College of Engineering
Proposed Catalog Changes
Effective Summer 2020

Department of Computer Science

1. Add the following courses:

CS 474 Deep Learning
3 credits
Joint-listed with CS 574
Deep Learning is enabling many rapid technological advances across multiple science disciplines, from automated speech recognition through medical image analysis and to autonomous robots and vehicles. This course will cover Deep Learning topics on gradient decent (GD), cross-validation, regularization, deep feedforward neural networks (NNs), convolutional NNs (CNNs), recurrent NNs (RNNs), deep architectures, transfer learning, and multitask learning. In this course students will learn to: understand and describe concepts and implementations of: deep forward networks, regularization, CNNs, RNNs, and transfer learning; apply CNNs and RNNs for modeling, analyzing, and solving real-world problems; select and apply adequate or best-fit toolboxes to train, tune, and test a deep neural network. Students will also gain an ability to successfully communicate, collaborate, and lead within a project group setting. Additional work required for graduate credit.
Pre-req: (CS 121 or MATH 330) and STAT 301

Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls
Rationale: The course was taught once as a special topic in Spring 2018 and will be taught again in Fall 2019. There are broad connections from deep learning to topics in machine learning, data science, computer vision, and digital image processing. Add this course with a formal course number will allow us to teach it continuously to meet the students' needs of training and enable them the necessary skillset. Resources: The instructor Dr. Min Xian is a new hire in the department of computer science for the domain of data science and machine learning. He already created three other new special topic courses CS 404/504 Python for Machine Learning (PML), CS 404/504 Convex Optimization (CO), and CS 404/504 Digital Image Processing (DIP). The instructor plans to propose DL, PML, and DIP as permanent courses, to teach DL in every fall semester, and to teach DIP and PML iteratively in spring semesters. The course Deep Learning was first taught in Spring 2018 as a special topic and received good feedback from students. Students will use open-source software and their laptops for the hands-on practice part of the courses.

CS 477 Python for Machine Learning
3 credits
Joint-listed with CS 577
Python is widely used for Machine Learning and Data Science. This course introduces students to current approaches and techniques for finding solutions to Data Science problems using Machine Learning with Python. Topics include: classification, regression, clustering, ensemble learning, and

deep learning. The course offers hands-on experiences with Machine Learning techniques using Python-based libraries and also modern tools used by computer and data scientists such as Jupyter Notebook. In this course students will learn: an ability to understand and describe the fundamental concepts and techniques of Machine Learning and their Python-based implementations; an ability to design, implement, and evaluate Python-based Machine Learning solutions for problems such as data classification and clustering. Students will also develop leadership and teamwork abilities through group discussions and projects. Additional work required for graduate credit.
Prereq: (CS 121 or MATH 330) and STAT 301

Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls
Rationale: The course was taught once as a special topic in Fall 2018 and 34 students took the course. There are broad connections from this course to topics in machine/deep learning, AI, data science, computer vision, and digital image processing. Add this course with a formal course number will allow us to teach it continuously to meet the students' needs of training and enable them the necessary skillset. Resources: The instructor Dr. Min Xian is a new hire in the department of computer science for the domain of data science and machine learning. He already created three other new special topic courses CS 404/504 Deep Learning, CS 404/504 Convex Optimization, and CS 404/504 Digital Image Processing. The instructor plans to propose Deep Learning (DL), Python for Machine Learning (PML), and Digital Image Processing (DIP) as permanent courses, to teach DL and DIP in every fall semester, and to teach PML in spring semesters. The course PML was first taught in Fall 2018 as a special topic and received good feedback from students. Students will use open-source software, and their laptops for the hands-on practice part of the courses.

CS 489 Semantic Web and Open Data
3 credits
Joint-listed with CS 589
The Semantic Web extends the core principles of the World Wide Web to make the meaning of data machine-readable. This course covers the technological framework and associated functionalities enabled by the Semantic Web and Linked Open Data that provide a space for large scale data integration, reasoning and analysis. In this course students will learn: an ability to understand and describe the fundamental concepts in Semantic Web, such as ontology, RDF, OWL, logic reasoning, ontology engineering, knowledge graph, Linked Data, SPARQL, Open Data, as well as the inter-relationships among those concepts; an ability to design and implement domain-specific solutions for Big Data problems using concepts such as ontology engineering, data querying, analysis, and transformation, and output generation; an ability to describe and apply ethical concepts such as privacy, intellectual property, and responsibility as they relate to data analysis and the Semantic Web. Students will also develop leadership and teamwork abilities through group projects. Additional work required for graduate credit.
Prereq: CS 360 or CS 479 or CS 579

Distance Availability: Yes
Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls
Rationale: The course was taught once as a special topic in Fall 2017 and will taught again in Fall 2018. There are broad connections from Open Data to topics in data science, data mining and machine learning. Add this course with a formal course number will allow us teach it

continuously to meet the students' needs of training and enable them the necessary skillset. Resources: The instructor Dr. Xiaogang Ma is a new hire in the department of computer science for the domain of data science. He already created another course CS 479/579 Data Science. The course Semantic Web and Open Data was first taught in Fall 2017 as a special topic and received good feedback from students. The university has good data resources to support this course, such as those from the Northwest Knowledge Network. Students will use their own laptops for the hands-on practice part of the courses.

CS 574 Deep Learning
3 credits
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Deep Learning is enabling many rapid technological advances across multiple science disciplines, from automated speech recognition through medical image analysis and to autonomous robots and vehicles. This course will cover Deep Learning topics on gradient decent (GD), cross-validation, regularization, deep feedforward neural networks (NNs), convolutional NNs (CNNs), recurrent NNs (RNNs), deep architectures, transfer learning, and multitask learning. In this course students will learn to: understand and describe concepts and implementations of: deep forward networks, regularization, CNNs, RNNs, and transfer learning; apply CNNs and RNNs for modeling, analyzing, and solving real-world problems; select and apply adequate or best-fit toolboxes to train, tune, and test a deep neural network. Students will also gain an ability to successfully communicate, collaborate, and lead within a project group setting. Additional work required for graduate credit.
Prereq: (CS 121 or MATH 330) and STAT 301

Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls

Rationale: The course was taught once as a special topic in Spring 2018 and will be taught again in Fall 2019. There are broad connections from deep learning to topics in machine learning, data science, computer vision and digital image processing. Add this course with a formal course number will allow us to teach it continuously to meet the students' needs of training and enable them the necessary skillset. Resources: The instructor Dr. Min Xian is a new hire in the department of computer science for the domain of data science and machine learning. He already created three other new special topic courses CS 404/504 Python for Machine Learning (PML), CS 404/504 Convex Optimization (CO), and CS 404/504 Digital Image Processing (DIP). The instructor plans to propose DL, PML, and DIP as permanent courses, to teach DL in every fall semester, and to teach DIP and PML iteratively in spring semesters. The course Deep Learning was first taught in Spring 2018 as a special topic and received good feedback from students. Students will use open-source software, and their laptops for the hands-on practice part of the courses.

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deep learning. The course offers hands-on experiences with Machine Learning techniques using Python-based libraries and also modern tools used by computer and data scientists such as Jupyter Notebook. In this course students will learn: an ability to understand and describe the fundamental concepts and techniques of Machine Learning and their Python-based implementations; an ability to design, implement, and evaluate Python-based Machine Learning solutions for problems such as data classification and clustering. Students will also develop leadership and teamwork abilities through group discussions and projects. Additional work required for graduate credit.

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CS 589 Semantic Web and Open Data
3 credits
Joint-listed with CS 489
The Semantic Web extends the core principles of the World Wide Web to make the meaning of data machine-readable. This course covers the technological framework and associated functionalities enabled by the Semantic Web and Linked Open Data that provide a space for large scale data integration, reasoning and analysis. In this course students will learn: an ability to understand and describe the fundamental concepts in Semantic Web, such as ontology, RDF, OWL, logic reasoning, ontology engineering, knowledge graph, Linked Data, SPARQL, Open Data, as well as the inter-relationships among those concepts; an ability to design and implement domain-specific solutions for Big Data problems using concepts such as ontology engineering, data querying, analysis, and transformation, and output generation; an ability to describe and apply ethical concepts such as privacy, intellectual property, and responsibility as they relate to data analysis and the Semantic Web. Students will also develop leadership and teamwork abilities through group projects. Additional work required for graduate credit.
Prereq: CS 360 or CS 479 or CS 579

Distance Availability: Yes
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Rationale: The course was taught once as a special topic in Fall 2017 and will taught again in Fall 2018. There are broad connections from Open Data to topics in data science, data mining and

machine learning. Add this course with a formal course number will allow us teach it continuously to meet the students' needs of training and enable them the necessary skillset.
Resources: The instructor Dr. Xiaogang Ma is a new hire in the department of computer science for the domain of data science. He already created another course CS 479/579 Data Science. The course Semantic Web and Open Data was first taught in Fall 2017 as a special topic and received good feedback from students. The university has good data resources to support this course, such as those from the Northwest Knowledge Network. Students will use their own laptops for the hands-on practice part of the courses.

2. Reactivate the following courses (**Effective Spring 2020**):

CS 441 Advanced Operating Systems
3 credits
Joint-listed with CS 541
Principles of contemporary operating systems for network and distributed computer systems; sequential processes, scheduling, process synchronization, device management, file systems, memory management, and protection and security. Additional work required for graduate credit.
Prereq: CS 240

Distance Availability: Yes, via Engineering Outreach
Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls
Rationale: This course is currently inactive. The purpose of this form is to reactivate the existing course. The course is an important one for students wanting a more in-depth understanding of operating systems, particularly operating systems supporting distributed and networked systems, which are of increasing importance in computer science.
This course was taught roughly every other year. There was an extended gap when the primary instructor for the course, Dr. Robert Rinker, took on duties as the director of the Coeur d'Alene computer science program. These duties included teaching several introductory CS courses at North Idaho College (NIC) to start the pipeline of students to UI (student complete their first two years of CS at NIC and then transfer to the UI program). During that time Dr. Rinker didn't teach CS441/541. NIC has since hired an instructor for the courses Dr. Rinker was teaching and he is again available to teach CS441/541.

CS 541 Advanced Operating Systems
3 credits
Joint-listed with CS 441
Principles of contemporary operating systems for network and distributed computer systems; sequential processes, scheduling, process synchronization, device management, file systems, memory management, and protection and security. Additional work required for graduate credit.
Prereq: CS 240

Distance Availability: Yes, via Engineering Outreach
Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls

Rationale: This course is currently inactive. The purpose of this form is to reactivate the previously existing course. The course is an important one for students wanting a more in-depth understanding of operating systems, particularly operating systems supporting distributed and networked systems, which are of increasing importance in computer science.
This course was taught roughly every other year. There was an extended gap when the primary instructor for the course, Dr. Robert Rinker, took on duties as the director of the Coeur d'Alene computer science program. These duties included teaching several introductory CS courses at North Idaho College (NIC) to start the pipeline of students to UI (student complete their first two years of CS at NIC and then transfer to the UI program). During that time Dr. Rinker didn't teach CS441/541. NIC has since hired an instructor for the courses Dr. Rinker was teaching and he is again available to teach CS441/541.

3. Reactivate and change the following course:

CS 507 ~~Fundamentals of Research~~ Computer Science Research Methods
3 credits
~~Cross-listed with FOR 510~~
~~The research process, the graduate program, and the graduate research project; objectives, techniques, and challenges; science and the scientific method; research literature; ethics; creativity; writing and speaking about research; preparation of a proposal for the graduate research project. Students should be in very early stages of planning their research.~~ Introduction to Computer Science Research Methods for Graduate Students. Reading and writing research papers, experimental design, statistical analysis, responsible conduct of research, best practices in Computer Science research.
~~**Prereq:** Permission~~

Distance Availability: Yes
Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls
Rationale: This course was previously offered in conjunction with FOR as a broader research methods course. This course – more specific to Computer Science - has recently been offered as a CS 504. Replacing this special topics course with a permanent course will not change our workload.

4. Change the following course:

CS 383 Software Engineering
~~3~~4 credits
Current topics in development of software systems; software life cycle model, requirements definition, requirements analysis, software specification, software architectural design, engineering discipline in software development, software measurement, user interface design, legal and ethical issues in software product development. Projects are developed to demonstrate application of concepts.
Prereq: CS 210, CS 240 and CS 270 or Permission.

Geographical Areas: Moscow, Coeur d'Alene, Idaho Falls
Rationale: ABET Student Outcome 3: "Communicate effectively in a variety of professional contexts" relies heavily on this course, which means there are a large number of presentations during the semester. This does not leave a lot of room for traditional lectures, especially during semesters like this last one where we lost two lectures to snow closures.
ABET Student Outcome 4 "Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles." was recently removed from this course, to try to get back some of that lecture time, but I would like to re-add it as part of this request. CS 383 is a unique opportunity for the students to discuss copyright issues in the context of a project they are actually building; the students are required to "plagiarize" some aspect of their project and know the legal/social implications if they were to market their game as is. This is actually one of the most popular aspects of the course. (Ethics week also gives the students a needed "down week" where no new technical aspects will be added to the project requirements so students can catch up before the oral exams).

Department of Electrical and Computer Engineering

1. Add the following course:

ECE 370 Introduction to Probability, Statistics and Random Signals
3 credits
Part I of this course will cover the mathematical fundamentals of probability, statistics and random variables (1.5 credits). Part II will focus on application of the study of signals and systems involving uncertainty. Applications will include elementary problems in signal detection, signal processing, and communication (1.5 credits). Part I: Introduction to Probability Theory: axioms of probability, repeated trials, the concept of random variables, functions of random variables, sequences of random variables. Statistics: Estimation, Hypothesis testing. Part II: Systems with stochastic inputs, power spectrum, discrete-time processes, Gaussian noise, Poisson points and shot noise, spectral representation of random signals, mean square estimation.
Prereq: MATH 175, MATH 310 or Permission

Distance Availability: Yes
Rationale: The proposed course will present material similar to that in STAT 301 from fundamental and theoretical point of views, but with more emphasis on electrical and computer engineering problems. Specifically, students will characterize signals statistically and determine their probability distribution functions and their cumulative distribution functions. These are necessary skills for both electrical and computer engineering degree requirements. This proposal is a result of the department's continuous improvement process, required by our accreditation organization, ABET.

2. Make the following curricular changes:

Computer Engineering (B.S.Comp.E.)

Required course work includes the university requirements (see regulation J-3) and:

CHEM 111	General Chemistry I	3
CHEM 111L	General Chemistry I Laboratory	1
COMM 101	Fundamentals of Oral Communication	2
CS 120	Computer Science I	4
CS 121	Computer Science II	3
CS 150	Computer Organization and Architecture	3
CS 210	Programming Languages	3
CS 240	Computer Operating Systems	3
CS 270	System Software	3
ECE 101	Foundations of Electrical and Computer Engineering	2
ECE 210	Electrical Circuits I	3
ECE 211	Electrical Circuits Lab I	1
ECE 212	Electrical Circuits II	3
ECE 213	Electrical Circuits II Lab	1
ECE 240	Digital Logic	3
ECE 241	Logic Circuit Lab	1
ECE 292	Sophomore Seminar	0
ECE 310	Microelectronics I	3
ECE 311	Microelectronics I Lab	1
ECE 340	Microcontrollers	3
ECE 341	Microcontrollers Lab	1
ECE 350	Signals and Systems I	3
ECE 351	Signals and Systems I Lab	1
ECE 370	Introduction to Probability, Statistics and Random Signals	3
ECE 440	Digital Systems Engineering	3
ECE 482	Computer Engineering Senior Design I	3
ECE 483	Computer Engineering Senior Design II	3
ECE 491	Senior Seminar	0
ENGL 317	Technical Writing	3
MATH 170	Calculus I	4
MATH 175	Calculus II	4
MATH 176	Discrete Mathematics	3
MATH 310	Ordinary Differential Equations	3

MATH 330	Linear Algebra	3
PHIL 103	Introduction to Ethics	3
or AMST 301	Studies in American Culture	
PHYS 211	Engineering Physics I	3
PHYS 211L	Laboratory Physics I	1
PHYS 212	Engineering Physics II	3
PHYS 212L	Laboratory Physics II	1
~~STAT 301~~	~~Probability and Statistics~~	~~3~~
Select one of the following:		3-4
ECON 201	Principles of Macroeconomics	
ECON 202	Principles of Microeconomics	
ECON 272	Foundations of Economic Analysis	
Technical Electives:		
Select from upper-division computer engineering, electrical engineering, and computer science courses.		15
Total Hours		112-113

Courses to total 128 credits for this degree, not counting ENGL 101, MATH 143, and other courses that might be required to remove deficiencies.

Rationale: The proposed course will present material similar to that in STAT 301 from fundamental and theoretical point of views, but with more emphasis on electrical and computer engineering problems. Specifically, students will characterize signals statistically and determine their probability distribution functions and their cumulative distribution functions. These are necessary skills for both electrical and computer engineering degree requirements. This proposal is a result of the department's continuous improvement process, required by our accreditation organization, ABET.

Electrical Engineering (B.S.E.E.)

Required course work includes the university requirements (see regulation J-3) and:

CHEM 111	General Chemistry I	3
CHEM 111L	General Chemistry I Laboratory	1
CS 120	Computer Science I	4
ECE 101	Foundations of Electrical and Computer Engineering	2
ECE 210	Electrical Circuits I	3
ECE 211	Electrical Circuits Lab I	1
ECE 212	Electrical Circuits II	3

ECE 213	Electrical Circuits II Lab	1
ECE 240	Digital Logic	3
ECE 241	Logic Circuit Lab	1
ECE 292	Sophomore Seminar	0
ECE 310	Microelectronics I	3
ECE 311	Microelectronics I Lab	1
ECE 320	Energy Systems I	3
ECE 321	Energy Systems I Laboratory	1
ECE 330	Electromagnetic Theory	3
ECE 331	Electromagnetics Laboratory	1
ECE 340	Microcontrollers	3
ECE 341	Microcontrollers Lab	1
ECE 350	Signals and Systems I	3
ECE 351	Signals and Systems I Lab	1
ECE 370	Introduction to Probability, Statistics and Random Signals	
ECE 480	EE Senior Design I	3
ECE 481	EE Senior Design II	3
ECE 491	Senior Seminar	0
ENGR 210	Engineering Statics	3
ENGR 220	Engineering Dynamics	3
ENGR 360	Engineering Economy	2
ENGL 317	Technical Writing	3
MATH 170	Calculus I	4
MATH 175	Calculus II	4
MATH 275	Calculus III	3
MATH 310	Ordinary Differential Equations	3
MATH 330	Linear Algebra	3
PHIL 103	Introduction to Ethics	3
or AMST 301	Studies in American Culture	
PHYS 211	Engineering Physics I	3
PHYS 211L	Laboratory Physics I	1
PHYS 212	Engineering Physics II	3
PHYS 212L	Laboratory Physics II	1
~~STAT 301~~	~~Probability and Statistics~~	~~3~~
Select one of the following:		3-4
ECON 201	Principles of Macroeconomics	

ECON 202	Principles of Microeconomics	
ECON 272	Foundations of Economic Analysis	
Select one upper-division	Engineering Science elective:	3
ENGR 320	Engineering Thermodynamics and Heat Transfer	
ENGR 335	Engineering Fluid Mechanics	
ENGR 350	Engineering Mechanics of Materials	
ENGR 428	Numerical Methods	
MATH 428	Numerical Methods	
PHYS 428	Numerical Methods	
Select 18 credits of Technical electives taken from upper-division Engineering, Math, Physics, Statistics, and Computer Science courses: [1]		18
ECE 410	Microelectronics II	
or ECE 418	Introduction to Electronic Packaging	
ECE 420	Energy Systems II	
ECE 430	Microwave and Millimeter Wave Circuits	
or ECE 432	Propagation of Wireless Signals	
or ECE 434	Antenna Principles and Design	
ECE 440	Digital Systems Engineering	
or ECE 443	Distributed Processing and Control Networks	
ECE 450	Signals and Systems II	
ECE 460	Semiconductor Devices	3
or ECE 465	Introduction to Microelectronics Fabrication	
Total Hours		117-118

[1] Students may request, after approval by their academic advisor and the Petition Committee, to use other upper division technical courses in the College of Science or in Engineering Management (EM) in partial fulfillment of this requirement. Of these eighteen credits a minimum of twelve credits must be selected from electrical engineering courses including at least nine credits from these courses.

Courses to total 128 credits for this degree, not counting ENGL 101 , MATH 143 , and other courses that might be required to remove deficiencies.

Rationale: The proposed course will present material similar to that in STAT 301 from fundamental and theoretical point of views, but with more emphasis on electrical and computer engineering problems. Specifically, students will characterize signals statistically and determine their probability distribution functions and their cumulative distribution functions. These are necessary skills for both electrical and computer engineering degree requirements. This proposal is a result of the department's continuous improvement process, required by our accreditation organization, ABET.

Department of Engineering

1. Change the following course:

ENGR 220 Engineering Dynamics
3 credits
Particle and rigid body kinematics and kinetics; rectilinear, curvilinear, and relative motion, equations of motion, work and energy, impulse and momentum, systems of particles, rotation, rotating axes, rigid body analysis, angular momentum, vibration, and time response. Cooperative: open to WSU degree-seeking students.
Prereq: ENGR 210 and MATH 175

Rationale: There were students who failed to pass Math 175 but took ENGR 220. But the use of Math in ENGR 220 is quite intensive. Just like other sophomore year courses, it is better to add Math 175 as a prerequisite to ENGR 220.

Department of Mechanical Engineering

1. Add the following course:

ME 495 Mechanics in Design and Manufacturing
3 credits
An examination of the mechanics of deformation, shaping, and forming of materials, and the manufacturing processes utilizing them. Discussion of the four main material classes, their properties and their applications. Topics include elasticity, plasticity, and continuous material flow, microstructural concerns, advanced material failure mechanisms, materials testing, and design for manufacture.
Prereq: ME 341

Distance Availability: Yes
Rationale: Adding ME 498 - Mechanics in Design and Manufacturing - will provide Mechanical Engineering students with critical knowledge of manufacturing processes. The course serves two primary functions, to provide a background in the science of forming and deformation of materials, and to provide a broad overview of manufacturing and characterization techniques that graduating engineers will use in industry. Content in this course provides a foundation for graduate level studies in the areas of advanced/additive manufacturing or plastic forming. The course will be taught by ME faculty with industrial experience as needed, likely once each academic year. This course has been offered as a special topics course (ME 404) since the department hired Dr. Maughan as an associate professor (two years). There is enough interest in the course as a technical elective to include it in the catalog. The course offers an alternative

technical elective to replace some course offerings (e.g. ME 452) that are no longer regularly taught. Since it is a replacement alternative the department has the resources to offer this course on the typical schedule.

2. Change the following course:

ME 123 Introduction to Mechanical Design
3 credits
Introduction to engineering design process and analysis techniques including problem solving skills, development of software learning skills, graphical analysis, data analysis, and documentation skills. ~~Three lec and one open 2-hr lab a wk.~~ The course includes lecture and lab periods each week. (Fall only)
Coreq: ~~MATH 170.~~ MATH 143 and MATH 144

Rationale: This course does not depend on knowledge or abilities in calculus. But a co-requirement of algebra and trigonometry would be necessary to be successful in the course.

Additionally, if going back to a once-per-year offering in the Fall semester, this allows students starting their first semester in MATH 143 and MATH 144 to stay on-track in the mechanical engineering curriculum.

Department of Nuclear Engineering

1. Add the following course:

NE 587 Nuclear Decommissioning
3 credits
Concepts and strategies for decommissioning nuclear facilities including project and program management, waste management, and site environmental restorations.
Prereq: NE 450

Distance Availability: Yes
Geographical Areas: Moscow, Idaho Falls
Rationale: It is projected that a full quarter of the current U.S. nuclear generation capacity will be retired and require decommissioning by 2050. These decommission activities will require trained engineers with a skill set and knowledge base beyond those needed for projected construction of the new nuclear plants (conventional, small modular, and microreactors) during the same time period. This course will provide students with an introduction of the key engineering and management skills needed for the safe decommission of nuclear facilities. The ongoing Idaho National Laboratory Educational Contract will support the delivery of the course.