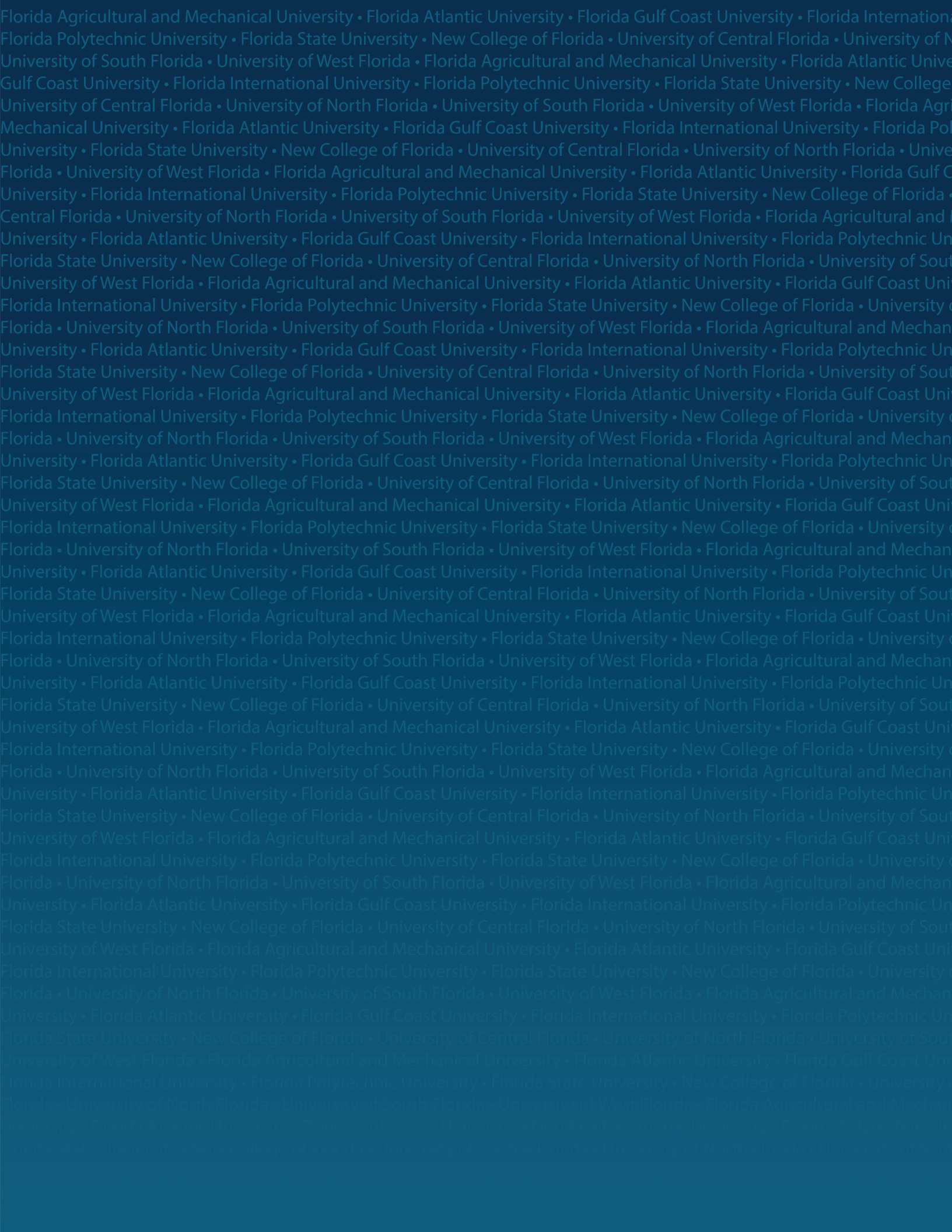
Ph.D. in Engineering Education
University of Florida
CIP 14.9999
Board of Governors
Staff Analysis

November 10, 2022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Summary

The University of Florida (UF) proposes a doctorate in Engineering Education, a degree program that prepares graduates to conduct research and develop evidence-based practices to improve engineering instruction. The degree is designed for working professionals with a bachelor's or master's degree in a STEM-related field. Unlike traditional programs that focus on developing technical skills in a specific engineering discipline, this program will equip students with broad-based, transferable skills to become researchers, educators, and practitioners in engineering education. Graduates of the proposed program will be qualified for postsecondary employment as researchers or teaching faculty. Additional employment opportunities include industry positions in corporate training management, course development, and instructional design. The proposed program will be a Program of Strategic Emphasis in STEM and the third program in the System under CIP 14.9999.

Program Description

Engineering education is an emerging discipline that focuses on formal training in teaching and assessing student learning in the field. As such, graduates of UF's program will acquire knowledge and skills to better educate students and professionals to address the complex engineering problems of the 21st century. The program will adopt a research-to-practice approach in which students not only learn how to conduct research but apply research in a variety of contexts and settings.

The curriculum will consist of courses in a traditional engineering discipline, research methods, curriculum design, student learning, and engineering education. These courses will provide the foundation for subsequent research that contributes to UF's and the State University System's goals for creating new knowledge. Admission to the Ph.D. in Engineering Education program requires a minimum of a bachelor's degree in a STEM field and related work experience or a master's degree in engineering or computer science.

To graduate from the program, students must earn 90 credit hours beyond a bachelor's degree, pass a candidacy examination, successfully defend a dissertation, submit one peer-reviewed article for publication, and deliver a presentation at a conference, seminar, or workshop. Additionally, students must participate in a research-to-practice experience and create an engineering education portfolio, highlighting the student's teaching experience, research, and application of this research in different settings, such as industry and academic training experiences. Students who do not fulfill these requirements but earn a minimum of 30 credits towards the doctorate, pass comprehensive examinations, or defend a thesis will receive master's degrees. A maximum of 30 credit hours may transfer and apply toward the Ph.D. for any student entering the program with a master's degree in a related field.

If approved by the Board of Governors, UF will implement the program in spring 2023 at the currently approved graduate tuition rate of $448.73 per credit hour for resident students and $690.21 for non-resident students.

Need for Graduates in the Labor Market

A doctoral degree in engineering education provides employment opportunities for graduates in academia and industry. In an academic setting, graduates may pursue careers as faculty or researchers. Graduates may also obtain employment with engineering companies as technical training specialists and managers who develop, implement, and evaluate professional development programs for engineers. To demonstrate workforce demand, UF supplied employment data from the U.S. Bureau of Labor Statistics and the Florida Department of Economic Opportunity, job postings from the American Society of Engineering Education, and letters of support from industry partners.

National and Florida Workforce Demand

Table 1 provides an overview of state and national demand for postsecondary engineering educators, training managers, training specialists, and other engineering-related industry positions. The Department of Economic Opportunity projects that Florida's demand for postsecondary engineering faculty will increase by 18% through 2028. Nationally, demand for university engineering instructors is projected to increase by 12.5% over the next ten years, exceeding the national average growth for other occupations.

Graduates may also obtain employment with engineering companies as technical training managers and specialists who conduct work-related training to improve individual skills and organizational performance. These occupations are projected to increase by 16% in Florida and 11% nationally. While these industry occupations may require a bachelor's degree, individuals may need to pursue further education to advance in the occupation.

Table 1: Labor Market Demand, CIP Codes 14.9999, 13.0607, 13.1201[1]

Occupations	Percent Change in Job Openings		Annual Average Job Openings		Total # of New Jobs		Education Level Needed for Entry
	FL 2021-29	U.S. 2020-30	FL 2021-29	U.S. 2020-30	FL 2021-29	U.S. 2020-30	
Engineering Teachers, Postsecondary	18.0*	12.5	164*	5,100	263*	5,800	Doctoral or professional degree
Training and Development Managers	15.5	10.7	202	4,300	303	4,500	Bachelor's degree
Training and Development Specialists	16.2	10.8	2,403	35,200	3,292	35,500	Bachelor's degree

An asterisk (*) indicates that the number or percent is based on 2020-28 projections from the Florida Department of Economic Opportunity since 2021-29 data were unavailable.
[1] Table 1 includes two additional CIP codes, 13.0607 and 13.1201, which cover other degree programs with a similar focus on multiple aspects of learning and adult education in various settings.
Sources:
Date Retrieved: 9/6/2022
U.S. Bureau of Labor Statistics - https://data.bls.gov/projections/occupationProj
Florida Department of Economic Opportunity - http://www.floridajobs.org/labor-market-information/data-center/statistical-programs/employment-projections

Supplemental Workforce Data

The University of Florida provided sample job openings from a job board maintained by the American Society of Engineering Education and supplied additional examples of employment opportunities. The job board included 75 positions, including university teaching and research faculty, academic journal editors, K-12 STEM educators, and university program coordinators in engineering programs. The institution also provided sample jobs to demonstrate a need for individuals with a doctorate in engineering education. Specifically, advertised positions included a Technical Program Management Director role at Google, an Education-to-Workforce Industry Specialist position at Amazon, and a Manufacturing Training Specialist role at Honeywell.

The University of Florida supplied multiple letters of support from industry partners, demonstrating a need for doctoral graduates with an engineering education background, along with examples of jobs. For example, the Chief Learning Scientist at Boeing Commercial Airplanes listed job openings for a Senior Machine Learning Scientist. Salaries for these positions ranged from $90,000 to $200,000. The Director of Human Resources at Medtronic offered support for the program, highlighting the need for high-quality professional development in the company to support the growth and expertise of its employees. Other industry partners expressed a need for doctoral graduates in this field who can produce materials for technical instruction, oversee the development of e-learning programs, and lead cross-functional teams to evaluate, develop, and manage projects for new product development.

Student Demand and Projected Enrollment

The University of Florida anticipates the program will appeal to students with a bachelor's or master's degree in engineering-related areas who want to pursue careers as professors and researchers. The university provided data from the Engineering National Graduate Institutional Name Exchange Database that indicated over 443 students from 2019 to 2021 expressed interest in pursuing a degree in engineering education at the institution. As further evidence of support, UF supplied communications received by engineering faculty over the past five years from students who were either interested in learning more about the proposed program or declaring their intent to pursue the degree if offered by the institution.

Projected Student Enrollment

As reflected in Table 2, UF initially anticipates an enrollment of ten students in year one, five of whom will transfer from the institution's existing doctoral programs in engineering. The institution anticipates recruiting ten new students per year for the first three years and five new students per year for the next two years of the program. Sources of students will include graduates from related undergraduate programs at public and private institutions in Florida, including UF.

Table 2: Projected Student Enrollment

	Student Headcount	Student FTE
Year 1	10	7.5
Year 2	20	15
Year 3	30	22.5
Year 4	35	26.25
Year 5	40	30

Alignment with Institutional and System Strategic Priorities

The Ph.D. in Engineering Education supports the Board of Governors 2025 Strategic Plan goals by increasing the number of degrees awarded in Programs of Strategic Emphasis and strengthening the quality and reputation of academic programs and universities. Additionally, the program will produce graduates who will improve the education of engineers, resulting in a skilled workforce that is better prepared to support economic growth in the state and nation. By engaging prospective students in engineering societies, such as the National Society of Black Engineers and the American Indian Science and Engineering Society, the program will support UF's commitment to achieving a diverse student body. Finally, the new program will increase research in areas such as educational technologies and curriculum interventions, resulting in more opportunities to attract external funding.

Proposed Program Costs

The proposed program will be primarily funded through Education and General funds. As shown in Table 3, the anticipated total program cost is $191,703 in year one and $996,535 in year five. The majority of projected costs are for faculty and staff salaries.

Table 3: Projected Program Costs

Total		Percentage & Dollar Amount					Auxiliary Funds	Cost per FTE	SUS 19-20 Average Cost per FTE (CIP 14)
		Current Reallocated	New Recurring	New Non-Recurring	Contracts & Grants	Philanthropy & Endowment			
Year 1	$191,703	100% $191,703	0% $0	0% $0	0% $0	0% $0	$0	$25,560	$20,638
Year 5	$996,535	73% $728,025	0% $0	0% $0	27% $268,510	0% $0	$0	$24,268	

Conclusion and Board Staff Comments

If approved, the Ph.D. in Engineering Education will be the second Engineering Education program in the System and the third doctoral program under CIP 14.9999. The University of Florida provided adequate evidence of workforce need and student demand for the program. The proposed program will support the Board of Governors 2025 Strategic Plan by increasing the degrees awarded in Programs of Strategic Emphasis and producing research to attract more external funding. Board staff has no concerns regarding the proposal.

Appendix A

Assessment of the University Review Process in accordance with Board of Governors Regulation 8.011

Prior to submitting a program proposal to the Board of Governors' office, the institution and its Board of trustees are required to ensure that all programs meet the requirements of Board of Governors Regulation 8.011. Section C is an assessment of the university's review process to ensure that all criteria have been considered.

ACCOUNTABILITY

Check either the "yes" or "no" box and make comments beneath the criterion as appropriate.

1. ***Overall –*** *The proposal is in the correct format, includes all necessary signatures, and contains complete and accurate tables for enrollment projections, faculty effort, and the proposed budget.*

YES **NO**

☒ ☐ **The proposal has been approved by the university board of trustees and includes all required signatures.**

The University of Florida's Board of Trustees approved the proposed program on April 22, 2022.

☒ ☐ **The university has provided a proposal written in the standard State University System format, which addresses new academic program approval criteria outlined in Board of Governors Regulation 8.011.**

The University of Florida submitted the proposed program in the standard State University System format.

☒ ☐ **The pre-proposal was reviewed by the Council of Academic Vice Presidents Academic Coordination Group, and any concerns identified by the group have been listed and addressed in the proposal.**

The CAVP Academic Coordination Group reviewed the pre-proposal on September 2, 2021, and had no concerns.

☒ ☐ **The university has provided data that supports the need for an additional program in the State University System as well as letters of support or concern from the provosts of other state universities with substantially similar programs.**

There are two other doctoral programs under CIP 14.9999. Florida Atlantic University offers a Ph.D. program in Transportation and Environment Engineering that is not substantially similar to UF's proposed program. The other is a Ph.D. in Engineering and Computing Education offered at Florida International University (FIU). The University of Florida met with the Director of the School of Computing, Construction, and Engineering Education at FIU to discuss any potential effect the proposed program might have on FIU's program. FIU agreed there is a great need

for the proposed program in the state and indicated in its letter of support that UF's program would also offer collaborative opportunities for both institutions to improve instruction in related undergraduate programs and K-12 STEM education in Florida.

☒ ☐ **The university has provided complete and accurate projected enrollment, faculty effort, and budget tables that are in alignment with each other.**

The University of Florida submitted all required tables in Appendix A of the proposal.

☒ ☐ **The university has included a statement in the proposal signed by the equity officer as to how this proposal will meet the goals of the university's equity accountability plan.**

The Equal Opportunity Officer signed the proposal on November 5, 2021.

☒ ☐ **The program does not substantially duplicate programs at FAMU or FIU, or if it does, evidence was provided that consultations have occurred with the affected university on the impact of the new program on existing programs.**

Florida International University has a Ph.D. program in Engineering and Computing Education, which has a more applied focus on computing research and education. The University of Florida met with the Director of the School of Computing, Construction, and Engineering Education at FIU to discuss any potential effect the proposed program might have on FIU's program. Both institutions agreed there is a need for another program in the state and that UF's program would not negatively affect the FIU program. A letter of support from FIU indicated that the program would serve the state's needs and that both programs could potentially attract out-of-state students.

2. Budget – *The proposal presents a complete and realistic budget for the program consistent with university and Board of Governors policy and shows that any redirection of funding will not have an unjustified negative impact on other needed programs.*

YES NO

☒ ☐ **The University Board of Trustees has approved the most recent budget for this proposal.**

The University of Florida's Board of Trustees approved the budget in conjunction with the full proposal on April 22, 2022.

☒ ☐ **The university has reviewed the budget for the program to ensure that it is complete and reasonable, and the budget appears in alignment with expenditures by similar programs at other System institutions.**

The cost per full-time equivalent for the proposed program aligns with the 2019-2020 State University System's expenditure analysis for graduate programs in the CIP 14.

☐ ☒ **The proposal indicates that the program will follow the cost-recovery or market-rate funding models. If so, details and timelines for getting approvals for these funding models are included in the proposal.**

The institution will use Education and General funding to support the program.

☒ ☐ **In the event that resources within the institution are redirected to support the new program, the university has identified this redirection and determined that it will not have a negative impact on undergraduate education, or the university has provided a reasonable explanation for any impact of this redirection.**

The University of Florida anticipates that implementing the program will yield no negative impact on related undergraduate programs.

READINESS

Check either the "yes" or "no" box and make comments beneath the criterion as appropriate.

3. Program Quality *– The proposal provides evidence that the university planning activities have been sufficient, and responses to any recommendations to program reviews or accreditation activities in the discipline pertinent to the proposed program have been addressed.*

YES NO

☒ ☐ **The university has followed a collaborative planning process for the proposed program in accordance with policies and procedures adopted by the university board of trustees.**

The University of Florida provided a narrative and chronological table of events that occurred during the development of the proposal and a list of the campus constituents involved.

☒ ☐ **An external consultant has reviewed the proposal and supports the department's capability of successfully implementing this new program.**

Dr. Donna Riley, Professor of Engineering Education at Purdue University, reviewed the program. She fully supported the institution's capability to implement the program.

☒ ☐ **The university has found the level of progress that the department has made in implementing the recommendations from program reviews or accreditation activities in the discipline pertinent to the proposed program to be satisfactory.**

The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) reviews all Herbert Wertheim College of Engineering programs. In the most recent seven-year program review in 2017, the reviewers identified an increased undergraduate teaching load for faculty as an area of weakness in engineering departments, except for the Department of Engineering Education. In

response, the proposed program's department is now offering college-wide engineering courses to reduce the teaching load for faculty in other engineering programs.

Dr. Donna Riley, the external consultant who reviewed the proposed program, fully supported the institution's capability to implement the program and offered several recommendations.

She recommended that the institution establish milestones to ensure that students have adequate time to meet the publication requirement for graduation. In response, the department will include additional information about milestones and deadlines in its graduate student manual.

Dr. Riley also suggested incorporating a writing requirement into the admissions criteria. The institution will implement this recommendation by requiring applicants to submit an essay on an engineering education topic. The Ph.D. committee in the department will also develop a rubric to evaluate each essay's quality, criticality, and innovativeness.

She also recommended accommodations for students with disabilities who may have difficulty meeting the two-week qualifying examination period. In response, program faculty will ensure accommodations for students who may have difficulty meeting this timeline based on disability and other extenuating circumstances.

The last recommendation was to increase recruiting and advising efforts. The department is currently discussing ways that the college can support further recruitment and advising. In addition, the tenure-track faculty within the department have recently volunteered to develop and advertise information sessions. These will be recorded for future use in marketing efforts.

☒ ☐ **The university has analyzed the feasibility of providing all or a portion of the proposed program through distance learning.**

The university will offer the program through traditional face-to-face delivery on the main campus.

☐ ☒ **If necessary, the university has made allowances for licensure and legislative approval to be obtained in a timely manner.**

There is no applicable licensure or legislative approval required for the proposed program.

4. Curriculum *- The proposal provides evidence that the university has evaluated the proposed curriculum and found that it describes an appropriate and sequenced course of study, and that the university has evaluated the appropriateness of specialized accreditation for the program.*

YES NO

☒ ☐ **The university has reviewed the curriculum and found that the course of study presented is appropriate to meet specific learning outcomes and industry-driven competencies discussed in the proposal.**

An advisory board composed of industry members and engineering alumni consulted with the department to develop the program's curriculum and industry-driven competencies.

☒ ☐ **The university anticipates seeking accreditation for the proposed doctoral program or provides a reasonable explanation as to why accreditation is not being sought.**

There is no specialized accreditation available for doctoral programs in engineering, only undergraduate programs.

5. Faculty *– The proposal provides evidence that the university is prepared to ensure a critical mass of faculty will be available to initiate the program based on estimated enrollments and that faculty, in the aggregate, have the necessary experience and research activity to sustain a doctoral program.*

YES NO

☒ ☐ **The university has reviewed the evidence provided and found that there is a critical mass of faculty available to initiate the program based on estimated enrollments.**

Ten faculty are participating in year one of the program, which is sufficient for implementing the program based on estimated enrollments. The institution plans to hire three additional faculty to participate in the program beginning in fall 2024.

☒ ☐ **The university has reviewed the evidence provided and found that the faculty, in aggregate, has the necessary experience and research activity to sustain the program.**

Current faculty either have terminal degrees in engineering education or have conducted scholarly work in the field.

☒ ☐ **The university has reviewed the evidence provided and found the academic unit(s) associated with this new degree to be productive in teaching, research, and service.**

The proposal included sufficient evidence that the academic unit(s) associated with the proposed program has been productive in all three areas.

☒ ☐ **If appropriate, the university has committed to hiring additional faculty in later years based on estimated enrollments.**

The proposal indicates that UF plans to hire additional tenure-track faculty as enrollment increases in the program.

6. Resources *– The proposal provides evidence that the university has ensured the available library volumes and serials; classroom, teaching laboratory, research laboratory, office space, equipment, clinical and internship sites, fellowships, scholarships, and graduate assistantships will be sufficient to initiate the program, and that, if applicable, funding has been secured to make more resources available as students proceed through the program.*

YES NO

☒ ☐ **The university has provided a signed statement from the library director verifying that the library volumes and serials available are sufficient to initiate the program.**

The library director signed the proposal on November 3, 2021.

☒ ☐ **The university has ensured that the physical space necessary for the proposed program, including classrooms, laboratories, and office space, is sufficient to initiate the program.**

There is sufficient physical space to implement the program.

☒ ☐ **The university has ensured that the necessary equipment is available to initiate the program.**

There is sufficient equipment available to implement the program.

☒ ☐ **The university has ensured that fellowships, scholarships, and graduate assistantships are sufficient to initiate the program.**

The university will financially support all students through graduate assistantships.

☒ ☐ **If applicable, the university has ensured that the department has arranged a suitable number of clinical and internship sites.**

The proposed Ph.D. program includes a significant experiential educational component. Students can participate in a teaching experience, a practical internship (e.g., educational policy internship, educational industry partner), or curriculum development/creation/transformation.

STATE UNIVERSITY SYSTEM OF FLORIDA

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