Florida Agricultural and Mechanical University
Ph.D. in Materials Science and Engineering
CIP 40.1001
Proposal Documents

STATE UNIVERSITY SYSTEM OF FLORIDA

Board of Governors, State University System of Florida

REQUEST TO OFFER A NEW DEGREE PROGRAM

In Accordance with BOG Regulation 8.011

(Please do not revise this proposal format without prior approval from Board staff)

Florida A&M University Institution Submitting Proposal	**Fall 2023** Proposed Implementation Term
FAMU-FSU College of Engineering Name of College(s) or School(s)	 Name of Department(s)/Division(s)
Materials Science Engineering Academic Specialty or Field	**Ph.D. in Materials Science and Engineering** Complete Name of Degree
40.1001 (14.1801) Proposed CIP Code (2020 CIP)	

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

June 2, 2022 Date Approved by the University Board of Trustees	6/1/2022 President's Signature — Date
6/27/22 Board of Trustees Chair's Signature — Date	5/18/22 Provost's Signature — Date

PROJECTED ENROLLMENTS AND PROGRAM COSTS

Provide headcount (HC) and full-time equivalent (FTE) student estimates for Years 1 through 5. HC and FTE estimates should be identical to those in Appendix A – Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Appendix A – Table 3A or 3B. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 by dividing total E&G by FTE.

Implementation Timeframe	HC	FTE	E&G Cost per FTE	E&G Funds	Contract & Grants Funds	Auxiliary/ Philanthropy Funds	Total Cost
Year 1	2	2	$20,323	$40,647	$49,585		$90,232
Year 2	2	2					
Year 3	3	3					
Year 4	4	4					
Year 5	5	5	$8,129	$40,647	$109,585		$150,232

Additional Required Signatures

I confirm that I have reviewed and approved Need and Demand Section III.F. of this proposal.

Latrecha K. Scott — 7/15/2022

Signature of Equal Opportunity Officer | **Date**

I confirm that I have reviewed and approved Non-Faculty Resources Section VIII.A. and VIII.B. of this proposal.

Faye Watkins — 7/13/2022

Signature of Library Dean/Director | **Date**

Introduction

I. Program Description and Relationship to System-Level Goals

A. Describe within a few paragraphs the proposed program under consideration, and its overall purpose, including:

- **degree level(s)**
- **majors, concentrations, tracks, specializations, or areas of emphasis**
- **total number of credit hours**
- **possible career outcomes for each major (provide additional details on meeting workforce need in Section III)**

Florida A&M University proposes to offer an interdisciplinary doctoral degree program in Materials Science and Engineering (MS&E) beginning Spring 2023. The proposed program will be offered jointly within the FAMU-FSU College of Engineering and utilize faculty that currently teach within the existing MS&E program at Florida State University (FSU), related programs in the College, and Physics and Chemistry departments on the Main campus of FAMU.

Completion of the doctoral program requires a minimum of 54 credits, including a minimum of 27 credits of letter-graded courses and a minimum of 24 credits of doctoral-level research. In their first year, students will gain a firm grounding in the fundamentals of MS&E through core courses (12 credits) taught by faculty members from different departments (these courses are already available). The student and their research advisor will determine which elective specialization courses are best for their research. Students will also register for the existing weekly Interdisciplinary Seminar Series (ISS), taken every semester through graduation (0 credits). In the ISS, students will be exposed to FAMU and FSU faculty and external researchers working in the area of MS&E. They will learn presentation skills and present their research. Importantly, ISS is the glue that binds the MS&E students as a community, as they will be doing their research in far-flung labs on the main FAMU campus, in the FAMU-FSU College of Engineering, or in Innovation Park.

As background information, Materials Science is defined by the National Center for Education Statistics (NCES) under CIP Code 40.1001 as " A program that focuses on the general application of mathematical and scientific principles to the analysis and evaluation of the characteristics and behavior of solids, including internal structure, chemical properties, transport, and energy flow properties, thermodynamics of solids, stress and failure factors, chemical transformation states and processes, compound materials, and research on industrial applications of specific materials." Historically, periods have been referenced to materials, such as the Stone Age, the Bronze Age, the Iron Age, and most recently, the Silicon Age. A similar CIP code (14.1801) exists in a related discipline, materials engineering and is utilized at other SUS institutions. In today's society, familiarity with materials is based on current technologies that depend on advanced materials that improve people's lives like batteries that power electronic devices and electric vehicles; solar cells for green energy; integrated circuits, solid-state memory, and displays for electronic devices; lightweight, smart prostheses; and advanced composites (more than 50% by weight) in the latest generation of commercial aircraft. The MS&E program at FAMU and FSU will allow students to gain specialty in areas of magnetic materials, materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries.

Materials Science and Engineering programs were created at FSU in 2008 and were administered by the FSU Graduate School until Spring 2021, when they were moved to the FAMU-FSU College of Engineering (COE). The Materials Science and Engineering degree (master's and doctoral) programs now residing in the FAMU-FSU COE create an opportunity for FAMU students to participate by creating a joint program between the Universities, similar to all other programs within the College. Additionally, the programs create opportunities for increased collaboration between faculty on the main FAMU campus, specifically in Chemistry and Physics. The programs will also increase the number of graduate degrees awarded in STEM; an Area of Strategic Emphasis identified by the Board of Governors.

The MS&E program at FAMU and FSU will advance the State and Federal calls to increase competence in science, technology, engineering, and math (STEM) in upcoming generations and to promote interdisciplinary approaches to solve fundamental problems in a global environment. Specifically in Florida, the aerospace industry is an essential component of the State's economy. Further, the military and NASA drive the development of new materials because improved performance materials are paramount for them. As such, there are several federal research laboratories in the Panhandle region, including Eglin and Tyndall AFBs, the Naval Surface Warfare Center, and the Naval Air Station Pensacola, that need new, well-trained MS&E graduates in their workforce. In addition, many industries in Florida, like defense and aerospace contractors, need materials science and engineering research. With the advanced knowledge gained in materials science and related areas of chemistry and physics, graduates from the proposed program will be able to apply knowledge gained from understanding, developing, testing, and applying materials that will form the foundation for present and future technologies. Doctoral-trained graduates are also eligible for careers in academia.

B. If the proposed program qualifies as a Program of Strategic Emphasis, as described in the Florida Board of Governors 2025 System Strategic Plan, please indicate the category.

- **Critical Workforce**
  - ☐ Education
  - ☐ Health
  - ☐ Gap Analysis
- **Economic Development**
  - ☐ Global Competitiveness
  - ☒ Science, Technology, Engineering, and Math (STEM)

☐ **Does not qualify as a Program of Strategic Emphasis.**

II. Strategic Plan Alignment, Projected Benefits, and Institutional Mission and Strength

A. Describe how the proposed program directly or indirectly supports the following:

- **System strategic planning goals (see link to the 2025 System Strategic Plan on the New Program Proposals & Resources webpage)**
- **the institution's mission**
- **the institution's strategic plan**

The MS&E programs contributes directly to several of the State University System (SUS) Strategic Planning Goals in the 2025 System Strategic Plan. The specific areas in which the PhD in MS&E will impact or contribute are:

- **Teaching and Learning**
  - **Strengthen Quality and Reputation of the Universities**
  - **Increase Degree Productivity & Program Efficiency**
  - **Increase the Number of Degrees Awarded in Programs of Strategic Emphasis**
- **Scholarship, Research and Innovation**
  - **Increase Research Activity and Attract More External Funding**

The addition of a doctoral degree in Materials Science and Engineering will enhance teaching and learning at FAMU and within the Joint College of Engineering by developing doctoral students understanding of the theoretical foundations and practice of empirical research in materials science to promote transformative learning environments and promote deeper analysis and critical thinking, which can be used in the practice of rigorous research for both students and faculty. Building on existing faculty strengths, this type of program can further strengthen the quality and reputation of FAMU and the Joint College of Engineering by producing high-quality graduates in high-demand STEM areas and provide increased opportunities for empirical studies and research that lead to solving complex real-world solutions in the area of materials science and engineering. With the addition of this degree, faculty disciplines will be able to pursue grants from their research in areas such as, magnetic materials, materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries. The proposed program will also increase degree productivity in areas of strategic emphasis, which is a goal for both the State University System and FAMU.

The MS&E program is also consistent with FAMU's mission. Florida Agricultural and Mechanical University (FAMU) is an 1890 land-grant institution dedicated to the advancement of knowledge, resolution of complex issues and the empowerment of citizens. FAMU's distinction as a doctoral/research institution will continue to provide mechanisms to address emerging issues through local and global partnerships. Expanding upon the University's land-grant status, it will enhance the lives of constituents through innovative research, engaging cooperative extension, and public service.

In direct support of its mission, the proposed MS&E programs align with FAMU's dedication to the "advancement of knowledge and resolution of complex issues".

Materials engineers and materials scientists "plan and carry out complex research projects, such as the development of new products and testing methods" (BLS, 2021). According to the Bureau of Labor Statistics, "the number of scientific research projects that involve multiple disciplines is increasing, and it is common for materials scientists to work on teams with other scientists, such as biologists, physicists, computer specialists, and engineers". Each of these areas are aligned with degree programs in areas of strategic emphasis and are offered at both FAMU and FSU. Further, advances in materials science and engineering are steadily rising with the increase in building materials, human services, batteries, nanotechnology, etc. As these areas continue to emerge, graduates of FAMU's MS&E program will be equipped to handle complex problems utilizing creative thinking to address real world problems associated with the advances of materials science consistent with the mission.

Along with the Board of Governor's 2025 Strategic Plan and FAMU mission, the proposed MS&E program aligns well with FAMU's goal for High Impact Research, Commercialization, Outreach, and Extension Services. Specific to Strategic Priority 3 of FAMURising, the Ph.D. in MS&E will address the following goals:

- Goal 1: Expand and enhance cutting-edge research and creative scholarship for the benefit of the state of Florida, the nation, and the world.
- Goal 2: Increase research productivity, commercialization and return on investment.
- Goal 3: Increase the number of nationally recognized graduate programs.

Much of what is made in society is built from materials. A Ph.D. program in Materials Science and Engineering will add opportunities for FAMU and the Joint College faculty to engage in cutting-edge research to keep pace with constant changing societal needs for materials and provide an avenue to create new materials and enhance existing materials for the benefit of the nation as a whole. Faculty associated with the program are already active in research. The Ph.D. will serve to increase their research contributions to FAMU and the State of Florida, and train graduates who can also use advanced knowledge in positions that require advanced decision-making and skills necessary to implement effective solutions around the development and deployment of materials. Having a strong research-oriented doctoral program attracts increased numbers of students with diverse backgrounds, which is also aligned with FAMU's mission.

FAMU and FSU have faculty in STEM fields who will collaborate in the interdisciplinary MS&E Ph.D. program. At FAMU, faculty from engineering, physics, and chemistry will participate at the onset. As the program grows, additional faculty will join the program. As the MS&E Ph.D. program will help attract additional graduate students, greater contributions to the SUS Strategic Planning Goals and the FAMU Strategic Plan are anticipated. Further, this program supports the FAMU and SUS missions of educating more diverse students in high-tech STEM fields to compete in the 21st century global economy.

B. Describe how the proposed program specifically relates to existing institutional strengths. This can include:

- **existing related academic programs**
- **existing programs of strategic emphasis**

- **institutes and centers**
- **other strengths of the institution**

FAMU-FSU College of Engineering ranks as the #2 doctoral-granting undergraduate engineering school in Florida by U.S. News and World Report. The College is also ranked #4 for graduate engineering among public schools in Florida. This is a testament of the strength of faculty from both FAMU and FSU who teach in the joint college. With the proposed MS&E degree, faculty members and their students will have access to appropriate lab space and shared facilities in the National High Magnetic Field Laboratory (NHMFL). Faculty also utilize and conduct research in the NSF-CREST grant space within the NHMFL and within the High-Performance Materials Institute (HPMI) in Innovation Park. In addition, space is being remodeled in FAMU's Centennial Research Building for a recent new hire doing materials related research. All these facilities (NHMFL, HPMI, and the Centennial Building) are adjacent to the FAMU-FSU College of Engineering.

FAMU has a strong record as a Top 100 producer of graduate degrees to minorities as evidenced in its rankings by Diverse Issues in Higher Education. In the 2019 publication of Diverse Issues, FAMU is ranked #28 for graduate degrees in engineering awarded to African Americans. Florida State University is ranked #98 in the production of engineering degrees awarded to Hispanics. Because the MS&E program will build on the academic strengths of both institutions and faculty teaching jointly in the FAMU-FSU College of Engineering, students will have increased exposure to diverse experiences to support high achievement in the classroom.

The proposed PhD program also builds on the strengths of researchers in the FAMU Chemistry and Physics departments. Their research includes the study of membranes for hydrogen fuel cells and water purification, photocatalysis for generating hydrogen, quantum control and machine learning in Materials Science, laser-matter interactions, study of the interplay of spin, charge, lattice, and orbital degrees of freedom in functional materials under extreme conditions, and computational design of materials for generating clean energy. Additionally, FAMU and FSU faculty within the joint College and departmental faculty collaborating in materials science conduct high-quality research leading to sustainable solutions for today's economy.

C. Provide the date the pre-proposal was presented to the Council of Academic Vice Presidents Academic Program Coordination (CAVP ACG). Specify whether any concerns were raised, and, if so, provide a narrative explaining how each concern has been or will be addressed.

The CAVP proposal for FAMU's proposed degree in Materials Science and Engineering was presented on September 2nd at the fall 2021 meeting. Members of the group voiced support for the program as an addition to the State University System and joint FAMU-FSU College of Engineering. No formal concerns were noted.

D. In the table below, provide a detailed overview and narrative of the institutional planning and approval process leading up to the submission of this proposal to the Board office. Include a chronology of all activities, providing the names and positions of both university personnel and external individuals who participated in these activities.

- **If the proposed program is a bachelor's level, provide the date the program was entered into the APPRiSe system, and, if applicable, provide narrative responding to any comments received from APPRiSe.**
- **If the proposed program is a doctoral-level program, provide the date(s) of the external consultant's review in the planning table. Include the external consultant's report and the institution's responses to the report as Appendix B.**

Up until Jan. 1, 2021, the MS&E graduate programs resided in the Graduate School at FSU. Because during its implementation the program was only approved at FSU, faculty involved in the program were employed by FSU and admissions was limited to FSU students. As the program grew, FAMU faculty from the FAMU-FSU College of Engineering began to participate in the program in 2013. Although faculty were able to participate, FAMU as an institution could not enroll students.

As the years progressed and under new leadership within the FAMU-FSU College of Engineering, discussions ensued between the former dean of the College (J. Murray Gibson, Ph.D.), the director of the program (Eric Hellstrom, Ph.D.) and the dean of the Graduate School (Mark Riley, Ph.D.) regarding the possibility of moving the program to the FAMU-FSU College of Engineering. Benefits noted for the move included: increased visibility of the program, increased enrollment, greater participation from faculty in the College, and opportunities for FAMU students to enroll in the program. In June 2020, institutional administration and program faculty agreed to change the location of the program to the FAMU-FSU College of Administration and include it as interdisciplinary program with Professor E. Hellstrom continuing to serve as the Director. MS&E was transferred effective Jan. 1, 2021.

At the same time discussions were being held to move the programs to the College, former Dean Gibson and program faculty were having planning meetings with FAMU Provost Maurice Edington and FAMU Assistant Vice President of Program Quality Sundra Kincey about the possibility of adding the same degrees at FAMU to create synergistic opportunities for its students. Formal representation of the College's objectives to add degrees in MS&E at FAMU were included in the College's strategic goals and presented to Provost Edington on Sept. 28, 2020.

After MS&E was moved to the FAMU-FSU College of Engineering, formal steps were taken to begin developing a proposal for the FAMU MS&E program. Prior to development of the required CAVP pre-proposal, former Dean Gibson proposed the idea and goals for graduate programs in MS&E at FAMU at the July 20, 2021 meeting of the FAMU-FSU COE Joint Council. The Council indicated support for the degree. Following, discussions were held with Board of Governors staff and FAMU Board of Trustees regarding FAMU's intent to develop new graduate programs in MS&E with a proposed implementation date of Spring 2023.

There were several meetings with FAMU faculty and administration in early Sept. 2021. On Sept. 1, 2021, Hellstrom met by Zoom with Dean Richard Alo (FAMU College of Science and Technology) and some of his staff, and Professors Nelly Mateeva and Bidhan Saha (department chairs of Chemistry and Physics, respectively) to explain the existing FSU MS&E program and answer questions. On Sept. 3, 2021, Hellstrom met by Zoom with faculty employed on FAMU lines in the FAMU-FSU College of Engineering,

Dean Gibson and AVP Kincey to talk about creating the program and get the faculty member buy-in to create the program. On Sept. 7, 2021 there was a Zoom meeting with Provost Edington, AVP Kincey, Dean Richard Alo (FAMU College of Science and Technology) and his staff members, plus staff members from the BOG to talk about details for submitting the proposal to be considered at the June 2022 BOG meeting. On Sept. 13, 2021, Hellstrom met by Zoom with members of the FAMU chemistry department to explain the existing MS&E Ph.D. program and answer further questions. Submission to the FAMU BOT is planned for the April 2022 meeting.

The table below provides a visual synopsis of the prior narrative.

Planning Process

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
Planning activities to move MS&E from Graduate School to FAMU-FSU COE, which was needed to be able to create the joint FAMU-FSU MS&E program		
Dec. 19, 2019	Dean Gibson, Eric Hellstrom, Huckaba, Mark Riley	Met to discuss moving MS&E from the FSU Graduate school to the FAMU-FSU COE
Feb. and June, 2020	MS&E faculty members plus Dean Gibson, Huckaba, Mark Riley	All MS&E faculty members alerted by email about plans to move MS&E from the Graduate School to FAMU-FSU COE. MS&E faculty were asked for comments and concerns.
Summer and Fall 2020	Dean Gibson and FSU administration	Working to move MS&E from the Graduate School to FAMU-FSU COE
Jan. 1, 2021	FSU and FAMU-FSU COE administration	MS&E officially transferred from Graduate school to FAMU-FSU COE
Planning activities to create the FAMU MS&E M.S. program		
Sept. 28, 2021	Provost Maurice Edington, Dean Murray Gibson	Presentation to FAMU Provost by former Dean Gibson to formally move MS&E to FAMU-FSU COE, which would allow creating FAMU MS&E M.S. program.
July 20, 2021	FAMU-FSU COE Joint Council	Presentation to FAMU Provost by former Dean Gibson to the FAMU-FSU COE Joint council.
Aug. 16, 2021	Provost Maurice Edington Dean Murray Gibson, Eric Hellstrom, Director Program Faculty Institutional Level Committee (UPARC)	CAVP Proposals reviewed and approved by FAMU Internal Committee and Provost
Sept. 1, 2021	College of Science and Technology Dean, Richard Alo and administrative team Eri Hellstrom, Director Nelly Mateeva, Department Chair (Chemistry) Saha Bidhan, Department Chair, (Physics)	Discussion of feasibility of FAMU MS&E programs and potential collaborations from Chemistry and Physics departments
September 2, 2021	CAVP Academic Coordination Group	CAVP Pre-Proposal Approval

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
Sept. 3, 2021	Jaamel Ali, Prof. CBE Natalie Arnett, Prof. CBE Tarik Dickens, Prof. IME Subramanian Ramakrishnan, Prof. CBE Murray Gibson, Dean Eric Hellstrom, Director Sundra Kincey, Asst. VP of Program Quality	FAMU MS&E programs and potential collaborations from Chemistry and Physics departments
Sept. 7, 2021	FAMU Academic Affairs Leadership FAMU-FSU College of Engineering Administrators Program Faculty (Engineering, Chemistry, Physics)	Q&A with FAMU and Board of Governors Staff Members
Sept. 13, 2021	College of Science and Technology Dean, Richard Alo and administrative team Eri Hellstrom, Director Nelly Mateeva, Department Chair (Chemistry) Saha Bidhan, Department Chair, (Physics)	FAMU MS&E collaborative partner discussions
September/October 2021	President, Provost, Faculty Senate, University Curriculum Committee	Approval of MS&E Proposal by FAMU Internal Administrators and Committee
June 2022	FAMU Board of Trustees	Approval of MS&E Proposal by FAMU Board of Trustees

E. Provide a timetable of key events necessary for the implementation of the proposed program following approval of the program by the Board office or the Board of Governors, as appropriate, and the program has been added to the State University System Academic Degree Program Inventory.

Events Leading to Implementation

Date	**Implementation Activity**
June - July 2022	Board of Governors Staff Review for BOG Consideration
June – July 2022	Develop MOUs between collaborating departments
July – September 2022	Collaborate with BOG Staff in Preparation for November BOG Meeting
November 2022	Review by BOG
Spring 2023	Marketing and recruitment of students
Spring 2023	Update internal systems
Fall 2023	Enroll first cohort

Institutional and State Level Accountability

III. Need and Demand

A. Describe the workforce need for the proposed program. The response should, at a minimum, include the following:

- **current state workforce data as provided by Florida's Department of Economic Opportunity**
- **current national workforce data as provided by the U.S. Department of Labor's Bureau of Labor Statistics**
- **requests for the proposed program from agencies or industries in your service area**
- **any specific needs for research and service that the program would fulfill**

Materials science experimental, computational, and theoretical research forms an important vehicle to create new materials and improve existing materials that underpin developing new technologies in medicine, energy, transportation, electronics, communications, information, building, construction, homeland security and national defense. Many major federal funding agencies, including the National Science Foundation, Department of Energy, Department of Defense, and NASA support large research programs in materials science and engineering. In addition, many companies employ materials in their products and need employees who are knowledgeable about materials science.

High technology industries have an increasing need for materials scientists, including in manufacturing, automotive, aerospace, catalysis, electronics, construction, medical science, and nanotechnology. The Bureau of Labor Statistics states that "Employment of materials engineers is projected to grow eight percent from 2020 to 2030". Growth is expected to be particularly strong for materials scientists and engineers working on nanomaterials and biomaterials. Also, according to the Aerospace Industries Association, there will be a need for more people in the aerospace industries, including materials scientists, as baby boomers retire, and the industry creates more advanced designs with more outstanding capabilities and higher efficiencies.

Florida has a strong national presence in key economic sectors such as aerospace, defense, marine and space. Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics – top aerospace/defense companies in the U.S. – all have substantial operations in Florida, and all employ materials scientists. New materials are key to advances in these industries, such as the carbon-fiber composites being used in military aircraft and the latest commercial Boeing and Air Bus planes. On the national level, well-known companies in which materials scientists and engineers play key roles include 3M, Apple, Alcoa, Boeing, Cummins, DuPont, Exxon Mobil, General Dynamics, GE, General Motors, HP, IBM, Intel, Lockheed Martin, Motorola, and Xerox. The MS&E graduates can also work in research and development in national labs, and industrial labs.

The increasing budget and scales of federal agencies' SBIR/STTR programs in MS&E fields have created and will continue to have a greater need for M.S. graduates in these fields. Recent placements of M.S. and Ph.D. graduates from the FSU MS&E program show that the job-market is strong. Recently, many Ph.D. graduates work for small, high-

tech businesses, with many of them taking leadership roles in those companies working on SBIR/STTR projects. Examples of companies and labs that have employed these graduates are Advanced Conductor Technology, CERN, Enovix, GE, Imprint-Energy, Intel, X-energy, and several national labs. These companies, some of which are small start-up companies, show that materials play a central role in many advanced, new technologies, and MS&E graduates will be readily employed. In a recent survey of FSU MS&E graduates, they said their companies would be interested in hiring FAMU MS&E graduate students.

The MS&E program director reached out to select companies to inquire about the possibility of hiring graduates from the Ph.D. in Materials Science and Engineering if approved. Based on responses from the companies, there is demand for doctoral-prepared graduates in MS&E. Salary outlook suggests that students will be paid well upon initial employment as recent Ph.D. graduates from the existing program at the joint college currently makes upwards of $110,000 per year with annual bonus of at seven percent.

Email 1
From: Charlie Sanabria <charlie@cfs.energy>
Date: Mon, 25 Oct 2021 08:28:36 -0400
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>

Hi Eric,
I am very glad to hear this. Here at CFS we take diversity and inclusion very seriously, and always make sure that our interview pool (for every single position) includes individuals from underrepresented minorities. We would be more than happy to see applications from FAMU students who earned an MS or PhD from the combined MS&E program. Their applications will be given a fair chance and when/if hired, they will be very welcome with open arms into the CFS family.

I'm Looking forward to it!

Cheers,
Charlie

Email 2
From: Daniel Brown <dbrown@x-energy.com>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: RE: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Wed, 27 Oct 2021 22:28:43 +0000

Hi Dr. Hellstrom,

I am writing to you let you know that as a hiring manager for X-energy, I would be interested in interviewing students graduating from the combined MS&E program from FAMU for potential employment. Please let me know if any additional information for the upcoming proposal.

As an update, I am still working for X-energy. In the last year I have been promoted to Program Manager, TRISO Fuel Fabrication. X-energy is an advanced nuclear reactor and fuel fabrication company. It manufactures fuel that seals uranium particles in a protective coating, which makes meltdown impossible and retains the waste inside forever. X-energy also designs plants that unlock the fuel's potential in a process that's as clean as wind or solar. When combined, the result is reliable carbon-free baseload power, produced more safely and affordably than ever before and available anywhere, at any time. My role involves leading a team of 6 R&D scientists to develop advanced nuclear fuel utilizing high temperature ceramic materials. We are currently performing R&D work to support nuclear reactors supplying power to the grid and space nuclear propulsion. I would also like to mention X-energy is rapidly growing and looking to hire high quality scientists and engineers. Within the next 5 years, the team in Oak Ridge, TN is expected to grow from 50 employees to approximately 350 employees. I am more than happy to speak with students graduating and interested in hearing more about our opportunities.

Regards,

Dan

Email 3

From: Jeremy Weiss <Jeremy.Weiss@Colorado.EDU>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: RE: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Wed, 27 Oct 2021 16:39:12 +0000

Hi Eric,

The inclusion of FAMU in the MSE program would not have any weight one way or the other on our decision to hire them. Including myself, ACT has already hired 4 people with FAMU-FSU COE degrees, two of which also hold degrees from the FSU MSE program. I'm sure we will continue to consider FSU and FSU/FAMU graduates in the future, and if you have any specific students that are excelling and about to graduate, please encourage them to send Danko an email, as we are still in need of a couple more good employees.

All the best,
-Jeremy

Email 4
From: Kang Yao <ky12@my.fsu.edu>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Wed, 27 Oct 2021 03:26:36 +0000
X-OrganizationHeadersPreserved:
CO6P220MB0420.NAMP220.PROD.OUTLOOK.COM

Dear Dr. Hellstrom,

Great to hear from you and hear about news about MS&E.

As mentioned previously, I started a position with Enovix last November. I asked my manager and they said they would consider interviewing as long as the candidate is a good fit. Hope this answers your question!

Best regards,
Kang

Email 5

From: Omotola Ogunsolu <ooo13@my.fsu.edu>
To: "hellstrom@asc.magnet.fsu.edu" <hellstrom@asc.magnet.fsu.edu>
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Fri, 29 Oct 2021 05:12:56 +0000
X-OrganizationHeadersPreserved:
PH0P220MB0570.NAMP220.PROD.OUTLOOK.COM

Hello Dr Hellstrom,
As already mentioned below, Intel will hire FAMU MS&E graduates.

Tola

Email 6

From: Yesusa Collantes Goicochea <ykc13@my.fsu.edu>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Thu, 28 Oct 2021 05:15:23 +0000

Hello Eric

Intel is interested in hiring MSE program students. I can participate

Cheers

Yesusa

Email 7
From: Jesse Smithyman <jessesmithyman@gmail.com>
Date: Wed, 27 Oct 2021 07:27:04 -0700
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>

Hi Eric,

I think this sounds like a great idea. In general, yes, Imprint Energy would be interested in interviewing FAMU/FSU MS&E students with relevant experiences.

Best,
Jesse

Additional job announcements seeking individuals trained at an advanced level in materials science and engineering are included within the appendices.

Creating the MS&E program will also enhance FAMU's ability, along with program faculty in the FAMU-FSU College of Engineering, to increase federal research funding, graduate student recruitment, and doctoral degree production. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially. Already FAMU faculty associated with this proposal have won substantial NSF grants in materials-related areas and having the FAMU MS&E doctoral degree will provide additional opportunities for major funding from federal agencies.

Bureau of Labor Statistics data show that positions for MS&E graduates will continue to grow and MS&E graduates are well paid. Positions for doctoral-prepared graduates will likely increase, and salaries are expected to be higher for graduates with an advanced degree. The Bureau's data estimate that employment for materials engineers with at least a baccalaureate degree will grow between 3.9% and 12% over the next ten years from 2020 to 2030. The table below shows job growth projected by BLS by occupation aligned with the Materials Science CIP code 40.1001.

Table 1 - Bureau of Labor Statistics

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	4.1%	14,700	Bachelor's	$149,530
Materials Engineers	8.4%	1,800	Bachelor's	$95,640
Materials Scientists	3.9%	700	Bachelor's	$99,460
Engineering Teachers, Postsecondary	12.5%	9,300	Doctoral or Professional	$103,600

Growth in the State of Florida is more robust according to the Florida Department of Economic Opportunity. Employment change percent ranges from 11.7% - 14.8% for the years projected from 2021-2029 for the same occupations.

Table 2 - Florida Department of Economic Opportunity

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	14.8%	643	Bachelor's	$137,550
Materials Engineers	11.7	44	Bachelor's	$97,032
Materials Scientists*	Data Not Available	Data Not Available	Bachelors	$104,166
Engineering Teachers, Postsecondary*	18%	164	Doctorate	$104,996

**Occupational Employment Projections for SOC-Code 19-2032 (Materials Scientists) statewide data not available for 2020-2028 and 2021-2029 from FLDOE. Postsecondary Engineering Teachers data provided*

from v4 of FLDOE Data Tool for years 2020-2028. Verified with BOG staff on October 13, 2022.

According to O*NET, within the State of Florida, the highest annual median salary for Materials Engineers is in the Palm Bay-Melbourne-Titusville area, as shown in the accompanying table.

Location	Annual Low (10%)	Annual Q_L (25%)	Annual Median (50%)	Annual Q_U (75%)	Annual High (90%)
United States	$60,580	$76,650	$98,300	$127,110	$161,080
Florida	$48,850	$48,850	$82,070	$126,950	$162,630
Crestview-Fort Walton Beach-Destin, FL	$60,680	$77,500	$99,040	$126,780	$162,410
Jacksonville, FL	$62,360	$77,480	$97,090	$119,770	$123,210
Miami-Fort Lauderdale-West Palm Beach, FL	$59,630	$63,430	$82,310	$113,820	$128,420
Orlando-Kissimmee-Sanford, FL	$60,770	$79,890	$82,530	$122,650	$166,210
Palm Bay-Melbourne-Titusville, FL	$65,080	$91,000	$105,120	$130,720	$163,320

Survey data from O*NET indicates that about 48% new hires need a bachelor's to perform jobs in this occupation, 33% doctoral degree required, and 10% master's degree required. We surmise that with the higher number of positions needed for the doctoral degree, greater numbers of students will seek entry for master's level programs as a path to the doctorate. The graphs below show job postings in positions related to Materials Science and Engineering nationally for 2021.

Table 4 - MS&E Job Postings Requiring Advanced Degree

Target Occupations

*Filtered by the proportion of the national workforce in these occupations with a Master's degree or Doctoral or professional degree

94,336	+2.8%	$49.01/hr $101.9K/yr	7,683
Jobs (2021)*	% Change (2021-2026)*	Median Earnings	Annual Openings*

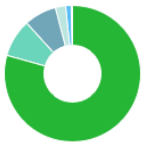
Occupation	2021 Jobs*	Annual Openings*	Median Earnings	Growth (2021 - 2026)*
Architectural and Engineering Managers	72,979	5,759	$71.87/hr	+2.88%
Cost Estimators	11,919	1,146	$31.99/hr	+1.40%
Materials Engineers	6,311	465	$45.98/hr	+4.50%
Materials Scientists	3,127	313	$47.82/hr	+1.50%

Table 3 - Top Posted Job Titles

Opportunities to close the diversity gap also exist with the proposed program in Materials Science and Engineering offered jointly within the FAMU-FSU College of Engineering. The graph below depicts a breakdown of ethnicity for occupations associated with this discipline. FAMU can contribute to increase the number of minorities prepared for advanced entry into the profession, specifically increased numbers of African American graduates.

Table 5 - MS&E Occupation Race/Ethnicity Breakdown

Occupation Race/Ethnicity Breakdown



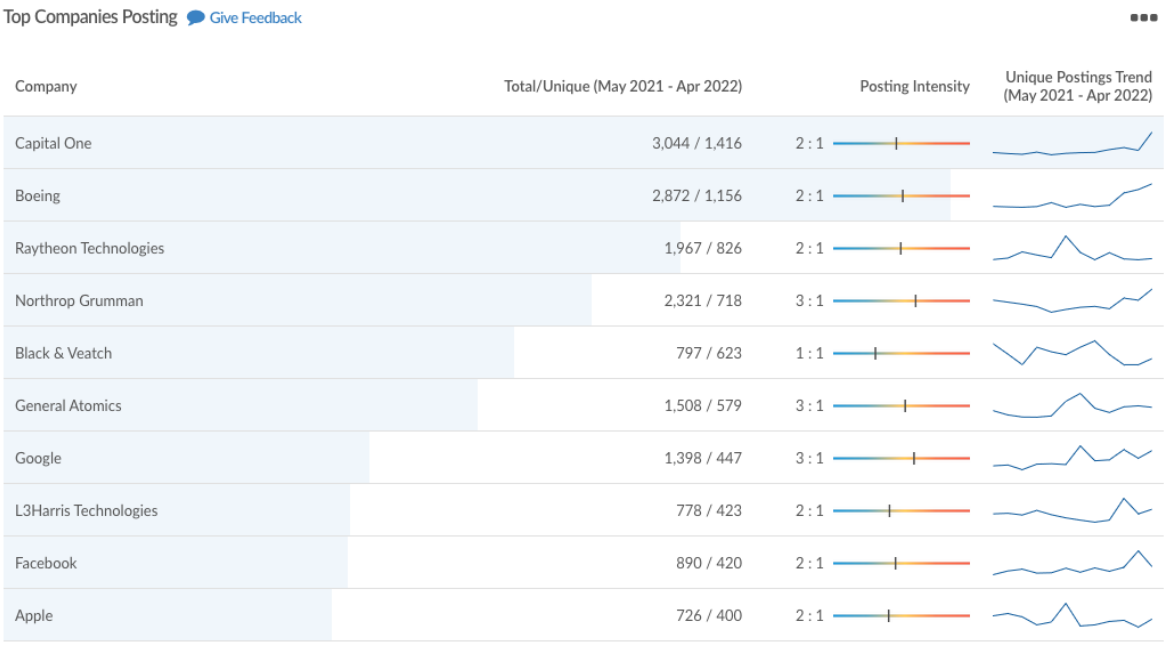
Race/Ethnicity	2021 Jobs	2021 Percent
White	350,347	79.3%
Asian	39,565	9.0%
Hispanic or Latino	33,864	7.7%
Black or African American	10,785	2.4%
Two or More Races	5,718	1.3%
American Indian or Alaska Native	1,066	0.2%
Native Hawaiian or Other Pacific Islander	376	0.1%

Job Title	Total/Unique (May 2021 - Apr 2022)	Posting Intensity	Unique Postings Trend (May 2021 - Apr 2022)
Engineering Managers	6,031 / 2,429	2 : 1	
Project Engineers	2,997 / 1,294	2 : 1	
Directors of Engineering	2,675 / 1,232	2 : 1	
Directors of Data Engineering	1,718 / 833	2 : 1	
Data Engineering Managers	1,905 / 807	2 : 1	
Chief Engineers	1,673 / 777	2 : 1	
Engineering Program Managers	1,424 / 564	3 : 1	
Materials Engineers	1,176 / 460	3 : 1	
Materials Scientists	1,306 / 410	3 : 1	
Project Engineering Managers	1,117 / 395	3 : 1	

Total/Unique (May 2021 - Apr 2022)

In addition to Florida industries as sources for occupations, a significant number of companies across the United States are seeking graduates with advanced degrees related to Materials Science and Engineering as evidenced by the graph below.

Table 6 - Total Companies Job Postings



Sources: Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Materials Engineers, at https://www.bls.gov/ooh/architecture-and-engineering/materials-engineers.htm (visited *September 08, 2021*).

Florida Department of Economic Opportunity and O*NET
https://www.onetonline.org/link/localwages/17-2131.00?st=FL&g=Go (visited October 3, 2021)

B. Provide and describe data that support student demand for the proposed program. Include questions asked, results, and other communications with prospective students.

Materials are used in almost everything we use in our modern society and new developments and advances in materials science underlie improvements in these technologies. For example, when people hear Intel, they think about Intel making the microprocessors that are the brains of computers. The unknown is that Intel is an applied materials science company whose core expertise is taking the drawings of the circuit diagrams for the latest microprocessor and transforming it into a complex 3-D maze of interconnected electronic components that are etched into a tiny chip of silicon that is the microprocessor in your computer. Fabricating microprocessors requires an assortment of materials and chemical processes that Intel is continually modifying and improving to make even faster microprocessors. This example shows where MS&E M.S. graduates are vital to the economy.

Engaging FAMU students in the MS&E Ph.D. program as part of the joint FAMU-FSU College of Engineering where the program already resides at Florida State University will address under-representation of African Americans amongst M.S. Materials Scientists and Engineers and in STEM fields in general. The FAMU-FSU College of Engineering is

the #4 producer of PhDs to African Americans of all US engineering schools but cannot yet offer degrees in MS&E to FAMU students.

Several current students in FAMU's NSF CREST (Centers of Research Excellence in Science and Technology – Center for Additive Manufacturing) research center have inquired about when a FAMU MS&E program would be created. They wanted to do their materials-related research in the CREST and earn their graduate degree in MS&E, because this degree would more closely identify their expertise to potential employers, and it would better identify their formal education for the rest of their careers.

Currently, there are thirteen students enrolled in the existing FSU MS&E doctoral program. That number is expected to grow as a result of widening the pool of potential students and placement of the program within the FAMU-FSU College of Engineering.

The College recently surveyed students in other HBCUs that had strong programs that could feed into MS&E, such as chemistry, physics, and undergraduate engineering programs. These surveys were sent to individual faculty members at the HBCUs for the faculty members to forward to the students. FAMU in the FAMU-FSU College of Engineering, chemistry and physics programs were also surveyed. Results are summarized below.

The following questions were asked in the survey with 36 individuals responding.

Table 7 - Please rate your level of interest in a graduate degree in Materials Science and Engineering to be potentially offered at Florida A&M University in the FAMU-FSU College of Engineering?

Very High	High	Somewhat High	Low	Not Interested
27.78% (N=10)	19.44% (N=7)	36.11% (N=13)	13.89% (N=5)	2.78% (N=1)

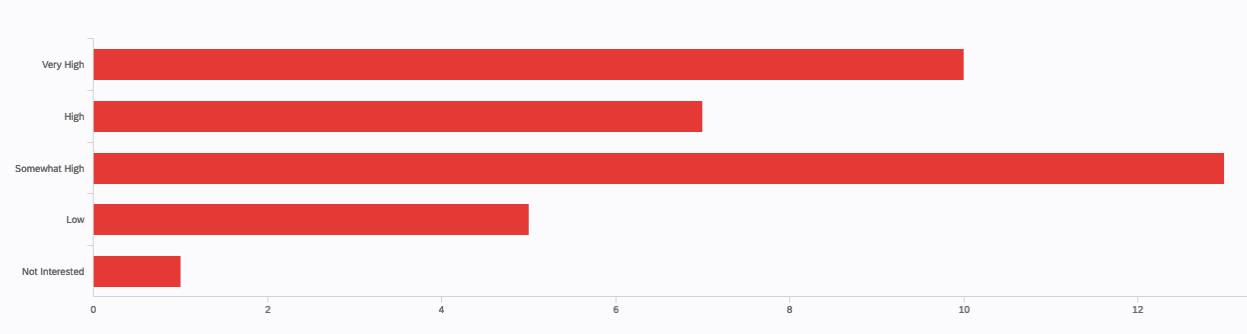


Table 8 - If a graduate degree in Materials Science and Engineering is offered, which level of degree would you likely apply?

Master of Science MS&E	Ph.D. MS&E	Both (completing MS first and then applying to the Ph.D.)
55.56% (N=20)	11.11% (N=4)	33.33% (N=12)

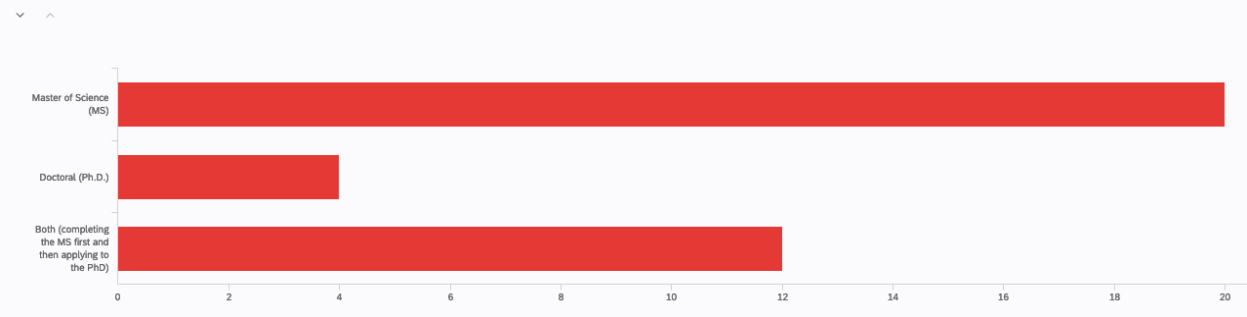


Table 9 - Likelihood of Applying to Master's MSE&E if it were launched in the next 1-2 years.

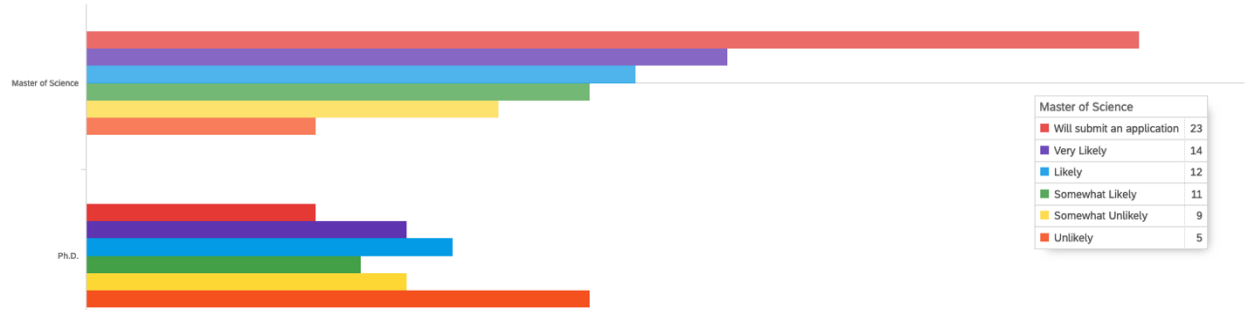


Table 10 - Likelihood of Applying to Ph.D. if launched in the next 1-2 years

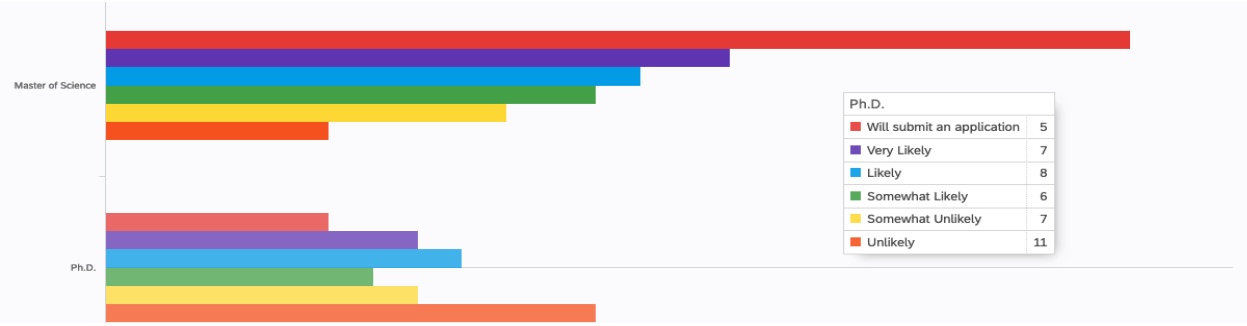
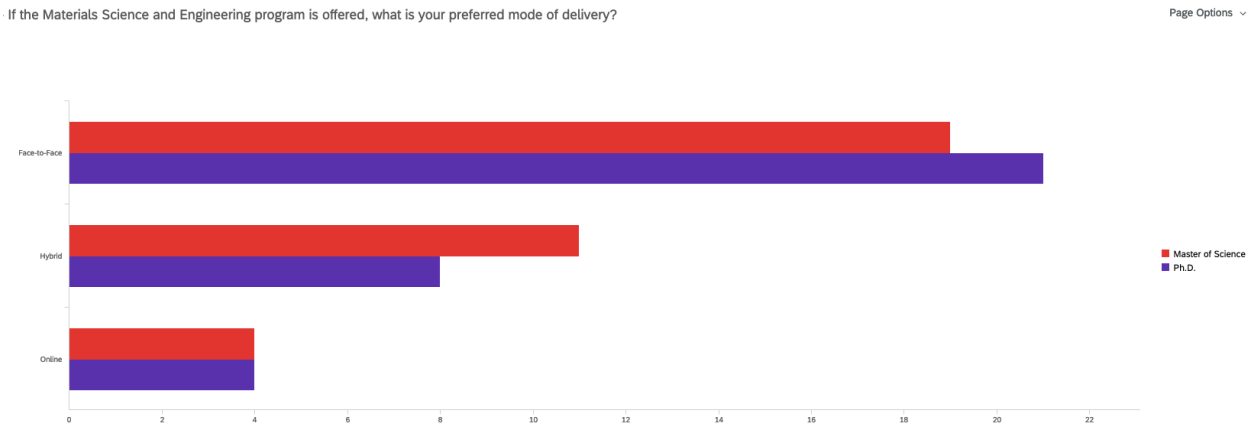


Table 11 - Preferred Mode of Delivery



C. Complete Appendix A – Table 1 (1-A for undergraduate and 1-B for graduate)

with projected student headcount (HC) and full-time equivalents (FTE).

- **Undergraduate FTE must be calculated based on 30 credit hours per year**
- **Graduate FTE must be calculated based on 24 credit hours per year**

In the space below, provide an explanation for the enrollment projections. If students within the institution are expected to change academic programs to enroll in the proposed program, describe the anticipated enrollment shifts and impact on enrollment in other programs.

Year One

New students (N=2) for the doctoral program are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. After full implementation and development of marketing strategies, the program anticipates growing the program modestly each year until it reaches at least five students by year five. With additional marketing efforts, the program will expand enrollment in the outyears.

Year Two

New students (N=2) for the doctoral program are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU.

Year Three

In year three, we plan to enroll approximately three (N=3) graduate students for the doctoral degree in Materials Science and Engineering program in year three. The three students are expected to come from comparable undergraduate programs at FAMU and FSU (N=2); undergraduate students from private institutions within the State of Florida, graduates from Florida public universities, or one out-of-state student (N=1).

Year Four

We plan to enroll approximately four (N=4) graduate students for the doctoral degree in Materials Science and Engineering program in year four. The four students are expected to come from comparable undergraduate programs at FAMU and FSU (N=2); undergraduate students from private institutions within the State of Florida, graduates from Florida public universities (N=1), or one out-of-state student (N=1).

Year Five

We plan to enroll approximately five (N=5) graduate students for the doctoral degree in MS&E program in year five. The five students are expected to come from comparable undergraduate programs at FAMU and FSU (N=2); undergraduate students from private institutions within the State of Florida (N=1), graduates from Florida public universities (N=1), or one out-of-state student (N=1).

D. Describe the anticipated benefit of the proposed program to the university, local community, and the state. Benefits of the program should be described both quantitatively and qualitatively.

Numerous reasons exist to offer a joint program in MS&E between FAMU and FSU,

particularly as the program already exists within the FAMU-FSU College of Engineering. In 2011, then Provost Harris wrote in her support letter for the FSU MS&E Ph.D. proposal that it would be beneficial for FAMU and FSU to cooperate in MS&E in the future. If implemented, the program will have multiple benefits to FAMU, FSU, the Panhandle region, the State of Florida, and the Nation that includes the following:

- Provide a means to recruit students interested in studying MS&E and create a way to educate and train them to earn an M.S. in a broad, interdisciplinary manner.
- Build on the sizable investments FAMU and FSU have made in start-up packages and infrastructure support for faculty members researching materials-related areas.
- Offer a new STEM program relatively inexpensively.
- Increase FAMU-FSU College of Engineering research visibility.
- Provide increased opportunities for FAMU and FSU to secure greater funding in materials research, particularly large-scale, interdisciplinary grants. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially.
- Address the critical education need to produce more engineers within the United States and Florida, especially in the areas of materials.
- Contribute to research, economic development, and job creation in the Panhandle region and across the State.
- Increase the Nation's technical capability by attracting and enabling additional research and highly trained researchers for new product development.
- Help address underrepresentation of minorities in STEM disciplines, engineering in particular. The FAMU-FSU College of Engineering has already demonstrated progress in this area by being the number four producer of Ph.D.'s to African Americans of all US engineering schools.

E. If other public or private institutions in Florida have similar programs that exist at the four- or six-digit CIP Code or in other CIP Codes where 60 percent of the coursework is comparable, identify the institution(s) and geographic location(s). Summarize the outcome(s) of communication with appropriate personnel (e.g., department chairs, program coordinators, deans) at those institutions regarding the potential impact on their enrollment and opportunities for possible collaboration in the areas of instruction and research.

Input from the Council of Academic Vice Presidents Coordination Group suggested that demand is available for materials scientists and materials engineers nationally and within the State of Florida. A discussion regarding the addition of a program at FAMU as part of the program offerings within the joint FAMU-FSU College of Engineering was held including a review of enrollment and degree productivity for the last five years (shown below) within the SUS.

Table 12 - SUS Degree Productivity (Materials Science and Materials Engineering)

Institution	2020	2019	2018	2017	2016	Total by Institution
Florida International University	4	6	5	6	3	**24**

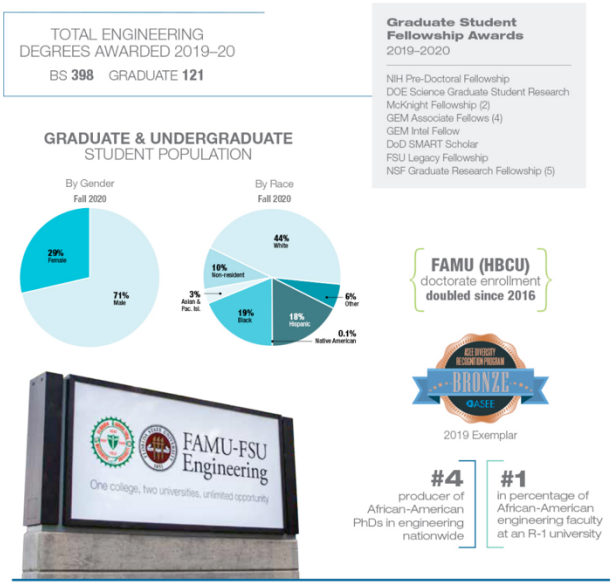
Florida State University	2					**2**
University of Central Florida	2	8	5	15	3	**33**
University of Florida	12	16	20	22	22	**72**
Grand Total	**20**	**30**	**30**	**43**	**28**	**131**

As part of the joint College, collaborations between FAMU and FSU will occur organically. Collaborations with other institutions may also result due to the interdisciplinary nature of the program and research opportunities available to faculty. Discussions to expand the program beyond the FAMU-FSU College of Engineering were had on the Main campus, which resulted in participation by FAMU chemistry and physics departments. Additional conversations within the system have yet to occur as the onboarding of the College's new dean occurred July 15, 2022. Presently, there are three doctoral programs in MS&E within the SUS with some overlap at FIU, UCF, and UF (excluding FSU).

The uniqueness for the proposed program is that it will be on the strengths of FAMU and FSU faculty collaboratively in a single setting where students from both institutions will engage and learn from the experiences of faculty at two distinct institutions. Faculty and students will also have access to participate in ongoing and new research in the High-Performance Materials Institute, which focuses on advanced composites made with carbon fibers and carbon nanotubes. This institute, which is also located near the College of Engineering is the only one of its kind in Florida. The advanced studies done in this institute are defining the cutting edge of research on new composites for military and civilian applications.

F. Describe the process for the recruitment and retention of a diverse student body in the proposed program. If the proposed program substantially duplicates a program at FAMU or FIU, provide a letter of support from the impacted institution(s) addressing how the program will impact the institution's ability to attract students of races different from that which is predominant on the FAMU or FIU campus. The institution's Equal Opportunity Officer shall review this Section of the proposal, sign, and date the additional signatures page to indicate that all requirements of this section have been completed.

In accordance with FAMU's Non-Discriminatory Policy Statement, "each member of the University community is permitted to work or attend class in an environment free from any form of discrimination including race, religion, color, age, disability, sex, sexual harassment, sexual orientation, gender identity, gender expression, marital status, national origin, and veteran status". As an HBCU, FAMU has a population of students that are primarily traditionally underrepresented students. Florida State has a population of majority students and a significant minority representation. As such, the proposed program situated within the joint FAMU-FSU College of Engineering is in a unique position to attract students from various backgrounds, races, and ethnicity as well as center itself to increase gender representation within the STEM disciplines. As evidence of its commitment to diversity, the FAMU-FSU College of Engineering earned a Bronze Award and Exemplar Status from the American Society of Engineering Education (ASEE) in the inaugural year of the ASEE Diversity Recognition Program. The college is one of only two engineering programs in Florida to earn the distinctions.



Initial efforts of the program will be to focus on existing partnerships from member institutions of the Florida-Georgia Louis B. Stokes Alliance for Minority Participation. This Alliance has several member and co-member community colleges and several four-year institutions without graduate programs. Additional recruitment efforts will focus on internal campaigns to recruit highly qualified undergraduate students locally at FAMU and FSU with a specific focus in Chemistry, Physics, and Engineering departments. As this program is one of few offered at HBCUs, FAMU and FSU will join efforts to attract students nationally from other HBCUs across the U.S.

Digital media will be used to advertise the program on FAMU, FSU, and FAMU's NSF-CREST websites. Email campaigns will also be conducted to increase awareness of the program to highly populated enrollment areas for both FAMU and FSU. During the discussion of the proposed program with the Council of Academic Vice Presidents Coordination Group, Florida International University posed no concerns for the addition of the program at FAMU to be delivered collaboratively with FSU as part of the joint FAMU-FSU College of Engineering.

IV. Curriculum

A. Describe all admission standards and all graduation requirements for the program. Hyperlinks to institutional websites may be used to supplement the information provided in this subsection; however, these links may not serve as a standalone response. For graduation requirements, please describe any additional requirements that do not appear in the program of study (e.g., milestones, academic engagement, publication requirements).

MS&E will follow FAMU's admission standards with the following additional requirements.

Admission Criteria for the Ph.D. in MS&E

- An earned bachelor's degree from a regionally accredited U.S. institution, or a comparable degree from an international institution, with a minimum 3.0 (on a 4.0 scale) grade point average (GPA) in all work attempted while registered as an upper-division undergraduate student working towards a bachelor's degree; or
- A graduate degree from a regionally accredited U.S. institution, or a comparable degree from an international institution.
- GRE test scores with the following requirements: Quantitative exam be in the 75th or higher percentile; Verbal exam be in the 55th or higher percentile.
- International students whose first language is not English are required to take an English language exam. Acceptable scores are 80 total on the Internet-based TOEFL examination or 6.5 on the IELTS exam.
- Three (3) letters of recommendation

MS&E specific requirements

- Undergraduate or graduate degree in a STEM field.
- Submit a statement of professional goals
- Three letters of recommendation that assess the student's capabilities to do graduate research.

Graduation Criteria for the Ph.D. in MS&E

- Students must pass a minimum of 54 credits of which a minimum of 27 credits must be letter graded and a minimum of 24 credits must be in Ph.D. research.
- Students must pass all of the required letter-graded coursework with a minimum 3.0 GPA. In addition to meeting the university requirement to maintain an overall GPA of 3.0 or above, MS&E students need to achieve a grade of "B" or better in each core course. Students not achieving a "B" must either retake the course or take another core course in a different topic area that will be selected by MS&E in consultation with the instructor of the core course in which the student did not achieve at least a "B."
- Students must take a written qualifying exam in their second year. This will be based on the required core courses.
- Students must write, present, and defend a written document for their preliminary exam, typically in their third year. This written document is a prospectus that covers the research they have done and their research plans through graduation.

The written document is reviewed by the student's research committee, and the student presents and defends it.

- Students must write a dissertation, which must be an original work and will serve in part to demonstrate the student's ability to carry out research. On completion, the dissertation will be defended orally in front of the dissertation committee.

B. Describe the specific expected student learning outcomes associated with the proposed program and include strategies for assessing the proposed program's learning outcomes. If the proposed program is a baccalaureate degree, include a hyperlink to the published Academic Learning Compact and the document itself as Appendix C.

The specific learning outcomes are:

(1) Ability to demonstrate a thorough knowledge of MS&E: Students graduating with a Ph.D. in MS&E must demonstrate an understanding of a range of topics in MS&E and must also demonstrate the ability to carry out meaningful, independent research.

Assessment Plan: This learning outcome will be assessed by the student performance in the core courses with a written exam, an oral presentation of the research topic with an oral examination (prospectus) of the elective specialization courses and the final oral defense of the dissertation. The evaluation will be based on the following measurements: (1) at least 75% of all students in MS&E will pass the written qualifying exam covering the core courses; (2) at least 80% of the students who pass the qualifying exam will pass their oral preliminary exam; and (3) at least 80% of the students who pass their preliminary exam will pass their dissertation defense.

(2) Ability to present their work in an oral or a poster presentation: Students graduating with a Ph.D. in MS&E will be able to orally communicate their research work to others in the field.

Assessment Plan: This learning outcome will be assessed by the student performance by participation in the MS&E ISS (Interdisciplinary Seminar Series), in the dissertation defense, and oral presentations. The evaluation will be based on the following measurements: (1) at least 80% of the students in the program will pass their preliminary exam, which has an oral component; (2) at least 80% of the students who pass their preliminary exam will pass their dissertation defense; (3) at least 80% of the students will have given an oral presentation of their research in a public forum, preferably at a professional conference in their research area.

(3) Ability to communicate through the written medium. Students graduating with a Ph.D. in MS&E will be able to communicate their work to others in the field through journal articles.

Assessment plan: This learning outcome will be assessed by at least 80% of the students completing a paper and submitting it to a journal or a technical conference before graduating.

(4) Ability to function as an independent scientist/engineer. Students graduating with a Ph.D. in MS&E must demonstrate an ability to function as independent scientists and

engineers, which includes identifying problems in MSE, designing experimental or theoretical methods to address these problems, and performing the corresponding research to solve these problems.

Assessment Plan: This learning outcome will be assessed by the student's performance on the annual Ph.D. evaluations, which includes a research presentation to the student's research committee. At least 80% of the students in the program will have satisfactory annual evaluations.

C. If the proposed program is an AS-to-BS capstone, provide evidence that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as outlined in State Board of Education Rule 6A-10.024. Additionally, please list the prerequisites, if any, and identify the specific AS degrees that may transfer into the proposed program.

☒ **Not applicable to this program because it is not an AS-to-BS Capstone.**

D. Describe the curricular framework for the proposed program, including the following information where applicable:

- **total numbers of semester credit hours for the degree**
- **number of credit hours for each course**
- **required courses, restricted electives, and unrestricted electives**
- **a sequenced course of study for all majors, concentrations, tracks, or areas of emphasis**

The FAMU MS&E program will become an integral part of the existing FSU MS&E program offered in the joint college. The curriculum will be identical for FAMU and FSU students. In the first year, the curriculum will use courses in the existing FSU MS&E curriculum. FAMU students will be able to take FSU courses and FSU students will be able to take FAMU courses through the existing FAMU-FSU cooperative agreement.

Students entering the program with a B.S. degree (or equivalent) will be required to a take a minimum of 54 credits including at least 27 credits of letter-graded courses and at least 24 credits of dissertation research. Students will also take the Interdisciplinary Seminar Series (0 credits) the entire time they are in MS&E. The letter-graded credits are described below.

27 credits (minimum) of letter-graded courses

- Four core courses (minimum 12 credits)
  - Three (3) Fundamental Core Courses: - One course from each of these areas
    - Survey of Materials
    - Thermodynamics
    - Solid state science for materials scientists/engineers
  - One (1) Elective Core Courses: - One course from either of these areas
    - Survey of Synthesis and Processing
    - Characterization of Materials
- Five (5) Elective Specialization Courses (minimum 15 credits)

24 credits (minimum) of dissertation research

Fundamental Core Courses (9 total cr) – Students must take a course in each of the three areas.

Survey of materials – This topic includes an introduction to advanced materials, biomaterials, nanomaterials, and/or topics in materials chemistry, and is covered in several existing courses in mechanical engineering, in chemistry and biochemistry, and in biological science. Incoming MS&E students will have a wide variety of backgrounds. The survey course provides fundamental understanding about materials these students need for the other MS&E courses. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, and Mechanical Engineering. This course deals with the wide variety of basic properties of ceramics, steels, optical, magnetic, and electrical materials.

- *Typically, ECH 5934 (3 cr) – Special Topics in Chemical Engineering: Chemical Engineering Materials*

Thermodynamics – This topic concerns the fundamental properties of thermodynamics, as applied to materials science. Existing courses in chemical and biomedical engineering, chemistry, and physics cover this topic. Although each of these courses is based on the same set of fundamental equations, the examples used in each course is based on what is most important for the course's home department. A course dedicated to Thermodynamics for Materials Science has been created for MS&E students. This course deals with energy terms that determine the stability of solid materials and the tendency for reactions to occur.

- *EML 5930 (3 cr) – Special Topics in Mechanical Engineering: Thermodynamics for Materials Science.*

Solid state science for materials scientists/engineers - This topic covers the essential areas of structural, thermal, electronic, and magnetic properties of materials, including superconducting, magnetic, semiconducting, and ferroelectric materials of strong current technological interest. This course is an introduction to a large variety of materials characterization techniques that have been developed and are currently used in materials science research. It also provides the fundamental background in band theory to understand electronic, optical, and magnetic properties of solid materials.

- *PHZ 5475 (3 cr) - Materials Characterization*

Elective Core courses (3 total cr) - Students must take one course from one of the following two areas:

Survey of synthesis and processing. - This topic addresses the synthesis of materials in bulk, thin film, amorphous, single crystals; morphologies and their transformation into structures for measurement; applications in technology and commercialization. The two courses listed below cover the same basic synthesis topics. EIN 5930 emphasizes a variety of synthesis techniques for a different material systems. EML 5182 focuses on synthesis of composite materials.

- *EIN 5930 3 cr) – Special Topics in Industrial Engineering: Synthesis and Processing of Advanced Materials*
- *EML 5182 (3 cr) – Composite Materials Engineering*

Characterization of materials. - This topic covers materials measurement, including optical, physical, electronic, magnetic, resonant and scattering methods, and microstructural probes. The two courses listed below cover the same basic information about how to characterize materials. The differences are that the main emphasis in EMA 5514 focuses on using electron microscopy to characterize materials, whereas EML 5930 is broader than EMA 5514 and examines several different methods to characterize the microstructures of materials.

- *EMA 5514 (3 cr) – Electron Microscopy*
- *EML 5930 (3 cr) – Special Topics in Mechanical Engineering: Microstructures of Materials*

Interdisciplinary Seminar Series – students take this 0-credit seminar every semester they are in MS&E.

The seminar course will be offered by FAMU and FSU faculty to provide students with an opportunity to obtain information on advances in materials research though presentations by visiting scientists and from FAMU and MS&E faculty. Students will learn and practice presentation skills in this seminar. In addition to technical topics, this seminar series will have talks on business related topics to help prepare the students to take leadership roles as they move from the university setting to industry and society. The seminar will serve as a forum for MS&E faculty members who wish to recruit MS&E students, and so some of these seminar sessions will be set aside to allow multiple faculty members to make short presentations advertising their research programs.

- *ISC 5937 (0 cr) – Interdisciplinary Seminar Series – MS&E*

Elective specialization courses (15 total cr)

These courses are selected by the student and their advisor with the goal of providing the most benefit to the student's research. See Section VIII.E. for a list of these courses.

Suggested course sequence for a student entering MS&E entering in a fall semester. The sequence also shows when other actions, such as selecting an advisor and taking required exams need to be done.

Ph.D.		
------ Year 1 ------		
Fall	**Spring**	**Summer**
• **2 Required Core courses** • **1 Elective Specialization course** • **ISS seminar**	• **1 Required Core course** • **1 Elective Core course** • **1 Elective Specialization course** • **ISS seminar** • **Choose research advisor by end of**	• **Research**

	Spring semester	
------ Year 2 ------		
Fall	**Spring**	**Summer**
• **2 Elective Specialization courses** • **Research** • **ISS seminar** • **Take Ph.D. preliminary exam**	• **1 Elective Specialization course** • **Research** • **ISS seminar**	• **Research**
------ Year 3 ------		
Fall	**Spring**	**Summer**
• **Research** • **ISS seminar** • **Prepare and defend preliminary exam / prospectus**	• **Research** • **ISS seminar**	• **Research**
------ Year 4 ------		
Fall	**Spring**	**Summer**
• **Research** • **ISS seminar**	• **Research** • **ISS seminar**	• **Research**
------ Year 5 ------		
Fall	**Spring**	**Summer**
• **Research** • **ISS seminar**	• **Research** • **ISS seminar** • **Defend Ph.D. dissertation**	• **Graduated**

E. Provide a brief description for each course in the proposed curriculum.

The core courses are described above. The current section is a compilation of elective courses.

- *Chemistry of Materials:* This course introduces materials chemistry, with strong emphasis on the interdisciplinary nature of materials research. The course provides an overview of various classes of materials, including the synthesis and characterization of materials, their structural and physical properties, and how those properties relate to specific applications. (CHM 5715 3 cr)
- *Electrochemistry.* Instrumentation and techniques in electrochemistry, including such topics as electrode processes, potentiometry, voltammertry, and coulometry. (CHM 5153 3 cr).
- *Polymer Chemistry:* The course covers polymers (plastics) which encompass nearly every facet of our daily lives, and the rich variety of properties and functions that characterize these materials, which is deeply seeded in the chemistry and architecture of their macromolecular structure. This course broadly surveys these materials, the current state of the field, and the modern challenges and research opportunities within it. (CHM 5450 3 cr)
- *Characterization of Materials I:* This course deals with microscopic and diffraction methods used for structural characterization of materials, as well as with transport

and magnetic measurements. Recommended for students involved in materials research. (CHM 5716 3 cr)

- *Topics in Materials Chemistry II:* Introduction to materials chemistry, focusing on the structure, properties, and functions of polymers, organic and soft materials, and bio-inspired materials. This course is intended for graduate students involved in materials research. (CHM 5718 3 cr)
- *Chemical and Physical Characterization of Biopolymers*. Course covers biopolymer types and conformations; solution properties of biopolymers; macromolecular equilibria; hydrodynamic behavior; determination of size and shape; biopolymer separations; introduction to biological spectroscopy. (BCH 5745 3 cr).
- *Advanced Polymer Physical Science and Engineering:* This course is a graduate introduction to static and dynamic polymer physics, including models of chains and macroscopic properties. (**ECH 5820** 3 cr)
- *Polymer Science and Engineering.* The course offers graduates fundamental concepts and structure-property relationships of polymeric materials. (ECH 5828 3 cr)
- *Solid State Sensors:* This course covers the fabrication of solid-state sensors, their characterization, operational principles, and applications for acoustic, mechanical, magnetic, radiation, thermal, chemical, and biologic sensors. (EEE 5333 3 cr)
- *Semiconductor Device Theory:* This course covers elementary quantum physics, energy-band theory, carrier properties, theory of p-n junctions, optoelectronics diodes, bipolar junction transistors, and field-effect transistors. **(EEE 6353 3 cr)**
- *Introduction to Energy Storage:* This course provides students with an overview on energy storage technologies and devices with focus on electrochemical storages including advanced rechargeable batteries, electrochemical capacitors, and fuel cells. **(EEL 5075 3 cr)**
- *Photovoltaics:* This course educates students in the design and applications of solar energy technology. This course focuses on theoretical fundamentals of solar energy conversion, types of solar cells and their operations, optical engineering, and energy storage and distribution systems. The course covers solar energy insolation and global energy needs, current trends in photovoltaic energy engineering, solar cell material science, design and installation of solar panels for residential and industrial applications and connections to the national grid and cost analysis of the overall system. (**EEL 5284** 3 cr)
- *Applied Optimization.* The course offers student fundamental of Heuristic Optimization and its applications in engineering design, production and materials research. (ESI 5408 3 cr)
- *Technology Entrepreneurship and Commercialization.* This course provides students with a hands-on educational experience proposing and analyzing technology-based ideas for development as a product and introducing the product into the market. (EIN 5445 3 cr)
- *Advanced Composite Engineering Topics.* A survey course on advanced composite topics, including fabrication process modeling and simulation, high temperature resins and composites, fiber preform and liquid composite molding (LCM), electrical and EMI shielding properties of composite materials. (EIN 5930 3 cr)

- *Composite Materials Engineering.* This course offers students fundamental knowledge of constitutional materials, interface, fabrication and basic mechanical behaviors of composite materials. (EMA 5182 3 cr)
- *Mechanical Metallurgy.* This course offers students fundamentals of metallurgy. (EMA 5226 3 cr)
- *Materials for Energy Systems.* Introduction to several classes of Materials that are used in systems that produce, store or transfer energy. It concentrates on three main areas in which energy is transformed to useful sources: solar to chemical energy by photocatalysis, nuclear to electric energy by controlled nuclear reactions, and chemical to electrical energy in solid oxide fuel cells. (EML 5930 3 cr)
- *Applied Superconductivity.* This course offers students an introduction to superconductivity, superconducting materials, and the technology challenges related to their processing and application. (EML 5072 3 cr)
- *Continuum Mechanics.* This course offers student fundamentals of continuum mechanics. (EML 5611 3 cr)
- *Introduction to Advanced Materials*: The course provides the fundamentals of the science and practical uses of materials. (EML 5930 3 cr)
- *Computational Physics Laboratory:* This course introduces students to the use of computers to solve computationally intensive problems, including basic instruction in physics problem solving using numerical solutions to differential equations, numerical integration, Monte Carlo, partial differential equations, linear algebra, distributed processing and symbolic algebra. The course also provides instruction in computational techniques and software development skills and practice in using network and software development tools including telnet, ftp, spreadsheets, databases, code management systems, and the World Wide Web. (PHZ 5156 3 cr)
- *Materials Characterization:* This course is an introduction to a large variety of materials characterization techniques that have been developed and are currently used in materials science research. (PHZ 5475 3 cr)
- *Condensed Matter Physics I.* Crystal structure phonons, electron in metals, semiconductors, magnetism, ferroelectrics, and liquid crystals. (PHZ 5491 3 cr)
- *Condensed Matter Physics II.* Elementary excitations in solids, the many-body problem, quantum fluids and superconductivity, magnetism, dielectrics, collective effects in fluids. (PHZ 5492 3 cr)
- *Applied Computational Science I*. This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of coursework and lab work provides the proper blend of theory and practice with problems culled from the applied sciences. Topics include numerical solutions to ODEs and PDEs, data handling, interpolation and approximation, and visualization. (ISC 5315 3 cr)
- *Applied Computational Science II*. This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of coursework and lab work provides the proper blend of theory and practice with problems culled from the applied sciences.

Topics include mesh generation, stochastic methods, basic parallel algorithms and programming, numerical optimization, and nonlinear solvers. (ISC 5316 3 cr)

F. For degree programs in medicine, nursing, and/or allied health sciences, please identify the courses that contain the competencies necessary to meet the requirements identified in Section 1004.08, Florida Statutes. For teacher preparation programs, identify the courses that contain the competencies necessary to meet the requirements outlined in Section 1004.04, Florida Statutes.

☒ **Not applicable to this program because the program is not a medicine, nursing, allied health sciences, or teacher preparation program.**

G. Describe any potential impact on related academic programs or departments, such as an increased need for general education or common prerequisite courses or increased need for required or elective courses outside of the proposed academic program. If the proposed program is a collaborative effort between multiple academic departments, colleges, or schools within the institution, provide letters of support or MOUs from each department, college, or school in Appendix D.

As a graduate program, general education courses are not required. However, because this program is interdisciplinary, departments outside of the FAMU-FSU College of Engineering will participate on both FAMU's and FSU's main campuses. Enrollment in courses for the MS&E program will be shared with students from collaborating disciplines. Increased enrollment in shared courses because of the M.S. in MS&E is expected to have minimal impact on existing courses. The chemistry and physics departments have ample space within the classrooms and labs to accommodate enrollment of students from the MS&E programs. Each program typically has enrollment spaces for at least thirty students. Currently, capacity exists in each program for both courses and lab space. Program faculty within each department confirmed that they have space in their labs for additional students.

H. Identify any established or planned educational sites where the program will be offered or administered. If the proposed program will only be offered or administered at a site(s) other than the main campus, provide a rationale.

This program will be offered as part of the FAMU-FSU College of Engineering located in Tallahassee Florida. Students will take classes on the FAMU main campus, in the FAMU-FSU College of Engineering, and on the FSU main campus. Students will do their research where their advisor has their research labs on the FAMU main campus, in buildings in the FAMU-FSU Collee of Engineering, and in research buildings in Innovation Park (in Tallahassee) including FAMU's Centennial building and the National High Magnetic Field Laboratory.

I. Describe the anticipated mode of delivery for the proposed program (e.g.,

face-to-face, distance learning, hybrid). If the mode(s) of delivery will require specialized services or additional financial support, please describe the projected costs below and discuss how they are reflected in Appendix A – Table 3A or 3B.

The courses will be delivered in the traditional face-to-face manner at the FAMU-FSU College of Engineering, FAMU main campus, or on the FSU campus as part of the cooperative agreement between the two universities.

J. Provide a narrative addressing the feasibility of delivering the proposed program through collaboration with other institutions, both public and private. Cite any specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.

The Ph.D. in Materials Science and Engineering will be offered jointly between FAMU and FSU as part of the joint College. No additional institutions will be involved in the course offerings at this time.

K. Describe any currently available sites for internship and/or practicum experiences. Describe any plans to seek additional sites in Years 1 through 5.

☒ Not applicable to this program because the program does not require internships or practicums.

V. Program Quality Indicators - Reviews and Accreditation

A. List all accreditation agencies and learned societies that would be concerned with the proposed program. If the institution intends to seek specialized accreditation for the proposed program, as described in Board of Governors Regulation 3.006, provide a timeline for seeking specialized accreditation. If specialized accreditation will not be sought, please provide an explanation.

Undergraduate programs in MS&E are accredited through ABET, which accredits engineering programs. The FAMU-FSU College of Engineering does not have an undergraduate program in MS&E. There are no accreditation agencies for graduate programs (M.S. or Ph.D.) in Materials Science and Engineering.

B. Identify all internal or external academic program reviews and/or accreditation visits for any degree programs related to the proposed program at the institution, including but not limited to programs within academic unit(s) associated with the proposed degree program. List all recommendations emanating from the reviews and summarize the institution's progress in implementing those recommendations.

The FSU MS&E program, which the FAMU MS&E M.S. program will join, underwent an internal FSU Quality Enhancement Review (QER) in 2018. A summary of the reviewer's comments is provided below, and his full report is in the Appendix.

CURRICULUM

- *Strengths*: Well designed and flexible curriculum; good use of weekly seminar; excellent first-year research rotation
- *Weaknesses*: Core course content is not under control of MS&E program. With the movement of the MS&E programs to the FAMU-FSU College of Engineering, the program director and faculty have increased oversight of the program, including course offerings.
- **Progress towards addressing weakness:** One course, Thermodynamics for Materials Science has been created specifically as a core course for MS&E. It is housed within the Department of Mechanical Engineering in the FAMU-FSU COE.

STUDENTS

- *Strengths*: Good numbers of applications; high quality students admitted to program; strong positive student view of program and faculty; strong sense of community among students
- *Weaknesses*: Unpredictability of elective course offerings is a concern for some students; large variation in opportunities for teaching assistantships
- **Progress towards addressing weakness:** *Elective courses:* Scheduling when elective courses will be taught is outside the direct control of MS&E. MS&E now identifies the elective courses being offered across the departments associated with MS&E at the beginning of each enrollment period and informs students of available what electives. *TA opportunities:* MS&E does not have any TA positions. All TA positions are available through the student's faculty advisor's home department. MS&E now requires all its incoming students to take the TA teaching course and all international

students to take the TOEFL.

FACULTY

- *Strengths*: High quality affiliated faculty with positive international reputations, good external rewards, research support, and publication profiles; cluster hire in materials science (early 2010's)
- *Weaknesses*: There are no faculty appointments dedicated to MS&E
- **Progress towards addressing weakness:** MS&E is an interdisciplinary program, not a department, so it will not have its own faculty members. MS&E continues to try to have input in the individual departments' hiring process to inform prospective faculty members about the MS&E program.

RESOURCES

- *Strengths*: Unique research strengths in the National High Magnetic Field Lab, High Performance Materials Institute, and the Applied Superconductivity Center; excellent laboratory facilities; good access to labs by students and first-year fellowships for research rotations.
- *Weaknesses*: There is no direct source of financial support; administrative support is low if program growth is desired. Dr. Eric Hellstrom serves as the program director for the both the master's and doctoral programs at FSU that now reside within the FAMU-FSU College of Engineering. He will continue in this role with the implementation of the program at FAMU.
- **Progress towards addressing weakness:** MS&E has direct financial support for first-year fellowships from FSU. Additional funding will be made available from FAMU for admitted doctoral students as well.

C. For all degree programs, discuss how employer-driven or industry-driven competencies were identified and incorporated into the curriculum. Additionally, indicate whether an industry or employer advisory council exists to provide input for curriculum development, student assessment, and academic-force alignment. If an advisory council is not already in place, describe any plans to develop one or other plans to ensure academic-workforce alignment.

The graduate MS&E program does not have an industry advisory council. The Ph.D. is research-oriented, and all the Ph.D. graduate students will be supported as research assistants on faculty members' research grants, which are typically funded by a federal agency or industry. To get funding, an MS&E faculty member writes a proposal to a federal agency or industry that addresses a significant scientific problem in some area of materials science and engineering. Proposals are funded that address cutting-edge research in areas that are important to the federal agency or industry. Thus, the MS&E students work on research topics the scientific and technical communities have identified as important, relevant, and timely.

The MS&E doctoral core courses give the students the general background that underpins the discipline of MS&E. Each student takes a different set of elective specialization courses that they choose in consultation with their research advisor to aid with their research. New elective specialization courses relevant for MS&E are being developed at a rate of about one every two to three years. These courses are typically based on topics that are relevant to the faculty member's research who develops the course.

Generally, students graduating with a Ph.D. in Materials Science and Engineering are primarily hired at a national laboratory or company because the organization is interested in the general research area the student studied while enrolled. As such, competencies for the FAMU MS&E program were developed based on a review of job postings for post-doctoral positions and recommendations provided by national laboratories, such as Lawrence Livermore National Laboratory. These types of companies are typically seeking graduates that help advance manufacturing processing of materials using cost-savings techniques.

Because materials science is an interdisciplinary field, faculty reviewed curricula at different institutions to determine the types of courses that may be offered by collaborating units. In many cases, fundamental courses included in the curricula were related to structures, kinetics, properties, thermodynamics, and processing. Oftentimes, faculty expertise and student composition were the defining characteristics. The proposed program's curriculum builds on both. It includes some of the foundation aspects common across many curricula as well unique areas of interests of faculty. As such, to attract more students and increase collaboration across the campus, chemistry and physics were added as significant components to build the curriculum to meet industry demand.

VI. Faculty Participation

A. Use Appendix A – Table 2 to identify existing and anticipated full-time faculty who will participate in the proposed program through Year 5, excluding visiting or adjunct faculty. Include the following information for each faculty member or position in Appendix A – Table 2:

- **the faculty code associated with the source of funding for the position**
- **faculty member's name**
- **highest degree held**
- **academic discipline or specialization**
- **anticipated participation start date in the proposed program**
- **contract status (e.g., tenure, tenure-earning, or multi-year annual [MYA])**
- **contract length in months**
- **percent of annual effort that will support the proposed program (e.g., instruction, advising, supervising)**

This information should be summarized below in narrative form. Additionally, please provide the curriculum vitae (CV) for each identified faculty member in Appendix E.

The table below provides a list of faculty participating in the program and anticipated efforts for years one and five. For this proposal, only information for FAMU faculty is included as the program at FSU has been in existence for more than ten years. However, it should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating departments.

Faculty Code	Name	Highest Degree Held	Academic Discipline or Specialty	Program Start Date	Contract Status	Contract Length	Percent Effort
A	Ali, Jamel	Ph.D.	Chemical and Biomedical Engineering	Fall 2023	Tenure-earning	9-month	5%
A	Arnett, Natalie	Ph.D.	Chemical and Biomedical Engineering/ Chemistry	Fall 2023	Tenure-earning	9-month	5%
A	Dickens, Tarik	Ph.D.	Industrial and Manufacturing Engineering	Fall 2023	Tenured	9-month	5%
A	Johnson, Lewis	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%
A	Kattel, Shyam	Ph.D.	Physics	Fall 2023	Tenure-earning	9-month	5%
A	Ramakrishnan, Subramanian	Ph.D.	Chemical and Biomedical Engineering	Fall 2023	Tenured	9-month	5%
A	Senevirathne, Keerthi	Ph.D.	Chemistry	Fall 2023	Tenured	9-month	5%
A	Thirunavukkuarasu Komalavalli	Ph.D.	Physics	Fall 2023	Tenured	9-month	5%
A	Weatherford, Charles	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%

B. Provide specific evidence demonstrating that the academic unit(s) associated with the proposed program have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, and other qualitative indicators of excellence (e.g., thesis, dissertation, or research supervision).

Graduate faculty members in the proposed Ph.D. Materials Science and Engineering have been productive in teaching, research and grant acquisition. The proposed MS&E is an interdisciplinary program mainly that is independent of any existing academic unit. Faculty that will teach in the MS&E currently teach in related programs in the FAMU-FSU College of Engineering, FAMU Physics, and FAMU Chemistry departments. The departments as a whole have been productive in enrollment, degrees awarded in STEM degrees across engineering, physics, and chemistry. The table below provides a brief synopsis and evidence that FAMU faculty contributing to the program are research active. It shows that from July 2015 through June 2021 they brought in more than $4.12M in research funding and there are two new grants that start in FY 22 that will bring in another $1.5 M over the next three years.

Name	**Department**	**Professional Publications**	**Externally-funded research activities – 2015 through 2021**[1]
Ali, Jamel	Chemical and Biomedical Engineering	8 Refereed Journal Articles 15 Proceedings	1 @ $79,705 from NSF
Arnett, Natalie	Chemical and Biomedical Engineering/ Chemistry	4 Refereed Journal Articles 15 Proceedings	1 @ $49,999[2] from NSF
Dickens, Tarik	Industrial and Manufacturing Engineering	6 M.S. Theses 1 Ph.D. Dissertation 29 Refereed Journal Articles 5 Proceedings 1 Book Chapter	2 @ $238,996 from NSF and MI Tech U
Johnson, Lewis	Physics	15 Refereed Journal Articles 45 Conference Presentations 4 MS Theses 5 PhD Dissertations	
Kattel, Shyam	Physics	58 Refereed Journal Articles 1 Proceeding	1 @ $2,154,718 from NSF
Ramakrishnan, Subramanian	Chemical and Biomedical Engineering	2 M.S. Theses 3 Ph.D. Dissertation 18 Refereed Journal Articles 2 Book Chapters	5 @ $2,154,718 from NSF

Name	Department	Professional Publications	Externally-funded research activities – 2015 through 2021[1]
Senevirathne, Keerthi	Chemistry	1 M.S. Thesis 4 Refereed Journal Articles	2 @ $150,000 from NSF HBCU and UP
Thirunavukkuarasu, Komalavalli	Physics	11 Refereed Journal articles	4 @ $1,353,323 from DOD and ONR
Weatherford, Charles	Physics	2 M.S. Thesis 3 Ph.D. Dissertations 2 Books 4 Book Chapters 95 Refereed Journal Articles 144 Proceedings	3 @$9.5 million from National Nuclear Security Agency

[1]Funding data are through June 30, 2021.
[2]Arnett has two NSF grants that started in FY 22 that total $1.5 M over the next 3 years.

In addition to research, FAMU collaborating faculty in Physics and Chemistry are active at the graduate level in teaching. Collective graduate enrollment for physics and chemistry are shown below for the last five years.

Table 13 - Graduate Enrollment Chemistry and Physics

	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Beginning Graduate	12	12	7	8	7
Advanced Graduate	14	15	13	14	10
Total	26	27	20	22	17

VII. Budget

A. Use Appendix A – Table 3A or 3B to provide projected costs and associated funding sources for Year 1 and Year 5 of program operation. In narrative form, describe all projected costs and funding sources for the proposed program(s). Data for Year 1 and Year 5 should reflect snapshots in time rather than cumulative costs.

The budget in Table 3A provides projected costs of the MS&E program and associated funding sources. The total budget for Year One is $90,232. For this proposal, only information for FAMU faculty are included because the FAMU program will become joint with the existing FSU program, which has been in existence for more than ten years. It should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating FSU departments. No additional costs will be incurred on the FSU side from implementing the FAMU program.

Nine full-time faculty are expected to participate in Year One from FAMU from disciplines in engineering, physics, and chemistry. Reallocated dollars from the percent effort of those faculty equate to a total of $50,232. Of the reallocated faculty salaries, approximately $40,647 will be allocated from the Dean's budgets from the FAMU-FSU College of Engineering and College of Science and Technology at FAMU. The remaining dollars of $9585 will come from contracts and grants. The remaining $9,585 is reallocated funding from existing contracts and grants faculty salary dollars. By year five, reallocation dollar will be stable at $50,232. However, an increase in assistantship is expected.

It is anticipated that new Ph.D. students will be supported in year one with at least $40,000 dedicated to fellowships. This amount of funding could support at least two full-time Ph.D. students at $20,000 annually. By year five, the goal is to increase the level of support for at least five full-time students at $100,000 collectively until the program reaches its overall target sustainable goal. The funding source for the assistantships will be contracts and grants as students will be supported by faculty research grants. The total cost to the program in year five is $150,232. Until such time as faculty are able to fully support students on their research grants, additional sources of support for graduate student funding will come from existing institutional monies dedicated for fellowships and teaching assistants. Such sources include the Dean's budget from the joint College, Title III dollars to support graduate students, and monies from the School of Graduate Studies generally used for graduate assistantships.

B. Use Appendix A – Table 4 to show how existing Education & General (E&G) funds will be reallocated to support the proposed program in Year 1. Describe each funding source identified in Appendix A – Table 4, and provide a justification below for the reallocation of resources. Describe the impact the reallocation of financial resources will have on existing programs, including any possible financial impact of a shift in faculty effort, reallocation of instructional resources, greater use of adjunct faculty and teaching assistants, and explain what steps will be taken to mitigate such impacts.

The overall budget for FAMU's contribution to the FAMU-FSU College of Engineering is $1,034.205. Approximately $22,691 will be reallocated to the Materials Science and

Engineering program, leaving a total of $1,011,514.

The overall budget for the FAMU College of Science and Technology is $10.5M. Approximately, $27,541 will be reallocated to the Materials Science and Engineering for faculty from chemistry and physics to support the program, leaving a total of $11,483,973. The program does not anticipate negative impact to existing programs with the implementation of a new program in materials science and engineering.

C. If the institution intends to operate the program through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-level tuition, as described in Board of Governors Regulation 8.002, provide a rationale and a timeline for seeking Board of Governors' approval.

☒ Not applicable to this program because the program will not operate through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-level tuition

D. Provide the expected resident and non-resident tuition rate for the proposed program for both resident and non-resident students. The tuition rates should be reported on a per credit hour basis, unless the institution has received approval for a different tuition structure. If the proposed program will operate as a continuing education program per Board of Governors Regulation 8.002, please describe how the tuition amount was calculated and how it is reflected in Appendix A – Table 3B.

This program will charge graduate tuition rates as shown below.

Fees

Registration and tuition fees are established by the Board of Education and the FAMU Board of Trustees as required by the Florida Legislature. These fees are subject to change without notice. The current credit hour fee schedule is as follows:

	IN-STATE	OUT-OF-STATE
Undergraduate	$151.78	$549.80
Graduate	405.67	1,022.04
Law	455.86	1,097.89

E. Describe external resources, both financial and in-kind support, that are available to support the proposed program, and explain how this amount is reflected in Appendix A – Table 3A or 3B.

A major source of support for doctoral students is funds for research assistantships paid from faculty members' research grants. Faculty members associated with this proposal are successful raising research funds, which includes support for a graduate student to do research in the faculty member's lab. These grants pay the student's stipend

and also pay for in-state tuition. Beyond individual faculty support, the program administrators and faculty will aid students seeking fellowships from organizations such as the Graduate Education for Minorities (GEM) Fellowship Program. In addition, federal Title III funds administered by FAMU will be available for graduate students in the MS&E program. All MS&E students will be eligible to be funded as research assistants from their advisor's research grants from the day they enter MS&E. The academic-year research assistantships planned as part of the initial implementation of the proposal is available to doctoral-level students. An increase in assistantships and fellowships is expected by year five of the program.

VIII. Non-Faculty Resources

A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5 below, including but not limited to the following:

- **the total number of volumes and serials available in the discipline and related disciplines**
- **all major journals that are available to the university's students**

The Library Director must sign the additional signatures page to indicate that they have review Sections VIII.A. and VIII.B.

Existing library collections in engineering, physics and chemistry are suitable to the materials Science and Engineering program. Library collections contain archival resources, including journal back files, as well as current resources that support a curriculum in Materials Science and Engineering directly and indirectly through interdisciplinary collections in the sciences and technology. Library collections in these disciplines are well balanced and suitable to support all levels of teaching and research including advanced study. FAMU's Dean of Libraries conducted a search of journals and research materials available to students enrolled in the MS&E. All materials are relevant and provide up-to-date content aligned with the proposed program. Within FAMU Libraries, journals are available to students in multiple formats, including hard-copy and electronic. The following table shows library holdings in support of Materials Science and Engineering.

The University Libraries provide collections of current books, periodicals, and pertinent reference materials, which have been selected with faculty input and are readily accessible to faculty and students both onsite and off campus. Samuel H. Coleman Memorial Library (the main library) and branch libraries provide traditional print, as well as electronic access to full text databases, e-journals, e-books, and streaming video. Library collections in chemistry, engineering, and physics will support the master's and doctoral degrees in Materials Science and Engineering. The following table shows library holdings in support of Materials Science and Engineering. Lists of pertinent journals and databases are attached.

Books	4,115
Electronic Books	3515
Electronic Journals	156
Electronic databases	38

The University maintains borrowing agreements and memberships that mutually enhance resources availability for FAMU and other Florida learning communities. Partnerships are with the State University Libraries of Florida, the Florida College System Libraries and the State Library of Florida. The libraries are members of the Florida Virtual Campus (FLVC) which provides the centralized, automated library system used by Florida's 40 public college and university libraries. Florida public postsecondary college and university libraries provide services directly and indirectly to students and faculty of State of Florida postsecondary institutions. Resources held by the other 39 Florida public postsecondary institutions supplement holdings in support of Materials Science and Engineering.

Onsite and reciprocal borrowing privileges to students and faculty at all 40 Florida public institutions of postsecondary education is provided. Service includes daily document delivery via statewide courier among the libraries in the Florida Library Information Network (FLIN). FAMU students and faculty have access to the courier service for interlibrary loan transactions.

Access to Collections and Services

Students, faculty, and staff have access to collections, resources, and services 24 hours a day, seven days a week, either through the 105 hours that the main library is open or through the library web page. Through the University Libraries' web page, faculty and students have full access to the FAMU library catalog on or off campus, and the library catalogs of the State University System and Florida College System libraries. Online resources and services are available within the libraries, from campus computers, in faculty offices, and from residence halls. Off-campus access is also available 24 hours a day to authenticated users (students, faculty, and staff). Support services such as instruction, interlibrary loans, loan renewals, course reserves, reference assistance, and distance learning services are also accessible from the web page.

Services

FAMU Libraries provide a full range of traditional and innovative library services. Users have access to reference services via local and toll free telephone and through the AskALibrarian electronic mail, online chat, and text services. Services enable users to access and to use information resources in the libraries and from remote locations. The Information Commons, in Coleman Library, allows users to access main library services from one common area. Several Library services are available from this service point. Services include borrowing privileges, interlibrary loan, course reserves, reference and research services, and systems support services.

Borrowing Privileges

Students, faculty, and staff have borrowing privileges at the FAMU Libraries, and reciprocal borrowing privileges to the 40 public universities and colleges in Florida. Borrowers may view and renew items that are currently checked out through the online catalog.

Interlibrary Loan

Students, faculty, and staff who are currently enrolled and engaged in academic research have Interlibrary Loan (ILL) borrowing privileges to the 40 public universities and colleges

in Florida and to other libraries globally. Requests may be initiated in person or through the online catalog, which along with reciprocal borrowing and the provision of licensed databases, provides access to materials that the University does not own.

Course Reserves

Print and electronic materials may be placed on reserve at the libraries. The reserve service provides a central and convenient location for students to retrieve materials. These materials are owned by the University or come from the private collections of faculty members who place materials on reserve for enrolled students.

Reference and Research Services

On site and virtual reference/research services are provided. Reference Services include individual research/consultation, the provision of electronic and print research guides and the provision of online tutorials. Reference librarians provide a variety of instructional services to meet the information literacy needs of students, faculty, staff, administrators, and the community at large.

Instruction/Information Literacy

The University Libraries provide competent, quality, and timely instruction through a variety of instructional services. Information is delivered through informal and point of use instruction, individual and group instruction, formal orientations and literacy sessions, orientation to new student groups, subject specific scheduled workshops, printed handouts, research guides and online tutorials. Instruction is provided to local users as well as to distance learners. Information literacy sessions are designed to equip users with the skills needed to locate, evaluate, and use library information resources and services. Formal literacy instruction is based upon goals as defined by classroom faculty. Information literacy classes provide hands-on interactive instruction. Library instruction is based on the Association of College and Research Libraries (ACRL) Framework for information Literacy for Higher Education.

Liaison Program

Librarians work with all academic units to assure that the collection supports defined curricular goals and those adequate services, including instruction are provided. Each academic program has appointed a representative to serve as library liaison. The representative works in collaboration with the subject librarian to evaluate, select, and purchase resources recommended for academic programs.

Systems Support Services

The Systems Department provides and maintains 250 public computers along with software, hardware, and support services necessary for providing and using information resources. Computers are configured to provide access to the libraries' web page and online catalog. Computers are also configured with various types of production software allowing users' access to the Microsoft Office Suite (Word, Excel, PowerPoint, OneNote, OneDrive), SPSS, SAS, LockDown Browser, and more. Additional services are made available in response to customer service surveys and other assessment.

Computers are located on each floor of the main library and in all branch libraries. Printing is available from all computers. Documents queued to print may be picked up via the closest print station within the main library or any branch library. Scanning stations are available near the Information Commons Desk and provides scanning of photos and documents. Multiple sizes are available.

A help desk is staffed as part of the Information Commons to assist users with software applications and technology support. Helpdesk staff assists users with directional questions, laptop registration and circulation, referrals and resolution of computing and printing needs and issues.

Staff

All Library and related personnel meet or exceed minimal educational requirements as defined by the Association of College and Research Libraries (ACRL). Librarians hold master's degrees from ALA accredited schools. Additionally, two faculty librarians have completed the specialists' degree in library science and three faculty librarians have completed master's degrees in other subject disciplines. The University employs 12 librarians. Support staff are also very well qualified.

Facilities

All faculty and students have full access to the facilities of FAMU's Coleman Memorial Library and branch libraries. These facilities adequately support faculty and student use of information technology for instruction, learning and research. Coleman Memorial Library occupies approximately 88,964 net square feet. Almost 20,000 additional square feet are available in the branch libraries. The University Libraries have a seating capacity of 834, including group study rooms, a student study lounge and cafe, and 20 graduate study carrels. Coleman Library also includes an information literacy classroom and teleconference rooms. All library facilities are wired for internet access. The main library and its immediate grounds are wireless, enabling students and faculty convenient and generous access to the wireless network using their own supported laptops, or they may borrow a network-ready laptop from the Library Systems Department for use in the library.

Pertinent Materials Science and Engineering Journals

- Acta Crystallographica. Section B, Structural Science, Crystal Engineering and Materials
- Advanced Engineering Materials
- Advances in Materials Science and Engineering
- Advances in Materials Science
- Annals of Solid and Structural Mechanics
- Annual Review of Materials Research
- Case Studies in Engineering Failure Analysis
- Chemical Engineering Science
- Colloids and Surfaces. B, Biointerfaces
- Composites. Part A, Applied Science and Manufactures
- Computational Materials Science
- Corrosion Engineering, Science, and Technology
- Engineering Science and Technology
- EPJ Applied Metamaterials.
- Hazardous Waste & Hazardous Materials
- Integrating Materials and Manufacturing Innovation.

- IOP Conference Series. Materials Science and Engineering
- Iranian Journal of Science and Technology, Transactions of Mechanical Engineering
- Journal of Applied Biomaterials & Functional Materials
- Journal of Dynamic Behavior of Materials
- Journal of Failure Analysis & Prevention
- Journal of Materials.
- Journal of Remanufacturing
- Journal of Renewable Materials
- Materials Science & Engineering. A Structural Materials
- Materials Science & Engineering. B, Solid-State Materials for Advanced Technology
- Materials Science & Engineering. C, Biomimetic Materials, Sensors and Systems
- Materials Science & Engineering. R, Reports A Review Journal
- Mechanics of Advanced Materials and Structures
- Modelling and Simulation in Materials Science and Engineering
- Nature Reviews. Materials
- Nuclear Materials and Energy
- Progress in Additive Manufacturing
- Research Letters in Materials Science
- Soft Materials

Materials Science and Engineering Databases

- Access Engineering
- ACM Digital Library
- ACS Journals
- Aluminum Industry Abstracts
- American Chemical Society Journals (ACS)
- American Society of Civil Engineering Database (ASCE)
- AIP
- Ceramic Abstracts
- Civil Engineering Abstracts
- Compendex
- Engineering Village
- Engineered Material Abstracts
- Engineering Village
- Environmental Engineering Abstracts
- IEEE Xplore
- Inspec
- Engineering Village
- IOP Electronic Journals
- Materials Business File
- Materials Research Database
- Mechanical & Transportation Engineering Abstracts
- Mechanical Engineering Abstracts
- Solid State & Superconductivity Abstracts
- Sustainability Science Abstracts
- ANTE: Abstracts in New Technology and Engineering
- Applied Science & Technology Source
- Earthquake Engineering Abstracts
- Engineering Collection
- Proquest Engineering Research Database
- ScienceDirect
- SciFinder
- SpringerLink
- Taylor & Francis

- Wiley Online Library

Additional Library Resources in Support of the

Materials Science and Engineering

Library resources currently available to implement and/or sustain the proposed program through Year 5

Existing library collections in engineering, physics and chemistry are suitable to the materials Science and Engineering program. Library collections contain archival resources, including journal back files, as well as current resources that support a curriculum in Materials Science and Engineering directly and indirectly through interdisciplinary collections in the sciences and technology. Library collections in these disciplines are well balanced and suitable to support all levels of teaching and research including advanced study. The following table shows library holdings in support of Materials Science and Engineering. The library's current budget with annual increases of 3-5% should sustain these collections through year five.

Current FAMU Libraries' Holdings in Support of Materials Science and Engineering

Resources	Engineering	Materials Science
Books	146,232	56,781
Electronic Books	133,174	55,634
Electronic Journals	5,941	342
Electronic databases	40	40

Major journals that are available to Materials Science and Engineering students

These journals are accessible online through the University Libraries' web site.

- **ACS Biomaterials Science and Engineering, *2015-present***
- **Acta Crystallographica Section B: Structural Science, Crystal Engineering and Materials, *1997-present***
- **Advanced Materials for Science and Engineering (ICAMSE), International Conference on IEEE, *2016-present***
- **Advances in Materials Science and Engineering, *2008-present***
- **Advances in Science and Technology, *2012-2020***
- **Biobase Material Science and Engineering (BMSE), International Conference on IEEE, *2012-present***
- **Environmental Engineering Science, *1997-present***
- **Foundations of Materials Science & Engineering, *2015-2016***
- **Hazardous Waste & Hazardous Materials, *2015-present***
- **IEEE Transactions on Device and Materials Reliability, *2021-present***
- **IOP Conference Series: Materials Science and Engineering, *2009-present***
- **Iranian Journal of Science and Technology, Transactions of Mechanical Engineering, *2011-present***
- **Journal of Ultra Scientist of Physical Sciences - Section B (Physics, Geology, Nano Technology Engineering, Bio Sciences, Material Science Management), *2017-present***
- **Key Engineering Materials, *2015-2020***
- **Materials Science & Engineering, *2003-present***

- **Materials Science & Engineering A: Structural Materials: Properties, Microstructure and Processing, *1988-present***
- **Materials Science and Engineering B: Solid-State Materials for Advanced Technology, *2003-present***
- **Materials Science and Engineering C, *2003-present***
- **Materials Science and Engineering: R: Reports, *2003-present***
- **Materialwissenschaft und Werkstofftechnik, *1999-present***
- **Modelling and Simulation in Materials Science and Engineering, *1992-present***
- **Supramolecular Science, *1994-present***

B. Discuss any additional library resources that are needed to implement and/or sustain the program through Year 5. Describe how those costs are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional library resources are needed to implement or sustain the proposed program.

C. Describe any specialized equipment and space currently available to implement and/or sustain the proposed program through Year 5.

Each of the faculty members already has the specialized research equipment in their research laboratory needed to carry out high-quality research. Often this was purchased as part of a new faculty member's startup package. The faculty members also have access to shared equipment within their department. In addition, faculty members associated with the High-Performance Materials Institute and the National High Magnetic Field Laboratory, which are located in Innovation Park adjacent to the FAMU-FSU College of Engineering, have access to shared equipment in these two research facilities. All students enrolled in the program will have access to materials and instructional materials to support teaching and learning. However, restrictions are placed on select equipment that may have been included as part of start-up packages for faculty and available only to students working in the lab as a dedicated research assistant.

- KLA iNano
- Nanoscience Scanning Electron Microscopy (SEM)
- Laser nScrypt 3Dn-300 nScrypt 3Dn-450
- Meltio M450
- MTS 858 test machine
- NozTek extruder
- Thinky Planetary Mixer
- Hot presses (6"x6", 12"x12" and 24"x24")
- Thermogravimetric Analyzer, TGA Q50, TA Instrument
- HDR TA Instrument
- Anton Paar MCR 302 Rheometer - Qty 2
- TA instruments Differential Scanning Calorimeter (DSC)
- Brookhaven Instruments Dynamic Light Scattering
- Wyatt Instruments Static and Dynamic Light Scattering (Multi Angle)
- Wyatt Instruments Laser Light Scattering Viscometric Detector
- Wyatt Instruments Differential Refractometer
- Wyatt Instruments Laser Light Scattering Zeta Potential Machine (Mobius)
- Agilent 1200 High Performance Liquid Chromatography with UV Vis detector
- LS Instruments Diffusing Wave Spectroscopy
- 8 Glove Glovebox
- Qsense E4 Quartz Crystal Microbalance

- Beckman Coulter Benchtop Centrifuge
- nScrypt 3Dn-300 BAT bioprinter
- Optical Microscope
- Schlenk Line/Fume Hood
- Nikon Eclipse Ti2
- Prime 95b sCMOS Camera for microscope
- MagnebotiX AG MFG-100 System
- Azur Light Systems 5W
- 1064nm single-frequency laser
- Acousto-optical deflector system
- Excella E-25 Incubated Shaker
- Labconco Purifier® Logic®+ Class II A2 Biosafety Cabinets (4’ and 5’)
- Accu-jet Pro Pipet Controllers
- Stirring Hotplates
- Analytical Balance
- Kepco BOP 100-2DL802E 200 W Bipolar Power Supplies
- National Instruments NI PCIe-6363
- X Series DAQ
- Qsonica 700-Watt sonicator system
- ThorLabs Nexus Optical Table (4' x 8')
- VWR CO2 Incubator
- VWR -80C Freezer Chest
- Thermo Scientific Orion Star A211 pH Benchtop Meter
- VWR Standard Heavy-Duty Vortex Mixer
- PURELAB flex Water Purification System
- VWR Standard Series Refrigerators and Freezer
- GentleMACS™ dissociator
- Beckman Coulter Avanti JXN-30 Floor Centrifuge
- Beckman Coulter Allegra® X-14 Series Benchtop Centrifuge
- Eppendorf 5425 Centrifuge
- Nanodrop OneC Spectrophotometer
- SunP Biotech 3D BIOMAKER Bioprinter
- Cell Link INKREDIBLE+ Bioprinter
- Anton Paar MCR 302 Rheometer
- Broadband Fourier Transform Infrared Spectrometer (Bruker vertex 70v)
- Optical microscope cryostat (Cryo Industries)
- Diamond anvil cells
- Nitrogen-purged glove box (Vacuum Technology Inc.)
- Computer-controlled micromanipulator
- Photoluminescence setup (HR 4000 Ocean Optics).
- High voltage electrospinning setup
- Shimadzu GC-8A Gas chromatograph
- Photocatalytic testing setup including a Newport Xenon lamp & power supply
- WaveDriver 10 Potentiostat Bundle with Rotating Disk Electrodes
- Schlenk lines
- Tube and box furnaces
- Fume hoods
- Wet-chemistry stations
- Local Workstation computers (two 8 cores HP workstation and one 32 core HP workstation)

Software licenses * Vienna Ab-Initio Simulation Package (VASP) * Material Studio * Materials Design

D. Describe any additional specialized equipment or space that will be needed to implement and/or sustain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Appendix

A – Table 3A or 3B. Costs for new construction should be provided in response to Section X.E. below.

☒ Not applicable to this program because no new I&R costs are needed to implement or sustain the program through Year 5

E. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Appendix A – Table 3A or 3B includes only I&R costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs, in particular, would necessitate increased costs in non-I&R activities.

☒ Not applicable to this program because no new capital expenditures are needed to implement or sustain the program through Year 5.

F. Describe any additional special categories of resources needed to operate the proposed program through Year 5, such as access to proprietary research facilities, specialized services, or extended travel, and explain how those projected costs of special resources are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional special categories of resources are needed to implement or sustain the program through Year 5.

G. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5, and explain how those are reflected in Appendix A – Table 3A or 3B.

☐ Not applicable to this program because no fellowships, scholarships and/or graduate assistantships will be allocated to the proposed program through Year 5.

The program anticipates adding two graduate research assistantships each year. Each assistantship is estimated at $20,000 for a total of $40,000 in years one through five. The students who receive these assistantships will do three 10-week-long rotations in faculty member's research labs to find a good fit between the student, their research interests, and a faculty member's research and funding. At the beginning of their first summer, these students are expected to move to a faculty member's research groups where they will be supported from research grants for the remainder of their time as a graduate student. Support for the program is expected to increase in alignment with FAMU's strategic priorities for academic programs. A review of the program's budgetary needs as part of the growth of programs within the FAMU-FSU College of Engineering are held in accordance with FAMU's annual budgeting process, which typically begins with a discussion between the deans and provost.

IX. Required Appendices

The appendices listed in tables 1 & 2 below are required for all proposed degree programs except where specifically noted. Institutions should check the appropriate box to indicate if a particular appendix is included to ensure all program-specific requirements are met. Institutions may provide additional appendices to supplement the information provided in the proposal and list them in Table 4 below.

Table 1. Required Appendices by Degree Level

Appendix	Appendix Title	Supplemental Instructions	Included? Yes/No	Required for Degree Program Level		
				Bachelors	Masters/ Specialist	Doctoral/ Professional
A	Tables 1-4		x	X	X	X
B	Consultant's Report and Institutional Response					X
C	Academic Learning Compacts	Include a copy of the approved or proposed Academic Learning Compacts for the program	Not Applicable	X		
D	Letters of Support or MOU from Other Academic Units	Required only for programs offered in collaboration with multiple academic units within the institution	Forthcoming	X	X	X
E	Faculty Curriculum Vitae		X	X	X	X
F	Common Prerequisite Request Form	This form should also be emailed directly to the BOG Director of Articulation prior to submitting the program proposal to the Board office for review.	Not Applicable	X		
G	Request for Exemption to the 120 Credit Hour Requirement	Required only for baccalaureate degree programs seeking approval to exceed the 120 credit hour requirement	Not Applicable	X		
H	Request for Limited Access Status	Required only for baccalaureate degree programs seeking approval for limited access status	Not Applicable	X		

Table 2. Additional Appendices

Appendix	Appendix Title	Description
I	FAMU Provost Letter to FSU	Letter of Support for FSU MS&E

APPENDIX A

TABLE 1-B

PROJECTED HEADCOUNT FROM POTENTIAL SOURCES

(Graduate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1 HC	Year 1 FTE	Year 2 HC	Year 2 FTE	Year 3 HC	Year 3 FTE	Year 4 HC	Year 4 FTE	Year 5 HC	Year 5 FTE
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	0	0	0	0	0	0	0	0	0	0
Students who transfer from other graduate programs within the university**	0	0	0	0	0	0	0	0	0	0
Individuals who have recently graduated from preceding degree programs at this university	2	2	2	2	2	2	2	2	2	2
Individuals who graduated from preceding degree programs at other Florida public universities	0	0	0	0	1	1	1	1	1	1
Individuals who graduated from preceding degree programs at non-public Florida institutions	0	0	0	0	0	0	0	0	0	0
Additional in-state residents***	0	0	0	0	0	0	0	0	0	0
Additional out-of-state residents***	0	0	0	0	0	0	1	1	1	1
Additional foreign residents***	0	0	0	0	0	0	0	0	1	1
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
Totals	**2**	**2**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**

* List projected annual headcount of students enrolled in the degree program. List projected yearly cumulative ENROLLMENTS instead of admissions.

** If numbers appear in this category, they should go DOWN in later years.

*** Do not include individuals counted in any PRIOR category in a given COLUMN.

APPENDIX A

Table 2

Anticipated Faculty Participation

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Jamel Ali, Ph.D. Chemical and Biomedical Engineering	Assistant Professor	Tenure-earning	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Natalie Arnett, Ph.D. Chemical and Biomedical Engineering and Chemistry	Associate Professor	Tenure-earning	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Tarik Dickens, Ph.D. Industrial and Manufacturing Engineering	Associate Professor	Tenured	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Lewis Johnson, Ph.D. Physics	Professor	Tenured	Fall 2023	12	1.00	0.05	0.05	12	1.00	0.05	0.05
A	Shyam Kattel, Ph.D. Physics	Assistant Professor	Tenure-earning	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Subramanian Ramakrishnan Chemical and Biomedical Engineering	Professor	Tenured	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Keerthi Senvirathne Physics	Professor	Tenured	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Komalavalli Thirunavukkuarasu Physics	Associate Professor	Tenure-earning	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
D	Charles Weatherford Physics	Professor	Tenured	Fall 2023	12	1.00	0.05	0.05	12	1.00	0.05	0.05
	Total Person-Years (PY)							**0.38**				**0.38**

Faculty Code	Code Description	Source of Funding	PY Workload by Budget Classification Year 1		Year 5
A	Existing faculty on a regular line	Current Education & General Revenue	0.33		0.33
B	New faculty to be hired on a vacant line	Current Education & General Revenue	0.00		0.00

APPENDIX A

Table 2

Anticipated Faculty Participation

C	New faculty to be hired on a new line	New Education & General Revenue	0.00		0.00
D	Existing faculty hired on contracts/grants	Contracts/Grants	0.05		0.05
E	New faculty to be hired on contracts/grants	Contracts/Grants	0.00		0.00
F	Existing faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
G	New faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
H	Existing or new faculty teaching outside of regular/tenure-track line course load	Enterprise Auxiliary Funds	0.00		0.00
		Overall Totals for	**0.38**		**0.38**

APPENDIX A

TABLE 3A

EROLLMENT AND GROWTH

PROJECTED COSTS AND FUNDING SOURCES

Institutions should not edit the categories or budget lines in the table below. This table is specific to state-funded (E&G) programs, and institutions are expected to explain all costs and funding sources in Section VII.A. of the proposal. Detailed definitions for each funding category are located at the bottom of the table.

Budget Line Item	Reallocated Base* (E&G) Year 1	Enrollment Growth (E&G) Year 1	New Recurring (E&G) Year 1	New Non-Recurring (E&G) Year 1	Contracts & Grants (C&G) Year 1	Philanthropy/ Endowments Year 1	Other Funding Year 1 - Please Explain in Section VII.A. of the Proposal	**Subtotal Year 1**	Continuing Base** (E&G) Year 5	New Enrollment Growth (E&G) Year 5	Other*** (E&G) Year 5	Contracts & Grants (C&G) Year 5	Philanthropy/ Endowments Year 5	Other Funding Year 5 - Please Explain in Section VII.A. of the Proposal	**Subtotal Year 5**
Salaries and Benefits (Faculty)	40,647	0	0	0	9,585	0	0	**$50,232**	40,647	0	0	9,585	0	0	**$50,232**
Salaries and Benefits (A&P and USPS)	0	0	0	0	0	0	0	**$0**	0	0	0	0	0	0	**$0**
OPS (including assistantships & fellowships)	0	0	0	0	40,000	0	0	**$40,000**	0	0	0	100,000	0	0	**$100,000**
Programmatic Expenses****	0	0	0	0	0	0	0	**$0**	0	0	0	0	0	0	**$0**
Total Costs	**$40,647**	**$0**	**$0**	**$0**	**$49,585**	**$0**	**$0**	**$90,232**	**$40,647**	**$0**	**$0**	**$109,585**	**$0**	**$0**	**$150,232**

*Identify reallocation sources in Table 4.

**Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "new recurring") from Years 1-4 that continue into Year 5.

***Identify if non-recurring.

****include library costs, expenses, OCO, special categories, etc.

Faculty and Staff Summary

Total Positions	Year 1	Year 5
Faculty (person-years)	0.38	0.38
FTE (A&P and USPS)	0	0

Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	$40,647	$40,647
Annual Student FTE	2	5
E&G Cost per FTE	20323.43125	8129.4

Table 3 Column Explanations

Reallocated Base* (E&G)	1	E&G funds that are already available in the university's budget and will be reallocated to support the new program. Please include these funds in the Table 4 – Anticipated reallocation of E&G funds and indicate their source.
Enrollment Growth (E&G)	2	Additional E&G funds allocated from the "Student and Other fees Tust Fund" contingent on enrollment increases.
New Recurring (E&G)	3	Recurring funds appropriated by the Legislature to support implementation of the program.
New Non-Recurring (E&G)	4	Non-recurring funds appropriated by the Legislature to support implementation of the program. Please provide an explanation of the source of these funds in the budget section (section VII.A.) of the proposal. These funds can include initial investments, such as infrastructure.
Contracts & Grants (C&G)	5	Contracts and grants funding available for the program.
Philanthropy Endowments	6	Funds provided through the foundation or other Direct Support Organizations (DSO) to support the program.
Continuing Base** (E&G)	7	Includes the sum of columns 1, 2, and 3 over time.
New Enrollment Growth (E&G)	8	See explanation provided for column 2.
Other*** (E&G)	9	These are specific funds provided by the Legislature to support implementation of the program.
Contracts & Grants (C&G)	10	See explanation provided for column 5.
Philanthropy Endowments	11	See explanation provided for column 6.
Other Funding	12	Any funding sources not already covered in any other column of the table. Please provide an explanation for any funds listed in these columns in the narrative for Section VII.A. of the proposal.

APPENDIX A

TABLE 4

ANTICIPATED REALLOCATION OF EDUCATION GENERAL FUNDS*

Program and/or E&G account from which current funds will be reallocated during Year 1	Base before reallocation	Amount to be reallocated	Base after reallocation
FAMU-FSU College of Engineering	1,034,205	22,691	**$1,011,514**
College of Science and Technology	10,500,000	27,541	**$10,472,459**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
Totals	$11,534,205	$50,232	**$11,483,973**

*** If not reallocating E&G funds, please submit a zeroed Table 4**

EXTERNAL REVIEWER REPORT

MATERIALS SCIENCE AND ENGINEERING QER

October 4-5, 2018

Dr. William H. Warnes, Oregon State University

INTRODUCTORY COMMENTS

The following report summarizes the two day external review of the Materials Science and Engineering (MS&E) Graduate Program at Florida State University. The review was conducted by Dr. William Warnes on October 4 and 5, 2018 as part of the FSU Quality Enhancement Review process.

It is important to know from the outset that the MS&E graduate degree program is unusual in the following ways:

1) It is a graduate program without a correlated department. As such, the program holds no faculty appointments and has no control over courses. All affiliated faculty have tenure homes in member departments, not in the MS&E program;
2) The interdisciplinary program is the only graduate degree under the FSU Graduate School, with the Director reporting directly to the Graduate Dean;
3) The students matriculating in the MS&E program conduct their thesis research under the guidance of faculty advisors in the member departments, and thus are performing research essential to the productivity of the departmental tenure home of their faculty advisor, in spite of earning a degree in MS&E.

These features distinguish the interdisciplinary graduate degree program from most other discipline specific degrees at the University. They provide both desirable features for the students and faculty in the program, as well as opportunities and difficulties for administration within the "normal" University structure.

This non-departmental structure is fairly common across the U.S. for interdisciplinary programs within the Science and Engineering arena (N.B. programs such as Materials Science and Bioengineering are often in this circumstance), and most other Universities struggle with the best way to support such programs.

This review report focuses primarily on the PhD program, since the MS degree has been strongly de-emphasized by the MS&E program and faculty since the establishment of the PhD program in 2011.

CURRICULUM

Strengths: Well designed and flexible curriculum; good use of weekly seminar; excellent first-year research rotation

Weaknesses: Core course content is not under control of MS&E program

The current curriculum was established at the formation of the program (2008) and consists of three required core courses, one elective core course (chosen from a limited list of six graduate courses), and 4 (for the M.S.) or 5 (for the Ph.D.) elective courses chosen from a larger list of graduate courses.

The design of the curriculum is good, and consistent with the national and international norms for MS&E. The flexibility demonstrated in the elective courses provides significant opportunity for the student and faculty advisor to fine-tune the course of study for the individual student. This provides the best instructional support for the thesis research and the student interests, and is a significant strength of the program.

Two more strengths of the curriculum are the weekly seminar and the first-year fellowship research rotation program. The seminar is required each semester (0 credits) and is well attended by the students. It clearly provides good exposure to the interdisciplinary topics, allows for social interaction and community building among the students (who can become spread out through the various member departments), gives a platform for practice of professional presentation skills in a safe and supportive environment, and maintains contacts among the students for access to research labs and capabilities across campus. The research rotation allows each student opportunities to sample several research areas before settling on a faculty advisor and thesis area. It also gives faculty a chance to "try out" a student for a ten-week period before committing to on-going support through research contracts or as a teaching assistant. The rotation requires a considerable amount of effort to manage but has significant benefits for both the student and the faculty.

The required courses are those needed for a graduate degree in MS&E. A significant difficulty for the program is that none of the courses in the curriculum are under the direct control of the program. Each course, including the required core courses, is offered by member departments. The difficulty arises when the course content is changed to support the needs of the offering department rather than containing the content needed by MS&E students. This is clearly a problem, and was raised as a concern by both students and faculty during the review.

An illustrative example of this is the required core course *Materials Thermodynamics and Kinetics* (ECH5934), offered by the Chemical Engineering Department. Sometime within the past two years, Chemical Engineering decided to change the topic coverage of the course to focus on thermodynamics of chemical processing systems (rather than solid systems) and reduce kinetics coverage to only a few lectures. (N.B. the current course description is "a detailed study of some topic of special interest to chemical engineers".) This has left the MS&E students without a graduate exposure to either materials thermodynamics or kinetics (time dependent processes), which are critical topics for an MS&E graduate.

Several other examples of the difficulties in the MS&E curriculum without program control over course content are described in the MS&E self-study report.

Possible Solutions for Weaknesses: Assigning three courses each year to the MS&E program to "buy-out" the teaching of faculty from their departmental teaching responsibilities would

allow the MS&E program to regain control over the course content in the most critical courses. This could be a re-assignment of teaching resources from departments, or a new budget item supported through the Graduate School. These courses ***must be taught*** even though the current numbers of students who are required to enroll in them will initially be small (5-8 new MS&E students each year.)

STUDENTS

Strengths: Good numbers of applications; high quality students admitted to program; strong positive student view of program and faculty; strong sense of community among students
Weaknesses: Unpredictability of elective course offerings is a concern for some students; large variation in opportunities for teaching assistantships

In the interviews with the MS&E graduate students (more than 15 students over the two days) it was clear that the students have strongly positive experiences with the faculty, the other graduate students in the program, and the overall design of the graduate curriculum. Of particular importance to the students was the accessibility and openness of the faculty, the support for and access to research equipment needed for thesis work (across the University), the flexibility of the graduate curriculum, and especially the value of the first-year research rotation.

Of specific concern to the students was the content of the required core courses, as mentioned in the curriculum section above. The uncertainty of the timing of elective course offerings made it difficult for some students to do longer range planning. As well, several students indicated that they were unclear about the graduation requirements and timelines for filing university paperwork. In part this last concern is due to the differences in requirements between the MS&E program and the requirements of the home departments of the faculty advisor. Most students felt that the timeline/requirements were not issues because there was someone they could go to with questions (either the Director or Judy Gardner, the staff person for the program) and get quick definitive answers.

A point of anxiety for some students is the process of obtaining support from a faculty member after the first-year fellowship concludes. Several students commented that some faculty are reluctant to commit to research assistant support, and some faculty are forbidden to offer MS&E students teaching assistant support. These concerns expressed by the students were validated during discussions with faculty. Faculty in some member departments are strongly discouraged from supporting MS&E students on research appointments since these degrees "will not count" toward the productivity of the department (and may not be accepted as faculty productivity for those going through promotion and tenure.) In addition, some departments restrict available teaching assistant support to students with a degree in the departmental program. This limitation on teaching assistantships leave the faculty member completely reliant on research support for MS&E students and prevents the use of teaching assistantships as a "safety net" when there is a lapse in research funding. The lack of a safety net for the MS&E students strongly biases some faculty against supporting an MS&E student. The departments of Chemistry, Physics, and Industrial Engineering were identified by both students and faculty in this context. Issues such as this are common among interdisciplinary graduate programs nationwide. Lacking a home department, it is difficult for programs such as these to operate and

prosper within the rigid structures and rules that govern the promotion/tenure and budgeting processes.

As a side note, discussions with faculty revealed that support levels for graduate students are quite variable across the member departments. Individual departments seem to have different levels of support from one another, and there are differences in how support is determined. The graduate students did not express concern over the support levels or the variation between them, indicating that the support is reasonable in comparison with the cost of living in Tallahassee. If this variability continues and the program grows in size, students will become aware of the differences in support among departments, which could affect their decisions about what research to pursue for the thesis.

Review of the graduation times and the degree process shows that students are graduating within reasonable times (4.6 years on average), and the qualifier and preliminary exam process provides good feedback for both students and faculty on student degree progress and expectations.

Reviewing the application and matriculation data it is apparent that the program attracts a good variety of high quality applicants from both domestic and international sources. The small number of admissions each year (7 average) allows for a very selective process, and the first-year fellowships provide an excellent incentive to attract students to the program. The program could admit more students easily if more fellowship support were available. The current student body is diverse in gender (~40% female), and country of origin (~70% nonresident alien). Domestic ethnic diversity could be better (100% white), but is limited by the application pool (74% white) and admitted students who choose to matriculate to the program.

Post-graduation placement data is very good, with nearly 100% placement of students in National Laboratories, private companies, or university positions.

Possible Solutions for Weaknesses: Providing some University level guidance on the use of graduate teaching assistantships could help make the process more uniform among member departments. Allowing any graduate student with the appropriate background to apply to be a teaching assistant, regardless of their proposed major, would provide a more equitable platform for providing teaching assistantship opportunities, especially within interdisciplinary programs such as MS&E. Creating a safety-net fund for faculty with MS&E students on research appointments who lose funding, would significantly improve the confidence of the faculty to appoint MS&E students, even when their home department will not provide teaching assistantships to these students.

FACULTY

Strengths: High quality affiliated faculty with positive international reputations, good external rewards, research support, and publication profiles; cluster hire in materials science (early 2010's)

Weaknesses: There are no faculty appointments dedicated to MS&E

Faculty affiliated with the MS&E program are of high quality, with good international reputations, strong records of research funding and scholarly publications. Because the MS&E program does not have an academic departmental home, there are no faculty (other than the

part-time Director) who are part of the MS&E program. There is no direct control of faculty lines in the budget for hiring within MS&E. Therefore, the program relies on the generosity of member departments to hire faculty with a focus on materials research.

In the early 2010's, FSU set out to intentionally hire a group of faculty with a specific focus on materials related research. These faculty, about 14 faculty at present, have provided a strong basis for the establishment of the PhD program, and have their tenure homes in a variety of MS&E member departments (Physics, Chemistry, Chemical Engineering, Scientific Computing, Industrial Engineering, and Mechanical Engineering.) These recent hires constitute about half of the affiliated faculty for the MS&E program.

Because all faculty have tenure homes in specific departments, there is no mandated commitment to the MS&E graduate program beyond personal interest from individual faculty. This weakens the ability of faculty to support MS&E (especially new un-tenured faculty) with specialized coursework or graduate student financial support. While volunteerism among the faculty has been partially successful so far, future materials related hires of faculty will not strengthen the MS&E program without addressing the disconnect between MS&E program responsibilities and departmental responsibilities. Hiring faculty with the expectation of being part of the MS&E program and then not enabling their participation through graduate student support and teaching assignments is unfair to the incoming faculty hired as part of a materials science initiative. If it continues it will weaken the program and eventually lead to its failure.

Possible Solutions for Weaknesses: Faculty hired through University initiatives in support of materials related research could have a portion of their FTE clearly assigned to support the MS&E program. This could take the form of a teaching assignment in the MS&E core or service related to administration of the MS&E program. The reassignment of faculty FTE could be extended to all MS&E affiliated faculty, but especially to those recent materials focused hires (since 2010.)

RESOURCES

Strengths: Unique research strengths in the National High Magnetic Field Lab, High Performance Materials Institute, and the Applied Superconductivity Center; excellent laboratory facilities; good access to labs by students; first-year fellowships for research rotations

Weaknesses: There is no direct source of financial support; administrative support is low if program growth is desired

The MS&E program enjoys good support from university level instructional and research facilities and technologies. Of particular note are the world-class laboratories in the National High Magnetic Field Lab, HPMI, and ASC. All of these facilities provide great visibility to FSU and are attractive to both potential students and faculty members. Several MS&E students related that they chose to come to FSU primarily because of the presence of these lab facilities and their associated faculty.

Students are pleased with the level of IT support that they have in their offices and labs. All MS&E students have access to personal desk and office space, usually in shared rooms near their research laboratories, throughout their degree work. They are also enthusiastic about the

level of technician support for critical research infrastructure and equipment. Students also described a strong culture of shared access to research equipment and a positive collaborative experience in research, both key attributes of a successful interdisciplinary program.

Students were asked specific questions about access to library resources needed for classes and research. The response was very positive with everyone reporting that they had access to all the journal literature they needed, and that the library spaces were great for studying and meeting in small study groups.

Because the MS&E program does not have an academic departmental home, there are no direct sources of funding for the program through normal University routes; there are no faculty FTE assigned to MS&E, there are no student credit hours produced by courses taught by MS&E (other than research and thesis credits), there are no graduate teaching assistantships assigned to MS&E. The financial support for operating the program derives from 6 graduate fellowships/year for the first year research rotation (provided through the Graduate Dean), and the part-time support for the Director and Graduate Coordinator. With no other sources of revenue, the program is completely dependent on supportive agreements with individual administrators. This is not unusual for interdisciplinary programs, but does leave the program vulnerable to changes in University personnel to a greater extent than would be normal for a departmental degree program.

The current administrative resources include a part-time Director (2 weeks/year) and a part-time Graduate Coordinator (0.5 time.) Because the size of the program is small, this level of administrative support is probably about right. However, it will not be adequate if the program grows in size and scope. This is particularly important to track now that the Director is temporarily taking on additional administrative roles in the University. Increasing the number of students admitted to MS&E should be concurrent with an increase in administrative support.

One additional area that is chronically under-supported in many interdisciplinary programs is someone to keep the on-line information current and correct. Since this is often the first line of contact with potential students, as well as the first place current students look for answers to degree-related questions, it is important for the information to be constantly updated and accessible.

Possible Solutions for Weaknesses: There are no easy fixes for these weaknesses other than finding additional sources of funding for administration of the program.

OVERALL ANALYSIS

Details of the review of the program are discussed more fully in the sections above. A summary of the major strengths and weaknesses is shown in the table below.

PROGRAM STRENGTHS	PROGRAM WEAKNESSES
Curriculum	
Well designed, flexible	Core content not under program control
First-year rotation is excellent	
Students	
High quality admissions	Minimal support for teaching asst.
Good community among students	
Faculty	
High quality affiliated faculty	No faculty FTE dedicated to MS&E
Focused hiring in materials areas	
Resources	
High quality, high visibility labs (NHMFL, HPMI, ASC)	No direct financial support from University
Strong culture of shared equipment and lab resources	Growth limited by lack of administrative support

The overall analysis of the program is that Materials Science and Engineering is an active, successful graduate program with high quality faculty and students. It is highly productive in materials research and has provided significant visibility to Florida State University nationally and internationally. Unique laboratory facilities and aggressive faculty hiring have had a significant positive impact on the program. The size of the student body is small but has the opportunity for growth with additional investment from the University.

The current graduate curriculum is well designed, but is pedagogically unsound because of the lack of programmatic control over the core coursework. ***This is, in my opinion, the most important weakness that must be corrected quickly.***

The core curriculum issues are, in part, entwined with the lack of faculty FTE and direct budget support. This is a common difficulty with interdisciplinary programs, but must ultimately be addressed for continued success and growth of the program. While having more financial resources will certainly help, reassignment of current departmental resources to more specifically enable affiliated faculty to support the MS&E program can solve many of the resource issues within MS&E.

ADDITIONAL EXTERNAL REVIEWER COMMENTS/OBSERVATIONS

There are three additional issues that arose in discussions with various faculty and administrators that should be mentioned.

<u>Moving the MS&E Program into a Single College:</u> One way that universities try to make an interdisciplinary program “fit” within the existing College/Departmental structure is to move the program into a single College. Mentioned as a possibility during the review was the idea

that the MS&E program be moved from the University level (under the Graduate Dean) to the College of Engineering. The majority of the active affiliated faculty have tenure homes within the College of Engineering. This can be a successful approach if it enables more direct budgetary support for the program and provides additional control over critical aspects of the program. However, it also has the significant risk of alienating those affiliated faculty and departments outside the College of Engineering. This can significantly weaken the interdisciplinary focus of the program, curriculum, and research. The current association of MS&E with the Graduate School provides a non-disciplinary administrative home and could be maintained. If movement of the program into a single College would provide a pathway for more resources and curricular control then it should be considered. The limited university resources for the program at present (first year fellowships, Director and staff positions) should follow the program to wherever it finds an administrative home. The success of most interdisciplinary programs relies on the enthusiasm of the individuals who are in the administrative line, from the active faculty and director, through the deans and University. The current Director and Deans are very strong and key supporters of the program. Changes in personnel may point to a change in administrative home in order to provide continued support for the program, but that condition is not, in my opinion, facing the MS&E program at present.

Forming a MS&E Department: Another route for fitting interdisciplinary programs into the university structure is to develop the program into a new academic department. While this has the benefit of more easily fitting into the existing university structures, it is also expensive in terms of time commitment, financial resources, infrastructure, and staffing. Given the small size of the current MS&E program at Florida State, it is unlikely that forming a new department would be a viable option. It is noteworthy that several of the member departments already offer undergraduate specializations in materials related coursework. These materials options could be the progenitor of a future undergraduate degree offered through a new MS&E department. As the program grows, consideration of forming a department should be revisited.

MS&E in Five-Ten Years: The current MS&E program may continue as it is without additional changes to administration or direct support, but it will be limited to its current small size. Florida State would miss the opportunity to grow MS&E and allow it to become even more impactful. It is worth the effort to find a workable support path for MS&E as an exemplar for other interdisciplinary programs within the university. Interdisciplinarity will become increasingly important for the universities of the future, and spending the (time and financial) resources now to find a place for interdisciplinary programs within the university structure will pay big benefits in the future.

Florida Agricultural and Mechanical University
TALLAHASSEE, FLORIDA 32307-3200
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OFFICE OF THE PROVOST AND
VICE PRESIDENT FOR ACADEMIC AFFAIRS

March 1, 2011

Dr. Robert Bradley
Interim Provost
Florida State University
212 Westcott
Tallahassee, FL 32306

Dear Dr. Bradley:

Thank you for sharing with me a copy of Florida State University's (FSU) proposal for a PhD in Materials Science. Former Dean Chen and Dr. Eric Hellstrom have discussed the proposal with me.

Florida A&M University (FAMU) is supportive of this proposal to establish an interdisciplinary PhD program administered by the Graduate School at FSU. The proposed degree appears to provide opportunities to students in a field that is important to the State of Florida, and to have the potential for cooperation between our two institutions that would be mutually beneficial. FAMU faculty in the joint College of Engineering may participate, as appropriate, provided that their responsibilities pertaining to FAMU are not adversely affected. We do not want the initiation of this program by FSU to preclude FAMU from initiating its own MS and PhD degree programs in Materials Science in the future in niche areas that are not duplicative of FSU's research efforts. We would appreciate FSU's expression of support of FAMU, should we seek to implement MS and PhD degrees in Materials Science in the future, and your offer to collaborate on such an endeavor, thus making efficient use of the resources at the two universities.

Sincerely,

Cynthia Hughes Harris

Cynthia Hughes Harris, PhD
Provost and Vice President for Academic Affairs

Cc Dr. John Collier, Interim Dean FAMU-FSU College of Engineering
Dr. Eric Hellstrom

Vacancy Name: IRC109287

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Description

Job Title	**Characterization Postdoc**
Location	**Los Alamos, NM, US**
Organization Name	**MST-8/Materials Science in Radiation & Dynamics Extremes**
Minimum Salary	
Maximum Salary	

What You Will Do

MST-8 is seeking outstanding advanced microstructure characterization postdoc candidates for characterization and analysis related to metals deformation and failure processes. Characterization and analysis will include defect structures (dislocations, twins, transformed phases) and their dependence on evolving microstructures (grain size/morphology, grain orientation, boundary misorientation, phase structure, twin network, etc.). Samples may come from a variety of metal systems including hcp metals, alloys that deform by transformation induced plasticity, metallic laminates, and others. Techniques may include SEM, EBSD, TKD, (S)TEM, **and/or** high energy x-ray diffraction microscopy (HEDM). The successful candidate will work with a team of experimentalist and modelers to develop and validate models of deformation and failure.

What You Need

Minimum Job Requirements:

- Demonstrated knowledge of metals deformation behavior.
- Significant knowledge and experience with electron microscopy including (S)TEM, FIB, and SEM **OR**
- Significant knowledge and experience with HEDM experiments and analysis.

Education/Experience: A PhD in materials science, physics, chemistry, or a related engineering discipline completed within the last 5 years or soon to be completed.

Desired Qualifications:

- Significant knowledge and experience with electron microscopy including TEM, FIB, and SEM **AND** significant knowledge and experience with HEDM experiments and analysis
- Ability to obtain a Q clearance, which generally requires US citizenship.

Location: This position will be located in Los Alamos, NM.

COVID Vaccine:

The COVID vaccine is mandatory for all Laboratory employees, on-site contractors, and on-site subcontractors unless granted an accommodation under applicable state or federal law. This requirement will apply to those working on-site, those teleworking, and all new hires.

Note to Applicants: For technical questions related to this position contact Dr. Rodney J McCabe (rmccabe@lanl.gov). Candidates may be considered for a Director's Fellowship and outstanding candidates may be considered for the prestigious Marie Curie, Richard P. Feynman, J. Robert Oppenheimer, or Frederick Reines Fellowships.

Where You Will Work

Located in beautiful northern New Mexico, Los Alamos National Laboratory (LANL) is a multidisciplinary research institution engaged in strategic science on behalf of national security. Our generous benefits package includes:

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- Free basic life and disability insurance
- Paid childbirth and parental leave
- Award-winning 401(k) (6% matching plus 3.5% annually)
- Learning opportunities and tuition assistance
- Flexible schedules and time off (paid sick, vacation, and holidays)
- Onsite gyms and wellness programs
- Extensive relocation packages (outside a 50 mile radius)

Additional Details

Directive 206.2 - Employment with Triad requires a favorable decision by NNSA indicating employee is suitable under NNSA Supplemental Directive 206.2. Please note that this requirement applies only to citizens of the United States. Foreign nationals are subject to a similar requirement under DOE Order 142.3A.

Position does not require a security clearance. Selected candidates will be subject to drug testing and other pre-employment background checks.

New-Employment Drug Test: The Laboratory requires successful applicants to complete a new-employment drug test and maintains a substance abuse policy that includes random drug testing.

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Employment Status	**Full Time**
Appointment Type	**Postdoc** Postdoc

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Job: Postdoctoral Fellow–High-Pressure Materials Synthesis

Posted on August 19, 2022 by Jeff Lightfield

Department: EPL – Earth and Planets Laboratory
Salary:
Location: Washington, D.C.

The Earth and Planets Laboratory (EPL), Carnegie Institution for Science, seeks applications for an experimental postdoctoral position focused on the synthesis and characterization of novel materials produced under high-pressure conditions. The position will involve the use of equipment including diamond anvil cells and large-volume presses (Paris-Edinburgh / multianvil) to synthesize novel materials with an emphasis on extended covalent frameworks, as well as physical properties characterization under both high-pressure and ambient conditions. The successful candidate will work closely in a team comprised of experimental and computational physicists, chemists, and materials scientists. Please refer questions to tstrobel@carnegiescience.edu.

Minimum qualifications: A PhD in physics, chemistry, materials science or a related field is the requirement for this position.

Desired qualifications: Expertise in solid-state physics/chemistry and characterization of optical and

electrical properties. Understanding of high-pressure techniques including laser-heated diamond anvil cells and/or large-volume press techniques is desirable. The successful candidate is expected to be able to work in both independent and collaborative group environments.

The initial appointment is for one year with the possibility for an additional year pending progress and availability of funds. The position is expected to be available starting fall 2022, and will remain open until filled. The position will be based at the Broad Branch Road campus of the Carnegie Institution for Science in Washington, DC. This is an FLSA Exempt position. Interested parties should send a cover letter, curriculum vitae (including publications), statement of research interests, and contact information for a minimum of three references.

Only complete applications submitted via this website will be considered.

At Carnegie, we are committed to building a diverse and inclusive community. We believe academic environments should be places where diverse groups of people with a variety of viewpoints and ideas can thrive and work together. As such, we encourage applicants from under-represented groups and backgrounds to apply. The Carnegie Institution is an equal opportunity employer. All qualified applicants will receive consideration for employment and will not be discriminated against on the basis of gender, race/ethnicity, protected veteran status, disability, or other protected group status.

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Applied Polymer Science - Aging and Lifetime Prediction - Postdoctoral Researcher

Livermore, CA, USA
Full-time
Job Code 1: PDS.1 Post-Dr Research Staff 1
Organization: Physical and Life Sciences
Category: Postdoctoral/Fellowship
Security Clearance: Anticipated DOE Q clearance (requires U.S. citizenship and a federal background investigation)
Pre-Employment Drug Test: Required for external applicant(s) selected for this position (includes testing for use of marijuana)
Pre-Placement Medical Exam: Not applicable
Position Type: Post Doctoral
Referral Bonus: Not applicable

Company Description

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Job Description

We have an opening for a **Postdoctoral Researcher** to conduct research in Applied Polymer Science with a focus on polymer aging, degradation, and service lifetime prediction for a diverse range of engineering polymers. You will actively participate in the research to evaluate, study, and quantify the effects of a range of stressors, including radiation, mechanical and thermal loads on the properties and long-term function of a range of polymer materials. Classes of polymer include but are not limited to silicone elastomers, polyolefins, Urethanes, and fluoropolymers. This position is in the Nanoscale Integration Science group of the Materials Science Division.

In this role you will

- Conduct research in polymer aging and lifetime prediction with a focus on kinetics and mechanisms of aging and degradation processes in complex, multiphase polymer systems

aging and degradation processes in complex, multiphase polymer systems.
- Develop and contribute to new experimental and theoretical models of polymer aging degradation and lifetime under a range of stress conditions.
- Design and perform studies in a laboratory setting that provide new understanding of the physical and chemical underpinnings of long-term polymeric aging phenomena.
- Contribute to and actively participate in the conception, design, and execution of research to address defined problems.
- Pursue independent but complementary research interests and interact with a broad spectrum of scientists internally and externally to the Laboratory.
- Collaborate with scientists in a multidisciplinary team environment to accomplish research goals.
- Document research; publish papers in peer-reviewed journals, and present results within the DOE community and at conferences.
- Perform other duties as assigned.

Qualifications

- Ability to secure and maintain a U.S. DOE Q-level security clearance which requires U.S. citizenship.
- PhD in Chemistry, Materials Science, Chemical Engineering, or a related field.
- Experience in polymer degradation, aging and characterization
- Knowledgeable of the concepts of polymerization, degradation kinetics and mechanisms
- Ability as an innovative experimentalist with a broad range of experience in experimental design, techniques, and execution.
- Experience with applications of thermal analysis rheological analysis, microscopy, spectroscopy, and spectrometry to characterize polymer structure and morphology.
- Ability to develop independent research projects through publication of peer-reviewed literature.
- Proficient verbal and written communication skills as reflected in effective presentations at seminars, meetings and/or teaching lectures.
- Initiative and interpersonal skills with desire and ability to work in a collaborative, multidisciplinary team environment.

Qualifications We Desire

- Experience with Polymer relaxometry.
- Experience in multiscale polymer modeling.
- Knowledge in applied kinetics including isoconversional analysis.

Additional Information

All your information will be kept confidential according to EEO guidelines.

Position Information

This is a Postdoctoral appointment with the possibility of extension to a maximum of three years. Eligible candidates are those who have been awarded a PhD at time of hire date.

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This position requires a Department of Energy (DOE) Q-level clearance. If you are selected, we will initiate a Federal background investigation to determine if you meet eligibility requirements for access to classified information or matter. In addition, all L or Q cleared employees are subject to random drug testing. Q-level clearance requires U.S. citizenship. For additional information, please see DOE Order 472.2.

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External applicant(s) selected for this position will be required to pass a post-offer, pre-employment drug test. This includes testing for use of marijuana as Federal Law applies to us as a Federal Contractor.

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LLNL invites you to review the Equal Employment Opportunity posters which include EEO is the Law and Pay Transparency Nondiscrimination Provision.

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Hardware

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Summary

Posted: **Oct 11, 2022**
Weekly Hours: **40**
Role Number:**200433832**

Why Apple?

At Apple we believe our products begin with our people. By hiring a diverse team we drive creative thought. By giving that team everything they need we drive innovation. By hiring incredible engineers we drive precision. And through our collaborative process we create memorable experiences for our customers.

These elements come together to make Apple an amazing environment for motivated people to do the greatest work of their lives.

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We have a talented team of people from a wide variety of backgrounds. We all work together in a beautiful customized lab where we design, engineer and develop the best softgoods products in the world.

If this sounds like an exciting challenge, we hope you will consider a place in our team!

What is the role?

We are seeking an enthusiastic engineer to drive material development in the areas of high performance polymers and composites. The position requires you to drive strategic development of next generation materials, engage in hands-on project-based work, and establish key material supplier relationships for advancing innovation in material sustainability.

We encourage anyone who is passionate about sustainability and the environment, building relationships, developing top technical talent, and approaching problem

that end, we are committed to professional development across all aspects of materials and communication, with mentorship and training opportunities both within and outside Apple.

Key Qualifications

- In-depth understanding of polymer science and materials structure/property/performance relationships
- Strong background in developing, characterizing and specifying polymer material for composites, performance coatings, adhesives and fibers applications in quantitative terms
- Expertise in statistical analysis and driving material development by establishing DoE methods
- Proven records in providing corrective action to solve complex problems and attention to details to ensure a successful product launch
- Effective in managing multiple projects to achieve rigorous standards and meet demanding schedules
- Proven track record in peer collaboration and teamwork
- Comfort working both independently and collaboratively on tight deadlines in a supportive environment
- Strong attention to detail and resolution to solve complex problems

Description

- Collaborate with industrial design, product design and manufacturing teams on material selection, design feasibility and manufacturing process development
- Scoping new sustainable technology/material scoping, including evaluation of supplier capabilities towards developing sustainable materials
- Creation of material specifications based on critical to quality attributes for product design - Utilize appropriate statistical and/or data analysis tools that translate these material critical attributes into repeatable and capable manufacturing process
- Establish and manage relationships with manufacturers/suppliers to identify emerging technologies and innovation in the area of material sustainability and circularity . Collaborate with them on the development of new technologies to meet Apple’s product roadmap needs

Education & Experience

- MS or PhD in Material Science & Engineering, Chemical Engineering, Polymer Science & Engineering or related fields
- 2-3+ years proven experience in material engineering preferred

Requirements

We carefully consider a wide range of compensation factors, including your background and experience. These considerations can cause your compensation to vary. Materials Engineer starts at a minimum annual salary $95,300. The actual pay may be higher depending on your skills, qualifications, and experience. Additionally, this role might be eligible for discretionary bonuses or commission payments as well as relocation. Every Apple employee also has the opportunity to become an Apple shareholder, because all team members are eligible for stock grants and also a discount when purchasing Apple stock.

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Materials Scientist

Job #: R-00095997
Location: Pittsburgh, PA
Category: Research Scientist
Schedule (FT/PT): Full Time
Travel Required: Yes, 10% of the time
Shift: Day
Potential for Telework: Yes, 10%
Clearance: None
Referral Eligibility (https://www.leidos.com/careers/erp): Ineligible
Group: Civil

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Description

Job Description:

Looking for an opportunity to make an impact?

The Leidos Research Support Team supporting the National Energy Technology Laboratory (NETL) is seeking a materials scientist to join our team in Pittsburgh, PA. This opportunity will allow side by side execution of research with world-class scientists and engineers using state of the art equipment to contribute to new areas of basic and applied research. The work will involve a multidisciplinary team, participation alongside other engineers, physicists, and data scientists to help develop next-generation tools aligned to the priorities of the DOE Fossil Energy and Carbon Management mission space. This position will allow for 15% telework and 5% travel may be expected for field test work and conference presentations.

NETL research is providing breakthroughs and discoveries that support home-grown energy initiatives, stimulate a growing economy, and improve the health, safety, and security of all Americans. Highly skilled women and men at NETL's three research sites – Albany (http://www.albanyresearchcenter.org/research.html), Oregon; Morgantown (https://www.youtube.com/watch?v=K_ZnyjwCwXA&list=PLQvqDqn4cuX_zZcj1VVXlkbPmvbOPX98W), West Virginia, and Pittsburgh (https://www.youtube.com/watch?v=ECyIs8hS73I&list=PLQvqDqn4cuX-o8wzbA1i-PCeV8xKkEMvR), Pennsylvania – conduct a broad range of research activities that support DOE's mission to advance the national, economic, and energy security of the United States.

If this sounds like the kind of environment where you can thrive, keep reading!

Primary Responsibilities:

- Design and develop gas and corrosion sensors for extreme environments (such as high pressure, high stress, water vapor, hydrogen, oxidation, corrosion, etc.) using various sensor platforms.
- Characterize synthesized sensor materials to optimize sensing performance and cost for implementation in current energy infrastructure.
- Collaborating with interdisciplinary team, including physicists and other science researchers to assist each other in accomplishing project-related tasks
- Building relationships with internal and external clients

- Creating and delivers oral and poster presentations of results
- Publications in high quality scientific peer-reviewed journals, presentations at national and international technical meetings.
- Development of new intellectual property based on the innovative research.
- Period status reporting and project reports (weekly/monthly/quarterly/annually) is required to update project managers and clients.
- This position will require extensive interface with clients and potential collaborative partners, so excellent verbal and written communication skills are required.

Basic Qualifications:

- Masters degree in science or engineering discipline (chemistry, material science, chemical engineering, etc.)
- 3+ years laboratory experience and a basic knowledge of metal thin film or nanoparticle synthesis using redox chemistry.
- Laboratory experience in characterization of synthesized materials including (UV-Vis spectroscopy, XPS, SEM, XRD).
- Significant contributions to authorship of posters/presentations at national conferences and/or peer-reviewed journal articles.
- Excellent oral and written communication skills.
- Candidates must meet NETL requirements for onsite access.

Preferred Qualifications:

- Ph. D. in science or engineering discipline. (chemistry, material science, chemical engineering, etc.)
- Laboratory experience using electrochemistry, solid-electrolyte interaction and electrolytic plating. Experience with electrochemical techniques such as potentiodynamic polarization, electrochemical impedance spectroscopy, and related data analysis.
- Laboratory experience safely using high pressure gas reactors for sample preparation and performance testing.
- First authorship of posters/presentations at national conferences and/or peer-reviewed journal articles

Program Specific Salary Range: $90K to $95K

Pay Range:

Pay Range $74,750.00 - $115,000.00 - $155,250.00
The Leidos pay range for this job level is a general guideline only and not a guarantee of compensation or salary. Additional factors considered in extending an offer include (but are not limited to) responsibilities of the job, education, experience, knowledge, skills, and abilities, as well as internal equity, alignment with market data, applicable bargaining agreement (if any), or other law.

Covid Guidance for the US

In order to enter Leidos facilities in the U.S. and to attend Leidos events outside our facilities, employees are required to be vaccinated for COVID-19 or maintain proof of a negative COVID-19 test within 96 hours of entry. In addition, we are receiving guidance from certain customers that onsite contractor personnel will need to be fully vaccinated to access customer facilities. If you are not vaccinated, please consider getting your COVID-19 vaccination as soon as possible. If you have any questions, please contact your Talent Acquisition POC.

About Leidos

Leidos (http://www.leidos.com)is a Fortune 500® technology, engineering, and science solutions and services leader working to solve the world's toughest challenges in the defense, intelligence, civil, and health markets. The company's 44,000 employees support vital missions for government and commercial customers. Headquartered in Reston, Virginia, Leidos reported annual revenues of approximately $13.7 billion for the fiscal year ended December 31, 2021. For more information, visit www.Leidos.com (http://www.Leidos.com).

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Beware of fake employment opportunities using Leidos' name. Leidos will never ask you to provide payment-related information during any part of the employment application process (i.e., ask you for money), nor will Leidos ever advance money as part of the hiring process (i.e., send you a check or money order before doing any work). Further, Leidos will only communicate with you through emails that are generated by the Leidos.com automated system – never from free commercial services (e.g., Gmail, Yahoo, Hotmail) or via WhatsApp, Telegram, etc. If you received an email purporting to be from Leidos that asks for payment-related information or any other personal information (e.g., about you or your previous employer), and you are concerned about its legitimacy, please make us aware immediately by emailing us at corp_security@leidos.com (mailto:corp_security@leidos.com?subject=Suspected%20careers%20fraud).

If you believe you are the victim of a scam, contact your local law enforcement and report the incident to the U.S. Federal Trade Commission (https://reportfraud.ftc.gov/#/).

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All qualified applicants will receive consideration for employment without regard to sex, race, ethnicity,

age, national origin, citizenship, religion, physical or mental disability, medical condition, genetic information, pregnancy, family structure, marital status, ancestry, domestic partner status, sexual orientation, gender identity or expression, veteran or military status, or any other basis prohibited by law. Leidos will also consider for employment qualified applicants with criminal histories consistent with relevant laws.

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Proj and Prog Management

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None
Administrative

Senior Transmission Line Engineer (https://careers.leidos.com/jobs/10767020-senior-transmission-line-engineer)

Pittsburgh, PA
None
Civil Engineering

Geomicrobiologist (https://careers.leidos.com/jobs/10685699-geomicrobiologist)

Pittsburgh, PA
None
Research Scientist

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Postdoctoral Scholar Employee

Bay Area, California, United States

Postdoctoral Fellow | ED-Energy Storage & Distributed R | 94951

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Lawrence Berkeley National Lab's (LBNL) Energy Storage & Distributed Resources Division has an opening for a Postdoctoral Scholar Employee to join the team.
In this exciting role, you will work with a world-class team from industry, academia, and national laboratories to understand, characterize and optimize structure-processing-function relationships of a broad class of ion-exchange membranes and interfaces as part of the Hydrogen and Fuel-cell program at Lawrence Berkeley National Laboratory. This will include advanced electrochemical diagnostics of the polymeric separators, solid-polymer electrolytes, and thin-films as well as their in-situ and operando structural characterization to ascertain the relevant multiscale properties, establish structure-property maps and provide guidance and concepts to mitigate any observed bottlenecks by means of materials design or device straggles. Such analyses may include modeling of the polymer properties and various physics occurring in these material systems. You will interact with the Energy Conversion Group, focused on understanding various phenomena in fuel-cells and electrolyzers with a particular emphasis on underlying fundamental processes occurring in ionomers and interfaces in a wide range of energy and environmental applications, as well as will complement the existing strengths in the hydrogen and fuel cell program in advanced material-level diagnostics, characterization, and analysis.

What You Will Do:

- Characterize structure-processing-property relationships in ion-conducting membranes and thin-films using advanced diagnostics for various energy conversion technologies, from fuel-cells to flow batteries and electrolyzers.
- Conceive and execute research that is novel and can lead to high impact.
- Develop in-situ structural and spectroscopic characterization techniques for functional soft matter.
- Work as part of a team to execute projects related to ion-exchange materials and electrochemical devices, and provide ideas, suggestions, and guidance to colleagues on material design, integration, characterization and modeling.
- Utilize and advance experimental techniques, for example, synchrotron-based X-ray scattering and spectroscopy, and other electrochemical characterization tools to probe structure and transport properties of ionic materials.
- Work on meeting milestones and reporting them to DOE.
- Publish original research in peer-reviewed journals; contribute to scientific publications; present research through talks and posters at conferences, workshops, and multi-investigator meetings.
- Collaborate and work with teams of researchers from diverse backgrounds, and interface with research teams from across industry, academia, and national laboratories.
- Uphold a culture of safety and promote diversity, equity, and inclusion, accountability.

Additional Responsibilities as needed:

- Participate in professional society activities.

- Work with the energy-conversion team in fuel-cell and electrolyzer diagnostics.
- Leverage the unique facilities at LBNL, including the Advanced Light Source and the Molecular Foundry, to conduct research on experimental characterization.
- Interact with the LBNL electrochemistry and polymer community (with extensive experience in fuel cells, electrolysis, material synthesis, theory and modeling, polymer characterization) to aid in relevant research activities.
- Work on development and/or implementation of custom stages multi-modal and in-situ/operando measurements.
- Ability to assemble and test fuel-cell and flow battery systems and perform diagnostics tests.

What is Required:

- PhD in chemical engineering, mechanical engineering, materials science or related field.
- Demonstrated experience in structure-property characterization of solid-polymer electrolytes and interfaces, ionomer membranes and thin-films.
- Proven experience in electrochemical characterization, membrane-property measurements, developing experimental setups and customizing environmental stages.
- Experience with polymer-physics and related characterizations such as spectroscopy and X-ray scattering.
- Hands-on experience working with polymer/ionomers, thin-film fabrication, electrochemical techniques (e.g., impedance), mechanical and chemical characterization techniques.
- Knowledge of, and experience with, thin-film fabrication and characterization, and familiarity with techniques such as ellipsometry, quartz-crystal microbalance, electrochemical impedance spectroscopy.
- Demonstrated ability to take initiative for tackling cross-disciplinary research problems from initiation to meaningful conclusion.
- Ability to learn rapidly and integrate new fields to demonstrate creative problem-solving skills.
- Ability and willingness to work in a team environment and collaborate with researchers from various backgrounds.
- Experience in bridging different fields, approaches, and/or novel techniques for solving materials problems.
- Strong publication record.
- Strong communication skills; written, visual and verbal.
- Data management and organization skills.

Desired Qualifications:

- Experience with hydrogen fuel cells and electrolyzers, and diagnostics methods.
- Knowledge of solid-polymer electrolytes, composites, mechanics, and polymer chemistry.
- Familiarity with data curation and visualization, statistics, and advanced data analysis.
- Knowledge and hands-on experience with nanofabrication.

Notes:

- This is a full-time, 1 year, postdoctoral appointment with the possibility of renewal based upon satisfactory job performance, continuing availability of funds and ongoing operational needs. You must have less than 4 years of paid postdoctoral experience. Salary for Postdoctoral positions depends on years of experience post-degree.
- This position is represented by a union for collective bargaining purposes.
- Salary will be predetermined based on postdoctoral step rates.
- This position may be subject to a background check. Any convictions will be evaluated to determine if they directly relate to the responsibilities and requirements of the position. Having a conviction history will not automatically disqualify an applicant from being considered for employment.
- Work will be primarily performed at Lawrence Berkeley National Lab, 1 Cyclotron Road, Berkeley, CA.

Based on University of California Policy - SARS-CoV-2 (COVID-19) Vaccination Program and U.S Federal Government requirements, Berkeley Lab requires that all members of our community obtain the COVID-19

vaccine as soon as they are eligible. As a condition of employment at Berkeley Lab, all Covered Individuals must Participate in the COVID-19 Vaccination Program by providing proof that vaccination requirements have been met or submitting a request for Exception or Deferral. Visit covid.lbl.gov for more information.

Berkeley Lab is committed to Inclusion, Diversity, Equity and Accountability (IDEA) and strives to continue building community with these shared values and commitments. Berkeley Lab is an Equal Opportunity and Affirmative Action Employer. We heartily welcome applications from women, minorities, veterans, and all who would contribute to the Lab's mission of leading scientific discovery, inclusion, and professionalism. In support of our diverse global community, all qualified applicants will be considered for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, age, or protected veteran status.

Equal Opportunity and IDEA Information Links:

Know your rights, click here for the supplement: Equal Employment Opportunity is the Law and the Pay Transparency Nondiscrimination Provision under 41 CFR 60-1.4.

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Equal Opportunity and IDEA Information Links:

Know your rights, click here for the supplement: "Equal Employment Opportunity is the Law." and the Pay Transparency Nondiscrimination Provision under 41 CFR 60-1.4.

The Lawrence Berkeley National Laboratory provides accommodation to otherwise qualified internal and external applicants who are disabled or become disabled and need assistance with the application process. Internal and external applicants that need such assistance may contact the Lawrence Berkeley National Laboratory to request accommodation by telephone at 510-486-7635, by email to eeoaa@lbl.gov or by U.S. mail at EEO/AA Office, One Cyclotron Road, MS90R-2121, Berkeley, CA 94720. These methods of contact have been put in place ONLY to be used by those internal and external applicants requesting accommodation.

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September 27, 2022

MEMORANDUM

TO: Dr. Maurice Edington
Provost & Vice President of Academic Affairs
Florida Agricultural and Mechanical University

FROM: Dr. Christy England
Vice Chancellor of Academic and Student Affairs

RE: Ph.D. in Materials Science and Engineering, CIP 40.1001

The initial review of the Ph.D. in Materials Science and Engineering, CIP 40.1001, has been completed. The following clarifications and revisions are required. Please note that a substantive delay in responding to these issues and/or failure to adequately address the issues in the initial response may delay the implementation of this program.

- In Section II.A. (pp. 4 – 5), please expand on how the doctoral program will meet each of the Board's 2025 System Strategic Plan's and FAMURising's goals identified in the proposal. There are also four mentions of the master's program in this section rather than the doctoral program.

- In addition to Florida State University's (FSU) existing doctoral program, please identify in Section II.B. (pp. 5 – 6) the strengths of Florida Agricultural and Mechanical University's (FAMU) chemistry and physics department that the program will build upon.

- Section III.A. (p. 11) notes program graduates will be prepared for jobs in high technology industries. Please provide additional details and documentation regarding the type of positions mentioned and the qualifications for these positions. These examples may include job announcements or letters from industry partners. These letters should describe an industry need for doctoral graduates with a materials science and engineering background, examples of positions that graduates may qualify for, and estimated salary ranges associated with those positions.

- Please revise the labor market demand tables in Section II.A. (p. 11) to accurately reflect recent employment projections from the Florida Department of Economic Opportunity. If data for an occupation is not available in the most

recent CIP-SOC crosswalk tool available in ARTS, use the file from a year prior for which the data is available.

- Since the CAVP ACG meeting on September 2, 2021, what conversations have occurred with the System and private institutions regarding the program? Have there been any discussions regarding the collaboration? Also, please identify ways this program differs from other Materials Sciences & Engineering programs in the System, including those under 14.1801. Also, please correct the proposal to state that the doctoral program was proposed at the CAVP ACG meeting rather than the master's program.

- In Section IV.G. (p. 28), please confirm that the chemistry and physics departments have sufficient space, laboratories, and faculty available to support the proposed program's shared courses and/or research.

- In Section V. B. (pp. 30 – 31), please summarize FSU's progress in implementing those recommendations provided by Dr. William H. Warnes, Oregon State University, on October 4 and 5, 2018, as part of the FSU Quality Enhancement Review process.

- In Section V.C. (p. 31), please expand on how employer-driven or industry-driven competencies were identified, specifically for non-academic research-related roles.

- In Section VI.A. (pp. 32 – 33) and Appendix A–Table 2, some faculty are listed as participating in the program before the program's implementation term. Please provide an explanation for the FTE and percent effort before the program's implementation. If faculty are not participating in the proposed program prior to the implementation term, please edit the proposal to reflect the correct program start date.

- In Section VI.B. (p. 33), the proposed program is incorrectly identified as the M.S. in Materials Science and Engineering.

- In Section VII.A. (p. 35), please explain the proposed program's contingency plan if the faculty could not secure the projected contract and grant (C&G) funds.

- In Section VII.B. (pp. 35 – 36), the proposal states that the total amount of reallocated funds for the proposed program is $50,232. The College of Science and Technology and the FAMU-FSU College of Engineering will reallocate $40,647. The remaining funds, $9,585, will come from C&G funds. Please confirm whether the $9,585 reallocated funds are from existing C&G funds awarded to faculty or if these are projected funds.

- Section VII.E (p. 36) notes that research assistantships will be major sources of support for master's thesis students. What will be the source of support for doctoral students? Additionally, please clarify the degree level at which assistantships are made available and if additional assistantships will be available through year five as headcounts increase.

- In Section VIII.A. (pp. 37 – 41), please confirm that the listed pertinent journals are available to students. Additionally, please note the edition year of the journals and the format in which they are made accessible.

- Please clarify if FAMU intends to hire additional faculty between years one and five based on estimated enrollments.

- In Section VIII.C. (pp. 42 – 43), please address whether students in the program who are not research or laboratory assistants will have access to the same equipment.

- Please correct the total calculations for columns Persons-Year Year 1 and 5 in Appendix A–Table 2. Please ensure this adjustment is consistent with Appendix A–Table 3A.

- Please complete the Rank and Contract Status columns in Appendix A-Table 2.

Please submit your response to this memo no later than **October 10, 2022.** Should you have questions, please contact Dr. Disraelly Cruz at (850) 245-9681 or Disraelly.Cruz@flbog.edu.

CE/evm

c: Dr. Sundra Kincey
Dr. Disraelly Cruz
Mrs. Erica Vander Meer

Florida Agricultural and Mechanical University
TALLAHASSEE, FLORIDA 32307-3100

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October 12, 2022

Dr. Christy England
Vice Chancellor of Academic and Student Affairs
Board of Governors
State University System of Florida

SUBJECT: FAMU Response for Ph.D. Materials Science and Engineering

---

Thank you for the review of Florida A&M University's proposal for a Ph.D. in Materials Science and Engineering. Please accept the following responses to the questions posed in your memorandum dated September 27, 2022.

In Section II.A. (pp. 4 – 5), please expand on how the doctoral program will meet each of the Board's 2025 System Strategic Plan's and FAMURising's goals identified in the proposal. There are also four mentions of the master's program in this section rather than the doctoral program.

The MS&E programs contributes directly to several of the State University System (SUS) Strategic Planning Goals in the 2025 System Strategic Plan. The specific areas in which the PhD in MS&E will impact or contribute are:

- Teaching and Learning
  - Strengthen Quality and Reputation of the Universities
  - Increase Degree Productivity & Program Efficiency
  - Increase the Number of Degrees Awarded in Programs of Strategic Emphasis
- Scholarship, Research and Innovation
  - Increase Research Activity and Attract More External Funding

The addition of a doctoral degree in Materials Science and Engineering will enhance teaching and learning at FAMU and within the Joint College of Engineering by developing doctoral students understanding of the theoretical foundations and practice of empirical research in materials science to promote transformative learning environments and promote deeper analysis and critical thinking, which can be used in the practice of rigorous research for both students and faculty. Building on existing faculty strengths, this type of program can further strengthen the quality and reputation of FAMU and the Joint College of Engineering by producing high-quality graduates in high-demand STEM areas and provide increased opportunities for empirical studies and research that lead to solving complex real-world solutions in the area of materials science and engineering. With the addition of this degree, faculty disciplines will be able to pursue grants from their research in areas such as, magnetic materials,

materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries. The proposed program will also increase degree productivity in areas of strategic emphasis, which is a goal for both the State University System and FAMU.

The MS&E program is also consistent with FAMU's mission. Florida Agricultural and Mechanical University (FAMU) is an 1890 land-grant institution dedicated to the advancement of knowledge, resolution of complex issues and the empowerment of citizens. FAMU's distinction as a doctoral/research institution will continue to provide mechanisms to address emerging issues through local and global partnerships. Expanding upon the University's land-grant status, it will enhance the lives of constituents through innovative research, engaging cooperative extension, and public service.

In direct support of its mission, the proposed MS&E programs align with FAMU's dedication to the "advancement of knowledge and resolution of complex issues". Materials engineers and materials scientists "plan and carry out complex research projects, such as the development of new products and testing methods" (BLS, 2021). According to the Bureau of Labor Statistics, "the number of scientific research projects that involve multiple disciplines is increasing, and it is common for materials scientists to work on teams with other scientists, such as biologists, physicists, computer specialists, and engineers". Each of these areas are aligned with degree programs in areas of strategic emphasis and are offered at both FAMU and FSU. Further, advances in materials science and engineering are steadily rising with the increase in building materials, human services, batteries, nanotechnology, etc. As these areas continue to emerge, graduates of FAMU's MS&E program will be equipped to handle complex problems utilizing creative thinking to address real world problems associated with the advances of materials science consistent with the mission.

Along with the Board of Governor's 2025 Strategic Plan and FAMU mission, the proposed MS&E program aligns well with FAMU's goal for High Impact Research, Commercialization, Outreach, and Extension Services. Specific to Strategic Priority 3 of FAMURising, the Ph.D. in MS&E will address the following goals:

- Goal 1: Expand and enhance cutting-edge research and creative scholarship for the benefit of the state of Florida, the nation, and the world.
- Goal 2: Increase research productivity, commercialization and return on investment.
- Goal 3: Increase the number of nationally recognized graduate programs.

Much of what is made in society is built from materials. A Ph.D. program in Materials Science and Engineering will add opportunities for FAMU and the Joint College faculty to engage in cutting-edge research to keep pace with constant changing societal needs for materials and provide an avenue to create new materials and enhance existing materials for the benefit of the nation as a whole. Faculty associated with the program are already active in research. The Ph.D. will serve to increase their research contributions to FAMU and the State of Florida, and train graduates who can also use advanced knowledge in positions that require advanced decision-making and skills necessary to implement effective solutions around the development and deployment of materials. Having a strong research-oriented doctoral program attracts increased numbers of students with diverse backgrounds, which is also aligned with FAMU's mission.

FAMU and FSU have faculty in STEM fields who will collaborate in the interdisciplinary MS&E Ph.D. program. At FAMU, faculty from engineering, physics, and chemistry will participate at the onset. As the program grows, additional faculty will join the program. As the MS&E Ph.D. program will help attract additional graduate students, greater contributions to the SUS Strategic Planning Goals and the FAMU

Strategic Plan are anticipated. Further, this program supports the FAMU and SUS missions of educating more diverse students in high-tech STEM fields to compete in the 21st century global economy.

In addition to Florida State University's (FSU) existing doctoral program, please identify in Section II.B. (pp. 5 – 6) the strengths of Florida Agricultural and Mechanical University's (FAMU) chemistry and physics department that the program will build upon.

FAMU-FSU College of Engineering ranks as the #2 doctoral-granting undergraduate engineering school in Florida by U.S. News and World Report. The College is also ranked #4 for graduate engineering among public schools in Florida. This is a testament of the strength of faculty from both FAMU and FSU who teach in the joint college. With the proposed MS&E degree, faculty members and their students will have access to appropriate lab space and shared facilities in the National High Magnetic Field Laboratory (NHMFL). Faculty also utilize and conduct research in the NSF-CREST grant space within the NHMFL and within the High-Performance Materials Institute (HPMI) in Innovation Park. In addition, space is being remodeled in FAMU's Centennial Research Building for a recent new hire doing materials related research. All these facilities (NHMFL, HPMI, and the Centennial Building) are adjacent to the FAMU-FSU College of Engineering.

FAMU has a strong record as a Top 100 producer of graduate degrees to minorities as evidenced in its rankings by Diverse Issues in Higher Education. In the 2019 publication of Diverse Issues, FAMU is ranked #28 for graduate degrees in engineering awarded to African Americans. Florida State University is ranked #98 in the production of engineering degrees awarded to Hispanics. Because the MS&E program will build on the academic strengths of both institutions and faculty teaching jointly in the FAMU-FSU College of Engineering, students will have increased exposure to diverse experiences to support high achievement in the classroom.

The proposed PhD program also builds on the strengths of researchers in the FAMU Chemistry and Physics departments. Their research includes the study of membranes for hydrogen fuel cells and water purification, photocatalysis for generating hydrogen, quantum control and machine learning in Materials Science, laser-matter interactions, study of the interplay of spin, charge, lattice, and orbital degrees of freedom in functional materials under extreme conditions, and computational design of materials for generating clean energy. Additionally, FAMU and FSU faculty within the joint College and departmental faculty collaborating in materials science conduct high-quality research leading to sustainable solutions for today's economy.

Section III.A. (p. 11) notes program graduates will be prepared for jobs in high technology industries. Please provide additional details and documentation regarding the type of positions mentioned and the qualifications for these positions. These examples may include job announcements or letters from industry partners. These letters should describe an industry need for doctoral graduates with a materials science and engineering background, examples of positions that graduates may qualify for, and estimated salary ranges associated with those positions.

The MS&E program director reached out to select companies to inquire about the possibility of hiring graduates from the Ph.D. in Materials Science and Engineering if approved. Based on responses from the companies, there is demand for doctoral-prepared graduates in MS&E. Salary outlook suggests that students will be paid well upon initial employment as recent Ph.D. graduates from the existing program at the joint college currently makes upwards of $110,000 per year with annual bonus of at seven percent.

Email 1

From: Charlie Sanabria <charlie@cfs.energy>
Date: Mon, 25 Oct 2021 08:28:36 -0400
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>

Hi Eric,
I am very glad to hear this. Here at CFS we take diversity and inclusion very seriously, and always make sure that our interview pool (for every single position) includes individuals from underrepresented minorities. We would be more than happy to see applications from FAMU students who earned an MS or PhD from the combined MS&E program. Their applications will be given a fair chance and when/if hired, they will be very welcome with open arms into the CFS family.

I'm Looking forward to it!

Cheers,
Charlie

Email 2
From: Daniel Brown <dbrown@x-energy.com>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: RE: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Wed, 27 Oct 2021 22:28:43 +0000

Hi Dr. Hellstrom,

I am writing to you let you know that as a hiring manager for X-energy, I would be interested in interviewing students graduating from the combined MS&E program from FAMU for potential employment. Please let me know if any additional information for the upcoming proposal.

As an update, I am still working for X-energy. In the last year I have been promoted to Program Manager, TRISO Fuel Fabrication. X-energy is an advanced nuclear reactor and fuel fabrication company. It manufactures fuel that seals uranium particles in a protective coating, which makes meltdown impossible and retains the waste inside forever. X-energy also designs plants that unlock the fuel's potential in a process that's as clean as wind or solar. When combined, the result is reliable carbon-free baseload power, produced more safely and affordably than ever before and available anywhere, at any time. My role involves leading a team of 6 R&D scientists to develop advanced nuclear fuel utilizing high temperature ceramic materials. We are currently performing R&D work to support nuclear reactors supplying power to the grid and space nuclear propulsion. I would also like to mention X-energy is rapidly growing and looking to hire high quality scientists and engineers. Within the next 5 years, the team in Oak Ridge, TN is expected to grow from 50 employees to approximately 350 employees. I am more than happy to speak with students graduating and interested in hearing more about our opportunities.

Regards,

Dan

Email 3

From: Jeremy Weiss <Jeremy.Weiss@Colorado.EDU>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: RE: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Wed, 27 Oct 2021 16:39:12 +0000

Hi Eric,

The inclusion of FAMU in the MSE program would not have any weight one way or the other on our decision to hire them. Including myself, ACT has already hired 4 people with FAMU-FSU COE degrees, two of which also hold degrees from the FSU MSE program. I'm sure we will continue to consider FSU and FSU/FAMU graduates in the future, and if you have any specific students that are excelling and about to graduate, please encourage them to send Danko an email, as we are still in need of a couple more good employees.

All the best,
-Jeremy

Email 4
From: Kang Yao <ky12@my.fsu.edu>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Wed, 27 Oct 2021 03:26:36 +0000
X-OrganizationHeadersPreserved: CO6P220MB0420.NAMP220.PROD.OUTLOOK.COM

Dear Dr. Hellstrom,

Great to hear from you and hear about news about MS&E.

As mentioned previously, I started a position with Enovix last November. I asked my manager and they said they would consider interviewing as long as the candidate is a good fit. Hope this answers your question!

Best regards,
Kang

Email 5
From: Omotola Ogunsolu <ooo13@my.fsu.edu>
To: "hellstrom@asc.magnet.fsu.edu" <hellstrom@asc.magnet.fsu.edu>
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Fri, 29 Oct 2021 05:12:56 +0000
X-OrganizationHeadersPreserved: PH0P220MB0570.NAMP220.PROD.OUTLOOK.COM

Hello Dr Hellstrom,
As already mentioned below, Intel will hire FAMU MS&E graduates.

Tola

Email 6

From: Yesusa Collantes Goicochea <ykc13@my.fsu.edu>
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
Date: Thu, 28 Oct 2021 05:15:23 +0000

Hello Eric

Intel is interested in hiring MSE program students. I can participate

Cheers

Yesusa

Email 7
From: Jesse Smithyman <jessesmithyman@gmail.com>
Date: Wed, 27 Oct 2021 07:27:04 -0700
Subject: Re: MS&E - proposal to include FAMU in existing FSU MS&E program
To: Eric Hellstrom <hellstrom@asc.magnet.fsu.edu>

Hi Eric,

I think this sounds like a great idea. In general, yes, Imprint Energy would be interested in interviewing FAMU/FSU MS&E students with relevant experiences.

Best,
Jesse

Additional job announcements seeking individuals trained at an advanced level in materials science and engineering are included within the appendices.

Please revise the labor market demand tables in Section II.A. (p. 11) to accurately reflect recent employment projections from the Florida Department of Economic Opportunity. If data for an occupation is not available in the most recent CIP-SOC crosswalk tool available in ARTS, use the file from a year prior for which the data is available.

Table 1 - Florida Department of Economic Opportunity

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	14.8%	643	Bachelor's	$137,550
Materials Engineers	11.7%	690	Bachelor's	$97,032
*Materials Scientists	Data Not Available	Data Not Available	Bachelors	$104,166
Engineering Teachers, Postsecondary	18%	1722	Doctorate	$104,996

**Occupational Employment Projections for SOC-Code 19-2032 (Materials Scientists) statewide data not available for 2020-2028 and 2021-2029 from FLDOE. Verified with BOG staff on October 13, 2022.*

Since the CAVP ACG meeting on September 2, 2021, what conversations have occurred with the System and private institutions regarding the program? Have there been any discussions regarding the collaboration? Also, please identify ways this program differs from other Materials Sciences & Engineering programs in the System, including those under 14.1801. Also, please correct the proposal to state that the doctoral program was proposed at the CAVP ACG meeting rather than the master's program.

Discussions to expand the program beyond the FAMU-FSU College of Engineering were had on the Main campus, which resulted in participation by FAMU chemistry and physics departments. Additional conversations within the system have yet to occur as the onboarding of the College's new dean occurred July 15, 2022. Presently, there are three doctoral programs in MS&E within the SUS with some overlap at FIU, UCF, and UF (excluding FSU). The uniqueness for the proposed program is that it will be on the strengths of FAMU and FSU faculty collaboratively in a single setting where students from both institutions will engage and learn from the experiences of faculty at two distinct institutions. Faculty and students will also have access to participate in ongoing and new research in the High-Performance Materials Institute, which focuses on advanced composites made with carbon fibers and carbon nanotubes. This institute, which is also located near the College of Engineering is the only one of its kind in Florida. The advanced studies done in this institute are defining the cutting edge of research on new composites for military and civilian applications.

In Section IV.G. (p. 28), please confirm that the chemistry and physics departments have sufficient space, laboratories, and faculty available to support the proposed program's shared courses and/or research.

The chemistry and physics departments have ample space within the classrooms and labs to accommodate enrollment of students from the MS&E programs. Each program typically has enrollment spaces for at least thirty students. Currently, capacity exists in each program for both courses and lab space. Program faculty within each department confirmed that they have space in their labs for additional students.

In Section V. B. (pp. 30 – 31), please summarize FSU's progress in implementing those recommendations provided by Dr. William H. Warnes, Oregon State University, on October 4 and 5, 2018, as part of the FSU Quality Enhancement Review process.

The FSU MS&E program, which the FAMU MS&E M.S. program will join, underwent an internal FSU Quality Enhancement Review (QER) in 2018. A summary of the reviewer's comments is provided below, and his full report is in the Appendix.

CURRICULUM

- *Strengths*: Well designed and flexible curriculum; good use of weekly seminar; excellent first-year research rotation
- *Weaknesses*: Core course content is not under control of MS&E program. With the movement of the MS&E programs to the FAMU-FSU College of Engineering, the program director and faculty have increased oversight of the program, including course offerings.

Progress towards addressing weakness: One course, Thermodynamics for Materials Science has been created specifically as a core course for MS&E. It is housed within the Department of Mechanical Engineering in the FAMU-FSU COE.

STUDENTS

- *Strengths*: Good numbers of applications; high quality students admitted to program; strong positive student view of program and faculty; strong sense of community among students
- *Weaknesses*: Unpredictability of elective course offerings is a concern for some students; large variation in opportunities for teaching assistantships

Progress towards addressing weakness: ***Elective courses:*** Scheduling when elective courses will be taught is outside the direct control of MS&E. MS&E now identifies the elective courses being offered across the departments associated with MS&E at the beginning of each enrollment period and informs students of available what electives. ***TA opportunities:*** MS&E does not have any TA positions. All TA positions are available through the student's faculty advisor's home department. MS&E now requires all its incoming students to take the TA teaching course and all international students to take the TOEFL.

FACULTY

- *Strengths*: High quality affiliated faculty with positive international reputations, good external rewards, research support, and publication profiles; cluster hire in materials science (early 2010's)
- *Weaknesses*: There are no faculty appointments dedicated to MS&E

Progress towards addressing weakness: MS&E is an interdisciplinary program, not a department, so it will not have its own faculty members. MS&E continues to try to have input in the individual departments' hiring process to inform prospective faculty members about the MS&E program.

RESOURCES

- *Strengths*: Unique research strengths in the National High Magnetic Field Lab, High Performance Materials Institute, and the Applied Superconductivity Center; excellent laboratory facilities; good access to labs by students; first-year fellowships for research rotations (Note: these fellowships are only for Ph.D. students)
- Weaknesses: There is no direct source of financial support; administrative support is low if program growth is desired. Dr. Eric Hellstrom serves as the program director for the both the master's and doctoral programs at FSU that now reside within the FAMU-FSU College of Engineering. He will continue in this role with the implementation of the program at FAMU

Progress towards addressing weakness: MS&E has direct financial support for first-year fellowships from FSU. Additional funding will be made available from FAMU for admitted doctoral students as well.

In Section V.C. (p. 31), please expand on how employer-driven or industry-driven competencies were identified, specifically for non-academic research-related roles.

Generally, students graduating with a Ph.D. in Materials Science and Engineering are primarily hired at a national laboratory or company because the organization is interested in the general research area the student studied while enrolled. As such, competencies for the FAMU MS&E program were developed based on a review of job postings for post-doctoral positions and recommendations provided by national laboratories, such as Lawrence Livermore National Laboratory. These types of companies are typically seeking graduates that help advance manufacturing processing of materials using cost-savings techniques. Because materials science is an interdisciplinary field, faculty reviewed curricula at different institutions to determine the types of courses that may be offered by collaborating units. In many cases, fundamental courses included in the curricula were related to structures, kinetics, properties, thermodynamics, and processing. Oftentimes, faculty expertise and student composition were the defining characteristics. The

proposed program's curriculum builds on both. It includes some of the foundation aspects common across many curricula as well unique areas of interests of faculty. As such, to attract more students and increase collaboration across the campus, chemistry and physics were added as significant components to build the curriculum to meet industry demand.

In Section VI.A. (pp. 32 – 33) and Appendix A–Table 2, some faculty are listed as participating in the program before the program's implementation term. Please provide an explanation for the FTE and percent effort before the program's implementation. If faculty are not participating in the proposed program prior to the implementation term, please edit the proposal to reflect the correct program start date.

The table below provides a list of faculty participating in the program and anticipated efforts for years one and five. For this proposal, only information for FAMU faculty is included as the program at FSU has been in existence for more than ten years. However, it should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating departments.

Faculty Code	Name	Highest Degree Held	Academic Discipline or Specialty	Program Start Date	Contract Status	Contract Length	Percent Effort
A	Ali, Jamel	Ph.D.	Chemical and Biomedical Engineering	Fall 2023	Tenure-earning	9-month	5%
A	Arnett, Natalie	Ph.D.	Chemical and Biomedical Engineering/ Chemistry	Fall 2023	Tenure-earning	9-month	5%
A	Dickens, Tarik	Ph.D.	Industrial and Manufacturing Engineering	Fall 2023	Tenured	9-month	5%
A	Johnson, Lewis	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%
A	Kattel, Shyam	Ph.D.	Physics	Fall 2023	Tenure-earning	9-month	5%
A	Ramakrishnan, Subramanian	Ph.D.	Chemical and Biomedical Engineering	Fall 2023	Tenured	9-month	5%
A	Senevirathne, Keerthi	Ph.D.	Chemistry	Fall 2023	Tenured	9-month	5%
A	Thirunavukkuarasu Komalavalli	Ph.D.	Physics	Fall 2023	Tenured	9-month	5%
A	Weatherford, Charles	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%

In Section VI.B. (p. 33), the proposed program is incorrectly identified as the M.S. in Materials Science and Engineering.

The correction has been made within the revised proposal.

In Section VII.A. (p. 35), please explain the proposed program's contingency plan if the faculty could not secure the projected contract and grant (C&G) funds.

Additional sources of support for graduate student funding will come from existing institutional monies dedicated for fellowships and teaching assistants. Such sources include the Dean's budget from the joint College, Title III dollars to support graduate students, and monies from the School of Graduate Studies generally used for graduate assistantships.

In Section VII.B. (pp. 35 – 36), the proposal states that the total amount of reallocated funds for the proposed program is $50,232. The College of Science and Technology and the FAMU-FSU College of Engineering will reallocate $40,647. The remaining funds, $9,585, will come from C&G funds. Please confirm whether the $9,585 reallocated funds are from existing C&G funds awarded to faculty or if these are projected funds.

The remaining $9,585 is reallocated funding from existing contracts and grants faculty salary dollars.

Section VII.E (p. 36) notes that research assistantships will be major sources of support for master's thesis students. What will be the source of support for doctoral students? Additionally, please clarify the degree level at which assistantships are made available and if additional assistantships will be available through year five as headcounts increase.

A major source of support for doctoral students is funds for research assistantships paid from faculty members' research grants. Faculty members associated with this proposal are successful raising research funds, which includes support for a graduate student to do research in the faculty member's lab. These grants pay the student's stipend and also pay for in-state tuition. Beyond individual faculty support, the program administrators and faculty will aid students seeking fellowships from organizations such as the Graduate Education for Minorities (GEM) Fellowship Program. In addition, federal Title III funds administered by FAMU will be available for graduate students in the MS&E program. All MS&E students will be eligible to be funded as research assistants from their advisor's research grants from the day they enter MS&E. The academic-year research assistantships planned as part of the initial implementation of the proposal is available to doctoral-level students. An increase in assistantships and fellowships is expected by year five of the program.

In Section VIII.A. (pp. 37 – 41), please confirm that the listed pertinent journals are available to students. Additionally, please note the edition year of the journals and the format in which they are made accessible.

FAMU's Dean of Libraries conducted a search of journals and research materials available to students enrolled in the MS&E. All materials are relevant and provide up-to-date content aligned with the proposed program. Within FAMU Libraries, journals are available to students in multiple formats, including hard-copy and electronic.

Please clarify if FAMU intends to hire additional faculty between years one and five based on estimated enrollments.

Support for the program is expected to increase in alignment with FAMU's strategic priorities for academic programs. A review of the program's budgetary needs as part of the growth of programs within the FAMU-FSU College of Engineering are held in accordance with FAMU's annual budgeting process, which typically begins with a discussion between the deans and provost.

In Section VIII.C. (pp. 42 – 43), please address whether students in the program who are not research or laboratory assistants will have access to the same equipment.

All students enrolled in the program will have access to materials and instructional materials to support teaching and learning. However, restrictions are placed on select equipment that may have been included as part of start-up packages for faculty and available only to students working in the lab as a dedicated research assistant.

Please correct the total calculations for columns Persons-Year Year 1 and 5 in Appendix A–Table 2. Please ensure this adjustment is consistent with Appendix A–Table 3A.

Faculty person years for Year 1 and Year 5 total 0.31.

Please complete the Rank and Contract Status columns in Appendix A-Table 2.

Updates have been made accordingly as shown in the table below.

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program
A	Jamel Ali, Ph.D. Chemical and Biomedical Engineering	Assistant Professor	Tenure-earning	Fall 2023
A	Natalie Arnett, Ph.D. Chemical and Biomedical Engineering and Chemistry	Associate Professor	Tenure-earning	Fall 2023
A	Tarik Dickens, Ph.D. Industrial and Manufacturing Engineering	Associate Professor	Tenured	Fall 2023
A	Lewis Johnson, Ph.D. Physics	Professor	Tenured	Fall 2023
A	Shyam Kattel, Ph.D. Physics	Assistant Professor	Tenure-earning	Fall 2023
A	Subramanian Ramakrishnan Chemical and Biomedical Engineering	Professor	Tenured	Fall 2023
A	Keerthi Senvirathne Physics	Associate Professor	Tenured	Fall 2023
A	Komalavalli Thirunavukkuarasu Physics	Associate Professor	Tenure-earning	Fall 2023
D	Charles Weatherford Physics	Professor	Tenured	Fall 2023