EXECUTIVE SUMMARY

Item Name: **Request for New Academic Programs for Northern Arizona University**

☒ Action Item

Requested Action: Northern Arizona University asks the board to approve the new program requests effective for the 2020-2021 catalog year.

Background/History of Previous Board Action

- As provided in board policy, Academic Strategic Plans may be modified during the year with the approval of the Academic Affairs and Educational Attainment Committee.

Discussion

Northern Arizona University seeks to add six new programs for implementation in the 2020-2021 academic year. This request is for the following new academic programs:

- Entry into the Profession of Nursing, Masters
- PK-12 College and Career Counseling, MEd
- Ecology and Evolutionary Biology, BS
- Electrical Engineering Technology, BS
- Software Engineering, BS
- Multidisciplinary Engineering, BS

All academic degree programs go through multiple review and approval processes to ensure their currency, quality, and relevance. At least once each semester, the Provost initiates the academic planning process. The academic deans, in consultation with the directors of the academic units, submit information on all proposed new degrees, concentrations, minors, and certificates for the ensuing year, as well as changes to existing degree titles, program disestablishments, and creation of new organizations, organizational changes and disestablishments. Once reviewed and approved by the Provost, these initiatives begin the review process, including, as applicable, the curriculum committees in the academic unit, college, Graduate College, and University Senate. At each level, a substantive review of the proposed program is completed to ensure quality and to avoid redundancy with other programs. At any step in the approval process, programs can be tabled and/or returned to the academic unit for further clarification and/or revision.

Contact Information:
Diane Stearns, Provost diane.stearns@nau.edu 928-523-2230
Chad Sampson, ABOR chad.sampson@azregents.edu 602-229-2512

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Statutory/Policy Requirements

ABOR Policy 2-223.A – the Academic Strategic Plan

Committee Review and Recommendation

The Academic Affairs and Educational Attainment Committee reviewed this item at its November 7, 2019 meeting, and recommended forwarding the item to the full board for approval.

Proposed New Programs	Degree	College/School	Page Number
Graduate Programs			
Entry into the Profession of Nursing	MEPN	School of Nursing	3
PK-12 College and Career Counseling,	MEd	Educational Psychology (EPS) College of Education	7
Undergraduate Programs			
Ecology and Evolutionary Biology	BS	Department of Biological Sciences	12
Electrical Engineering Technology	BS	School of Informatics, Computing, and Cyber Systems College of Engineering, Informatics, and Applied Sciences	16
Software Engineering	BS	School of Informatics, Computing, and Cyber Systems College of Engineering, Informatics, and Applied Sciences	20
Multidiciplinary Engineering	BS	Department of Civil Engineering, Construction Management, and Environmental Engineering School of Informatics, Computing, and Cyber Systems Department of Mechanical Engineering College of Engineering, Informatics, and Applied Sciences	25

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New Academic Program Request

University: Northern Arizona University

Name of Proposed Academic Program:

Entry into the Profession of Nursing, Masters

Academic Department:

School of Nursing

Geographic Site:

NAU Tucson Campus at Pima Community College, West Campus Tucson, Arizona

Instructional Modality:

In-person

Total Credit Hours:

57 credit hours

Proposed Inception Term:

May 2021 (12 week)

Brief Program Description:

The Entry into the Profession of Nursing is an accelerated entry-level master's degree that prepares students at the graduate level for future advanced practice with the education needed for national licensure. The EPN Master's program accepts students with a non-nursing bachelor's degree, who have met the science requirements. The demand for registered nurses is only increasing. According to the Bureau of Labor Statistics, employment of registered nurses is projected to grow 15 percent from 2016 to 2026 -- faster than the average for all occupations.

Master's nursing programs prepare individuals for a variety of advanced roles in administration, teaching, research, informatics, and direct patient care. Nurses at this level are in high demand as Clinical Nurse Leaders, nurse managers, clinical educators, health policy consultants, research assistants, public health nurses, and in many other capacities. Developed for those with a bachelor's or graduate degree in a discipline other than nursing, entry-level master's degrees are also referred to as generic or accelerated programs. These offerings generally take about 2 to 3 years to finish with baccalaureate-level content and initial RN licensure completed during the first year. These programs, many of which prepare Clinical Nurse Leaders, are paced for students who have proven their ability to succeed at a four-year college or university. More than 60 entry-level master's programs are available at schools nationwide.(American Association of Colleges of Nursing)

This new program is consistent with both ABOR, Goal #2, and NAU, Goal #1 Objective 1, which speaks to increasing access to higher education. The Institute of Medicine (IOM) (2010) also acknowledges that higher education for nurses is necessary due to shifting demographics and evolving complexities of care.

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The MEPN program addresses both access to higher education and the nursing shortage. It is important to note that the MEPN program is also compatible with the School of Nursing mission "[…] to provide outstanding education to students at the undergraduate, master's and doctoral level who can provide high quality health care services to individuals and diverse communities in an environment of constant change and emerging health care trends" (Northern Arizona University, 2019).

This program is unique compared to other programs offered within the School of Nursing (SON). Although, the SON offers an accelerated bachelor's degree and a master's generalist degree, the MEPN program, which is an accelerated entry-level master's degree, has not be previously offered by NAU.

Students will apply the nursing process to the study of health and illness in individuals and communities across the life span. This will include didactic and clinical course work. Skills will be applied in a variety of health care settings.

Learning Outcomes and Assessment Plan:

These program learning outcomes are based on the CCNE Essentials and the School of Nursing outcomes. They have been mapped to the Master's Essentials. Student progress will be measured and assessed through assignments, testing, clinical skills and simulations.

Learning Outcome 1 (LO1): Engagement in Clinical Practice and Prevention

- Concepts: Lifespan healthcare, culturally responsive healthcare interventions, services, and healthcare environments.
- Competencies: a) Integrate theory, evidence, professional perspectives, and patient preferences into clinical judgment to provide holistic patient-centered care across the lifespan and healthcare continuum, and in healthcare environments; b) Design patient-centered and culturally responsive strategies in the delivery of clinical prevention and health promotion interventions and/or services to individuals, families, communities, and aggregates/clinical populations.
- Measures: Direct measure of mastery using performance indicators and rubrics associated with clinical practice and prevention.

Learning Outcome 2 (LO2): Communication

- Concepts: Interprofessional practice, communication strategies, patient education, accessibility, practice patterns, information and communication technologies.
- Competencies: a) Develop and collaborate within interprofessional teams and partnerships by using effective communication strategies; b) Advance patient education, enhance accessibility of care, analyze practice patterns, and improve health care and nurse sensitive outcomes by using information and communication technologies.
- Measures: Direct measure of mastery using performance indicators and rubrics associated with communication.

Learning Outcome 3 (LO3): Critical Reasoning

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- Concepts: Research/Evidence on clinical nursing practice and patient centered care. Evidence
- Competencies: a) Synthesize evidence and nursing knowledge to evaluate and modify clinical nursing practice, in order to provide holistic, safe, comprehensive, patient-centered care; b) Integrate reliable evidence from multiple ways of knowing to inform practice and make clinical judgement.
- Measures: Direct measure of mastery using performance indicators and rubrics associated with critical reasoning.

Learning Outcome 4 (LO4): Leadership

- Concepts: Health care policy, financing, legal and regulatory processes, patient safety, health care leadership and care assessment.
- Competencies: a) Integrate knowledge and skills in leadership, quality improvement, health care policy and patient safety into practice to provide high quality care; b) Analyze how policies influence the structure and financing of health care, practice, and health outcomes; c) Examine the effect of legal and regulatory processes on nursing practice, healthcare delivery, and outcomes.
- Measures: Direct measure of mastery using performance indicators and rubrics associated with nursing leadership.

Learning Outcome 5 (LO5): Professionalism and Professional Values

- Concepts: Professional values, ethical and legal principles, standards of nursing practice, scientific and ethical principles.
- Competencies: a) Integrate professional values and their associated behaviors into the practice of nursing; b) Incorporate ethical and legal principles and professional standards into nursing practice; c) Integrate caring's affective characteristics into patient-centered care and with other healthcare professionals; d) Incorporate core scientific and ethical principles in identifying potential and actual ethical issues arising from practice, and assisting patients and other healthcare providers to address such issues.
- Measures: Direct measure of mastery using performance indicators and rubrics associated with professionalism and professional values.

Learning Outcome 6 (LO6): Global Health

- Concepts: Health equity and social justice, health disparities, social and cultural factors affecting health.
- Competencies: Advocate for health equity and social justice for vulnerable populations and the elimination of health disparities both locally and globally; Prioritize the social and cultural factors that affect health in designed and delivering care across multiple contexts
- Measures: Direct measure of mastery using performance indicators and rubrics associated with global health.

Projected Enrollment for the First Three Years:
Please provide anticipated enrollment numbers for each of the first three years of the proposed program

Year one: 10 students
Year two: 24 students

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Year three: 24 students

Evidence of Market Demand:
Please provide an estimate of the future state-wide and national demand for graduates of the proposed academic program. Please specify the source (e.g. Burning Glass; Jobs EQ; US Department of Labor) of workforce demand data and detail the assumptions that underpin these projections.

If job market data is unavailable or not applicable please explain why and elaborate another justification for the proposed program

Nationwide, the Bureau of Labor Statistics identified a need for nurses, with a growing rate of 15%. Arizona is designated as a state with a critical shortage of nurses; there is a need for approximately 30,000 nurses by 2025.

Similar Programs Offered at Arizona Public Universities:

University of Arizona began their program in 2011 and enrollment has doubled and expanded to Phoenix over the years. Currently, they accept 90 students per year in both Tucson and Phoenix.

Arizona State University's MEPN program admitted their first cohort fall 2019. It is a 5 semester program, compared to NAU's proposed 4 semester program.

Current enrollments at all three Arizona institutions will not meet the needs of the state. NAU's programs will complement ASU and UA programs and will increase the total number of graduates for Arizona.

New Resources Required?
Faculty staffing will be consistent with growing enrollments, appropriate for accreditation requirements, and assigned using allocation of existing resources.

Program Fee Required? YES | NO ✓ **Estimated Amount:**

External Accreditation? YES ✓ NO

Accreditor:

Will pursue accreditation through the Commission on Collegiate Nursing Education once the program meets the requirement of producing its first graduates.

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New Academic Program Request

University: Northern Arizona University

Name of Proposed Academic Program: PK-12 College and Career Counseling, MEd

Academic Department:
Educational Psychology (EPS)
College of Education

Geographic Site:
Flagstaff, Tucson – Pima CC, and Phoenix – North Valley

Instructional Modality:
In-person, with some Blended and Online Courses

Total Credit Hours: 36

Proposed Inception Term:
Fall 2020

Brief Program Description:
The MEd in PK-12 College and Career Counseling provides school counselors with career guidance and counseling skills to assist students as they explore their interests and strengths in relation to the value of educational choices and performance in achieving future aspirations. There is no other program like this being offered in the State of Arizona, and the program complements the current NAU EPS Counseling Programs (i.e., MA Clinical Mental Health Counseling and MED School Counseling).

There is a high demand in Arizona to hire school personnel as College and Career Counselors to assist students with information on high school course offerings, career options, the type of academic and occupational training needed to succeed in the workplace, and postsecondary opportunities that are associated with their interests. The vast majority of America's high school students (86%) expect to attend college, but many lack the support and guidance they need to prepare for enrollment and success in college. (U.S. Department of Education, NCES 2010-170). Furthermore, college-going rates differ disproportionately by family income, parent education level and other demographic characteristics. Too few students are graduating from high school ready for college. This education deficit is an urgent concern for the future of the nation as a whole and for our most underserved communities. (CollegeBoard.Org)

Counselors are employed in the PK-12 school systems where they have a direct impact on students' academic achievement, future career decisions, and are able to connect students with information and helpful resources in regards to their plans for the future. The proposed 36-hour M.Ed. in College and Career Counseling will provide students from educational and related backgrounds with the necessary training to work as college and career counselors in the PK-12 school systems. Graduates of this master's program will receive training in

counseling skills, gain exposure to the American School Counseling Association (ASCA) National Model components and its implementation, obtain current information and resources on building a college-going culture with diverse groups of students in PK-12, and learn to address legal and ethical issues in schools, as well as crisis and trauma situations in school settings.

The proposed 36-hour M.Ed. in College and Career Counseling will provide students with needed training in counseling skills and knowledge in the following content areas: Human Growth and Development, Social and Cultural Foundations, Helping Relationships, Group Work, Career and Lifestyle Development, Testing and Appraisal, Research and Program Evaluation, Ethics and Professional Orientation. In addition, students will complete a 300-hour internship in a school setting. Students will also be equipped to address legal, ethical, crisis, and trauma issues in schools.

This program is directly related to NAU's Strategic Goal #1 – Student Success and Access, preparing professionals whose purpose is to increase PK-12 College and Career Success. This new program aligns with the mission of the College of Education and workforce needs of Arizona PK-12 schools expressed by the Arizona Department of Education. Completion of this program would improve the qualifications and effectiveness of school personnel with Bachelor's degrees or other non-counseling Master's degrees who have been placed in Career Centers in PK-12 schools to assist students with the current college and career readiness emphasis in our public schools.

Learning Outcomes and Assessment Plan

Define the core concepts and competencies that the proposed program will deliver. Please explain how learning outcomes will be measured and assessed.

Learning Outcome 1 (LO1): The MEd PK-12 College and Career Counseling degree will follow the Council for Accreditation of Educator Preparation (CAEP) Standard:

- **Concepts:** Candidates will develop a deep understanding of the critical concepts and principles of the PK-12 College and Career Counseling field of preparation. Including:
  - ✓ Human Growth and Development
  - ✓ Social and Cultural Foundations
  - ✓ Helping Relationships
  - ✓ Group Work
  - ✓ Career and Lifestyle Development
  - ✓ Appraisal
  - ✓ Research and Program Evaluation
  - ✓ Orientation to Profession
- **Competencies:** Demonstrate conceptual and theoretical knowledge on the foundations of PK-12 College and Career Counseling, and competently apply this understanding to the PK-12 school setting, including ability to administer and interpret career assessments and communication of results to students, teachers and parents.
- **Measures and Assessment:** Successful completion of all program coursework and career counseling competency assessment, to include case studies with rubrics to demonstrate competency in conceptual and theoretical knowledge, as well as ability to effectively communicate.

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Learning Outcome 2 (LO2): Candidates will be able to demonstrate entry-level professional specialty practice skills to advance the learning of all PK-12 students toward attainment of college and career counseling standards. These skills include the application of data literacy, use of research and employment of data analysis and evidence to develop supportive school environments, leading and/or participating in collaborative activities with others such as peers, colleagues, teachers, administrators, community organizations, and parents, supporting appropriate applications of technology for the field.

- **Concepts:** Knowledge of current evidence-based career assessment, intervention and planning, including teaching, counseling and consultation.
- **Competencies:** Ability to integrate theory and practice, and apply these skills and concepts ethically and effectively in PK-12 settings.
- **Measures and Assessment:** Successful completion of internship with evaluation of competency by site supervisor and faculty supervisor.

Learning Outcome 3(LO3): Candidates will demonstrate ethical behavior and commitment to professional standards of practice, including cultural competence and trauma competence to effectively serve the needs of diverse populations in PK12 school settings.

- **Concepts:** ASCA Code of Ethics; theories and tenets of multicultural counseling, issues of diversity, trauma, historical trauma and the impact on human behavior and career development.
- **Competencies:** Ability to articulate, critically evaluate, reflect and apply sound ethical reasoning in complex situations in PK12 settings and demonstrate professional, ethical, multicultural competencies and trauma-informed behavior that addresses the needs of diverse students.
- **Measurement and Assessment:** Case studies with rubrics and successful completion of internship with evaluation of competency by site supervisor and faculty supervisor.

Projected Enrollment for the First Three Years:
Year one: 15
Year two: 35
Year three: 45

Evidence of Market Demand: In the past decade, there has been a national trend of integrating college readiness into education reform efforts in PK-12 schools (Savitz-Romer and Bouffard, 2014). Unfortunately, many school staff do not have specialized training in college and career readiness or counseling skills that would increase their effectiveness in assisting these students. This master's degree program provides the necessary specialized training in college and career readiness counseling. Additionally, the need for these counselors was also articulated through informal conversations with the Arizona Department of Education and the NAU school counseling faculty. Currently, Arizona's student-to-school counselor ratio is 905-to-1 with the recommended ratio being 250-to-1 (ASCA, 2019). Arizona's ratio is among the worst in the nation. Recent legislative action has also set aside funds to help meet this increased demand in schools.

The profession of school counseling is in high demand. The United States Bureau of Labor Statistics (2018) states that 324,500 school counseling positions are needed in the next 10 years. The profession has been under-employed for many years. However, recent escalation

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with mental health issues, bullying, threat assessment, and crisis intervention needs in today's schools, along with continued needs for career exploration and higher-education guidance counseling has increased the demand for counselors in schools. The American School Counselor Association (ASCA) recommends a counselor to student ratio of 1:250 and the national average is 1:455. In Arizona, the current ratio in Arizona schools is 1:905, or more than twice the national average. This ranks Arizona as the worst in the country. The Bureau of Labor Statistics is reporting a predicted 8% faster than average growth for school and career counselors indicating the growing demand for counselors in schools. The Occupational Outlook Handbook (2017) indicates that employment of school and career counselors is expected to grow by 13% from 2016 to 2026, about as fast as the average for all occupations. NAU is prepared to respond to the need for school counselors with a high quality nationally accredited program that will assist the students and the state address this demand and growing field. The 36-hour MEd PK-12 College and Career Counseling degree program will assist in meeting this need.

Similar Programs Offered at Arizona Public Universities:
Arizona State University (ASU) does not have a school counseling or similar program. University of Arizona (UA) does have a 60-hour counseling program - M.A. Counseling with two specializations. UA students can choose to specialize in School Counseling or Clinical Rehabilitation Counseling and Clinical Mental Health Counseling. However, the 36-hour NAU program is the first program in the state that focuses exclusively on College and Career Readiness in PK-12 school system. The students in the 36-hour program at NAU will develop specific knowledge and skills-competencies in the PK-12 system that focus on the counselor's role in student career and academic planning as well as communication skills for working with diverse populations to engage students in early career awareness and planning. Graduates will understand the importance of postsecondary choices and will be able to use data to guide academic planning as they work with students to transition them from middle school to high school and then to college.

There is no other program like this being offered in the State of Arizona, and the program will complement the current NAU EPS Counseling Programs (i.e., Clinical Mental Health Counseling School Counseling.

New Resources Required? (i.e., faculty and administrative positions; infrastructure, etc.): Faculty staffing will be consistent with growing enrollments, appropriate for accreditation requirements, and assigned using allocation of existing resources.

Program Fee Required? YES X NO _ **Estimated Amount:** $300/term

Program Fee Justification: The program fee will help support the cost of delivering this program by supporting faculty with hourly teaching assistants, lab aides, and graders. The fee will allow us to better incorporate and support technology in the curriculum and provide our students with current hands-on training and testing experiences through purchase of testing kits, testing protocols, and instruments. The fee will also allow faculty to make required site visits during student internships. A portion of the fee will be used for financial aid and scholarships for those students who demonstrate financial need. This fee eliminates the needs for class fees and out of pocket expenses for testing protocols, etc., and is consistent with program fees assessed on other similar practitioner programs in the department.

If levying a program fee, please justify the estimated amount.

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The cost of hourly student worker wages and/or experienced part-time temporary workers with related background will be hired to provide course support on a semester-long basis. In addition, the expense of traveling to multiple sites for faculty and supervisors is part of the internship requirement for on-site visits. The fee will also cover cost of current test kits, protocols and testing materials for students – along with costs of current technology used within the program.

External Accreditation? YES **X** NO

Accreditor:

We will pursue CAEP (Council for Accreditation of Educator Preparation) accreditation once the program meets the requirement of producing its first graduates.

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New Academic Program Request

University: Northern Arizona University

Name of Proposed Academic Program: Ecology and Evolutionary Biology BS
Academic Department: Department of Biological Sciences
Geographic Site: Flagstaff Mountain Campus
Instructional Modality: In person
Total Credit Hours: 120
Proposed Inception Term: Fall 2020
Brief Program Description: The BSEEB will be grounded in Biology as the primary area of expertise with overlapping competencies provided through existing program offerings in Forestry, Environmental Sciences and Informatics. Students will develop expertise in ecology, evolution and organismal biology from world-renowned NAU researchers working in those areas, and in forestry, environmental sciences and informatics. The BSEEB will complement several of NAUs areas of research expertise and growth enabling students to have better access to career pathways that require in depth knowledge of plants, animals, and microbes in their environment (NAU strategic Goal 1). It will further support the research mission by better connecting to research expertise and helping faculty find well trained students to assist with research (Goal 2). Local environmental focus combined with existing programs and partnerships to train underrepresented students and work with tribal colleges contributes to NAU's commitment to Native Americans (Goal 3). A commitment to connecting to the human environment and human impacts on the natural world will advance students' engagement and ability to contribute to a sustainable future (Goals 4 and 5). The BSEEB degree will allow NAU students to more quickly develop grounding in ecology, evolution and organismal biology by guiding them effectively through existing foundational courses. Highlights in the core curriculum would include a recently developed "Fundamentals of Evolution" course and a revised "Ecology" course with a required laboratory which teaches students outdoors on the Colorado Plateau. These early experiences will enable students to progress into research and internship experiences (High Impact Practices), along with their upper division coursework, so that they can compete for positions in graduate schools and for jobs in natural resources, public, non-profit, and educational sectors. A carefully selected group of upper division courses will emphasize fundamental understanding in biology; an

Contact Information:

Diane Stearns, Provost	diane.stearns@nau.edu	928-523-2230
Chad Sampson, ABOR	chad.sampson@azregents.edu	602-229-2512

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understanding of organisms and their evolution in their environment; quantitative skills; communication; integration of modern high-tech methods; and the application of basic science to applied problems in resource management, environmental change, and health. Students will be poised to contribute to managing the increasing environmental impact of humans on the Colorado Plateau and throughout Arizona.

Learning Outcomes and Assessment Plan:

LO1: Demonstrate understanding of the core natural sciences: Biology, Chemistry, and Physics.

- Concepts: Physics and chemistry underlie the biological sciences which in turn provide the basis for more advanced study in ecology and evolutionary biology.
- Competencies: Demonstrated understanding of introductory general physics, inorganic and organic chemistry, and the breadth of biology including the central dogma, inheritance, evolution, genetics, cell biology, core physiological process, development and the diversity of life.
- Measures and Assessment: Measures of mastery in the core introductory biology curriculum and in required physics and chemistry courses.

LO2: Demonstrate mastery of concepts in ecology and evolutionary biology by being able to comprehend, conduct, and communicate the scientific process in this field.

- Concepts: Evolution is an organizing force for life on earth; genetic mechanisms underlie evolution; and ecological phenomena are the cause and consequence of evolution.
- Competencies: Demonstrate in-depth understanding of ecology and evolution; explain and interpret scientific data and papers in ecology and evolutionary biology; communicate the results of scientific research to audiences from the public to managers to scientists.
- Measures and Assessment: Performance in sophomore-level ecology and evolution courses, upper division EEB courses, and the senior capstone. Progression in communications skill development as assessed in BIO 181L/182L, BIO 226/L, BIO 365, and the capstone class.

LO3: Understanding of the function of organisms in the natural environment.

- Concepts: Applying ecological and evolutionary knowledge requires in-depth understanding of the diversity of a group of organisms and how they function within ecosystems.
- Competencies: Learn details of the diversity and key adaptations of a group of organisms; apply ecology and evolutionary biology concepts in the field on the Colorado Plateau; be able to describe the major element (carbon, nitrogen, etc.) cycles in natural ecosystems.
- Measures and Assessment: Assessment in courses from the EEB organismal group, BIO 226/L and other field-based courses.

LO4: Demonstrate quantitative skills including math, models, statistics, computing or informatics for application to ecology and evolutionary biology.

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- Concepts: The ecology and evolutionary biology field requires a diverse set of quantitative tools.
- Competencies: Students will develop basic mathematical skills, apply quantitative reasoning to core population genetic and population demography models and ecosystem matter and energy fluxes, and use basic statistical and/or informatics tools in data analysis.
- Measures and Assessment: Assessment in required math and statistics/informatics courses, BIO226, BIO240, BIO244, and application-based activities in upper division course work.

LO5: Students demonstrate their ability to synthesize core Ecology and Evolutionary Biology concepts by applying those concepts to human and environmental problems and/or other subfields of biology.

- Concepts: Ecological and evolutionary knowledge applies to other fields.
- Competencies: Bring knowledge of ecology and evolutionary biology to issues in conservation, climate change, natural resource management, forestry, agriculture, or human health.
- Measures: Assessment in the EEB-related breadth group of courses which provide a broader and more applied perspective.

Projected Enrollment for the First Three Years:
Year one: 35
Year two: 75
Year three: 100

Evidence of Market Demand:
There is potentially very high student demand for this program, as evidenced by the fact that Environmental Studies (NCES CIP code 3.0103) is listed as an undergraduate growth area in Hannover's Market Analysis for NAU (2019), and ecology is a foundational instructional area in environmental studies. In addition, Natural resources is listed as a top growth area for graduate fields and an undergraduate BSEEB will build a cohort of qualified students to continue on to natural resources graduate programs at NAU, ASU, and U of A. The Bureau of Labor Statistics includes positive job growth projections from fields related to the BSEEB major with environment science growing at an above average rate of 8%, agriculture and food at an above average rate of 7%, and zoology and wildlife at an average rate of 5%. It is harder to find statistics in sub-specialties in natural resources that seem likely to grow due to the environmental impacts of human activities and the need for sustainable natural resource management. In one example, www.environmentalscience.org says "Job demand for all environmental specialists, including NEPA and CEQA managers is expected to grow between 11% between 2014 and 2024. That is 50% higher than the national average for all jobs, which is expected to be in the region of 7%."

The NAU Biology degree and Wildlife Management Certification are complimentary programs to the proposed BSEEB. The Biology degree has experienced growth since 2013 and maintains a current enrollment of approximately 870 undergraduates. In addition, the Wildlife Management Certification Program has seen 35% growth since 2013 and currently has 139 students enrolled, with 75 of those being Biology majors. The introductory ecology course has an annual enrollment of (~120-150) and the Evolutionary Biology capstone course that aligns with the proposed major already serves more than 60 students per year. There is high

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demand for research experiences for undergraduate students in ecology, evolution, ecosystems, botany, and wildlife at NAU. Furthermore, NAU students are in demand for state and federal natural resource agency positions, in consulting firms, and for admittance to graduate schools.
Similar Programs Offered at Arizona Public Universities: The University of Arizona has an Ecology and Evolutionary Biology department and a BS in Ecology and Evolutionary Biology with similar competencies. Distinctions: 1) NAU's degree will have a focus on the biomes (naturally occurring communities of animals and plants) of Northern Arizona and the Colorado Plateau with their unique variation caused by steep elevation gradients. Focus on these habitats will complement work with tribes on land in Northern Arizona; 2) NAU's BSEEB will have a unique selection of breadth coursework including human connections, informatics, and management perspectives from Biology, Informatics, Forestry, and Environmental Sciences; 3) The new BSEEB will be offered through an existing comprehensive Department of Biology contributing to depth and breadth of understanding life; and 4) Northern Arizona University's program will make use of overlapping, but not identical, research expertise. NAU has invested in research centers in this area (Center for Ecosystem Science and Society, Merriam-Powell Center for Environmental Research, and Landscape Conservation Initiative) and in several new high-research faculty in the Biology Department and the School of Informatics, Computing, and Cyber Systems. The most similar major at Arizona State University is the LABSCCBS: BS in Biology with emphasis in Conservation Biology and Ecology which has similarities in the early curriculum. Most of the same contrasts from U of A apply. However, ASU's program is in a Biology department, but is more focused on conservation in the upper division coursework than NAU.
New Resources Required? Anticipated new resources would be an increase in Teaching Assistants assigned to the core and upper-division courses of this major in step with increasing enrollment. Existing faculty and classes in Biology will serve this major as it is an area of research expertise for NAU. As the major grows, some faculty resources will be shifted to cover additional upper division and capstone offerings for this major.
Program Fee Required? YES NO X **Estimated Amount:**
External Accreditation? YES NO X

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New Academic Program Request

University: Northern Arizona University

Name of Proposed Academic Program: Bachelor of Science in Electrical Engineering Technology (BSEET)
Academic Department: School of Informatics, Computing, and Cyber Systems College of Engineering, Informatics, and Applied Sciences
Geographic Site: Extended campuses
Instructional Modality: Online
Total Credit Hours: 120
Proposed Inception Term: Fall 2020
Brief Program Description: Electrical Engineering Technology (EET) is a branch of engineering technology that Prepares graduates with skills necessary to enter careers in the application, design, manufacture, and operation of electronic systems. Electrical Engineering Technology is distinguished from other branches of engineering technology by its emphasis on electronic systems, and from Electrical Engineering (EE) by its emphasis on applied techniques and knowledge over more abstract concepts and theory. Graduates of the BS in EET program are well prepared to excel in careers that develop and implement electronic systems, with particular expertise in power and energy systems. A unique feature of NAU's BS in EET is the depth and breadth of expertise required through prior learning and field experience. A significant number of credits are acquired via the evaluation of technical portfolios, which are evaluated by EET faculty and staff. The program allows energy management professionals to advance their knowledge and skills by employing the strong professional training received from military experience and/or employment in industry, and blending it into a bachelor's degree pathway at NAU which covers a broad spectrum of electrical engineering technology topics, while providing in-depth expertise in power systems, power electronics, and electronics project management. Areas covered by the EET program enjoy healthy growth in professional opportunities that is based on demand for this type of educational pathway among engineering technology professionals. Furthermore, this program directly supports the NAU objective to "increase access to higher education, particularly for Arizona students". It also supports the NAU objective to "enhance student learning through high-quality student learning experiences" by leveraging existing programmatic and curricular expertise to create new kinds of learning experiences that build on existing areas and programs of strength. And finally, it supports the

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NAU objective to "increase enrollment, retention, and graduation of diverse students" by developing an applied program designed for underserved learners with prior non-traditional learning experiences.

This program builds on expertise in the College of Engineering, Informatics, and Applied Sciences (CEIAS) which offers six ABET accredited programs in engineering and computer science. Two of those programs from the School of Informatics, Computing, and Cyber Systems (SICCS) are BS degrees in Electrical Engineering and Computer Engineering, which are accredited by the ABET Engineering Accreditation Commission (EAC). The Electrical Engineering Technology degree is designed with an eye toward eventual accreditation under the ABET Engineering Technology Accreditation Commission (ETAC).

Learning Outcomes and Assessment Plan:
Learning outcomes are based on ABET ETAC requirements.

Learning Outcome 1 (LO1) an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline;

- Concepts: a) Physics (including electromagnetism), b) Chemistry (including material properties), c) engineering design, d) electronics testing.
- Competencies: a) ability to apply math and science to the design of new electronic systems, b) ability to solve engineering problems with algebra and trigonometry.
- Measures and Assessments: Direct measure of mastery using performance indicators and rubrics associated with classes in advanced design coursework.

Learning Outcome 2 (LO2) an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;

- Concepts: a) engineering analysis, b) implementation and fabrication techniques.
- Competencies: a) ability to analyze control and power systems; b) ability to design and implement control and power systems.
- Measures and Assessments: Direct measure of mastery using performance indicators and rubrics associated with classes in advanced design coursework.

Learning Outcome 3 (LO3) an ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;

- Concepts: a) Oral communication in an applied context: communication in project teams, delivering presentations, and communicating technological risks to diverse audiences; b) Written communication in an applied context: writing project reports and communicating complicated technology issues.
- Competencies: a) Ability to communicate electrical engineering technology issues to diverse academic, and professional audiences through reports, proposals, and presentations.
- Measures and Assessments: Direct measure of mastery using performance indicators and rubrics associated with research project coursework.

Learning Outcome 4 (LO4) an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and

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- Concepts: a) circuits, b) computer programming, c) analog and digital electronics, and d) engineering standards.
- Competencies: a) the ability to build and test circuits; b) the ability to use computer programming for EET analysis and design, c) the ability to apply engineering standards to the building, testing, operation, and maintenance of electronic systems.
- Measures and Assessments: Direct measure of mastery using performance indicators and rubrics associated with classes in advanced design coursework.

Learning Outcome 5 (LO5) an ability to function effectively as a member as well as a leader on technical teams.

- Concepts: a) Leadership and Teamwork: Working with diverse colleagues and clients to develop electronic systems and providing leadership in a team or corporate context; b) Project Management: The use of project management and engineering principles to design and implement electronic and power systems.
- Competencies: a) Ability to solve problems in a team setting and provide leadership in problem solving and analysis; b) Ability to lead electrical engineering and computer engineering development and implementation teams.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with coursework in leadership and teamwork.

Measurement and assessment of LO1-LO5 will use a continuous improvement model. Classes where mastery is demonstrated for an outcome are summatively assessed using performance indicators, rubrics, metrics, and targeted levels of attainment. Direct measures for each learning outcome will be deployed in key classes where mastery experiences take place for that outcome (e.g., Capstone Senior Design class EET486C). Indirect measures include Senior Exit Surveys, Industry Surveys, and Faculty surveys. This assessment then drives future improvement to the program. This mirrors the assessment and continuous improvement model used in our existing Computer Science and Engineering programs at NAU and meets ABET accreditation requirements.

Projected Enrollment for the First Three Years:

Year one: 25
Year two: 72
Year three: 145

Evidence of Market Demand:
O*NET OnLine projects 9,500 job openings each year from 2016 - 2026 for Energy Engineers in the United States, of which 50% will require a bachelor's degree. The U.S. Bureau of Labor Statistics (BLS) does not have a specific category for EET but it does forecast job growth (2018-2028) in Electrical Engineering at 2%, Computer Hardware Engineering at 6%, and Electricians at 10%. NAU's BS in EET program has a particular emphasis in power, which is not tracked by BLS but engineers are one of the most sought-after occupations by the power industry. According to the Solar Foundation, 53% of manufacturing firms related to the power industry reported difficulty in hiring qualified engineers. Burning Glass notes, "workers do not have the specific technical skills employers need. This is particularly a problem as new technology becomes integrated into more fields. Job postings for electricians, for example, increasingly

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ask for electrical engineering." This degree seeks to address exactly this combination of skill relevance and supply shortage.

Similar Programs Offered at Arizona Public Universities:
Neither Arizona State University (ASU) nor University of Arizona (UA) offer programs in Electrical Engineering Technology. Both schools do offer more traditional programs in Electrical Engineering and Computer Engineering. The emphases of these programs are considerably different than the more applied BSEET program described here, which is distinct in its focus on applied practice and its incorporation of prior learning and field experience.

New Resources Required? (i.e. faculty and administrative positions; infrastructure, etc.):
This proposed program requires no additional investment in physical infrastructure. Existing faculty with extensive expertise in electrical engineering and engineering technology, including power systems engineering, power electronics, and engineering design, provide a solid foundation for supporting the BSEET design.

Program Fee Required? YES X NO **Estimated Amount: $425/term**

Program Fee Justification:
The proposed program fee is consistent with program fees in other programs within the College of Engineering, Informatics, and Applied Sciences, including our electrical engineering and computer engineering programs. These fees are an essential part of defraying the higher expenditures needed to provide students with a quality education that is technologically current and meets employer expectations. Additional expenses for CEIAS programs include, but are not limited to, market-driven instructional expenses, specialized facility and equipment expenditures, software licensing, the maintenance and updating technological infrastructure, and enhancing the learning experience through additional investments in instructional personnel. A portion of the fee will be used for financial aid and scholarships for those students who demonstrate merit and financial need.

External Accreditation? YES X NO

Accreditor: We anticipate eventual ABET accreditation once the program meets the requirement of producing its first graduates.

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New Academic Program Request

University: Northern Arizona University

Name of Proposed Academic Program: Bachelor of Science in Software Engineering (BSSE)

Academic Department:
School of Informatics, Computing, and Cyber Systems
College of Engineering, Informatics, and Applied Sciences

Geographic Site:
Flagstaff, Arizona

Instructional Modality:
In-person

Total Credit Hours:
120

Proposed Inception Term:
Fall 2020

Brief Program Description:
Software engineering consists of the principled application of repeatable processes and methods for the design, development, maintenance, and evolution of software systems. The field is distinguished from programming and computer science by its emphasis on practical techniques supporting the team-based development of large-scale and long-lived software systems that are required to operate reliably and within specified functional and non-functional constraints.

Students in the BSSE will be provided with skills in software engineering processes, including requirements analysis, software design and architecture, software testing, multiple programming languages and libraries, cloud computing technologies, project management, and foundational areas such as data structures and algorithmic complexity. Elective selections will permit students to specialize in other application areas, including human-computer interaction, socio-technical computing, computer networks, high-performance computing, and cybersecurity. A capstone project will allow students to exercise the full breadth of their skillset by working with clients on real-world projects.

A distinctive characteristic of this program, and one that exemplifies its emphasis on workforce development, is the inclusion of required and industry-recognized professional certifications. All graduates of this program will be required to complete the Professional Software Developer (PSD) Certification offered by the IEEE Computer Society. In addition to the IEEE certification, all students will also be required to earn the Amazon Web Services (AWS) Certified Solutions Architect Professional (CSAP) certification.

Graduates of this program enjoy strong employment prospects, and this program responds to high demand by students and the industry as software systems become increasingly

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ubiquitous. Software developer positions are projected to grow by 21% through 2028 and command generous compensation. By providing educational pathways that prepare skilled software engineers to join and be successful in the workforce, this program will also contribute to our mission to "strengthen the university's contributions to the economic vitality of Arizona communities and beyond." This program also supports NAU's institutional mission to "increase access to higher education, particularly for Arizona students" by offering additional degree options in areas of high demand.

Our ability to efficiently support the BSSE program is strengthened by our roster of related programs, including our computer science and applied computer science programs, which share many core programming courses with software engineering, and our cybersecurity programs.

This program builds on expertise in the College of Engineering, Informatics, and Applied Sciences (CEIAS) which offers six ABET accredited programs in engineering and computer science. Two of those programs from the School of Informatics, Computing, and Cyber Systems (SICCS) are BS degrees in Electrical Engineering and Computer Engineering, which are accredited by the ABET Engineering Accreditation Commission (EAC). The Electrical Engineering Technology degree is designed with an eye toward eventual accreditation under the ABET Engineering Technology Accreditation Commission (ETAC).

Learning Outcomes and Assessment Plan:

Learning Outcome 1 (LO1): Identify, explain, and apply appropriate project and process management methods.

- Concepts: Structured lifecycle models, e.g. waterfall, spiral; agile management processes, e.g. Scrum, XP; effort estimation; task dependency analysis; team organization and management.
- Competencies: Organize software engineering work using a lifecycle model appropriate to the development context; manage and monitor progress in software engineering projects using a variety of management processes; estimate the effort associated with the development software modules; use dependency analysis to ensure that development progresses; effectively map software system designs to team structures.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in software process and project management; successful completion of IEEE PSD certification; rubrics associated with lifecycle management in summative senior capstone design coursework.

Learning Outcome 2 (LO2): Identify, explain, and apply the fundamental methods of software engineering.

- Concepts: Requirements elicitation and analysis methods; software design and architecture; software modeling languages, e.g. UML; software testing methods, e.g. unit testing.
- Competencies: Apply requirements elicitation and analysis methods to develop complete requirements specifications for complex software products; use design patterns and architectural styles appropriate to the problem domain; develop robust and reliable software systems through the principled application of software testing techniques.

- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in requirements engineering, design, and testing; successful completion of IEEE PSD certification; rubrics associated with software engineering methods in summative senior capstone design coursework.

Learning Outcome 3 (LO3): Apply appropriate programming methods to the development of high-quality software systems.

- Concepts: Contemporary programming languages, e.g. Python, Java; data structures and algorithmic complexity; software construction best-practices, e.g. coding and variable conventions, code organization, defensive programming.
- Competencies: Select and apply programming languages with features and characteristics appropriate to desired system characteristics; analyze and account for trade-offs in the selection of appropriate data structures and algorithms; develop high-quality systems that perform reliably and robustly; engineer software systems that are easily maintainable and long-lived.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in data structures and programming; successful completion of IEEE PSD certification.

Learning Outcome 4 (LO4): Identify, select, and apply contemporary technologies to the design of distributed software systems.

- Concepts: Cloud infrastructure and architectures; virtualization; cybersecurity in the cloud; distributed file systems, e.g. Hadoop; noSQL databases; cloud programming models, e.g. MapReduce.
- Competencies: Select appropriate compositions of technologies with which to support the development of cloud-based systems; develop and deploy systems on cloud computing infrastructures, such as Amazon Web Services (AWS); effectively use cloud-centric programming and data management techniques.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in cloud computing; successful completion of AWS CSAP certification.

Learning Outcome 5 (LO5): Engage in effective teamwork as a member of a software engineering team.

- Concepts: Team roles; teamwork communication strategies; work allocation and tracking; peer assessment and evaluation.
- Competencies: Distinguish and organize according to specific teamwork roles and responsibilities; effectively and professionally communicate with team members and defuse team conflicts; refer to and maintain current models of team progress; provide objective assessments of team member performance and productivity.
- Measures and Assessment: Rubrics associated with teamwork in summative senior capstone design coursework.

Learning Outcome 6 (LO6): Compose and engage in effective written and oral communication in software development.

- Concepts: Professional correspondence best-practices; responding to proposal solicitations; primary and secondary research; effective document structure; poster preparation; oral presentation best-practices.

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- Competencies: Develop professional documents and software documentation; effectively communicate results of development efforts; deliver effective oral presentations to specialist and lay audiences.
- Measures and Assessment: Rubrics associated with written and oral communication in summative senior capstone design coursework.

Assessment Process: The measures and assessment points discussed for LO1 through LO6 will be holistically integrated in a continuous assessment and improvement process. Systematic periodic reviews of assessment data and reporting on how this data meets targeted levels of attainment drive curricular improvements. This mirrors existing assessment and continuous improvement models currently deployed in our programs and meets ABET accreditation requirements.

Projected Enrollment for the First Three Years:
Year one: 30
Year two: 70
Year three: 120

Evidence of Market Demand:
Software engineers are among the most sought-after engineering professionals: The United States Department of Labor Bureau of Labor Statistics (www.bls.gov/ooh/computer-and-information-technology/software-developers.htm) projects that the number of software developer positions is growing "much faster than average" with a 21% growth projected through 2028. These positions are also well-compensated, with 2018 median pay at $105,590 per year and $50.77 per hour.

Similar Programs Offered at Arizona Public Universities:
University of Arizona (UA) does not offer a stand-alone software engineering program, but some related software engineering content is covered as part of the computer science program, as is common in such programs including our own computer science program at Northern Arizona University (NAU). Arizona State University (ASU) offers stand-alone software engineering programs in both in-person and online modalities. Our proposed BSSE program is distinct from UA and ASU offerings in its emphasis on cloud computing, to align with workforce needs in this rapidly-growing area, and by its explicit inclusion of required professional certifications (i.e. IEEE PSD and AWS CSAP) to better prepare students for quick entry into the profession.

New Resources Required? (i.e. faculty and administrative positions; infrastructure, etc.):
This proposed program requires no additional investment in physical or information technology infrastructure. Existing faculty with expertise in programming, software engineering processes, design and architecture, testing, and human-computer interaction provide a solid foundation for supporting the BSSE program's launch. Once the program is launched, and informed by enrollment numbers, we intend to add at least one more tenure-track faculty with specialized expertise in requirements engineering and agile methods through either the addition of a new faculty or the reassignment of an existing position.

Program Fee Required? YES X NO **Estimated Amount: $425/term**

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Program Fee Justification: The proposed program fee is consistent with program fees in other programs within the College of Engineering, Informatics, and Applied Sciences, including our computer science and applied computer science programs. These fees are an essential part of defraying the higher expenditures needed to provide students with a quality education that is technologically current and meets employer expectations. Additional expenses for CEIAS programs include, but are not limited to, market-driven instructional expenses, specialized facility and equipment expenditures, software licensing, the maintenance and updating technological infrastructure, and enhancing the learning experience through additional investments in instructional personnel. A portion of the fee will be used for financial aid and scholarships for those students who demonstrate merit and financial need.

External Accreditation? YES X NO ☐

Accreditor: We will pursue ABET accreditation once the program meets the requirement of producing its first graduates.

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New Academic Program Request

University: Northern Arizona University

Name of Proposed Academic Program: Bachelor of Science in Multidisciplinary Engineering (BSMDE)

Academic Department:
Department of Civil Engineering, Construction Management, and Environmental Engineering
School of Informatics, Computing, and Cyber Systems
Department of Mechanical Engineering
College of Engineering, Informatics, and Applied Sciences

Geographic Site:
Flagstaff, AZ

Instructional Modality:
In-person

Total Credit Hours:
120

Proposed Inception Term:
Fall 2020

Brief Program Description:
Multidisciplinary engineering combines expertise from multiple engineering fields to prepare students for a breadth of careers, particularly in emerging areas without clearly-defined existing programs of study and in areas that demand a well-rounded skillset such as validation and product safety engineers. The area is distinguished from other engineering disciplines by its emphasis on building breadth of engineering expertise and the ability to combine knowledge from multiple engineering fields over in-depth study in one limited engineering area. Multidisciplinary engineering also permits students to create customized programs of study that are aligned with and driven by their individual interests and passions rather than having to follow prescribed curricula, for example specializing in automation by combining coursework from mechanical and electrical engineering.

Students in the BSMDE program will be provided with skills and expertise in engineering design processes and tools, project and organizational management, engineering ethics, teamwork and communication, foundational mathematics and statistical analysis techniques, and the physical sciences underpinning engineering design. Elective selections will permit students to customize their program of study in areas of interest by combining coursework from multiple engineering disciplines.

Engineering professionals continue to enjoy strong employment potential, with projected growth of an average of 5% through the next decade. Building this program will also support NAU's institutional mission to "increase access to higher education, particularly for Arizona students" by offering additional degree options in areas of high demand. By providing educational pathways that prepare skilled software engineers to join and be successful in the workforce,

this program will also contribute to our mission to "strengthen the university's contributions to the economic vitality of Arizona communities and beyond."

Our ability to efficiently support the BSMDE program is strengthened by our roster of related engineering programs, including our civil, environmental, mechanical, electrical, and computer engineering programs.

This program builds on expertise in the College of Engineering, Informatics, and Applied Sciences (CEIAS) which offers six ABET accredited programs in engineering and computer science. Two of those programs from the School of Informatics, Computing, and Cyber Systems (SICCS) are BS degrees in Electrical Engineering and Computer Engineering, which are accredited by the ABET Engineering Accreditation Commission (EAC). The Multidisciplinary Engineering degree is designed with an eye toward eventual accreditation under the ABET Engineering Technology Accreditation Commission (ETAC).

Learning Outcomes and Assessment Plan:
Learning Outcome 1 (LO1): Identify, explain, and apply appropriate engineering design and project management methods.

- Concepts: Structured design process; effort estimation; task dependency analysis; team organization and management.
- Competencies: Appropriately organize engineering work; manage and monitor progress in engineering projects using a variety of management techniques; estimate engineering effort.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in design process and management; rubrics associated with process and management in summative senior capstone design coursework.

Learning Outcome 2 (LO2): Identify, explain, and apply fundamental engineering analytical techniques.

- Concepts: Design specification; foundational mathematical and physical science analytical methods, including methods from physics and chemistry; system testing.
- Competencies: Identify and specify design requirements; apply analytical methods that consider physical and material properties; apply mathematical analysis tools to design and test engineering systems.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in design, engineering analysis, and testing; rubrics associated with engineering methods in summative senior capstone design coursework.

Learning Outcome 3 (LO3): Apply appropriate engineering methods to the design and development of high-quality systems.

- Concepts: Contemporary engineering design toolsets; fundamental statics and dynamics; fabrication techniques; validation of design characteristics.
- Competencies: Select and apply appropriate engineering methods; develop engineering system and component designs; develop high-quality designs within needed tolerances.
- Measures and Assessment: Direct measure of mastery using performance indicators and rubrics associated with classes in engineering methods.

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Learning Outcome 4 (LO4): Engage in effective teamwork as a member of an engineering team.

- Concepts: Team roles; teamwork communication strategies; work allocation and tracking; peer assessment and evaluation.
- Competencies: Distinguish and organize according to specific teamwork roles and responsibilities; effectively and professionally communicate with team members and defuse team conflicts; refer to and maintain current models of team progress; provide objective assessments of team member performance and productivity.
- Measures and Assessment: Rubrics associated with teamwork in summative senior capstone design coursework.

Learning Outcome 5 (LO5): Compose and engage in effective written and oral communication in engineering.

- Concepts: Professional correspondence best-practices; responding to proposal solicitations; primary and secondary research; effective document structure; poster preparation; oral presentation best-practices.
- Competencies: Develop professional documents and design documentation; effectively communicate results of development efforts; deliver effective oral presentations to specialist and lay audiences.
- Measures and Assessment: Rubrics associated with written and oral communication in summative senior capstone design coursework.

Assessment Process: The measures and assessment points discussed for LO1 through LO5 will be holistically integrated in a continuous assessment and improvement process. Systematic periodic reviews of assessment data and reporting on how this data meets targeted levels of attainment drive curricular improvements. This mirrors existing assessment and continuous improvement models currently deployed in our programs and meets ABET accreditation requirements.

Projected Enrollment for the First Three Years:
Year one: 20
Year two: 40
Year three: 60

Evidence of Market Demand:
Engineering professions continue to grow at healthy rates: The United States Department of Labor O*NET (https://www.onetonline.org/link/summary/17-2199.00) projects that the number of general engineers—in the "Engineers, All Other" category that includes "Validation Engineers"—will grow between 4% to 6% through 2028. Median pay for engineers in this category in 2018 was at $96,980 per year or $46.62 per hour. Product Safety Engineers (https://www.onetonline.org/link/summary/17-2111.03) enjoy similar growth projections with an income of $89,130 per year or $42.85 per hour.

Similar Programs Offered at Arizona Public Universities:
Neither University of Arizona (UA) or Arizona State University (ASU) offer multidisciplinary or interdisciplinary engineering programs. Both UA and ASU offer Engineering Management programs, which include business coursework not included in the BSMDE but provide a similar broad preparation in a variety of engineering topics. ASU also offers a general engineering

program with a required concentration option in automotive, electrical systems, mechanical engineering systems, or robotics; this structure is similar to our proposed BSMDE and it similarly permits the creation of a custom focus area.

New Resources Required? (i.e. faculty and administrative positions; infrastructure, etc.):
This proposed program requires no additional investment in faculty, physical infrastructure, or information technology needs. Existing faculty with extensive expertise in multi- and inter-disciplinary engineering and an established set of courses in multidisciplinary engineering as part of our Design 4 Practice (D4P) program provide us with a solid foundation for a successful launch of the BSMDE program. This is further strengthened by the expertise of our faculty in our roster of engineering programs, including mechanical, civil, environmental, electrical, and computer engineering and computer science.

Program Fee Required? YES X NO _ **Estimated Amount: $425/term**

Program Fee Justification: The proposed program fee is consistent with program fees in other programs within the College of Engineering, Informatics, and Applied Sciences, including all our engineering programs. These fees are an essential part of defraying the higher expenditures needed to provide students with a quality education that is technologically current and meets employer expectations. Additional expenses for CEIAS programs include, but are not limited to, market-driven instructional expenses, specialized facility and equipment expenditures, software licensing, the maintenance and updating technological infrastructure, and enhancing the learning experience through additional investments in instructional personnel. A portion of the fee will be used for financial aid and scholarships for those students who demonstrate merit and financial need.

External Accreditation? YES X NO ⌐

Accreditor: We will pursue ABET accreditation once the program meets the requirement of producing its first graduates.