Employ tools from mathematics finance to value sports contracts in sports analytics. Connections with utility theory and constrained optimality. Analysis of sports organizations and the leagues they play in.
Effective Spring Semester 2025

MTH 481 Discrete Mathematics I
~~Fall of every year. Spring of every year.~~ Fall of every year. Spring of every year. Summer of every year. 3(3-0) P: MTH 309

Binomial and multinomial theorems. Graphs and digraphs, graph coloring. Generating functions, asymptotic analysis, trees. Representing graphs in computers.
Effective Fall Semester 2020

MTH 810 Error-Correcting Codes
Spring of every year. 3(3-0) RB: MTH 411 or MTH 414 or MTH 415 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.

Block codes, maximum likelihood decoding, Shannon's theorem. Generalized Reed-Solomon codes, modification of codes, subfield codes. Alterant and Goppa codes, cyclic codes and BCH codes.
Effective Spring Semester 2024

MTH 819 Algebra II
Spring of every year. 3(3-0) ~~RB: MTH 818~~ RB: (MTH 818) and MTH 818 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Modules and vector spaces, projectives modules, tensor algebra. Fields and Galois groups, algebraic and transcendental numbers, non-commutative rings. The Jacobson radical, the structure of semisimple rings with the descending chain condition.
Effective Fall Semester 2024

MTH 828 Real Analysis I
Fall of every year. 3(3-0) ~~RB: MTH 421 and MTH 461~~ RB: (MTH 421 and MTH 461) or MTH 421 and MTH 461 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Lebesgue measure on real line, general measure theory. Convergence theorems, Lusin's theorem, Egorov's theorem, Lp-spaces, Fubini's theorem. Functions of bounded variation, absolutely continuous functions, Lebesgue differentiation theorem.
Effective Fall Semester 2024

MTH 829 Complex Analysis I
Spring of every year. 3(3-0) ~~RB: MTH 421 and MTH 425~~ RB: (MTH 421 and MTH 425) and MTH 421 and MTH 425 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Cauchy theorem, identity principle, Liouville's theorem, maximum modulus theorem. Cauchy formula, residue theorem, Rouche's theorem. Casorati-Weierstrass theorem, Arzela-Ascoli theorem. Conformal mapping, Schwarz lemma, Riemann mapping theorem.
Effective Fall Semester 2024

MTH 841 Boundary Value Problems I
Fall of every year. 3(3-0) ~~RB: MTH 414 and MTH 421~~ RB: (MTH 414 and MTH 421) and MTH 414 and MTH 421 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Methods for solving boundary and initial value problems for ordinary and partial differential equations.
Effective Fall Semester 2024

MTH 842 Boundary Value Problems II
Spring of every year. 3(3-0) ~~RB: MTH 841~~ RB: (MTH 841) and MTH 841 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Continuation of MTH 841.
Effective Fall Semester 2024

MTH 843 Survey of Industrial Mathematics
Fall of every year. 3(3-0) RB: ((MTH 414 or MTH 415) or Some familiarity with mathematical software such as Mathematica, Matlab, etc.) and (MTH 421 and MTH 442) ~~R: Open only to master's students in the Industrial Mathematics major or approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Fundamentals of mathematical modeling in government and industry, including modes of industrial communication.
Effective Fall Semester 2024

MTH 844 Projects in Industrial Mathematics
Spring of every year. 3(3-0) RB: ((MTH 414 or MTH 415) or some familiarity with mathematical software such as Mathematica or Matlab.) and (MTH 421 and MTH 442 and MTH 843) ~~R: Open only to master's students in the Industrial Mathematics major or approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Participation as a member of a 3-4 person team on a significant industrial problem, with participation of an industrial liaison, including project report generation and reporting.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 1 semester after the end of the semester of enrollment.
Effective Fall Semester 2024

MTH 849 Partial Differential Equations
Spring of every year. 3(3-0) P: MTH 847 or approval of department RB: MTH 828 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Sobolev spaces and embedding theorems, weak solutions of second order elliptic equations in divergence form (existence, uniqueness, and regularity), Fredholm alternative, maximum principle, calculus of variations, Euler-Lagrange equations.
Effective Fall Semester 2024

MTH 850 Numerical Analysis I
Fall of every year. 3(3-0) ~~RB: MTH 414 and MTH 421~~ RB: (MTH 414 and MTH 421) and MTH 414 and MTH 421 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Convergence and error analysis of numerical methods in applied mathematics.
Effective Fall Semester 2024

MTH 852 Numerical Methods for Ordinary Differential Equations
Spring of every year. 3(3-0) RB: MTH 850 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Linear multi-step methods and single step nonlinear methods for initial value problems. Consistency, stability and convergence. Finite difference, finite element, shooting methods for boundary value problems.
Effective Fall Semester 2024

MTH 868 Geometry and Topology I
Fall of every year. 3(3-0) RB: (MTH 411 and MTH 421) or approval of department. R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Fundamental group and covering spaces, van Kampen's theorem. Homology theory, Differentiable manifolds, vector bundles, transversality, calculus on manifolds. Differential forms, tensor bundles, deRham theorem, Frobenius theorem.
Effective Fall Semester 2024

MTH 869 Geometry and Topology II
Spring of every year. 3(3-0) ~~RB: MTH 868~~ RB: (MTH 868) and MTH 868 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Continuation of MTH 868.
Effective Fall Semester 2024

MTH 880 Combinatorics I
Fall of every year. 3(3-0) RB: MTH 411 or MTH 482 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Enumerative combinatorics, recurrence relations, generating functions, asymptotics, applications to graphs, partially ordered sets, generalized Moebius inversions, combinatorial algorithms.
Effective Fall Semester 2024

MTH 881 Graph Theory
Spring of even years. 3(3-0) RB: MTH 880 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Basic concepts in graph theory, connectivity, algebraic and topological methods. Networks, graph algorithms, Hamiltonian and Eulerian graphs, extremal graph theory, random graphs.
Effective Fall Semester 2024

MTH 882 Combinatorics II
Spring of every year. 3(3-0) P: MTH 880 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Algebraic combinatorics including symmetric functions, group actions, and cluster algebra, geometric combinatorics including shellability, discrete Morse functions, and polytopes. Extremal combinatorics including Ramsey Theory and Sperner Theory.
Effective Fall Semester 2024

MTH 890 Readings in Mathematics
~~Fall of every year. Spring of every year. Summer of every year.~~ Fall of every year. Spring of every year. Summer of every year. 1 to 6 credits. A student may earn a maximum of 24 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Individualized study for Master's level students.
Effective Fall Semester 2024

MTH 910 Commutative Algebra
Fall of odd years. 3(3-0) ~~RB: MTH 819~~ RB: (MTH 819) and MTH 819 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Noetherian rings and modules, localization and tensor products, primary decomposition, Krull dimensions, graded rings and modules, Hilbert's Nullstellensatz, integral extensions, discrete valuation rings, Dedekind domains.
Effective Fall Semester 2024

MTH 912 Group Theory I
Fall of even years. 3(3-0) RB: MTH 819 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Permutation groups, solvable and nilpotent groups, simple groups. Representation and character theory. Extension theory and cohomology groups.
Effective Fall Semester 2024

MTH 914 Lie Groups and Algebras
Fall of odd years. 3(3-0) RB: MTH 819 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Nilpotent and semisimple algebras, the ad joint representation, root spaces, Weyl groups, Dynkin diagrams, classification of simple algebras.
Effective Fall Semester 2024

MTH 916 Introduction to Algebraic Geometry I
Fall of even years. 3(3-0) RB: MTH 818 and MTH 819 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Affine and projective algebraic varieties and their properties. Morphisms and singularities. Schemes and coherent sheaves. Sheaf cohomology and other related topics.
Effective Fall Semester 2024

MTH 917 Introduction to Algebraic Geometry II
Spring of odd years. 3(3-0) RB: MTH 916 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Continuation of MTH 916.
Effective Fall Semester 2024

MTH 918 Number Theory I
Fall of even years. 3(3-0) P: MTH 819 or approval of department R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Number fields and algebraic integers, prime ideals and factorization, cyclotomic fields, the class group, the Dirichlet unit theorem, different, discriminant, decomposition and inertia groups, local fields.
Effective Fall Semester 2024

MTH 919 Number Theory II
Spring of odd years. 3(3-0) P: MTH 918 or approval of department R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Topics from: class field theory, zeta and L-functions, modular forms, theory of elliptic curves, diophantine approximation, diophantine geometry.
Effective Fall Semester 2024

MTH 920 Functional Analysis
Spring of every year. 3(3-0) RB: MTH 828 ~~R: Open to graduate students in the College of Natural Science or approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Hilbert spaces, Banach spaces and locally convex vector spaces. Topics include Riesz representation theorem, Parseval's identity, Riesz-Fisher theorem, Fourier series operators, Hahn-Banach theorem, open mapping and closed graph theorems, Banach-Steinhaus theorem, duality theory for locally convex spaces, convexity, Krein-Milman theorem, theory of distributions, compact operators.
Effective Fall Semester 2024

MTH 921 Operator Theory
Fall of even years. 3(3-0) RB: MTH 829 and MTH 920 ~~R: Open to doctoral students in the College of Natural Science or approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Introduction to operator and spectral theory. Topics include Banach algebras, bounded and unbounded operators on Banach spaces, spectral theory for normal operators on a Hilbert space, C*-algebras, Schatten - von Neumann classes, the theory of Fredholm operators, semigroup theory.
Effective Fall Semester 2024

MTH 922 Harmonic Analysis
Fall of odd years. 3(3-0) RB: MTH 829 and MTH 920 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Fourier series, mean and pointwise convergence, conjugate functions, Fourier transform, Plancherel theorem, Paley-Wiener theorem, interpolation of operators, Hausdorff-Young thoerem.
Effective Fall Semester 2024

MTH 925 Random Variables and Stochastic Processes
Fall of every year. 3(3-0) ~~R: Open to doctoral students in the College of Natural Science or approval of department.~~ R: Open to doctoral students or graduate students or master's students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Introduction to measure-theoretic probability theory. Topics include infinite product spaces, Kolomogorov extension theorem, Borel Cantelli Lemma, law of large numbers, central limit theorem, conditioning, filtrations, martingales, Markov chains, Wiener process.
Effective Fall Semester 2024

MTH 928 Real Analysis II
Spring of odd years. 3(3-0) RB: MTH 828 ~~R: Open to doctoral students in the College of Natural Science or approval of department.~~ R: Open to doctoral students or graduate students or master's students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Continuation of MTH 828. Topics include Borel measures on locally compact spaces, complex measures, differentiable transformations and changes of variables in Rn.
Effective Fall Semester 2024

MTH 930 Riemannian Geometry I
Fall of even years. 3(3-0) RB: MTH 869 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Riemannian metrics, connections, curvature, geodesics. First and second variation, Jacobi fields, conjugate points. Rauch comparison theorems, Hodge theorem, Bochner technique, spinors. Further topics on curvature or submanifold theory.
Effective Fall Semester 2024

MTH 931 Riemannian Geometry II
Spring of odd years. 3(3-0) RB: MTH 930 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Continuation of MTH 930.
Effective Fall Semester 2024

MTH 935 Complex Manifolds I
Spring of even years. 3(3-0) RB: MTH 829 and MTH 869 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Riemann surfaces, Serre duality, Riemann-Roch theorem. Weierstrass points, Abel's theorem, Plucker formulas. Hermitian metrics, connections, curvature, Hodge theorem. Kaehler metrics, Kodaira vanishing theorem, Chern classes.
Effective Fall Semester 2024

MTH 940 Topics in Partial Differential Equations for Applied Math
Fall of odd years. 3(3-0) RB: MTH 828 ~~R: Open to doctoral students in the College of Natural Science or approval of department.~~ R: Open to doctoral students or graduate students or master's students in the College of Natural Science or in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Partial differential equation techniques for applied mathematics, including, bifurcation theory, partial differential equations as dynamical systems, boundary layers, asymptotic analysis, matched asymptotic and singular perturbations, and homogenization.
Effective Fall Semester 2024

MTH 941 Linear and Nonlinear Parabolic Equations
Spring of even years. 3(3-0) RB: MTH 940 ~~R: Open to doctoral students in the College of Natural Science or approval of department.~~ R: Open to doctoral students or graduate students or master's students in the College of Natural Science or in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Evolution equations with a comparison principle, including parabolic equations and Hamilton-Jacobi-Bellman equations, with an emphasis on existence and uniqueness of both classical and weak solutions. Linear and nonlinear cases, including quasi-linear parabolic equations related to geometric flows.
Effective Fall Semester 2024

MTH 942 Regularity for Second Order Elliptic Equations
Fall of even years. 3(3-0) RB: MTH 848 and MTH 849 ~~R: Open to doctoral students in the College of Natural Science or approval of department.~~ R: Open to doctoral students or graduate students or master's students in the College of Natural Science or in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Review of classical regularity results, such as Schauder theory and L-p theory. Elliptic equations with coefficients of low regularity (bounded and measurable) and nonlinear elliptic equations. The Harnack inequality and Holder regularity in the context of both weak solutions of divergence form equations and viscosity solutions of equations in non-divergence form. Higher regularity and applications to minimization problems.
Effective Fall Semester 2024

MTH 943 Hyperbolic and Dispersive Equations
Spring of odd years. 3(3-0) RB: MTH 942 ~~R: Open to doctoral students in the College of Natural Science. Approval of department.~~ R: Open to doctoral students or graduate students or master's students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Classical and modern techniques for higher dimensional hyperbolic and dispersive partial differential equations. Space-time integral estimates, including the classical Strichartz estimate for Schrodinger, Klein-Gordon, and Wave equations, and modern (multi)linear estimates using Fourier, physical-space, and microlocal techniques.
Effective Fall Semester 2024

MTH 950 Numerical Methods for Partial Differential Equations I
Spring of odd years. 3(3-0) RB: MTH 852 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Finite difference methods for ordinary and partial differential equations.
Effective Fall Semester 2024

MTH 951 Numerical Methods for Partial Differential Equations II
~~Spring of even years.~~ Fall of every year. Spring of every year. 3(3-0) R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Bachelor of Science in Mathematics or in the Mathematics Major or approval of department.
Finite element methods for ordinary and partial differential equations.
Effective Fall Semester 2024

MTH 960 Algebraic Topology I
Fall of every year. 3(3-0) RB: MTH 869 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Cohomology, products, duality, basic homotopy theory, bundles, obstruction theory, spectral sequences, characteristic classes, and other related topics.
Effective Fall Semester 2024

MTH 961 Algebraic Topology II
Spring of every year. 3(3-0) RB: MTH 960 R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Continuation of MTH 960.
Effective Fall Semester 2024

MTH 988 Representation Theory I
Fall of odd years. 3(3-0) P: MTH 819 or approval of department R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Representations of finite groups, unitary representations, tensor products and character tables, further theory (Frobenius-Schur indicator, Burnside's theorem, Mackey formula, Frobenius reciprocity), representations of GL(2; Fq), representations of symmetric groups (Young diagrams, Schur-Weyl duality), fundamental theorem of invariant theory, introduction to representations of compact groups
Effective Fall Semester 2024

MTH 990 Reading in Mathematics
~~Fall of every year. Spring of every year. Summer of every year.~~ Fall of every year. Spring of every year. Summer of every year. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Individualized study for doctoral level students.
Effective Fall Semester 2024

MTH 991 Special Topics in Algebra
~~Fall of every year. Spring of every year.~~ Fall of every year. Spring of every year. 3 to 6 credits. A student may earn a maximum of 18 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Advanced topics in algebra.
Effective Fall Semester 2024

MTH 992 Special Topics in Analysis
~~Fall of every year. Spring of every year.~~ Fall of every year. Spring of every year. 3 to 6 credits. A student may earn a maximum of 18 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Advanced topics in analysis.
Effective Fall Semester 2024

MTH 993 Special Topics in Geometry
~~Fall of every year. Spring of every year.~~ Fall of every year. Spring of every year. 3 to 6 credits. A student may earn a maximum of 18 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.
Advanced topics in geometry.
Effective Fall Semester 2024

MTH 994 Special Topics in Applied Mathematics

~~Fall of every year. Spring of every year.~~ Fall of every year. Spring of every year. 3 to 6 credits. A student may earn a maximum of 24 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.

Advanced topics in applied mathematics.

Effective Fall Semester 2024

MTH 996 Special Topics in Topology

~~Fall of every year. Spring of every year.~~ Fall of every year. Spring of every year. 3 to 6 credits. A student may earn a maximum of 18 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or master's students or doctoral students in the Applied Mathematics Major or in the Industrial Mathematics Major or in the Mathematics Major or approval of department.

Advanced topics in topology.

Effective Fall Semester 2024

MTH 999 Doctoral Dissertation Research

Fall of every year. Spring of every year. Summer of every year. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course. ~~R: Approval of department.~~ R: Open to graduate students or doctoral students in the Applied Mathematics Major or in the Mathematics Major. Approval of department.

Doctoral dissertation research.

Request the use of the Pass-No Grade (P-N) system.

Effective Fall Semester 2024

PHY 183 Physics for Scientists and Engineers I

Fall of every year. Spring of every year. 4(5-0) P: (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently) ~~Not open to students with credit in LB 273 or PHY 193H or PHY 231 or PHY 231C or PHY 233B.~~ Not open to students with credit in LB 273 or PHY 193H or PHY 231 or PHY 231C or PHY 183B.

Mechanics, Newton's laws, momentum, energy conservation laws, rotational motion, oscillation, gravity, and waves.

Effective Summer Semester 2021

PHY 232 Introductory Physics II

Fall of every year. Spring of every year. 3(4-0) P: PHY 231 or PHY 231C or PHY 183 or PHY 183B or PHY 193H or LB 273 ~~Not open to students with credit in LB 274 or PHY 184 or PHY 184B or PHY 232C or PHY 234B.~~ Not open to students with credit in LB 274 or PHY 184 or PHY 184B or PHY 232C or PHY 294H.

Electricity and magnetism; optics; atomic, nuclear, and subnuclear physics.

Effective Spring Semester 2024

PHY 234B Calculus Concepts in Physics II

Spring of every year. Summer of every year. 2 credits. P: (PHY 232 or PHY 232C) and ((MTH 133 or concurrently) or (MTH 153H or concurrently) or (LB 119 or concurrently)) ~~Not open to students with credit in LB 274 or PHY 184 or PHY 184B.~~ Not open to students with credit in LB 274 or PHY 184 or PHY 184B or PHY 294H.

Electricity and magnetism. This course is given in the competency based instruction format.

Effective Spring Semester 2024

PHY 480 Computational Physics

Spring of every year. 3(3-0) P: CMSE 201 ~~RB: CSE 131 or CSE 230~~

Applications of scientific computational techniques to solutions of differential equations, matrix methods, and Monte Carlo methods used in physics.

Effective Fall Semester 2024

PHY 864 Accelerator Technology
Spring of every year. 3(3-0) RB: PHY 422 and PHY 482 R: Open to graduate students in the College of Engineering or in the College of Natural Science.
REINSTATEMENT Key technologies for modern accelerators such as magnets, the normal conducting and super conducting radio frequency cavities, charged particle sources, diagnostic instruments.
Effective Spring Semester 2024

COLLEGE OF NURSING

NUR 861 Curriculum Design in Nursing Education
~~Summer of every year.~~ Fall of every year. 3(3-0) P: NUR 802 RB: Open only to master's students in Clinical Nurse Specialist-Nurse Education concentration. R: Open to graduate students in the Master of Science in Nursing.
Analysis and application of theories, principles, and concepts associated with curriculum development, design, and evaluation.
Effective Spring Semester 2024

NUR 866 Academic and Clinical Teaching Internship
~~Spring of every year.~~ Summer of every year. 3(1-6) P: NUR 861 RB: Open only to masters students in Clinical Nurse Specialist-Nurse Education concentration. R: Open to graduate students in the Master of Science in Nursing.
Guided field internship within an academic or health care setting. Synthesis and application of concepts to facilitate development of the advanced practice nurse as scholar, teacher, and collaborator.
Effective Spring Semester 2024

NUR 903 Healthcare Informatics
~~Fall of every year.~~ Spring of every year. 3(3-0) R: Open to graduate students in the College of Nursing or in the Master of Science in Nursing or in the Nursing Practice Major.
Health information systems and technologies in relationship to the delivery of efficient, high quality healthcare.
Effective Spring Semester 2024

NUR 914 Biostatistics for the APRN
~~Fall of every year. Spring of every year.~~ Fall of every year. 3(3-0)
The application of descriptive statistics, bivariable and multivariable inferential statistics (parametric and non-parametric), and essential epidemiological concepts
Effective Spring Semester 2024

COLLEGE OF OSTEOPATHIC MEDICINE

OMM 501 Student Coordinator for Osteopathic Manipulative Medicine Practical Laboratory
Fall of every year. Spring of every year. Summer of every year. 1(1-0) A student may earn a maximum of 8 credits in all enrollments for this course. P: OMM 511 C: OMM 500 concurrently
NEW Student Coordinator for elective course of didactic and clinical sessions which apply osteopathic principles and techniques on patients.
Request the use of the Pass-No Grade (P-N) system.
Effective Summer Semester 2024

OMM 520 Sports OMT
Fall of every year. Spring of every year. 1(1-0) A student may earn a maximum of 8 credits in all enrollments for this course. R: Open to graduate-professional students. Approval of department.
NEW Provide the student with an opportunity to actively treat MSU Division I athletes using OMT under the guidance of ONMM residents.
Request the use of the Pass-No Grade (P-N) system.
Effective Fall Semester 2024

OMM 521 Student Coordinator for Sports OMT
Fall of every year. Spring of every year. 1(1-0) A student may earn a maximum of 8 credits in all enrollments for this course. R: Open to graduate-professional students. Approval of department. C: OMM 520 concurrently

NEW
Student coordinators will help to coordinate the clinic functions that are able to provide the other student participants with an opportunity to actively treat MSU Division I athletes using OMT under the guidance of ONMM residents.
Request the use of the Pass-No Grade (P-N) system.
Effective Fall Semester 2024

OMM 590 Special Problems in Biomechanics
~~Fall of every year. Spring of every year. Summer of every year.~~ Fall of every year. Spring of every year. Summer of every year. 1 to 24 credits. A student may earn a maximum of 48 credits in all enrollments for this course. ~~R: Open only to graduate and graduate-professional students in the College of Osteopathic Medicine. Approval of department.~~ R: Open to graduate-professional students. Approval of department.

Each student works under faculty direction on an experimental, theoretical, or applied problem.
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2 semesters after the end of the semester of enrollment.
~~SA: BIM 590~~
Effective Fall Semester 2024

OMM 591 Osteopathic Manipulative Medicine Teaching Assistant Elective
Fall of every year. Spring of every year. Summer of every year. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. P: OMM 512 R: Open to graduate-professional students. Approval of department.

NEW
Provides students with experience in teaching OMM diagnosis and treatment in a small group setting. This is an unpaid TA experience.
Request the use of the Pass-No Grade (P-N) system.
Effective Fall Semester 2024

OST 585 Intro to Community-Based Service
Fall of every year. 1(1-0) A student may earn a maximum of 1 credit in all enrollments for this course.

NEW
Preparation for medically relevant service experience in local communities
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2 semesters after the end of the semester of enrollment.
Effective Fall Semester 2024

OST 586 Community-Based Service Learning
Spring of every year. 1(1-0) A student may earn a maximum of 1 credit in all enrollments for this course. P: OST 585 or concurrently or approval of college

NEW
Capstone for community-based service learning
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2 semesters after the end of the semester of enrollment.
Effective Spring Semester 2025

OST 601 ~~Transitions II: Classroom to Bedside~~ Transitions: Classroom to Bedside
Summer of every year. 5 credits. A student may earn a maximum of 10 credits in all enrollments for this course. R: Open to graduate-professional students in the College of Osteopathic Medicine.
Selected topics designed to assist the COM student in transitioning from the classroom to the clinical learning environment.
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 1 semester after the end of the semester of enrollment.
Effective Summer Semester 2024

OST 696 Global Health: SPAIN- Pre-Clinical Observation, Culture and Medicine
Summer of every year. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department; application required.

NEW International Clinical Immersion
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2 semesters after the end of the semester of enrollment.
Effective Summer Semester 2024

~~OSS 644~~
ORT 644 Sports Medicine Clerkship
Fall of every year. Spring of every year. Summer of every year. 1 to 20 credits. A student may earn a maximum of 30 credits in all enrollments for this course. R: Open to graduate-professional students in the College of Osteopathic Medicine.
Sports Medicine management and treatment. Proficiency in motor skills, aptitude, comprehension of concepts and principles, patient evaluations, diagnosis, management, therapy.
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 4 semesters after the end of the semester of enrollment.
Effective Fall Semester 2024

~~OSS 656~~
ORT 656 Orthopedic Clerkship
~~Fall of every year. Spring of every year. Summer of every year.~~ Fall of every year. Spring of every year. Summer of every year. 1 to 20 credits. A student may earn a maximum of 30 credits in all enrollments for this course. ~~RB: Completion of Units I and II. R: Open only to graduate-professional students in the College of Osteopathic Medicine.~~ R: Open to graduate-professional students or osteopathic medicine students in the College of Osteopathic Medicine.
Program developed to achieve proficiency in motor skills, aptitudes, comprehension of concepts and principles, patient evaluation, diagnosis, management, and therapy.
Request the use of the Pass-No Grade (P-N) system.
~~Request the use of ET-Extension to postpone grading.~~
~~The work for the course must be completed and the final grade reported within 4 semesters after the end of the semester of enrollment.~~ Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2 semesters after the end of the semester of enrollment.
~~SA: OM 656~~
Effective Fall Semester 2024