UNIVERSITY OF GEORGIA

University Council

March 10, 2023

UNIVERSITY CURRICULUM COMMITTEE – 2022-2023
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Graduate School – Christof Meile
Ex-Officio – Provost S. Jack Hu
Undergraduate Student Representative – Kate Lindgren
Graduate Student Representative – Yehia Abdelsamad

Dear Colleagues:

The attached proposal from the College of Engineering to offer a new major in Mechanical Engineering (Ph.D.) will be an agenda item for the March 17, 2023, Full University Curriculum Committee meeting.

Sincerely,

Susan Sanchez, Chair
cc: Provost S. Jack Hu
Dr. Marisa Pagnattaro

UNIVERSITY SYSTEM OF GEORGIA

USG Academic Degree Program Application

Released

December 3, 2021

Version Control

Date	*Changes*	*USG Approved date*	*Website update date*
12-18-2020	*Revised question 34 and 61 for clarity; Revised question 47 to include part b with the tuition comparison table for peer or competitive programs; reworded question 49 to include costs and benefits per fee; Revised question 50 related to additional costs to students; Revised question 51 to clarify the question related to indirect costs.*		

NOTE:

Italicization indicates a question or field on the in-take form

^= indicates accreditation related content

USG Routing

- ☐ *Program was part of the Annual Academic Forecast*
- ☐ *This proposal can be expedited (Nexus, established concentration with strong enrollment)*
- ☐ *This proposal requires USG integrated review*

USG ACADEMIC PROGRAM APPLICATION

A. OVERVIEW

To be completed as part of SharePoint Submission

1. ***Request ID****: (SharePoint Generated unique ID)*

2. ***Institution Name****: University of Georgia*

3. ***USG Sector:*** *Research University*

4. ***School/Division/College:*** *College of Engineering*

5. ***Academic Department:*** *School of Environmental, Civil, Agricultural and Mechanical Engineering*

6. ***Proposed Program Name:*** *Doctor of Philosophy with a major in Mechanical Engineering*

7. ***Major:*** *Mechanical Engineering*

8. ***CIP Code (6 digit):*** *14.1901*

9. ***Degree Level****: Doctoral*

10. ***Anticipated Implementation Semester and Year:*** *Fall 2023*

11. ***Was this program listed in the most recent Academic Forecast?***
    - ☒ *Yes*
    - ☐ *No (If no, explain why below)*

12. ***Program Description***
    (Provide a description of the program to be used in the Board of Regents meeting packet):

The field of mechanical engineering is responsible for the development of a wide range of products and processes that vary across many dimensions such as size and complexity. Mechanical engineering has often been touted as the most multidisciplinary of the engineering fields, making it an attractive profession for students preparing to enter many engineering industries. Mechanical engineering skills are necessary throughout the design, analysis, manufacturing, deployment, maintenance, and end of life of various complex systems. To that end, mechanical engineers are needed as part of the engineering enterprise in the United States.

Considered the broadest and most versatile of the engineering professions, a Ph.D. in Mechanical Engineering offers students an opportunity to specialize in a field that spreads across all engineered systems. With system complexity increasing, doctorate degrees in Mechanical Engineering have become more attractive. Further, as society becomes more connected and modernized through the adoption of inventions and technologies, new challenges continue to emerge that must be addressed by mechanical engineers with advanced degrees.

A Ph.D. program in Mechanical Engineering would offer graduate courses on the recent advances and emerging research in mechanical engineering, such as automation, robotics, thermal and fluid systems, energy systems, mechanics, design and manufacturing, and nanoengineering, with the aim to prepare students for successful careers in industry, academia, and government. Leveraging the strength of UGA's colleges, there is an opportunity to present an interdisciplinary Ph.D. that addresses tomorrow's engineering challenges, while considering social sciences, behavioral sciences, computer science, and artificial intelligence.

There is a high demand for talents in the field for meeting the aforementioned challenges. The U.S. Bureau of Labor Statistics projects 7% growth in mechanical engineering over the next decade[1]. The proposed Ph.D. in mechanical engineering also aligns with the recent strategic goals of the State of Georgia, such as the recent emphasis on manufacturing and electric mobility, and the United States, such as the recent emphasis on infrastructure and manufacturing. The University of Georgia is uniquely equipped to meet the needs of the state and nation through the proposed program.

13. Accreditation: Describe disciplinary accreditation requirements associated with the program (if applicable, otherwise indicate not applicable).

Not applicable

14. Specify SACSCOC or other accreditation organization requirements^.

Mark all that apply.

☐ Substantive change requiring notification only [1]

☐ Substantive change requiring approval prior to implementation [1]

☐ Level Change [2]

X None

B. STRATEGIC PLAN

15. How does the program align with your institutional mission and function? If the program does not align, provide a compelling rationale for the institution to offer the program.

A key mission of the UGA College of Engineering is to develop engineers for the 21st century by inspiring students to reach their full potential and pursue bold, collaborative research to identify and solve the challenges of our time. The proposed Ph.D. program will develop leaders in a field in great need of their

[1] https://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm

[1] See page 17 (Requiring Approval Prior to Implementation) of SACSCOC Substantive Change Policy and Procedures document.
[2] See page 3 (Level Change Application) of SACSCOC Seeking Accreditation at a Higher or Lower Degree Level document for level change requirements.

expertise. Further, growth in the mechanical engineering program, including graduate students pursuing Ph.D.'s in Mechanical Engineering, would allow research teams to pursue challenging research projects. This program would support both necessary workforce needs and advancements in the college's research footprint.

Institutionally, three of the missions the proposed Ph.D. program would immediately impact are: (1) a commitment to excellence in a teaching/learning environment dedicated to serving a diverse and well-prepared student body, to promoting high levels of student achievement, and to providing appropriate academic support services, (2) a commitment to excellence in research, scholarship, and creative endeavors that are focused on organized programs to create, maintain, and apply new knowledge and theories; that promote instructional quality and effectiveness; and that enhance institutionally relevant faculty qualifications, and (3) a commitment to excellence in public service, economic development, and technical assistance activities designed to address the strategic needs of the state of Georgia along with a comprehensive offering of continuing education designed to meet the needs of Georgia's citizens in life-long learning and professional education. The program would allow for growth in the learning environment through degree and course offerings in a growing field. Further, the program would afford growth in research, scholarship, and creative pursuits within mechanical engineering by having a community of research leaders within the program. Given the state's need for mechanical engineering experts, this major would have an immediate impact by creating a well-equipped workforce in mechanical engineering.

16. How does the program align with your institution's strategic plan and academic program portfolio?
Identify the number of existing and new courses to be included in the program.

The University of Georgia 2020 Strategic Plan states that "UGA is poised to address Georgia's most daunting issues: economic development and job creation, public health, and obesity."

The College of Engineering at UGA currently offers a Ph.D. in Engineering with various areas of emphasis such as Dynamic Systems and Controls, Mechanics and Materials, and Fluid and Thermal Systems. These areas of emphasis were developed as part of the initial graduate program in the College of Engineering when it was first formed in 2012. The long-term goal was to develop free-standing Ph.D. programs once a critical mass of students was enrolled. The faculty in the School of Environmental, Civil, Agricultural, and Mechanical Engineering believe a critical mass has now been reached, as shown from recent growth in Ph.D. student enrollment. Further, faculty have witnessed greater interest in students pursuing a Ph.D. within the emphasis areas that would typically fall under a Mechanical Engineering Ph.D., suggesting that there is ample interest in a standalone Ph.D. in Mechanical Engineering. The current Ph.D. in Engineering with mechanical emphasis program offers 42 graduate courses, which should be sufficient for the proposed new Ph.D. program in Mechanical Engineering.

C. NEED

17. Was this proposal and the design of the curriculum informed by talking with alumni, employers, and community representatives?

☐ *No*

☒ *Yes (If yes, use the space below to explain how their input informed this proposal)*

The proposed Ph.D. program was discussed at College of Engineering IAB meeting in Fall 2022.
A letter of support from the members of the industry advisory board is included in the appendix.

18. Does the program align with any local, regional, or state workforce strategies or plans?

☐ *No*

☒ *Yes (If yes, please explain below)*

The investment in artificial intelligence, automation, Internet of Things, and cyber-physical systems as well as manufacturing plants is anticipated to drive market growth in transforming the traditional mechanical engineering field. Jobs for mechanical engineers in Georgia are growing at a rate of 22.1%, faster than the nationwide estimated projection of 7%. The projection of job openings related to mechanical engineering in Georgia is expected to be 1,000 annually from 2018 to 2028.

The projected growth of the economy will be incomplete without a concomitant level of investment in degree programs which can generate an engineering workforce in support of these key economic sectors. As a public land-grant and sea-grant research university in the state of Georgia, the University of Georgia with its strengths in interdisciplinary programs has the unique capability to implement a rigorous, broadly based mechanical engineering program to meet societal needs and becomes the U.S. leader in this critical discipline.

In the past decade, the University of Georgia has made progress in growing its engineering programs. The University established a comprehensive College of Engineering in 2012 and School of Environmental, Civil, Agricultural and Mechanical Engineering in 2017. Mechanical engineering programs at the bachelor's and master's level were developed over 10 years ago and have been successfully implemented. Enrollment in the undergraduate program has grown to a five-year moving average of 700 students. Since the School was formed in 2017, multiple new faculty have been hired and have been active in mechanical engineering research and teaching. The School of Environmental, Civil, Agricultural and Mechanical Engineering has the infrastructure, research, and education resources and experience to further advance its mechanical engineering programs with a Ph.D. program.

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19. Provide any additional evidence of regional demand for the program^ (e.g. prospective student interest survey data, community needs, letters of support from employers)

The initial long-term goal of the College of Engineering was to develop free-standing Ph.D. programs once a critical mass of students was enrolled. The faculty in the School of Environmental, Civil, Agricultural, and Mechanical Engineering believe a critical mass has now been reached, as shown from recent growth in Ph.D. student enrollment, from 98 students in 2020 to 117 students in 2022. The past few years have witnessed the growing number of Ph.D. students graduating from the college's Engineering (Ph.D.) program with the emphasis in mechanical engineering. Anecdotal evidence obtained from current students also indicates they prefer named majors as opposed to a generic major title in engineering. Introducing a new Ph.D. in Mechanical Engineering will recruit more graduate students and subsequently increase research productivity in this multidisciplinary field. It will also enable the school to attract and retain the most talented faculty who are focused on building a strong and sustainable research program.

Many of UGA's peer and aspirational schools and departments already have named majors in their disciplines, and those that do not are moving away from generalized Engineering Ph.D. programs. It is important for UGA to keep pace with other institutions to maintain competitiveness when recruiting doctoral students.

Another key point to mention is the ability for Ph.D. students to attain jobs using a specific Ph.D. such as Mechanical Engineering. Generalized Engineering Ph.D. programs are limited as many employers, including academic institutions, prefer that candidates have degrees in the field for which they are applying. Increasing the number of UGA Ph.D. graduates into academia will have a substantial impact on the program perception and maturity.

[2] https://explorer.gdol.ga.gov/vosnet/mis/Current/gaworkforcecurrent.pdf

Based on enrollment numbers at other universities, the increase in enrollment in engineering at the University of Georgia, and this University's geographic location, faculty conservatively estimate 25-30 Ph.D. degrees conferred per year within five years.

20. Identify the partners you are working with to create a career pipeline with this program[3]. Mark all that apply.

☐ High School CTAE	☒ Other USG institutions	☒ Professional associations
☐ High School STEM	☐ Other universities	☐ Other (specify below)
☐ Career academies	☐ Employers	☐ None
☐ TCSG programs	☐ Community partnerships	

[3] Provide letters of support and explain the collaboration and how partners will share or contribute resources. (Consider internal pipeline programs – "off-ramp program" Nursing to integrated health or MOUs for pathways with other USG institutions (pipelines – keep them in state for grad school if we can)

21. Are there any competing programs at your own institution?

☒ *No*

☐ *Yes (If yes, provide additional information about the competing program(s) below).*

This program's content is currently being offered as areas of emphasis under Engineering (Ph.D.). These areas of emphasis will be phased out after the approval of Mechanical Engineering (Ph.D.).

22. What is the program's service area (local, regional, state, national)? If outside of the institution's traditional service area, provide a compelling rationale for the institution to offer the program. If the program's service area is a region within the state, include a map showing the counties in the defined region.

The program's service area is national. The program service area is used as the basis for labor market supply and demand analysis.

23. Do any other higher education institutions in close proximity offer a similar program?

☐ *No*

☒ *Yes (If yes, provide a rationale for the institution to offer the program)*

In Georgia, the Georgia Institute of Technology (Georgia Tech) is the only institution in the University System of Georgia to offer Mechanical Engineering Ph.D. programs. While Georgia Tech has a track record of producing high quality mechanical engineering graduates in traditional curriculum settings, there is a need for more mechanical engineers educated in broad engineering settings with necessary knowledge from other related fields (e.g., data science) as convergence increasingly plays a critical role in scientific discovery and solving vexing research problems, recognized by the National Science Foundation (NSF)[3]. (See attached letter of support from the UGA Institute for Artificial Intelligence). The proposed program will build on the distinctive cross-disciplinary strengths at UGA and offer students opportunities to collaborate on research projects with faculty in the College of Engineering and the Franklin College of Arts and Science. In fact, faculty in the School of Environmental, Civil, Agricultural, and Mechanical Engineering actively participate in several interdisciplinary research centers that are unique to UGA such as the Institute for Resilient Infrastructure Systems, the New Materials Institute, Georgia Informatics Institutes for Research and Education, Institute for Artificial Intelligence, and the Engineering Education Transformations Institute.

Additionally, multiple engineering faculty at UGA actively collaborate with Georgia Tech on large, multi-institution grants including multiple manufacturing initiatives supported by federal and state funding. These collaborations build on complimentary expertise at both institutions and provide a comprehensive and convergent approach to addressing broad engineering challenges. A dedicated Mechanical Engineering Ph.D. program at UGA would help recruit additional students to supplement these efforts.

[3] https://www.nsf.gov/od/oia/convergence/index.jsp

24. Based on the program's study area, what is the employment outlook for occupations related to the program, according to the CIP to SOC crosswalk in the Qlik IPEDS Application. An Excel version of the CIP to SOC crosswalk is also available from NCES. If data for the study area is not available, then use state- or national-level data.

a. Click **here** for US and Georgia occupation projections.

b. Click **here** for 2026 Georgia Department of Labor data projections for the State or Georgia Workforce Board Regions in Qlik (link to GDOL Projections); data is also available through the GDOL Labor Market Explore Website.

c. For a custom Georgia geography, request a Jobs EQ report from **USG Academic Affairs office**.

Related Occupation	SOC code	Current Employment [2020]	Projected Employment [2030]	# Change	% Change	Average Annual Openings
Architectural and engineering managers	11-9041	197,800	205,900	14,700	7.4	1,470
*Mechanical engineers	17-2141	299,200	319,400	20,200	6.8	2,020
Mechanical drafters	17-3013	53,600	58,300	4,700	8.7	470
*Mechanical Engineering Technologists and Technicians	17-3027	40,400	44,400	4,000	9.9	400
*Engineering Teachers, Postsecondary	25-1032	46,300	51,400	5,100	11	510

*indicates the top three fields for graduate students.

25. Using IPEDS data, list the supply of graduates in the program and related programs in the service area.

A. Competitor Institutions Selected Based on Aspirational

a. National Level

Similar or Related Programs	CIP Code	Supply[1]	Competitor Institutions (Supply)[2]
Ph.D. in Engineering	14.0101	6	University of California-Berkeley (6)
Ph.D. in Mechanical Engineering	14.1901	251	University of Michigan-Ann Arbor (55) University of Illinois Urbana-Champaign (51) University of California-Berkeley (43) University of Minnesota-Twin Cities (32) University of California-Los Angeles (28) The University of Texas at Austin (27) University of Wisconsin-Madison (15)

b. Southeastern Regional Level

Similar or Related Programs	CIP Code	Supply[1]	Competitor Institutions (Supply)[2]

Ph.D. in Engineering	14.0101	0	
Ph.D. in Mechanical Engineering	14.1901	5	University of Virginia-Main Campus (5)

[1] Supply = Number of programs graduates last year within the study area
[2] Competitors = List other institutions that offer this program or a similar program in the area (see **Question 23**). Competitor Institutions are selected in each category based on aspirational.

B. <u>Competitor Institutions Selected Based on Peer</u>

a. National Level

Similar or Related Programs	CIP Code	Supply[1]	Competitor Institutions (Supply)[2]
Ph.D. in Engineering	14.0101	1	Indiana University-Bloomington (1)
Ph.D. in Mechanical Engineering	14.1901	271	Purdue University-Main Campus (60) Virginia Polytechnic Institute and State University (37) Ohio State University-Main Campus (26) Michigan State University (25) University of Maryland-College Park (23) North Carolina State University at Raleigh (21) University of Florida (18) University of California-Davis (16) University of Missouri-Columbia (15) University of Iowa (9) University of Kentucky (9) Stony Brook University (8) University of Arizona (4)

b. Southeastern Regional Level

Similar or Related Programs	CIP Code	Supply[1]	Competitor Institutions (Supply)[2]
Ph.D. in Engineering	14.0101	0	
Ph.D. in Mechanical Engineering	14.1901	85	Virginia Polytechnic Institute and State University (37) North Carolina State University at Raleigh (21) University of Florida (18) University of Kentucky (9)

[1] Supply = Number of programs graduates last year within the study area
[2] Competitors = List other institutions that offer this program or a similar program in the area (see **Question 23**). Competitor Institutions are selected in each category based on peer.

26. Based on the data provided in questions 24 and 25, discuss how this program will help address a need or gap in the labor market?

Mechanical engineering is the broadest of the engineering disciplines, combining principles from mechanical systems, thermal systems, manufacturing, and design. Thanks to their creativity and multidisciplinary skill set, mechanical engineers work in virtually every industry. They are critical to the transportation industry, working on everything from the development of hybrid and electric cars to autonomous cars, airplanes, and underwater vehicles. Mechanical engineers are also leaders in energy systems, working on efficient power generation and developing alternative energy sources to minimize environmental impacts. The new wave of innovation driven by artificial intelligence, automation, Internet of Things, and cyber-physical systems will continue to transform various engineering fields. This Mechanical Engineering (Ph.D.) program is timely for preparing professionals and experts for this evolving engineering field and for meeting present and emerging engineering needs for the local and regional engineering industries.

With a highly educated workforce, renowned research institutions, cutting-edge technological resources, and global access through Atlanta's Hartsfield-Jackson International airport, Georgia attracts billions in federal and private dollars. For example, SK Innovations recently built one of the largest battery manufacturing facilities in the U.S., spanning nearly 2.5 million square feet, in Commerce, GA[4]. Rivian Automotive has also announced its plans to open a vehicle manufacturing facility in East Atlanta[5].

To sustain such a strong growth and technological innovation, the need for mechanical engineering graduates who have broad training in engineering and cross-disciplinary fields for local and regional employers are increasing significantly. The proposed Mechanical Engineering (Ph.D.) would immediately address these local and regional needs.

27. Using data from *O*-Net,* identify the average salary for the related occupations identified in question 24. Then list at least three technical skills and three Knowledge, Skills and Abilities (KSAs) associated with the related occupations. This information can be found using at onetonline.org. (Standard Occupation Code = SOC)

SOC Code (6 digit)	Average Salary (O-Net data)	Occupation specific technology skills & KSAs
11-9041	$71.89 hourly, $149,530 annual	https://www.onetonline.org/link/summary/11-9041.00
17-2141	$45,82 hourly, $95,300 annual	https://www.onetonline.org/link/summary/17-2141.00
17-3013	$28.94 hourly, $60,200 annual	https://www.onetonline.org/link/summary/17-3013.00
17-3027	$29.07 hourly, $60,460 annual	https://www.onetonline.org/link/summary/17-3027.00
25-1032	$104,940 annual	https://www.onetonline.org/link/summary/25-1032.00

Notes:

[4] https://insideevs.com/news/536883/us-sk-innovation-battery-150gwh/

[5] https://rivian.com/newsroom/article/rivian-to-site-second-manufacturing-plant-in-georgia

28. Using GOSA Earning and Learnings data, what is the typical salary range 5 years after graduation from the program?

Average Salary	75th Percentile	50th Percentile	25th Percentile
1 year after graduation	N/A	N/A	N/A
5 years after graduation	N/A	N/A	N/A

Provide any additional comments, if needed:

No data are available for Ph.D. engineering graduates from GOSA Earning and Learning data.

29. Based on the data compiled and analyzed for this section (see Section C: Need), what is the job outlook for occupations filled by students with this degree?

Jobs for mechanical engineers in Georgia are growing at a rate of 22.1%, faster than the nationwide estimated projection of 7%[6]. The projected job openings related to mechanical engineering in Georgia is expected to be 1,000 annually from 2018 to 2028[7]. The investment in artificial intelligence, automation, Internet of Things, and cyber-physical systems as well as manufacturing plants is anticipated to drive market growth in transforming the traditional mechanical engineering field, which demands for well-trained professionals with a Ph.D. degree.

Locally, there is no doubt the state of Georgia will need more mechanical engineering students and highly qualified prospects as the number of corporations in key areas such as automation, automotive, and electrification move to the state. Further, the placement of such a program at UGA would only strengthen the state's potential to attract future corporations by ensuring a ready and properly trained workforce.

D. CURRICULUM

30. Enter the number of credit hours required to graduate^

72

31. Are you requesting a credit hour requirement waiver (either below or above traditional credit hour length requirements as prescribed by the University System of Georgia? See section 2.3.5 (Degree Requirements) of the USG Board of Regents Policy Manual here for more information).

☒ *No*

☐ *Yes* (If yes, explain the rationale for the request in the space below*)*

32. Related to SACSCOC accreditation, specify if the program format of the proposed program is a^:

[6] https://graddegree.com/careers/mechanical-engineers/georgia-us/
[7] https://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm

Format (Check 1)		50% or more of the program is delivered online
☐	Combination of on-campus and online	☐ Yes
☐	Combination of off-campus and online	☐ Yes
☐	Hybrid, combination delivery	☐ Yes

33. Is the program synchronous or asynchronous?[4] Mark one of the options below.

☐ *Synchronous*

The majority of courses are offered at scheduled, pre-determined times with students connecting to a virtual room or location and interacting with faculty and fellow students via web/video conferencing platform.

☐ *Asynchronous*

34. For associate's, Nexus, and bachelor's degree proposals, which High Impact Practices[5] (HIPs) will faculty embed into the program? Mark all that apply.

☒ First-Year Experiences

☐ Common Intellectual Experiences

☐ Learning Communities

☐ Writing-Intensive Courses

☒ Collaborative Assignments and Projects

☐ Undergraduate Research

☒ Diversity/Global Learning

☐ ePortfolios

☐ Service Learning, Community Based Learning

☐ Internships

☐ Capstone Courses and Projects

[4] See SACSCOC Handbook for Institutions Seeking Initial Accreditation here.

[5] See Kuh (2008). High-Impact Practices: What They Are, Who Has Access to Them, and Why They Matter. *Association of American Colleges and Universities*, *14*(3), 28-29).

35. Discuss how HIPs will be embedded into the program? Your discussion should provide specific examples and include whether the HIP is required or an optional component. It should also indicate at what point the experience is offered or required.

(i.e. "Students will be required to participate in an externship during their third year of enrollment, in order to develop skills in… etc.").

Students will be required in the first-year of the program to attend a structured orientation program; complete initial coursework which provides students with a strong foundation in their field and helps them develop key skills such as critical thinking and problem-solving; be assigned a mentor who will help navigate their program, provide guidance on academic and research issues, and connect them with other resources and opportunities; attend workshops and seminars on a variety of topics, such as grant writing, communication skills, and professional development to help Ph.D. students prepare for their future careers.

Collaborative assignments and projects can be a valuable component of a Ph.D. program in mechanical engineering by providing students with opportunities to work together and build important skills. Some ways that collaborative assignments and projects can be embedded into a Ph.D. program in mechanical engineering include team-based research projects, group-assignment, peer mentoring, interdisciplinary projects, etc.

36. Does the program take advantage of any USG initiatives?
Mark all that apply, and provide a letter of support from applicable initiatives' leadership.

[ ] eCampus *[ ] Georgia Film Academy*

[ ] FinTECH *[ ] Other: Specifiy Initiative Here*

37. ^ For associate's, Nexus, and bachelor's degree proposals, list the specific occupational technical skills, and KSAs identified in question 27 and show how they related to the program learning outcomes. Insert more rows as needed.
Complete this chart for the upper division or major curriculum only.

[1] Direct measures may include assessments, HIPs, exams, etc.

Alignment of Occupational KSAs [1]	Student Learning Outcome (s)	Direct Measure (s)	Data Source
Critical Thinking	Ability to identify problems and develop economically feasible solutions through critical thinking	Course assignments and exams; Research projects; Capstone projects; Direct observation from major professors.	Exams; Research project
Complex Problem Solving	Ability to perform efficiently in an interdisciplinary team as a member or as a leader to create a collaborative environment, integrating concepts, and techniques to solve challenging mechanical engineering problems	Course assignments and exams; Research projects; Capstone projects; Direct observation from major professors.	Course assignments; Research project
Coordination and Social Perceptiveness	Demonstrate the ability to effectively communicate experimental results orally with a range of audiences and exhibit efficient writing skills demonstrated through scientific publications and grant proposals	Faculty evaluation; Self-assessment; Mentor evaluations; Career development activities; Graduate surveys.	Faculty evaluation; graduate survey
Active Learning	Ability to identify problems and develop economically feasible solutions through critical thinking, scientific knowledge, engineering tools, and systematic approaches related to advanced mechanical engineering field	Course assignments and exams; Research projects; Capstone projects; Direct observation from major professors.	Research projects; Faculty evaluations
Writing	Demonstrate the ability to effectively communicate experimental results orally with a range of audiences and exhibit efficient writing skills demonstrated through scientific publications and grant proposals	Writing assignments such as research papers or technical reports; Presentations such as research seminars or project presentations; Peer and faculty evaluation;	Research project; Presentations; Technical reports
Engineering and Technology	Ability to perform efficiently in an interdisciplinary team as a member, integrate concepts, and techniques	Hands-on projects involving Digital technologies; Examinations such as programming	Hands-on project; Programming project; Presentations

	to solve challenging mechanical engineering problems.	skills; Faculty evaluation during the research meetings; Industry certifications	

38. For associate's, Nexus, and bachelor's degree proposals, fill in the table below to demonstrate the link between the learning outcomes and NACE career ready competencies.

Insert more rows as needed.

Career Ready Competencies (NACE)	Student Learning Outcomes	Direct Measure (s)[1]
Critical Thinking/Problem Solving	Ability to identify problems and develop economically feasible solutions through critical thinking	Course assignments and exams; Research projects; Capstone projects; Direct observation from major professors.
Oral/Written Communications	Demonstrate the ability to effectively communicate experimental results orally with a range of audiences and exhibit efficient writing skills demonstrated through scientific publications and grant proposals.	Writing assignments such as research papers or technical reports; Presentations such as research seminars or project presentations; Peer and faculty evaluation;
Team Work/ Collaboration	Ability to perform efficiently in an interdisciplinary team as a member or as a leader to create a collaborative environment	Group projects; Peer and faculty evaluations; Case studies or simulations for complex problems.
Digital Technology	Ability to perform efficiently in an interdisciplinary team as a member, integrate concepts, and techniques to solve challenging mechanical engineering problems.	Hands-on projects involving Digital technologies; Examinations such as programming skills; Faculty evaluation during the research meetings; Industry certifications
Leadership	Ability to perform efficiently in an interdisciplinary team as a leader.	Group projects for leadership roles; Peer evaluation on the leadership skills; Faculty evaluations; Leadership activities and workshops
Professionalism/ Work Ethic	Ability to identify problems and develop economically feasible	Faculty evaluation; Self-assessment; Mentor evaluations;

	solutions through critical thinking, scientific knowledge, etc.	Career development activities; Graduate surveys.
Career Management	Demonstrate the ability to effectively communicate experimental results orally with a range of audiences and exhibit efficient writing skills	Career assessments; Career development activities; Alumni surveys; Internships and co-op experiences; Mentor evaluation.
Global/Intercultural Fluency	Ability to identify problems and develop economically feasible solutions through critical thinking, scientific knowledge, engineering tools, and systematic approaches related to advanced mechanical engineering field	Self-assessment; Faculty evaluations; Study abroad experiences; Cross-cultural projects via international collaboration; Cultural diversity and inclusion training

[1] Direct measure may include assessments, HIPsREsill, exams, etc.

39. How will learning outcomes for the program be assessed? Attach the curriculum map for the upper division or major curriculum.

The assessment of the program will be conducted by the School of Environmental, Civil, Agricultural and Mechanical Engineering (ECAM) graduate faculty working in conjunction with the College of Engineering's Associate Dean for Academic Affairs. The results of the annual assessment will be reported to the UGA Office of Accreditation and Institutional Effectiveness, as well as to the School of Environmental, Civil, Agricultural and Mechanical Engineering graduate faculty and the ECAM External Advisory Board for their use in program development.

The student learning outcomes and the specific, measurable performance indicators are listed below:

a. **Ability to identify problems and develop economically feasible solutions through critical thinking, scientific knowledge, engineering tools, and systematic approaches related to advanced mechanical engineering field.**
   1. The research objectives are supported by a critical review of current, relevant literature.
   2. The research objectives address a critical societal and/or technological need.
   3. The research objectives will contribute novel and unique knowledge to the discipline.

b. **Ability to perform efficiently in an interdisciplinary team as a member or as a leader to create a collaborative environment, integrating concepts, and techniques to solve challenging mechanical engineering problems.**
   1. The student is able to identify and execute appropriate scientific/engineering methods to test the research objectives.
   2. The student can analyze and evaluate his/her data/model/simulations using correct statistical analysis, where appropriate.
   3. The student can draw sound conclusions that are supported by his/her results.
   4. The student demonstrates extensive knowledge of contemporary issues that are directly and indirectly associated with his/her research.
   5. The student has a clear understanding of required future work.

c. **Demonstrate the ability to effectively communicate experimental results orally with a range of audiences and exhibit efficient writing skills demonstrated through scientific publications and grant proposals.**
    1. The student presents information in a logical and interesting sequence with a clear and strongly supported central message.
    2. The student uses relevant graphics and/or multimedia to explain and reinforce the presentation.
    3. The student delivery (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and the speaker appears polished and confident.
    4. The student appearance, language, and presentation convey a high level of professionalism.

Direct assessment of the student learning outcomes will be performed by the Graduate Advisory Committee members during each student dissertation defense. An assessment rubric has been developed by the College of Engineering and is currently used for assessment of students in Engineering (Ph.D.). Indirect assessment of student learning outcomes will be undertaken with a student exit survey.

40. How will outcomes for graduates of the program be assessed?
(Outcomes may include employment and placement rates, student or employer surveys, or other assessments of graduate outcomes)

Alumni Survey: The Mechanical Engineering (Ph.D.) alumni will be asked to complete a Qualtrics survey every 3 years, which assesses employment and placement rates and the value of their education in their current position. This survey will also aid in determining specific courses and research areas in the Mechanical Engineering program that are considered the most relevant to the industry and whether new areas need to be incorporated into the program of study. The Graduate Coordinator will collect the survey responses and the School Chair will tabulate the results and report them to the faculty at the annual faculty meeting. This is an indirect assessment of all learning outcomes.

Advisory Board Focus Group: The Mechanical Engineering (Ph.D.) program has identified two primary constituencies: the *mechanical engineering industry* and *mechanical engineering alumni*. The School of Environmental, Civil, Agricultural, and Mechanical Engineering advisory board is comprised of representatives from both of these constituent groups. Each member of the board serves a three-year term; at the completion of the term each member can opt to step down from the board or commence another three-year term. Focus groups are performed during the annual advisory board meeting every three years to ensure graduate outcomes are consistent with industry needs and that outcomes are being attained. The results of the focus groups are reviewed by the School Chair to determine alignment with industry needs and satisfactory attainment. If an obvious disparity exists between the constituencies' needs, a special faculty meeting will be scheduled. Program faculty review feedback from the focus groups and draft an appropriate response based on constituent needs. This will be sent to the advisory board who will determine if the response is acceptable or if further revisions are needed.

41. List the entire course of study required to complete the academic program.
Include course: prefixes, numbers, titles, and credit hour requirements
Indicate the word "new" beside new courses
Include a program of study

Minimum requirement – 72 credit hours (minimum of 28 credit hours course work; minimum of 44 credit hours research and dissertation)

A thesis master's degree from an accredited university may be accepted for up to 12 credit hours, in which case a minimum of 60 credit hours of approved course work, research, and dissertation beyond the M.S. degree would be required.

Required Advanced Engineering Core Courses (7 credit hours):

- ENGR 8130, Statistical Learning and Data Mining in Engineering (3 credit hours)
- ENGR 8910, Foundations for Engineering Research (3 credit hours)
- ENGR 8950, Graduate Seminar (1 semester, 1 credit hour) *

Electives (21 credit hours):
Students must complete a minimum of 9 credit hours selected from the list of approved electives and an additional 12 credit hours of any courses. For electives, at least 3 credit hours must be 8000-level or above. Students will work with their graduate advisor to select the most appropriate coursework to ensure breadth of understanding as well as mastery of knowledge in a specific subject area. Students may work with their graduate advisor to develop an interdisciplinary plan of coursework drawing from the extensive graduate course offerings available outside the College of Engineering at UGA.

The University requires that students who are accepted to the Ph.D. program directly from a B.S. degree or who switch to a Ph.D. program before earning an M.S. degree must complete an additional 4 semester hours of University of Georgia courses open only to graduate students. Students entering Mechanical Engineering (Ph.D.) without a master's degree must have completed an undergraduate engineering degree.

Approved Electives:

- BIOE 6740, Biomaterials (3 credit hours)
- BIOE 6760, Biomechanics (3 credit hours)
- CVLE(MCHE) 8160, Advanced Fluid Mechanics (3 credit hours)
- CVLE(MCHE) 8350, Nonlinear Finite Element Analysis (3 credit hours)
- CVLE(MCHE) 8640, Advanced Strength of Materials (3 credit hours)
- CVLE(MCHE)(LAND) 6660, Sustainable Building Design (3 credit hours)
- ELEE 6210, Linear Systems (3 credit hours)
- ELEE 6220, Feedback Control Systems (3 credit hours)
- ELEE 6230, Sensors and Transducers (3 credit hours)
- ELEE 6235, Industrial Control Systems (3 credit hours)
- ELEE 6260, Introduction to Nanoelectronics (3 credit hours)
- ELEE 8310, MEMS Design (3 credit hours)
- ENGR 6350, Introduction to Finite Element Analysis (3 credit hours)
- ENGR 6670, Quality Engineering (3 credit hours)
- ENGR 6920, Theory of Design (3 credit hours)
- ENGR 8103, Computational Engineering: Fundamentals, Elliptic, and Parabolic Differential Equations (3 credit hours)
- ENGR 8180, Advanced Mass Transfer (3 credit hours)
- ENGR 8220, Microfluidic Transport Phenomena (3 credit hours)
- ENGR 8270, Computational Nanomechanics (3 credit hours)
- ENGR 8900, Directed Study in Engineering (1-3 credit hours)
- ENVE 6230, Energy in Nature, Civilization, and Engineering (3 credit hours)
- ENVE 6250, Energy Systems and the Environment (3 credit hours)
- ENVE 6530, Energy and Environmental Policy Analysis (3 credit hours)
- ENVE 6550, Environmental Life Cycle Analysis (3 credit hours)
- INFO 6150, Engineering Informatics (3 credit hours)
- MCHE 6360, Robotic Manipulators (3 credit hours)
- MCHE 6380, Solid Mechanics (3 credit hours)
- MCHE 6390, Advanced Mechanical Vibration (3 credit hours)
- MCHE 6400, Air Pollution Engineering (3 credit hours)
- MCHE 6430, Introduction to Tribology (3 credit hours)
- MCHE 6500, Advanced Thermal Fluid Systems (3 credit hours)
- MCHE 6530, Combustion and Flames (3 credit hours)

- MCHE 6580, Computational Fluid Dynamics (CFD) (3 credit hours)
- MCHE 6590, Fluid Mechanics II (3 credit hours)
- MCHE 6650, HVAC Systems for Buildings and Industry (3 credit hours)
- MCHE 6850, Advanced Manufacturing Processes (3 credit hours)
- MCHE 8170, Advanced Heat Transfer (3 credit hours)
- MCHE 8250, Combustion Science (3 credit hours)
- MCHE 8380, Continuum Mechanics (3 credit hours)
- MCHE 8500, Technical Foundations of Energy for Policy Practitioners (3 credit hours)
- MCHE 8850, Gas Dynamics (3 credit hours)
- MIST 6550, Energy Informatics (3 credit hours)

Research and Dissertation (44 credit hours):

- A minimum of 41 hours of Doctoral Research (ENGR 9000) or Project-Focused Doctoral Research (ENGR 9010). Typically, students complete more than 42 credit hours with the approval of the Graduate Advisory Committee.
- 3 hours of Doctoral Dissertation (ENGR 9300) is required on the Plan of Study.

** Only 3 hours of Graduate Seminar may apply on the Program of Study and be included in the 72-credit hour requirement. Students are strongly encouraged to continue regular attendance at speaker series presentations even if not formally registered in the seminar.*

YEAR ONE					
Fall Semester		**Hours**	**Spring Semester**		**Hours**
ENGR 8950	ECAM Graduate Seminar	1	ENGR 8950	ECAM Graduate Seminar	1
MCHE 8380	Continuum Mechanics	3	ENGR 8130	Statistical Learning & Data Mining in Engineering	3
ENGR 8910	Foundations for Engineering Research	3	ENGR 8103	Computational Engineering: Fundamentals, Elliptic, and Parabolic Differential Equations	3
ENGR 9000	Doctoral Research	2	ENGR 9000	Doctoral Research	2
Total Credit Hours		**9**	**Total Credit Hours**		**9**
Summer					
ENGR 9000	Doctoral Research	9			
Total Credit Hours		**9**			

YEAR TWO					
Fall Semester		**Hours**	**Spring Semester**		**Hours**
MCHE 8170	Advanced Heat Transfer	3	ENGR 8350	Nonlinear Finite Element Analysis	3
MCHE xxxx	Elective	3	MCHE xxxx	Elective	3
ENGR 8950	ECAM Graduate Seminar	1	ENGR 8950	ECAM Graduate Seminar	1
ENGR 9000	Doctoral Research	2	ENGR 9000	Doctoral Research	2
Total Credit Hours		**9**	**Total Credit Hours**		**9**
Summer					
ENGR 9000	Doctoral Research	9			
Total Credit Hours		**9**			

YEAR THREE					
Fall Semester		**Hours**	**Spring Semester**		**Hours**
MCHE xxxx	Elective	3	ENGR 9000	Doctoral Research	6
ENGR 9000	Doctoral Research	6	ENGR 9300	Doctoral Dissertation	3
Total Credit Hours		**9**	**Total Credit Hours**		**9**

E. IMPLEMENTATION

42. Provide an enrollment projection for the next four academic years

	Year 1	Year 2	Year 3	Year 4
Fiscal Year (Fall to Summer)	2023-24	2024-25	2025-26	2026-27
Base enrollment[1]	0	22	44	66

Lost to Attrition (should be negative)	0	-2	-2	-2
New to the institution	20	20	20	21
Shifted from Other programs within your institution	2	4	4	4
Total Enrollment	22	44	66	89
Graduates	0	0	0	17
Carry forward base enrollment for next year	22	44	66	72

[1]Total enrollment for year 1 becomes the base enrollment for year 2, and so on year 2, 3, 4.

a. **Discuss the assumptions informing your enrollment estimates (i.e. for example, you may highlight anticipated recruiting targets and markets, if and how program implementation will shift enrollment from other programs at the institution, etc.)**

Students in Engineering (Ph.D.) with an Area of Emphasis in Mechanical Engineering are expected to switch to the major in Mechanical Engineering (Ph.D.) in Year One. However, for planning purposes the school is assuming 2-4 students per year will transfer the new program and that the first students will graduate at the beginning of year 4 from the new program. This is a conservative assumption. Historical data indicate for the previous three years the college consistently recruited around 10 new students to Engineering (Ph.D.) with the area of emphasis each academic year and graduate 20-25% of current students. The school fully expects to sustain a program enrollment of at least 20 students for the new Ph.D. program in Mechanical Engineering and anticipates enrollment will increase in future years as additional faculty members are being recruited through the current Presidential Cluster Hiring Initiative.

b. ***If projections are significantly different than enrollment growth for the institution overall, please explain.***

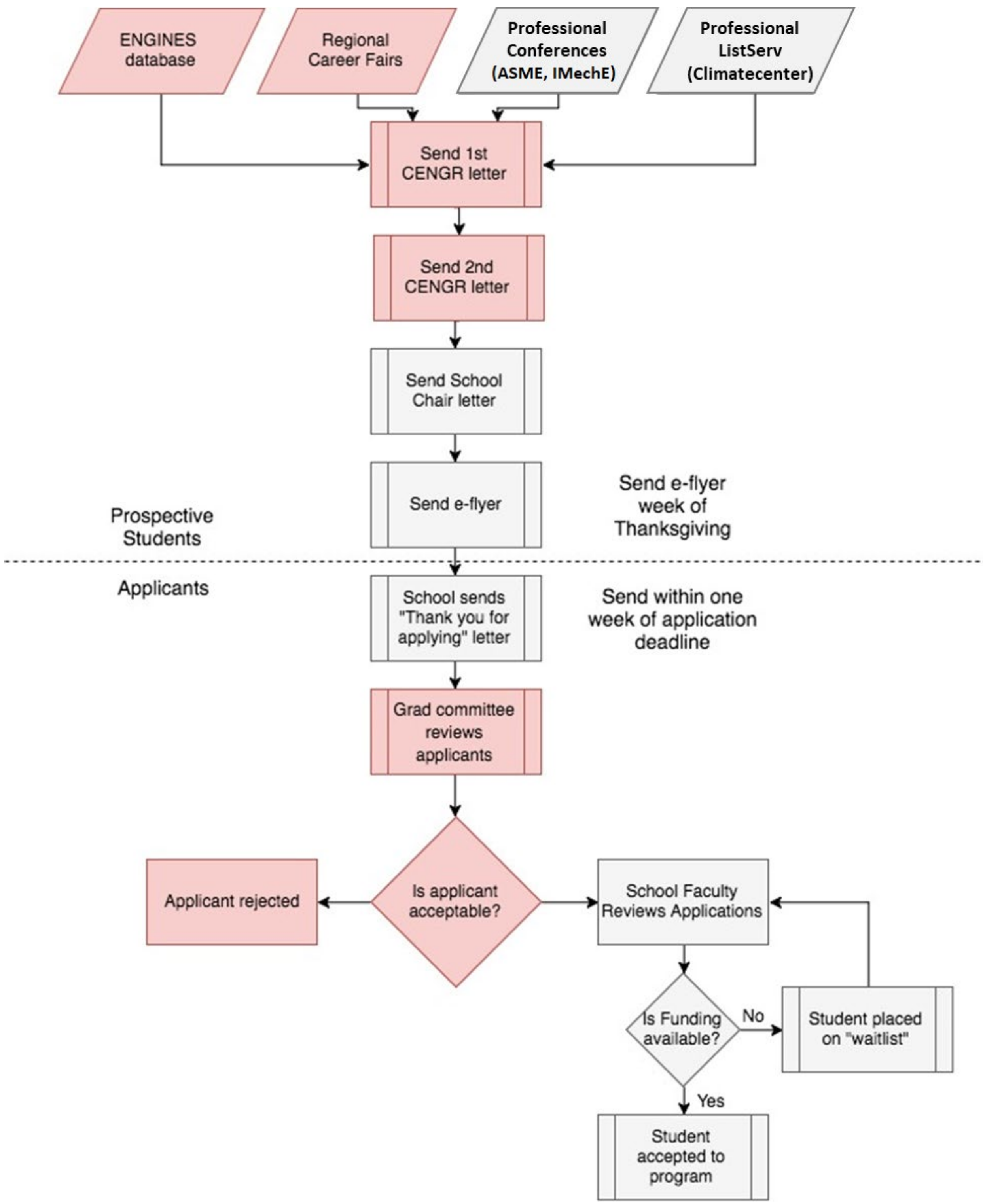
Not applicable

43. If projected program enrollment is not realized in year two, what actions are you prepared to take?

In the event that program enrollment is not realized, the School of ECAM will increase recruitment activities by increasing social media presence, advertising in relevant print and online publications such as the College of Engineering, ASME, IMechE, NSPE, AMPs, SAE, SES, SEM, etc., websites, and by proactively encouraging current undergraduate and M.S. students to pursue this Ph.D. program.

44. Discuss the marketing and recruitment plan for the program. Include how the program will be marketed to adult learners and underrepresented and special populations of students. What resources have been budgeted for marketing the new program?

The School of ECAM will utilize a number of avenues to market the new program and recruit students, including the ENGINES database of prospective engineering graduate students, regional career fairs, professional meetings including the American Society of Mechanical Engineering (ASME), Institute of Mechanical Engineers (IMechE), National Society of Professional Engineers (NSPE), Advanced Manufacturing & Processing Society (AMPs), Society of Automotive Engineering (SAE), Society of Experimental Mechanics (SEM), Society of Engineering Science (SES), American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and the Student Aerospace Initiative (SAI) American Physics Society (APS), American Society of Education Engineers (ASEE), and a variety of professional listservs, such as Climatecenter. The program will be prominently displayed on the school's website. The flow chart for student recruitment is presented below.



45. Provide a brief marketing description for the program that can be used on the Georgia OnMyLine website.

The Ph.D. in Mechanical Engineering provides maximum flexibility for students to address 21st century challenges on both traditional and emerging mechanical fields through their studies and research. Within the mechanical engineering degree, students should be able to apply fundamental principles to develop, design, manufacture, and test machines and other mechanical devices/systems.

46. If this proposal is for a Doctorate program, provide information below for at least three external and one USG reviewer of aspirational or comparative peer programs

Note: External reviewers must hold the rank of associate professor or higher in addition to other administrative titles.

Dr. Srinath Ekkad
Department Head and Richard W. Kritzer Distinguished Professor
Department of Mechanical and Aerospace Engineering
North Carolina State University
sekkad@ncsu.edu
919-515-2368

Dr. Pradeep Sharma
Hugh Roy and Lillie Cranz Cullen Distinguished University Professor & Department Chair
Department of Mechanical Engineering
University of Houston
psharma@uh.edu
713-743-4502

Dr. Toni Jacobi
Department Head and Richard W. Kritzer Distinguished Professor
Department of Mechanical Science and Engineering
University of Illinois, Urbana-Champaign
a-jacobi@illinois.edu
217-333-4108

Dr. Thomas R. Kurfess
Executive Director – Georgia Tech Manufacturing Institute
Professor and HUSCO/Ramirez Distinguished Chair in Fluid Power and Motion Control
Georgia Institute of Technology
kurfess@gatech.edu
404-385-0959

F. RESOURCES

F1. Finance: Complete and submit the Excel budget forms and the questions below (Do not cut and paste in the excel budget template into this document, submit the Excel budget templates separately.)

47. *Are you requesting a differential tuition rate for this program? (masters, doctoral, and professional programs only)*

☒ No (Move to answer question 48)

☐ Yes (If yes, answer questions 47a & 47b)

a. What is the differential rate being requested? The rate below should reflect the core tuition plus the differential, i.e. the tuition rate being advertised to the student.

In-State per Semester:

Out-of-State per Semester:

b. Provide tuition and mandatory fee rates assessed by competitive/peer programs per full-time student per semester. Please complete the table below:

Institution name	Link to institution's tuition & fee website	In-state tuition	Out-of-state tuition	In-state fees	Out-of-state fees

48. If existing funds are being reallocated, describe the impact on existing programs and the plan to mitigate these impacts.

Neither faculty nor staff hiring or reassignments are necessary, as the courses and program materials are already being offered as an area of emphasis under Engineering (Ph.D.). The school will not need to create new sections of any existing courses to meet additional demand.

49. If student fees are being charged (excluding mandatory fees), explain the cost and benefit to students, per fee.

Not applicable.

50. Are there any additional financial costs that students will have to take on as part of this program, but not assessed directly by the institution? (e.g. software licenses, equipment, travel, etc.) If so, please describe these costs and what strategies you have considered to decrease the student's financial burden?

No additional costs to students are anticipated.

51. How does the institution plan for and fund increased indirect costs associated with the growth in students anticipated in the proposed program? Consider costs such as student advisement, student support services, tutoring, career services, additional library materials, technology, or other infrastructure.

All resources needed for the program are pre-existing, as it is already being offered as an area of emphasis under Engineering (Ph.D.). The School of ECAM will utilize the current resources (personnel, library, equipment, laboratory, and computing) available at the school, college, and university levels. In addition, the school will obtain funds from the university for new hires as part of the Presidential Interdisciplinary Hiring Initiative.

F2. Faculty – Explain your faculty and staff plan for the program

52. Discuss how existing courses may be incorporated into this new program:

a. **Course Development**

# of total courses in the curriculum:	42
# of existing courses to be part of the new program	42
Net number of new courses to be developed	0

b. **Comment on the costs and workload related to the new course development.**

All courses are currently being offered. No new courses are being proposed or developed as part of the program and therefore, no new resources are needed to cover instructional costs.

53. Explain how <u>current faculty and staff</u> will contribute to the program.

a. ***How many faculty will be re-directed to this program from existing programs?***

0

b. **If this program is approved, what will be the new teaching load and distribution of time for the current faculty members? How will existing staff be impacted?**

The School of Environmental, Civil, Agricultural, and Mechanical Engineering has 24 faculty currently teaching courses that are directly related to the proposed program of study or who are performing mechanical engineering research. These faculty will be the major professors for students enrolled in the proposed Ph.D. program. The teaching loads for existing faculty will remain the same. The courses, currently offered as part of the existing areas of emphasis in Dynamics Systems and Controls, Mechanics and Materials, and Thermal and Fluid Systems under the Engineering (Ph.D.) major, will now be offered as part of the new major. Existing staff will not be impacted by the creation of the new major.

c. **List the faculty that will be redirected from their current teaching load assignments to support this new program.**

No faculty will be redirected from their current teaching assignments. The proposed degree will incorporate courses that are currently taught by existing, qualified faculty as part of the areas of emphasis in Dynamics Systems and Controls, Mechanics and Materials, and Thermal and Fluid Systems.

d. **Explain who will be teaching the existing courses that are being released so faculty can teach a new program course. Additionally, please discuss the fiscal implications associated with course releases and redirections of faculty.**

Not applicable; all courses are already being offered.

e. **What costs are included in your budget for course development? (Consider professional development, course development time buy out, overload pay, and re-training)**

Not applicable.

f. **Attach your SACSCOC roster for the proposed program. Include in parentheses the individual with administrative responsibility for the program and whether listed positions are projected new hires and/or currently vacant.**

Faculty Name	**Rank**	**Courses Taught**	**Academic Degrees**	**Current Workload** *% EFT Research, Instruction, Service*	**Other Qualifications and Comments** *Research Areas*
Camelio, Jaime	Full Professor	MCHE xxx	Ph.D., Mechanical Engineering, University of Michigan, 2002	30(R) 10(I) 60(S)	• Intelligent manufacturing systems • Cyber physical security for manufacturing systems – vulnerability mapping, mitigation technologies • Data mining and statistical learning applications for manufacturing processes and systems, process monitoring, diagnosis, prognosis, and control
Chorzepa, Mi Geum	Associate Professor	CVLE(MCHE) 8350 Nonlinear Finite Element Analysis, 3 (G), CVLE(MCHE) 8640 Advanced Strength of Materials, 3 (G)	Ph.D., Structural Engineering, Washington University in St. Louis, 2008	50(R) 50(I)	• Structural Analysis & Design • Nonlinear Finite Element Analysis • Nuclear Safety Related Structures • Containment Structures • Steel Plate Structures • Cryogenic Structures • Sustainable Building Design • Progressive Collapse Analysis • Materials Modeling • Forensic Engineering

					• Structural Repair Composite Materials Earthquake Engineering
Davis, Benjamin	Associate Professor	MCHE 6390 Advanced Mechanical Vibrations, 3 (G)	Ph.D., Mechanical Engineering, Duke University, 2008	50(R) 50(I)	• Structural Analysis & Design • Structural Vibration • Acoustics • Acoustic-Structure Interaction • Nonlinear Dynamics • Flow-Induced Vibration • Fluid-Structure Interaction • Elastic Stability
Freeman, Eric	Associate Professor	BIOE 6760 Biomechanics, 3 (G), ENGR 6350 Introduction to Finite Element Analysis, 3 (G) MCHE 6380 Solid Mechanics, 3 (G) ENGR 8220 Microfluidic Transport Phenomena, 3 (G)	Ph.D., Mechanical Engineering, University of Pittsburgh, 2012	60(R) 40(I)	• Microfluidics • Modeling • Electrophysiology • Drug Delivery • Bioinspiration • Smart Materials • Droplet Mechanics • Soft Materials
Gattie, David	Associate Professor	ENVE 6250 Energy Systems and the Environment, 3 (UG/G), MCHE 8500, Technical Foundations of Energy for Policy Practitioners, 3 (G)	Ph.D., Ecology, University of Georgia, 1993	50(R) 50(I)	• Energy systems and environmental issues • Power generation • Energy policy
Haidekker, Mark	Full Professor	ELEE 6220 Feedback Control Systems, 3(G)	Ph.D., Computer Science – University of Bremen, Germany, 1998	50(R) 50(I)	• Biosensing and bioimaging; • instrumentation

Handa, Hitesh	Associate Professor	BIOE 6740 Biomaterials, 3 (G)	Ph.D., Material Science & Engineering, Wayne State University, 2008	60(R) 40(I)	• Biomaterials for Medical Device Applications • Nitric Oxide Releasing Materials • Blood-Material Interactions • Antimicrobial and Hemocompatible Materials • Wound Healing Materials
Hilten, Roger	Assistant Professor of Practice	ENGR 6670 Quality Engineering, 3(G)	Ph.D. Bio and Ag Engineering, 2012	10(R) 10(I) 80(S)	•
Hu, S. Jack	Full Professor and Provost		Ph.D., Mechanical Engineering, University of Michigan, 1990	100(S)	• Manufacturing Systems • Assembly and materials joining • Smart manufacturing
Kastner, James	Associate Professor	ENGR 8180 Advanced Mass Transfer, 3 (G)	Ph.D., Applied Biology, Georgia Institute of Technology, 1993	60(R) 40(I)	• Biochemical engineering • Environmental, nanostructured and chemical catalysts • Enhanced biomass pyrolysis and gasification processes •
Kazanci, Caner	Associate Professor	ENGR 8103 Computational Engineering: Fundamentals, Elliptic, and Parabolic Differential Equations, 3 (G)	Ph.D., Mathematical Sciences, Carnegie Mellon University, 2005	50(R) 50(I)	• Biological and ecological modeling, simulation and analysis. • Numerical analysis, dynamical systems. • Ecological network analysis (ENA), ecological thermodynamics. • Stochastic modeling tools, individual based modeling. • Collective behavior of large biochemical reaction networks, the relation between network structure and system dynamics.
Kisaalita, William	Full Professor	ENGR 8910, Foundations for Engineering Research, 3(G)	Ph.D. in chemical engineering, Univer sity of British Columbia	60(R) 40(I)	• Microtissue engineering • Development engineering •
Lawrence, Thomas	Professor of Practice	MCHE 6650, HVAC Systems for Buildings and Industry, 3(G) CVLE(MCHE)(LAND) 6660, Sustainable Building Design, 3(G)	Ph.D., Mechanical Engineering, Purdu e University, 2004	22(R) 60(I) 18(S)	• Green buildings • Smart grid and building energy management • HVAC systems • Energy informatics
Leo, Donald	Full Professor and Dean	MCHE 6390, Advanced Mechanical Vibrations, 3 (G)	Ph.D., Mechanical and Aerospace Engineering, Unive rsity of Buffalo, 1995	100(S)	• Smart Materials • Biomolecular Materials
Li, Ke	Associate Professor	ENVE 6550, Environmental	Ph. D., Environmental	50I 50(I)	• Environmental engineering

		Life Cycle Analysis, 3(G)	Engineering, Michigan Technological University, 2003		• Water/wastewater treatment and sustainability •
Mani, Sudhagar	Full Professor	MCHE 8710, Engineering Properties of Animal and Plant Materials: Form and Function, 3(G)	Ph.D., Chemical and Biological Engineering, University of British Columbia, Canada, 2005	50(R) 50(I)	• Biological and chemical process modeling, simulation & optimization • Sustainable biomass feedstock supply logistics system • Novel biomass densification, torrefaction and thermal conversion technologies • Techno-Economic Analysis (TEA) and Life Cycle Assessment (LCA) • Novel routes to produce nano-size cellulose, chemicals & bio-composites •
Mativo, John	Full Professor		Ph.D., Mechanical Engineering, University of Dayton, 2020	50(R) 50(I)	• Energy • Mechanics • Mechatronics • STEM Education K-16
Morkos, Beshoy	Associate Professor	MCHE 6850, Advanced Manufacturing Processes, 3 (G) MCHE 6860, Advanced Vehicle Manufacturing, 3	Ph.D., Mechanical Engineering, Clemson University, 2012	50(R) 50(I)	• Computational Design • System Representation and Reasoning • Model Based System Engineering • Manufacturing Resource Optimization and Operations • Complex System Design • Cyber-Physical-Social Systems in Manufacturing • Human-AI interaction in Design and Manufacturing
Pidaparti, Ramana	Full Professor	ENGR 6560 Engineering Design Optimization, 3 (G); ENGR 8900 Directed Study in Engineering, 1-3	Ph.D., Aeronautics & Astronautics, Purdue University, 1989	50(R) 50(I)	• Design engineering and innovation • Computational mechanics • Drug delivery devices • STEM education
Rao, Haygriva	Professor of Practice	INFO 6150 Engineering Informatics, 3 (G)	PGD, Knowledge Engineering, National University of Singapore, 2001	100(I)	• *AI and Machine Learning*
Rotavera, Brandon	Associate Professor	MCHE 6500, Advanced Thermal Fluid Systems, 3 (G) MCHE 6530, Combustion	Ph.D., Interdisciplinary Engineering, Texas A&M University, 2012	60(R) 40(I)	• Biofuels • Sustainable Energy • Combustion • Thermodynamics, • Lasers/Optics • Physical Chemistry • Chemical Kinetics • Fluid Dynamics

		and Flames, 3 (G) MCHE 8250, Combustion Science, 3 (G) MCHE 8850 Gas Dynamics, 3 (G)			• Spectroscopy • Gas Chromatography • Mass Spectrometry
Saleh, Rawad	Associate Professor	MCHE 6400, Air Pollution Engineering, 3(G) ENGR 8990, Advanced Topics in Engineering	Ph.D., Environmental Engineering, Duke University, 2010	50I 50(I)	• Atmospheric Aerosols • Gas-particle Interaction • Aerosol optical properties • Combustion emissions • Air quality and climate modeling • Chemical Transport Modeling
Schramski, John	Associate Professor	ENVE 6230, Energy in Nature, Civilization & Engineering, 3(G)	Ph.D., Ecology, University of Georgia, 2006	60(R) 40(I)	• Energy systems • Ecosystem energetics • Thermodynamics • Theoretical ecology • Complex network analysis • Ecological network theory • Energy Supply and Demand • Environmental Energy Systems • Sustainable Use of Global Ecosystems • Food Security • Natural Resources Engineering
Wang, Xianqiao	Associate Professor	ENGR 8270, Computational Nanomechanics, 3(G) MCHE 8330, Continuum Mechanics, 3(G)	Ph.D. Mechanical Engineering, George Washington University, 2011	50(R) 50(I)	• Brain mechanics • Mechanics of architectured materials and structures • Materials design by machine learning and AI • Mechanics of cell and nanoparticle interactions • 2D materials • Multiscale modeling and simulations
Yang, Jidong	Associate Professor	ENGR 8990, Advanced Topics in Engineering, 3(G)	Ph.D., Civil Engineering, University of South Florida,	50(R) 50(I)	• Transportation Engineering and Planning • Sustainable and Resilient Infrastructure Systems • Smart Mobility Systems • Statistical and Econometric Models • Data Mining and Machine Learning Methods • Computer Vision and Artificial Intelligence Applications

54. Explain your plan for new faculty and staff for the program:

a. ***How many new faculty will be needed for this program over the next four years? Enter #0***

Explanation:
The faculty are already in place, and the courses are being offered under Engineering (Ph.D.). This proposal is only to move the program content from an area of emphasis to an independent major.

b. How many new staff will be needed for this program over the next four years?

No new staff are needed to offer the degree program.

c. Discuss why new or additional staff resources are needed. Consider staff needs, support services (i.e. advisement, faculty support, etc.)

No new staff or staff resources will be required for the proposed major.

F3. Facilities – complete the questions below:

55. Where will the program be offered? Mark all that apply

☒ Main campus

☐ Satellite campus: Specify Here

☐ Other: Specify Here

☐ 100% Online

56. Will new or renovated facilities or space be needed for this program over the next four years?

☒ No

☐ Yes (*If yes, complete the table below, inserting additional rows as needed).*

Capital Costs for Needed Facilities and Space

Facility/Space Name	Gross Square Footage	Start Up Costs	Ongoing Costs	Est. Occupancy Date	Funding Source
New Construction					
Renovations and Infrastructure*					
Purchases: Land, Buildings etc.					
Lease space					

TOTAL Cost		**$0**	**$0**		

*Include the name of the building or location being impacted and what will need to be done. Infrastructure includes new systems such as: water, electrical, IT networks, HVAC etc.

57. Discuss the impact of construction or renovation on existing campus activities and how disruptions will be mitigated. Explain how existing programs benefit from new facilities and/or space(s) and changes to existing space.

Not applicable

58. Will any existing programs be negatively impacted (e.g. lose classroom or office space) by proposed facility changes? If so, discuss how the impacts of these changes will be mitigated.^

No.

59. Are any of these new facilities or major renovations listed in the table above (Question 57) NOT included in the institution-level facilities master plan?

Not applicable

60. Will any of the following types of space be required: instructional, fine arts, meeting, study, or dedicated office?

☒ No (Move to Question 63).

☐ Yes (*If yes, complete question 62. Insert additional rows as needed).*

61. Complete the table below. Specify if these spaces are existing or new in the table below. If new, provide the semester and year of completion.

Space	New Space (ASF)	Use Existing Space (as is) (ASF)	Use Existing Space (Renovated) (ASF)	Semester/ Year of Occupancy

Dry Labs (STEM related)		10,000		Fall/2018; Spring/2022; Fall/2022
Wet Labs (STEM related)		2,000		Fall/2018/Spring/ 2022; Fall/2022
Dedicated Offices		6,000		Fall/2018; Spring/2022; Fall/2022
Fine Arts Spaces[1]				
Classrooms		4,000		Fall/2018; Fall/2022; Spring/2022
Meeting Rooms		300		Fall/2022
Student Study Space		500		Fall/2018; Spring/2022; Fall/2022
Other (Specify)				

[1]Fine arts spaces can include theatres, recital halls, visual arts studios, performing arts centers, recording studios, design labs, and other performance venues.

62. Are there facility needs related to accreditation? Are there any accreditation standards or guidelines that will impact facilities/space needs now or in the future? If so, please describe the projected impact.

Not applicable.

F4. Technology

63. Identify any major equipment or technology integral to program start-up and operations. List any equipment or assets over $5,000 (cumulative per asset) needed to start-up and run the program (insert rows as needed)

	Technology and Equipment	Start-up Costs	On-going Costs	Est. Start Date of Operations/Use
1				
2				
3				
4				
5				
6				
Total Technology Costs		**0**	**0**	

G. RISKS AND ASSUMPTIONS

64. In the table below, list any risks to the program's implementation over the next four years. For each risk, identify the severity (low, medium, high), probability of occurrence (low, medium, high), and the institution's mitigation strategy for each risk. Insert additional rows as needed. (e.g. Are faculty available for the cost and time frame).

Risk	Severity	Probability	Risk Mitigation Strategy

This major is currently offered as a concentration with a robust enrollment. Therefore, there is no assumed risk in implementing it as a major.

65. List any assumptions being made for this program to launch and be successful (e.g. SACSCOC accreditation request is approved, etc.).

The school has successfully developed Ph.D. engineering program with areas of emphasis in Dynamics Systems and Controls, Mechanics and Materials, Thermal and Fluid Systems. Student enrollment in the current program is strong and continues to increase. This successful experience together with current resources would ensure the success of the proposed Ph.D. program in Mechanical Engineering.

H. INSTITUTION APPROVAL

Have you completed and submitted the signature page?

APPENDIX I

Use this section to include letters of support, curriculum course descriptions, and recent rulings by accrediting bodies attesting to degree level changes for specific disciplines, and other information.

Course Descriptions

Course Prefix/Number	Credit Hours	Course Title	Course Description	Required /Elective
BIOE 6740	3	Biomaterials	Biomaterials and groundwork for topics such as mechanical, chemical, and thermal properties of replacement materials and tissues. Implantation of materials in the body is studied for the biological point of view.	S
BIOE 6760	3	Biomechanics	The application of engineering principles to solid mechanics and to body dynamics is discussed. The student should understand the mechanics of the musculoskeletal system.	S
ELEE 6210	3	Linear Systems	Time and frequency domain analysis of linear systems, convolution, fourier series, and fourier transforms with applications	S
ELEE 6220	3	Feedback Control Systems	The analysis and design of continuous and discrete time, and linear feedback control systems.	S
ELEE 6230	3	Sensors and Transducers	Fundamentals of the sensing process, transducers and their environments and the measurement problem. Transducer types and modeling. Displacement, motion, pressure, fluid-flow, temperature measurements.	S
ELEE 6235	3	Industrial Control Systems	Introduces basic concepts of industrial automation, modeling, and control of industrial processes. It introduces various elements in industrial automation, including pneumatic and hydraulic valves and actuators. Controller programming (such as PID and PLC) and tuning will be covered. Practical components include hardware selection, software design, and system integration.	S
ELEE 6260	3	Introduction to Nanoelectronics	Recent advances in nanoelectronics, including the novel properties and device structures when classical transport is replaced by quantum transport as the device size is reduced down to nanometer scale. Introduction of new fabrication and characterization techniques developed for these nanoscale devices.	S
ELEE 8310	3	MEMS Design	Exploration of the world of microelectromechanical systems (MEMS) through awareness of material properties, microfabrication technologies, structural behavior, sensing techniques, actuation schemes, fluid behavior, electronic circuits, and feedback systems. Lectures will be augmented with homework assignments and design projects.	S
ENGR 4350/6350	3	Finite Element Analysis (F)	Fundamental finite element theory for the solution of engineering problems. Geometrical modelling techniques, element selection, and tests for accuracy. Emphasis on problems in structural mechanics and elasticity.	S
ENGR 6560	3	Engineering Design Optimization	The design of better products and processes is a fundamental goal of all engineering. Fundamental concepts of optimization techniques that can be used for a variety of engineering components or systems.	S

ENGR 6670	3	Quality Engineering	Introduces fundamentals, principles, and techniques of quality engineering through a toolkit that includes project management, quality management, and quality improvement for products and processes. Throughout the course, students get hands-on experience in exploring, understanding, and developing quality management tools and strategies to address real-world industrial challenges.	S
ENGR 6920	3	Theory of Design	Design is structured process found in numerous professions. The theory of design provides a scientific basis for this structured process and provides principles for optimizing the design outcome. Two axioms of design, the independence axiom and the information axiom, and their applications in several disciplines will be investigated.	S
ENGR 8103	3	Computational Engineering: Fundamentals, Elliptic, and Parabolic Differential Equations	The use of computational mathematics to develop models, evaluate data, and make predictions of relevance to engineering. Numerical differentiation and integration, numerical solutions of algebraic, ordinary, elliptic and parabolic differential equations, error analysis, and programming techniques are examined in the context of engineering applications.	S
ENGR 8110	3	Informatics in Engineering and Environmental Systems	The philosophical and theoretical basis of informatics, with applications in civil engineering, environmental engineering, and the environmental sciences. Readily available software will be used throughout the course. Specific applications will depend on the needs of the students in the course.	S
ENGR 8130	3	Statistical Learning and Data Mining	Explores statistical learning methods and techniques with an emphasis on their applications in engineering. The focus will be on the classic and modern statistical and machine-learning methods, including linear and logistic regression, discriminant analysis, k-nearest neighbors, tree-based methods, support vector machines, principal components analysis, manifold learning, clustering methods, and artificial neural networks.	R
ENGR 8180	3	Advanced Mass Transfer	Basic laws of mass transport will be derived. Advanced mass transport will focus on molar flux, Fick's law, binary diffusion, two phase transfer, convective mass transfer, mass transfer coefficients, and mass transfer with chemical reaction. A project will be assigned requiring numerical solution of governing mass transport equations.	R
ENGR 8220	3	Microfluidic Transport Phenomena	A mathematical description of transport and exchange at smaller length scales. Topics include channel flow, transport laws, diffusion and dispersion, surface tension dominated flows, and charged species flows.	S
ENGR 8270	3	Computational Nanomechanics	Computational nanomechanics has been emerging as a fundamental engineering analysis tool for designing nanodevices and for predicting intriguing phenomena at the nanoscale. The basic knowledge of computational nanomechanics, such as force fields, interatomic potentials, statistical quantities, and program coding skills. Students are encouraged	S

			to develop a molecular dynamics program by themselves, learn and utilize analytical software to solve nanomechanics problems, and investigate fundamental questions in nanoscience.	
ENGR 8825	3	Bioinspired Design and Analysis	This course offers a unique interdisciplinary advanced design experience, and provides an opportunity to learn the bio-inspired design, develop competence as innovators, and gain the necessary tools and experience.	S
ENGR 8910	3	Foundations for Engineering Research	The philosophy of engineering research, research and design methodologies, review of the departmental research programs and related training goals, and writing and presenting thesis and dissertation proposals and grant proposals	R
ENGR 8950	1x4	ECAM Graduate Seminar	Presentations/discussions related to engineering research, teaching, design, and service presented by students, faculty, and industry leaders.	R
ENGR 8990	3	Advanced Topics in Engineering - Deep Learning and Engineering Applications	Introduces modern deep learning methods and architectures (e.g., convolutional neural networks (CNNs) and recurrent neural networks (RNNs), energy-based models) with an emphasis on their engineering applications. The focuses of the course will be on major advancements in deep learning in recent years. The core ideas and principles of deep learning will be discussed. Both supervised and self-supervised learning will be covered with an emphasis on vision applications, including image classification, object detection, and image segmentation.	S
ENGR 9000	3	Doctoral Research	Research while enrolled for a doctoral degree under the direction of faculty members.	R
ENGR 9010	3	Project-Focused Doctoral Research	Project-focused research while enrolled for the Ph.D. degree under the direction of faculty members. This course is for students who are performing sponsored research specifically devoted toward completing project deliverables important to project sponsors that may not be directly related to Ph.D. dissertation research.	R
ENGR 9300	Variable	Doctoral Dissertation	Dissertation writing under the direction of the major professor.	R
ENVE 6550	3	Environmental Life Cycle Analysis	An in-depth look at life cycle analysis (LCA), the existing models and analytical methodologies, and their applications. Conducting Life Cycle Analyses for small scale items such as individual manufactured products up through larger scaled engineered system items such as an engineered structure, transportation system, etc.	S
INFO 6150	3	Engineering Informatics	Provides instruction and insights into data, theory, and application of machine learning algorithms and skills to apply these algorithms to real world datasets and applications in Engineering. The course also provides hands-on experience through project work.	S
MCHE 6360	3	Robotics Manipulators	Derivation of kinematic equations and inverse kinematic solutions for robotic manipulators; general models for robot arm dynamics and dynamic coefficients for multiple degrees of freedom robot arms with parallel and serial structures; and control of single- and multiple-link	S

			manipulators and how to design simple feedback control laws.	
MCHE 6380	3	Solid Mechanics	A continuation of Strength of Materials. An introduction to elasticity, continuum mechanics, and 3-D stress transformations. Asymmetrical bending of beams, torsion of general cross-section bars, and energy methods are discussed.	S
MCHE 6390	3	Advanced Mechanical Vibration	Modeling and analysis of multi-degree-of-freedom vibrating systems, including free and forced response of both undamped and damped systems. Lumped parameter and distributed parameter systems will be studied. Application of time domain and frequency domain techniques to the design and analysis of complex mechanical systems.	S
MCHE 6400	3	Air Pollution Engineering	The course builds on concepts in thermodynamics, transport phenomena, and physical chemistry to introduce the formation of particulate and gaseous pollutants and their effect on air quality. Special focus will be on engineering design strategies to control pollutants associated with energy generation (power plants) and utilization (on-road vehicles) systems.	S
MCHE 6430	3	Introduction to Tribology	The study of friction, wear, lubrication, and the design of bearings from the consideration of engineering and materials science.	S
MCHE 6500	3	Advanced Thermal Fluid Systems	Advanced study of concepts in thermodynamics and fluid dynamics applied to thermofluid systems, including gas turbines, compressors, wind turbines, and rocket nozzles. Design analysis of pumps, fans, and wind turbines. Introduction to high-speed compressible flow, shock wave physics, and propulsion devices.	S
MCHE 6530	3	Combustion and Flames	Fundamentals of thermodynamics, fluid dynamics, and mass transfer in laminar and turbulent flames in combustion systems. Introduction to chemical kinetics, explosions, supersonic combustion, deflagration and detonation, and ignition dynamics. Introduction to combustion in stationary gas turbines for power generation, internal combustion engines, and combustion systems in jet engines.	S
MCHE 6580	3	Computational Fluid Dynamics	The course outlines how numerical data analyses are used to predict the fluid dynamics and thermal interactions between fluids and their surroundings. Fundamental concepts in modeling are first presented, then students compare CFD results to laboratory data. Students then apply their CFD skills to a more detailed project.	S
MCHE 6590	3	Fluid Mechanics II	Analysis of both internal and external viscous incompressible flows. Specific examples include pipe flow, flow between parallel plates, restriction flow meters, boundary layer flow, the Blasius equation, drag force, and lift force. An introduction to computational fluid dynamics, with application to the course topics, is also covered.	S
MCHE 6650	3	HVAC Systems for Buildings and Industry	A study of the system concepts, sizing, design, and equipment used for the heating, ventilation, and air conditioning systems in buildings (commercial and residential) as well as industrial applications.	S

MCHE 6660	3	Sustainable Building Design	Design features and technologies contained in sustainable (green) building design and the process to create a green building to include commercial and residential construction. Topics include energy and water, construction materials, site work, indoor environmental quality, and how design practices fit into the overall picture of developing a more sustainable society.	S
MCHE 8160	3	Advanced Fluid Mechanics	A mathematical treatment of fluid mechanics using tensors with emphasis on viscosity, momentum balance in laminar flow, equations of change, velocity distribution in laminar and turbulent flow, interphase transport, macroscopic balance, and polymeric liquids. Analytical and numeric methods for solving fluid mechanic problems will be used.	S
MCHE 8170	3	Advanced Heat Transfer	Conduction, convection, and radiation heat transfer will be covered from an analytical and applications viewpoint. Computer tools for solving heat transfer problems will be emphasized. Projects will involve the analyses of a research-related or design-related heat transfer problem involving at least two of the three heat transfer modalities.	S
MCHE 8250	3	Combustion Science	Fundamental concepts related to the use of combustion as a source of transportation energy and advanced combustion technologies. Topics include mathematics of combustion, characteristics and structure of flames, chemical thermodynamics/thermochemistry, chemical kinetics, potential energy surfaces, collision theory, and molecular structure of hydrocarbons and biofuels.	S
MCHE 8350	3	Nonlinear Finite Element Analysis	The formulations and numerical solution of nonlinear problems in structural, mechanical, and biological/biomedical engineering by finite element methods. Both geometric and material nonlinearities will be studied. Students are expected to learn how to use a finite element analysis tool and complete a practical engineering project.	S
MCHE 8380	3	Continuum Mechanics	Continuum mechanics is concerned with the deformations and motions of continuous material media under the influence of external effects. This course will present various classic theories of solid and fluids. The theory of continuous media- the basic laws of motion and constitutive theory-will be discussed.	S
MCHE 8500	3	Technical Foundations of Energy for Policy Practitioners	An in-depth study of the technical foundations appropriate and necessary for preparing practitioners to engage in the complex and diverse challenges of 21st-century energy policy development at state, national, and international levels. This will range from basic principles of energy conversion to analytical methods for translating technical energy concepts into implementable policy frameworks. All energy resources will be covered, with a particular focus on electric power generation.	S
MCHE 8640	3	Advanced Strength of Materials	Provides students with the essential knowledge necessary to analyze structural/mechanical systems and components as well as the ability to interpret	S

			analysis results. Basic concepts and tools for analyzing engineering problems (elasticity equations, equilibrium, compatibility, etc.) will be emphasized as well as the mathematical formulations.	
MCHE 8850	3	Gas Dynamics	This course is concerned with the physics of gas flows in propulsion devices, including gas turbine and rocket engines. Emphasis is placed on fluid mechanics and thermodynamics, including compressible flow, shock waves, and supersonic wind tunnels. Specific topics include inlets and nozzles, combustors and afterburners, and rocket engine design and performance.	S
MCHE(CHEM) 8970	3	Combustion Science	Fundamental concepts related to the use of hydrocarbons and biofuels as a source of transportation energy for advanced combustion technologies. Topics include chemical bonding, theory/mathematics of combustion, chemical thermodynamics, chemical kinetics, potential energy surfaces, collision theory, ignition dynamics, pollutant formation, and related topics applied to combustion.	S
MIST 6550	3	Energy Informatics	Energy Informatics involves analyzing, designing, and implementing systems to increase the efficiency of energy demand and supply systems. This requires the collection and analysis of data used to optimize energy distribution and consumption networks. Students will leverage the necessary information systems competencies and multi-disciplinary knowledge to increase societal energy efficiency.	S

Letter of Support from the University of Georgia Artificial Intelligence Institute

UNIVERSITY OF GEORGIA

Institute for Artificial Intelligence
518 Boyd Graduate Studies Research Center
200 D.W. Brooks Drive
University of Georgia
Athens, Georgia 30602-7404
TEL 706-542-0881 | FAX 706-542-2966
www.ai.uga.edu

Franklin College of Arts & Sciences
Institute for Artificial Intelligence

February 16, 2023

Dr. Bjorn Birgisson
School of Environmental, Civil, Agricultural and Mechanical Engineering
University of Georgia
Athens, GA

Dear Bjorn,

It is my pleasure to provide this letter of support for your proposal for a new PhD degree program in Mechanical Engineering. The University of Georgia has a very successful Presidential Interdisciplinary Faculty Hiring Initiative in Data Science and Artificial Intelligence that is helping with new faculty hires in Mechanical Engineering. This in addition to the formation of the School of Computing and the growth in the UGA Institute for Artificial Intelligence (AI Institute) opens up novel opportunities for collaboration. The coupling of our AI institute's focus on developing new data science and AI methods with the multitude of applications in manufacturing, automation, robotics and other application areas in Mechanical Engineering holds the promise of both enhancing the national standing of our AI Institute, as well as that of Mechanical Engineering. This also opens new opportunities for collaboration on courses in the future.

It is my hope that the proposed degree program will be approved by the University and the Board of Regents prior to the fall 2023 semester. I am happy to provide additional input as needed and please do not hesitate to contact me.

Sincerely,

Khaled Rasheed

Khaled Rasheed
Professor, School of Computing &
Director of the Institute for Artificial Intelligence
University of Georgia
khaled@uga.edu

Letters of Support from the Industrial Advisory Board for the School of Environmental, Civil, Agricultural and Mechanical Engineering

December 1, 2022

Dr. Bjorn Birgisson
School of Environmental, Civil, Agricultural and Mechanical Engineering
University of Georgia,
Athens, GA

Dear Bjorn,

It is my pleasure to provide this letter in support of your proposal for a new PhD degree program in Mechanical Engineering. As you are aware, I have had the privilege of serving on the Advisory Board for the School of Environmental, Civil, Agricultural and Mechanical Engineering for 5 years. This new program will be an excellent addition to the academic programs already offered to students.

I am a practicing structural engineer with my own engineering firm. I have almost 20 years' experience in the engineering and project management/construction project management industries. Deep engineering expertise is difficult to obtain and difficult to hire—UGA is solving both of those problems by expanding their degree offerings to include this PhD.

It is my hope that the proposed degree program(s) will be approved by the University and the Board of Regents prior to the fall 2023 semester. I am happy to provide additional input as needed and please do not hesitate to contact me.

Best regards,

Amanda Cherry

Amanda Cherry
CEO/President, Abode Engineering

November 29, 2022

Dr. Bjorn Birgisson
School of Environmental, Civil, Agricultural and Mechanical Engineering
University of Georgia,
Athens, GA

Dear Bjorn,

It is my pleasure to provide this letter in support of your proposal for a new PhD degree program in Mechanical Engineering. As you are aware, I have had the privilege of serving on the Advisory Board for the School of Environmental, Civil, Agricultural and Mechanical Engineering for the past two years. This new program will be an excellent addition to the academic programs already offered to students.

I currently serve as the Vice President of Marketing, Member Services and Governmental Affairs at Jackson EMC, an electric cooperative in northeast Georgia. As a cooperative we are owned by the members we serve. And as a cooperative, we strive to provide our over 250,000 members with reliable, affordable electricity and aim to exceed their expectations with the best possible service. In my eleven years at the cooperative, I have seen the evolution of opportunities and challenges impacting the utility industry. The proposed PhD program will develop future leaders who can think critically and strategically to develop solutions to the challenges of today and tomorrow such as electrical system automation, efficient power generation, and energy policy.

It is my hope that the proposed degree program(s) will be approved by the University and the Board of Regents prior to the fall 2023 semester. I am happy to provide additional input as needed and please do not hesitate to contact me.

Best regards,

Brittany Caison
Vice President, Marketing, Member Services and Governmental Affairs
Jackson EMC
bcaison@jacksonemc.com
706-367-6194

November 16, 2022

IMPACT
PUBLIC AFFAIRS

233 Peachtree St. NE, Suite 1225
Atlanta GA 30303

Dr. Bjorn Birgisson
School of Environmental, Civil, Agricultural and Mechanical Engineering
University of Georgia,
Athens, GA

Dear Bjorn,

It is my pleasure to provide this letter in support of your proposal for new PhD degree program in Mechanical Engineering. As you are aware, I have had the privilege of serving on the Advisory Board for the School of Environmental, Civil, Agricultural and Mechanical Engineering for 3 years. This new program will be an excellent addition to the academic programs already offered to students.

I received my bachelor of science in biological engineering from UGA in May 2001, and while working full-time, I obtained my MBA from UGA in December 2006. I spent half my career in consulting engineering (environmental) before I shifted to public policy. I worked as Deputy Director of the GA Environmental Protection Division before leaving state government to begin my own strategic consulting company. Today I am an owner / partner of Impact Public Affairs, where we work with firms all over the world as they seek growth in Georgia and interact with all levels of government. Every firm that we partner with is seeking quality candidates in engineering – the established engineering programs in Georgia are part of what attracts business to the state. As UGA College of Engineering has matured, the creation of this proposed program is completely justified in my opinion, and I fully support these efforts.

It is my hope that the proposed degree program(s) will be approved by the University and the Board of Regents prior to the fall 2023 semester. I am happy to provide additional input as needed and please do not hesitate to contact me.

Best regards,

L. Russell Pennington, P.E.
Partner, Impact Public Affairs

Documentation of Approval and Notification

Proposal: Major in Mechanical Engineering (Ph.D.)

College: College of Engineering

Department: School of Environmental, Civil, Agricultural, and Mechanical Engineering

Proposed Effective Term: Fall 2023

Approvals: Approvals:

- Environmental, Civil, Agricultural, and Mechanical Engineering School Chair, Dr. Bjorn Birgisson
- College of Engineering Associate Dean, Dr. Ramaraja Ramasamy
- Graduate School Associate Dean, Dr. Anne Shaffer

Letters of Support:

- Institute for Artificial Intelligence Director, Dr. Khaled Rasheed
- Abode Engineering President and CEO, Amanda Cherry
- Jackson EMC Vice President of Marketing, Member Services, and Governmental Affairs, Brittany Caison
- Impact Public Affairs Partner, L. Russell Pennington, P.E.