MECHANICAL ENGINEERING (MENG)

MENG 1000 - Design Thinking
3 Credits
In the course, students apply human-centered design thinking approach for creating innovative products. The course exposes students to the different phases of the design thinking process. They learn to apply appropriate design techniques at different phases. The concepts of observation, identification of unmet needs, design definition, creative idea generation and prototyping and testing are emphasized. Students also apply eco-design principles from the early concept design phases. The experiential activities include identifying user needs, crafting market opportunity, idea generation, and prototyping. (Offered in Spring)
Prerequisite(s): (ESCI 1700 or SE 1700)

MENG 1001 - Introduction to Aerospace & Mechanical Engineering
1 Credit
This course will introduce aerospace and mechanical engineering. Through hands-on activities, students will learn the basics of engineering design and entrepreneurship. Working in teams, students will build aerospace and mechanical systems, practice entrepreneurial thinking, and develop the personal and professional skills needed to engage in lifelong learning. This course is open to non-majors.

MENG 1002 - Computer-Aided Engineering Design
1 Credit
This course is an introduction to engineering drawing and computer aided design (CAD) and 3D solid modeling. Students will learn to interpret engineering drawings, create engineering drawings, and create 3D models of mechanical systems.

MENG 1011 - Prototyping
1 Credit
This course exposes students to the shop environment and the use of common hand and machine tools found in a typical fabrication shop in a safe manner. Emphasis is on using the right processes and right tools for the job. Safety in a fabrication shop is introduced and practiced.

MENG 2000 - Foundation to Engineering Design
3 Credits
Introduction to engineering, design philosophy, design methodology, design process, human factors, ethics, and economics. Various case studies will be presented to understand the principles of engineering. This course would prepare a student to think creatively in other engineering courses. Aided Eng. Design.
Prerequisite(s): (PHYS 1610* and MENG 1000*)

* Concurrent enrollment allowed.

MENG 2100X - Statics
3 Credits
Study of force systems acting on particles and rigid bodies, 2-D and 3-D equilibrium, trusses, frames machines, shear and moment diagrams, friction, centroids, area moment of inertia.
Prerequisite(s): PHYS 1610*

* Concurrent enrollment allowed.

MENG 2150 - Dynamics
3 Credits
Particle kinematics and kinetics in rectangular, cylindrical and normal-tangential coordinates; projectiles; relative motion using translating axes; work; conservative forces; conservation of energy; linear and angular impulse and momentum, conservation of momentum, rigid body kinematics and kinetics.
Prerequisite(s): ((ESCI 2100*, CVNG 2100*, or MENG 2100X*); MATH 1520)

* Concurrent enrollment allowed.

MENG 2310 - Thermodynamics
3 Credits
Properties, characteristics and fundamental equations of gases, application of first and second laws of thermodynamics in evaluation of engines, cycles and processes.
Prerequisite(s): MATH 2530*

* Concurrent enrollment allowed.

MENG 2400 - Mechatronics Systems Design
3 Credits
Review of the basics of microcontrollers programming and interfacing with mechanical systems. Selection and sizing of electro-mechanical components to satisfy the system requirements includes sizing of batteries, picking appropriate power supply, motors, sensors, data acquisition, and drivetrain systems. Design, prototype and test a smart system. Integrate with measurement, data analytics, and control systems.
Prerequisite(s): (ECE 1100 and ECE 1200)

MENG 2450 - Engineering Experimentation
3 Credits
A study of various measurement techniques in engineering and statistical analysis of experimental data. Applications to the measurement of strain, force, pressure, temperature, and fluid flow. An emphasis is given to the design of an experiment and error analysis using statistical data analysis. (Offered in Spring)
Prerequisite(s): (ECE 1100 and ECE 1200)

MENG 2910 - Co-Op with Industry
0 Credits (Repeatable for credit)
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the first experiential learning session. Grading system is determined by department offering course.
Prerequisite(s): (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S); CORE 1500*

* Concurrent enrollment allowed.
Restrictions:
Students with a classification of Freshman may **not** enroll.

Attributes: UUC:Reflection-in-Action

MENG 2913 - Co-Op in Mechanical Engineering
0 Credits (Repeatable for credit)
An optional supervised work experience with an agency, firm, or organization which employs engineers. The student receives a Pass or No Pass grade.
Prerequisite(s): CORE 1500*; (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S)

* Concurrent enrollment allowed.
Attributes: UUC:Reflection-in-Action

MENG 2930 - Special Topics
3 Credits (Repeatable for credit)

MENG 2980 - Independent Study
1 or 3 Credits (Repeatable for credit)

MENG 3001 - Mechanical Engineering Lab
1 Credit
This course supplements, enhances, and clarifies the materials covered in various lecture courses the students have taken including but not limited to Material Science, Thermodynamics, and Vibrations. In addition, this course provides hands-on experience with the tools and techniques used in the testing and experimentation, promotes good laboratory practices and techniques, and introduces the students to the statistical analysis of data, the interpretation of experimental results and the writing of clear, concise lab reports.
Prerequisite(s): (MENG 3110, ESCI 3110, or CVNG 4070); (MENG 3510, MENG 3510X, or BME 3400)

MENG 3010 - Machine Design
3 Credits
Design methodology, optimization, design of various machine elements including shafts, springs, belts, gears, and bearing. Design for strength and rigidity, fatigue and fracture.
Prerequisite(s): (MENG 3105, ESCI 3100, or CVNG 3105X)

MENG 3101 - Mechanics of Solids Lab
1 Credit
Laboratory experiments to emphasize material covered in lectures of MENG 3105.
Corequisite(s): MENG 3105

MENG 3105 - Mechanics of Solids
3 Credits
Stress and deformation due to axial load, torsion, bending and shear; properties of materials; statically indeterminate problems, analysis of plane stress and strain; combined loading; pressure vessels; beam deflections.
Prerequisite(s): (ESCI 2100, MENG 2100X, or CVNG 2100); MATH 2530*

* Concurrent enrollment allowed.

MENG 3110 - Linear Vibrations
3 Credits
Single and two degrees-of-freedom with and without damping, vibration dampers and absorbers; model properties of vibrating systems; vibration of lumped parameter and continuous systems; approximate numerical methods and digital computation. Review of test equipment and methods.
Prerequisite(s): (ESCI 2150 or MENG 2150); MATH 3550*

* Concurrent enrollment allowed.

MENG 3111 - Mechanics Laboratory
1 Credit
This course is the complementary laboratory course to lecture courses in Fluid Dynamics and Mechanics of Solids, providing the opportunity to directly engage and observe some of the concepts and phenomena described in the lectures. Other topics include laboratory procedures, statistical analysis of experimental data, and presentation of experimental results. (Offered in Fall and Spring)
Prerequisite(s): (ESCI 3100*, MENG 3105*, or CVNG 3105X*); (ESCI 3200* or MENG 3200*)

* Concurrent enrollment allowed.

MENG 3200 - Fluid Dynamics
3 Credits
Fluid mechanics, conservation of mass, momentum and energy, stream function; dimensional analysis and similitude; application to problems of inviscid and viscous flows, drag, flow measurements.
Prerequisite(s): MATH 2530*

* Concurrent enrollment allowed.

MENG 3201 - Fluid Dynamics Laboratory
1 Credit
Laboratory experiments in fluid dynamics to complement material covered in MENG 3200.
Corequisite(s): MENG 3200

MENG 3430 - Measurements
3 Credits
A study of various measurement techniques in engineering and statistical analysis of experimental data. Applications to the measurement of strain, force, pressure, temperature, and fluid flow. An emphasis is given to design of an experiment and error analysis using statistical data analysis.
Prerequisite(s): ECE 2001; ECE 2002

MENG 3510X - Materials Science
3 Credits
Materials Science is a multidisciplinary field requiring knowledge of chemistry, physics, and mechanics. In this first course we examine effect of chemistry on molecular structure and physical and mechanical properties of materials, and we examine methods of controlling those properties. Examples from the various engineering disciplines are used.
Prerequisite(s): (BME 3200 with a grade of C- or higher, CHEM 1120 with a grade of C- or higher, BME 3200 with a grade of C- or higher, and CHEM 1120 with a grade of C- or higher; MENG 3105, CHEM 1110, MENG 3105, and CHEM 1110; CVNG 3105X, CHEM 1110, CVNG 3105X, and CHEM 1110; ESCI 3100, CHEM 1110, ESCI 3100, and CHEM 1110)

MENG 3600 - Manufacturing Process
3 Credits
This course provides detailed discussion on various manufacturing processes: netshape, material removal, and joining and assembly processes. Students learn the fundamental principles and the tools-of-the-trade by working hand-on with the machine tools. The current manufacturing techniques such as rapid prototyping, manufacturing cells, and lean-manufacturing are discussed.
Prerequisite(s): (MENG 1011 or (ESCI 1011 and MENG 2011)); (MENG 3510, MENG 3510X, or BME 3400)

MENG 3910 - Co-Op with Industry
0 Credits (Repeatable for credit)
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the second experiential learning session.
Prerequisite(s): (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S); CORE 1500*

* Concurrent enrollment allowed.
Attributes: UUC:Reflection-in-Action

MENG 3915 - Internship with Industry
0-3 Credits (Repeatable for credit)
A work experience with an agency, firm or organization that employs persons in this degree field. This experience may be full time or part-time as required by the industry sponsor. This course is used for the first experiential learning session.
Prerequisite(s): CORE 1500*; (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S)

* Concurrent enrollment allowed.
Restrictions:
Enrollment limited to students with a classification of Junior or Senior.

Attributes: UUC:Reflection-in-Action

MENG 3930 - Special Topics
3 Credits (Repeatable for credit)

MENG 3939 - Collaborative Inquiry
1-3 Credits (Repeatable for credit)
Collaborative Inquiry Special Topics.
Prerequisite(s): Minimum Earned Credits of 60; CORE 1500*; (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S)

* Concurrent enrollment allowed.
Attributes: UUC:Collaborative Inquiry

MENG 3980 - Independent Study
1 or 3 Credits (Repeatable for credit)

MENG 4004 - Design I
3 Credits
Preliminary design of a mechanical system with emphasis on concurrent engineering, human factors, costs analysis, and material selection. The design project may be sponsored by industry or department. Also an emphasis is given to writing the design proposal and presenting it to a committee from the department.
Prerequisite(s): MENG 3010

MENG 4014 - Design II
3 Credits
Detailed design of a mechanical system, manufacturing the product if feasible, cost estimation, testing and demonstration of the product. A report on the final design is required and also the design should be presented to the faculty and peers from industry.
Prerequisite(s): MENG 4004

MENG 4024 - Mechanical Systems Design
3 Credits
This is the capstone course in Mechanical Engineering. The engineering design process: need analysis, development of specifications, function carriers, concept generation, selection of concept design, embodiment generation, selection of embodiment design, and detailed design of engineering systems. It uses analytic, numerical and experimental modelling in the design of engineering products. It covers technical and managerial perspectives, development and protection of intellectual property, working in a team and developing leadership skills, step management, engineering project management, use of codes in design, ethics, sustainability and entrepreneurship, budget development, risk analysis and risk mitigation.
Prerequisite(s): MENG 3010; MENG 4450; Minimum Earned Credits of 90

MENG 4110 - Fracture Mechanics and Plasticity
3 Credits
Advanced elasticity topics: plate theory, stress singularities at re-entrant corners, intro to fracture mechanics, mechanics of bonded interfaces, elastic contact mechanics; Plasticity topics: yield criteria in metal plasticity, deformation and incremental plasticity, elastic-plastic stress-strain relations, strain hardening, small-strain elastoplasticity (bending, torsion, buckling, disks and cylinders).

MENG 4150 - Finite Element Method I
3 Credits
Variational forms for 1D and 2D, Rayleigh Ritz, Galerkin, element matrices and assembly, formulation of axial/truss/beam/plane-frame structural elements, 2D field problem formulation, linear and triangular elements for heat transfer/irrotational flow, torsion of noncircular sections, elasticity, higher order and mapped elements, numerical integration. Lab applications and project included. This is the undergraduate version of this course.

MENG 4200 - Advanced Fluid Dynamics
3 Credits
Introduction to the physical concepts and mathematical analysis of fluid flow. Kinematics, stress, and thermodynamic properties of a fluid. Integral and differential equations for conservation of mass, momentum and energy. Applications in potential flow, viscous flow and compressible flow. Fluid flow measurements. This is the undergraduate version of this course.

MENG 4220 - Introduction to Turbulence
3 Credits
This course introduces the nature and origins of turbulence, transition mechanisms, turbulent transport of momentum and heat, dynamics of turbulence, wall-bounded and free shear flows, spectral dynamics, and statistical description of turbulence. This is the undergraduate version of this course.

MENG 4250 - Turbomachinery and Gas Turbines Analysis and Design
3 Credits
Upon completion of this course the students will be able to apply engineering principles of thermodynamics, fluid mechanics, statics, dynamics, vibrations, controls and mechatronics for the selection and design of turbomachinery, gas turbines, and their components. They will also be able to design suitable individual engine components for diverse applications and markets. Further they will be able to consider dynamic and strength of materials considerations, and suitable materials according to operating conditions such as pressure, temperature, rotating speed, mass flow rate, fuel properties and working fluid properties.

MENG 4300 - Heat Transfer
3 Credits
Conduction, Extended Surfaces, Transient Conduction, Computational Conduction, Convective Boundary Layer, External, Internal, and Free Convection, Boiling, Condensation, Heat Exchangers, Radiation, Blackbody Radiation, Radiation Exchange.
Prerequisite(s): (CSCI 1060 or CSCI 1300); (ESCI 2300 or MENG 2310); (ESCI 3200 or MENG 3200)

MENG 4304 - Thermal Systems Design
3 Credits
Use of energy and entropy balances in the study, analysis, preliminary design and optimization of traditional and emerging energy conversion components and powerplants. Definitions and use of static, stagnation and total properties at flow stations of working fluids. Euler equation in turbomachines. Energy and entropy balances for solar energy components. Applications to design and optimization of compressors, turbines, pumps, fans, heat exchangers, positive-displacement systems, and other energy conversion devices using various working fluid properties. Preliminary design and optimization of gas power cycles, Rankine power cycles, jet-propulsion, reciprocating-piston engine cycles, heating ventilation and air conditioning systems (HVAC), and renewable and sustainable energy powerplants.
Prerequisite(s): MENG 4300; CORE 1900; CORE 1500; CORE 1200*; CORE 2500*; CORE 1000

* Concurrent enrollment allowed.
Attributes: UUC:Self in the World

MENG 4310 - Reciprocating-Piston Engines Analysis and Design
3 Credits
Upon completion of this course the students will be able to apply engineering principles of thermodynamics, fluid mechanics, statics, dynamics, vibrations, controls and mechatronics for the selection and design of reciprocating piston engines and their components. They will also be able to design suitable individual engine components for diverse applications and markets. Further they will be able to consider dynamic and strength of materials considerations, and suitable materials according to operating conditions such as pressure, temperature, rotating speed, mass flow rate, fuel properties and working fluid properties.

MENG 4450 - Programmable Logic Controllers and Robotics
3 Credits
Introduction to mechatronic components: sensors, transducers, microprocessor-based systems and PLCs. Applications in motion control (AC/DC motors & stepper motors). Robotics. A major project in electro-mechanical system design and development.
Prerequisite(s): (ECE 2001 or MENG 2450); MENG 2400

MENG 4820 - Technology Entrepreneurship
3 Credits
The course is intended as a general introduction to the models and applications of entrepreneurship. The course provides the basis for technology entrepreneurship mindset. The course will introduce the three major forms of entrepreneurship-independent (as in self-employment), corporate entrepreneurship and social venturing. In addition, the course will educate students about the three key elements of modern entrepreneurship: the recognition and creation of opportunities, the development of strategies to realize those opportunities, and the packaging of those opportunities for maximum impact in intended markets. This is the undergraduate version of this course.

MENG 4830 - Medical Product Design and Entrepreneurship
3 Credits
Via group development of a specific healthcare product this course prepares students for a career in public or private sector in healthcare R&D, innovation and entrepreneurship in the next frontier: human health. After an introduction of basic anatomy and review of leading diseases and ailments, differences in the healthcare marketplace in the US, Europe and Asia are examined, with a view on pharmaceutical and medical-device development. Differences and similarities in pathways for regulatory approval processes (CE mark, FDA approval etc.), design to standards, and reimbursement-code strategies for various categories of products are examined.

MENG 4840 - Numerical Methods
3 Credits
In this course, students will learn how to develop numerical algorithms to solve engineering problems, which are then implemented in programming languages such as MATLAB, Python, and other commercial engineering software. Problems of interest to Aerospace, Mechanical, Civil, Electrical, Biomedical Engineering and Applied Physics will be addressed. This is the undergraduate version of this course.

MENG 4910 - Co-Op with Industry
0-3 Credits (Repeatable for credit)
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the third experiential learning session.
Prerequisite(s): MENG 3910; (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S); CORE 1500*

* Concurrent enrollment allowed.
Attributes: UUC:Reflection-in-Action

MENG 4915 - Internship with Industry
0-3 Credits (Repeatable for credit)
A work experience with an agency, firm or organization that employs persons in this degree field. This experience may be full time or part-time as required by the industry sponsor.
Prerequisite(s): MENG 3915; CORE 1500*; (CORE 1000 or UUC Ignite Seminar Waiver with a minimum score of S)

* Concurrent enrollment allowed.
Attributes: UUC:Reflection-in-Action

MENG 4930 - Special Topics: Mechanical Engineering
3 Credits (Repeatable for credit)

MENG 4980 - Advanced Independent Study in Mechanical Engineering
0-3 Credits (Repeatable for credit)
Credits to be arranged. Independent Study on a topic in Mechanical Engineering under the direction of a Faculty member.

MENG 5009 - Seminar
1 Credit (Repeatable for credit)
Presentations of current research by students, faculty, and guests. Registration required in the first semester. Seminar attendance expected in subsequent semesters.

MENG 5100 - Advanced Mechanics of Solids
3 Credits
Elasticity relations, linear elasticity assumptions, St. Venant's principle, transformation of stress, principal stresses in 3D, plane elasticity, Airy stress function, polynomial solutions, thermal stresses, relations in polar coordinates, point load solutions, stress concentration, axisymmetric problems, stresses in disks & cylinders, energy methods, Rayleigh Ritz, Buckling. Emphasis on advanced applications.

MENG 5110 - Fracture Mechanics and Plasticity
3 Credits
Advanced elasticity topics: plate theory, stress singularities at re-entrant corners, intro to fracture mechanics, mechanics of bonded interfaces, elastic contact mechanics; Plasticity topics: yield criteria in metal plasticity, deformation and incremental plasticity, elastic-plastic stress-strain relations, strain hardening, small-strain elastoplasticity (bending, torsion, buckling, disks and cylinders).
Prerequisite(s): MENG 5150 with a grade of C or higher; MENG 5100 with a grade of C or higher

MENG 5150 - Finite Element Analysis I
3 Credits
Variational forms for 1D and 2D, Rayleigh Ritz, Galerkin, element matrices and assembly, formulation of axial/truss/beam/plane-frame structural elements, 2D field problem formulation, linear and triangular elements for heat transfer/irrotational flow, torsion of noncircular sections, elasticity, higher order and mapped elements, numerical integration. Lab applications and project included.

MENG 5200 - Advanced Fluid Dynamics
3 Credits
Introduction to the physical concepts and mathematical analysis of fluid flow. Kinematics, stress, and thermodynamic properties of a fluid. Integral and differential equations for conservation of mass, momentum and energy. Applications in potential flow, viscous flow and compressible flow. Fluid flow measurements.

MENG 5220 - Experimental Methods in Fluid Dynamics
3 Credits
This lab-based course introduces students to the modern techniques used to investigate fluid dynamic problems, including pitot-static tubes, wake rakes, thermal anemometry, laser Doppler anemometry, particle image velocimetry, and pressure and temperature sensitive paints.
Prerequisite(s): MENG 5200

MENG 5240 - An Introduction to Turbulence
3 Credits
This course introduces the nature and origins of turbulence, transition mechanisms, turbulent transport of momentum and heat, dynamics of turbulence, wall-bounded and free shear flows, spectral dynamics, and statistical description of turbulence.

MENG 5310 - Reciprocating-Piston Engines Analysis and Design
3 Credits
Upon completion of this course the students will be able to apply engineering principles of thermodynamics, fluid mechanics, statics, dynamics, vibrations, controls and mechatronics for the selection and design of reciprocating piston engines and their components. They will also be able to design suitable individual engine components for diverse applications and markets. Further they will be able to consider dynamic and strength of materials considerations, and suitable materials according to operating conditions such as pressure, temperature, rotating speed, mass flow rate, fuel properties and working fluid properties.

MENG 5820 - Technology Entrepreneurship
3 Credits
The course is intended as a general introduction to the models and applications of entrepreneurship. The course provides the basis for technology entrepreneurship mindset. The course will introduce the three major forms of entrepreneurship-independent (as in self-employment), corporate entrepreneurship and social venturing. In addition, the course will educate students about the three key elements of modern entrepreneurship: the recognition and creation of opportunities, the development of strategies to realize those opportunities, and the packaging of those opportunities for maximum impact in intended markets. This is the graduate version of this course.
Attributes: BME Graduate Elective

MENG 5830 - Medical Product and Design and Entrepreneurship
3 Credits
Via group development of a specific healthcare product this course prepares students for a career in public or private sector in healthcare R&D, innovation and entrepreneurship in the next frontier: human health. After an introduction of basic anatomy and review of leading diseases and ailments, differences in the healthcare marketplace in the US, Europe and Asia are examined, with a view on pharmaceutical and medical-device development. Differences and similarities in pathways for regulatory approval processes (CE mark, FDA approval etc.), design to standards, and reimbursement-code strategies for various categories of products are examined.

MENG 5902 - Numerical Methods Using Matlab and LabVIEW
3 Credits
This course will introduce students to the Matlab and LabVIEW programming packages while teaching how to use software and numerical methods to solve engineering problems. Problems of interest to Aerospace, Mechanical, Civil, Electrical, and Biomedical Engineering programs will be addressed.

MENG 5910 - Co-op with Industry
1-6 Credits
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for experiential learning session.

MENG 5915 - Internship with Industry
1-3 Credits
A work experience with an agency, firm, organization that employs persons in this degree field. This experience may be full time or part time as required by the industry sponsor.

MENG 5930 - Special Topics
1-3 Credits (Repeatable for credit)
A one-time course on a particular topic, or a trial course that is expected to become a standard course with its own unique course number.

MENG 5964 - Master's Project
1-3 Credits (Repeatable for credit)
Theoretical/computational/experimental work that leads to a Project Report and of defense of the Project.

MENG 5974 - Research Topics
1-3 Credits

MENG 5980 - Graduate Independent Study in Mechanical Engineering
1 or 3 Credits (Repeatable for credit)

MENG 5984 - Graduate Independent Study in Mechanical Engineering
1-3 Credits (Repeatable for credit)
A non-classroom course in which a student explores a topic that is related to the student's graduate work and career goals.

MENG 5994 - Thesis Research
0-6 Credits (Repeatable for credit)
Research that leads to a Master's Thesis and final defense of the Thesis.

MENG 6910 - Co-op with Industry
1-6 Credits
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field.

MENG 6915 - Internship with Industry
1-3 Credits
A work experience with an agency, firm, organization that employs persons in this degree field. This experience may be full time or part time as required by the industry sponsor.

MENG 6930 - Special Topics
3 Credits (Repeatable for credit)

MENG 6974 - Advanced Research Topics in Mechanical Engineering
1-3 Credits
Theoretical or Computational or experimental work that is not part of the Dissertation.

MENG 6980 - Graduate Independent Study in Mechanical Engineering
1 or 3 Credits (Repeatable for credit)

MENG 6984 - Graduate Independent Study in Mechanical Engineering
1-3 Credits (Repeatable for credit)
A non-classroom course in which a student explores a topic that is related to the student's doctoral work and career goals.

MENG 6994 - Doctoral Dissertation Research
0-6 Credits (Repeatable for credit)
A non-classroom course in which a student explores a topic that is related to the student's doctoral work and career goals.