

### PROGRAM MODIFICATION PROPOSAL FORM

Name of Institution: **Clemson University**

Briefly state the nature of the proposed modification (e.g., adding a new concentration, extending the program to a new site, curriculum change, etc.): **We request extending our currently approved MS Mechanical Engineering program to the Campbell Graduate Engineering Center (CU-International Center for Automotive Research) instructional site in Greenville.**

Current Name of Program (include degree designation and all concentrations, options, and tracks):  
**MS Mechanical Engineering**

Proposed Name of Program (include degree designation and all concentrations, options, and tracks):  
**MS Mechanical Engineering [no change]**

Program Designation:

- |   |  |
|---|--|
| <input type="checkbox"/> Associate's Degree   | <input checked="" type="checkbox"/> Master's Degree                                  |
| <input type="checkbox"/> Bachelor's Degree: 4 Year  | <input type="checkbox"/> Specialist  |
| <input type="checkbox"/> Bachelor's Degree: 5 Year  | <input type="checkbox"/> Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA) |
| <input type="checkbox"/> Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.) |  |

Does the program currently qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes  
 No

If No, should the program be considered for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes  
 No

Proposed Date of Implementation: **15 August 2020**

CIP Code: **14.1901 [no change]**

Current delivery site(s) and modes: **Clemson University Main Campus (50104), Clemson University Restoration Institute (80401), Lowcountry Graduate Center (40149), Blended Distance Education (85500)**

Proposed delivery site(s) and modes: **Clemson University Main Campus (50104), Clemson University Restoration Institute (80401), Lowcountry Graduate Center (40149), Blended Distance Education (85500), Clemson Univ-Campbell Grad Engineer Ctr (CUICAR) (50116) [new]**

Program Contact Information (name, title, telephone number, and email address):

**Dr. Atul Kelkar; Mechanical Engineering Department Chair 864.656.5635; [atul@clemson.edu](mailto:atul@clemson.edu)**

**Dr. Jeremy King, Assoc Provost Instl Effectiveness; 864.934.3554; [jking2@clemson.edu](mailto:jking2@clemson.edu)**

**Dr. Christopher Kitchens, Assistant to the Dean for Academic Initiatives; 864.656.2131; [ckitche@clemson.edu](mailto:ckitche@clemson.edu)**

Institutional Approvals and Dates of Approval:

**Executive Vice President for Academic Affairs and Provost: 17 September 2019**

**Clemson University Board of Trustees: 11 October 2019**

### **Background Information**

*Provide a detailed description of the proposed modification, including target audience, centrality to institutional mission, and relation to strategic plan.*

The Clemson University College of Engineering, Computing and Applied Sciences (CECAS) will address industry demands, while leveraging its existing innovation campuses, by offering its extant approved MS Mechanical Engineering (MS ME) degree program at the Clemson University International Center for Automotive Research (CU-ICAR) in Greenville. The MS ME program is already approved for delivery at the Clemson University Restoration Institute (CURI) located in North Charleston. The Greenville location approval at CU-ICAR would complete our ability to leverage instruction across three sites that serve our innovation and workforce development partners and initiatives. The MS ME at CU-ICAR will target existing Clemson undergraduate students participating in a specialized advanced manufacturing undergraduate track. Offering this program at the CU-ICAR site will support Clemson University's *ClemsonForward* strategic plan by strengthening alliances with industry, growing the current MSME program, and leveraging Clemson's CU-ICAR innovation facilities and culture to provide specialized workforce development to key economic sectors.

### **Assessment of Need**

*Provide an assessment of the need for the program modification for the institution, the state, the region, and beyond, if applicable.*

Industry partners have expressed the need for an MS ME program to support South Carolina's advanced manufacturing industry. The Clemson University College of Engineering, Computing and Applied Sciences (CECAS) is developing an educational model focused on advanced manufacturing under the Clemson University Center for Advanced Manufacturing (CU-CAM). The first cohort of undergraduate mechanical engineering students pursuing the advanced manufacturing track at CUICAR started in the fall of 2019. The program allows students to complete their senior year at Clemson University International Center for Automotive Research (CU-ICAR), then pursue a combination BS,MS degrees in Mechanical Engineering should they choose. Offering the MS degree program at CUICAR expands the influence of CECAS graduate programs across multiple locations and is consistent with the University's land-grant mission.

### **Transfer and Articulation**

*Identify any special articulation agreements for the modified proposed program. Provide the articulation agreement or Memorandum of Agreement/Understanding.*

There are no articulation agreements for this program.

**Description of the Program**

<i>Projected Enrollment- Detailed Model</i>												
Year	Fall Headcount				Spring Headcount				Summer Headcount			
	New	Continuing	Lost	Graduate	New	Continuing	Lost	Graduate	New	Continuing	Lost	Graduate
2020-21	5	0	0	0	0	5	0	0	0	5	0	0
2021-22	15	5	2	0	0	18	0	0	0	18	0	0
2022-23	19	18	2	5	0	30	0	0	0	30	0	0
2023-24	19	30	2	13	0	34	0	0	0	34	0	0
2024-25	19	34	2	17	0	34	0	0	0	34	0	0

<b>Projected Enrollment</b>						
Year	Fall Headcount		Spring Headcount		Summer Headcount	
	New	Total	New	Total	New	Total
2020-2021	5	5	0	5	0	5
2021-2022	15	20	0	18	0	18
2022-2023	19	37	0	30	0	30
2024-2025	19	49	0	34	0	34
2025-2026	19	53	0	34	0	34

*Explain how the enrollment projections were calculated.*

Undergraduate Clemson students will be recruited from the BS Mechanical Engineering advanced manufacturing track. The BS program coordinator has surveyed current undergraduate students in the program estimate enrollment for the MS program at CUICAR. Based on the results, we estimate that approximately 50% of the UG students in this track will continue on for their MS at CUICAR in the long run, with a 2-3 year phased ramp up. The assumption is this will lead to an initial cohort of 5 students, all of whom persist to completion of their MS. Typical completion times of 2-2.5 years are assumed with modest attrition as estimated from our MS ME program at other sties. It is believed that new enrollments will grow by 10 students in Year 2, an additional 5 students in Year 3, and plateau thereafter. The projected model reaches a state of steady enrollment in Year 5.

### Curriculum

*Attach a curriculum sheet identifying the courses required for the program.*

A candidate for the Master of Science degree in Mechanical Engineering must satisfactorily complete an approved program of at least 30 graduate credit hours (24 hours of coursework and 6 hours of thesis research).

Students need to complete 3 core courses from the following list of courses.

- ME 8010 (Foundations of Fluid Mechanics)
- ME 8100 (Macroscopic Thermodynamics)
- ME 8180 (Intro to Finite Element Analysis)
- ME 8200 (Modern Control Engineering)
- ME 8290 (Energy Methods)
- ME 8310 (Convective Heat Transfer)
- ME 8370 (Theory of Elasticity)
- ME 8460 (Intermediate Dynamics)
- ME 8610 (Material Selection for Design)
- ME 8700 (Advanced Design Methods)

The thesis will be a written document that is submitted for review and approval to an advisory committee (including the research advisor). The thesis will be defended with an oral presentation to the same advisory committee.

Details of the graduate degree program can be found through the ME departmental website:

<https://www.clemson.edu/cecas/departments/me/index.html>

### Curriculum Changes

There are no curriculum changes. Clemson will be offering the same curriculum at an additional location.

Courses Eliminated from Program	Courses Added to Program	Core Courses Modified

### New Courses

*List and provide course descriptions for new courses.*

No new courses are proposed or associated with this site location addition.

**Similar Programs in South Carolina offered by Public and Independent Institutions**

*Identify the similar programs offered and describe the similarities and differences for each program.*

Program Name and Designation	Total Credit Hours	Institution	Similarities	Differences
Master of Science in Mechanical Engineering	30	Clemson University	Both are MS degrees that require a research thesis.	Clemson offers graduate courses on main campus and through the hybrid Charleston program. The main campus option allows for students to complete thesis research under the individual supervision of a research advisor (faculty). The Greenville campus offering will follow the same structure, procedures, and policies. The only difference is that the research may be completed in Greenville. There are currently ME graduate students who are being advised by faculty in Greenville and who are completing research projects in labs in Greenville.
Master of Science in Mechanical Engineering	33	Clemson University	Both are MS degrees requirement graduate coursework elements	The main campus offering of the MS degree accommodates students who are interested in completing coursework only (non-thesis) graduate degrees. The Greenville option will focus on thesis and research emphases. The thesis option will be 30 credits (24 credits of coursework and 6 credits of thesis)
Master of Science in Mechanical Engineering	30	USC Columbia	Both are Master of Science degrees	The USC program requires 24 credits of coursework (same as Greenville) and 6 hours of research (same as Greenville). The USC program requires students to take four required courses (FEA, Materials or Dynamics, Thermodyanmics or Heat Transfer, and Mechanics). The Greenville program requires students to take three core classes from a list of eleven choices.

### **Faculty**

*State whether new faculty, staff or administrative personnel are needed to implement the program modification; if so, discuss the plan and timeline for hiring the personnel. Provide a brief explanation of any personnel reassignment as a result of the proposed program modification.*

New personnel expenses are mitigated by leveraging capacity in the mechanical engineering instructional staff that support the advanced manufacturing track of the BS Mechanical Engineering program delivered at the CUICAR site.

### **Resources**

*Identify new library, instructional equipment and facilities needed to support the modified program.*

There are no new resources required.

**Library Resources:** Current library resources are adequate.

**Equipment:** The site has current classroom configurations with modern a/v capability as part of other programs

**Facilities:** The program location utilizes the One Research Drive building on the CUICAR site.

### **Impact on Existing Programs**

Will the proposed program impact existing degree programs or services at the institution (e.g., course offerings or enrollment)? If yes, explain

Yes

No

**Financial Support**

<b>Estimated Sources of Financing for the New Costs</b>						
<b>Category</b>	<b>2020-2021</b>	<b>2021-22</b>	<b>2022-23</b>	<b>2023-24</b>	<b>2024-25</b>	<b>Total</b>
Tuition Funding	\$28,575	\$109,880	\$196,038	\$243,552	\$259,435	\$837,482
Program-Specific Fees						
Special State Appropriation						
Reallocation of Existing Funds	\$170,250	\$175,862	\$181,673	\$187,690	\$193,922	\$909,396
Federal, Grant, or Other Funding						
<b>Total</b>	<b>\$198,825</b>	<b>\$285,742</b>	<b>\$377,711</b>	<b>\$431,242</b>	<b>\$453,357</b>	<b>\$1,746,878</b>
<b>Estimated New Costs by Year</b>						
<b>Category</b>	<b>2020-2021</b>	<b>2021-22</b>	<b>2022-23</b>	<b>2023-24</b>	<b>2024-25</b>	<b>Total</b>
Program Administration and Faculty and Staff Salaries	\$170,250	\$175,862	\$181,673	\$187,690	\$193,922	\$909,396
Facilities, Equipment, Supplies, and Materials						
Library Resources						
Other (Administrative Overhead)	\$5,715	\$21,976	\$39,208	\$48,710	\$51,887	\$167,496
<b>Total</b>	<b>\$175,965</b>	<b>\$197,838</b>	<b>\$220,880</b>	<b>\$236,400</b>	<b>\$245,809</b>	<b>\$1,076,892</b>
<b>Net Total</b> (i.e., Sources of Financing Minus Estimated New Costs)	<b>\$22,860</b>	<b>\$87,904</b>	<b>\$156,831</b>	<b>\$194,842</b>	<b>\$207,548</b>	<b>\$669,985</b>

### **Budget Justification**

*Provide a brief explanation for all new costs and sources of financing identified in the Financial Support table.*

The budget above reflects revenues and expenses for the additional site only. Program delivery at this site leverages current teaching and administrative capacity in the existing program (treated as internal reallocations in the revenues). Tuition projections are based on the enrollment model as assume 3% per annum growth in tuition. On the expense side, program delivery at the CUICAR site takes advantage of the current Campbell Graduate Engineering Center facilities, requiring no new capital expenditures.

### **Revenue Highlights:**

- **Tuition Funding:** The program uses Graduate Tier 2 tuition at \$635 per credit hour with this rate assumed to increase at a 3% annual growth rate.
- **Reallocation of Existing Funds:** Capacity in personnel resources will be reallocated from the existing MS and BS program to cover (in a full cost accounting sense) the faculty and staff salaries associated with program delivery at the requested site addition. Reallocated resources total \$170K in Year 1 and \$194K by Year 5. Because these represent an apportionment of sunk personnel costs, they are offset on the cost side of the budget.

### **Expense Highlights:**

- **Program Administration and Faculty and Staff Salaries:** The reallocated resources will be used to support the existing faculty and staff salaries at a cost of \$12.5K plus fringe per 3 credit hour course offering. The apportionment of these sunk personnel costs to program delivery at the new site are approximately \$170K in Year 1 and \$194K by Year 5. There are no additional real, net expenses associated with the requested program modification.
- **Administrative Overhead:** Administrative Overhead is calculated as 20% of tuition revenue and supports overhead costs associated with the program at both the College and University level.



**Evaluation and Assessment**

<b>Program Objectives (3-5 years after graduation)</b>	<b>Student Learning Outcomes Aligned to Program Objectives</b>	<b>Methods of Assessment</b>
Graduates will be contributing to improving and providing innovative solutions for the products and services in their industry and engineering profession.	Students can frame a real-world problem such that it can be addressed technically.	Thesis: The student will submit a research thesis to an advisory committee that presents relevant research in advanced manufacturing
Graduates will have advanced in level of responsibility, demonstrate leadership and assume the responsibilities of citizenship including service, mentoring, and effective collaboration.	Students can function on multi-disciplinary teams.	Coursework: The student will complete graduate level coursework that will integrate group projects.

Will any the proposed modification impact the way the program is evaluated and assessed? If yes, explain.

- Yes
- No

Will the proposed modification affect or result in program-specific accreditation? If yes, explain; and, if the modification will result in the program seeking program-specific accreditation, provide the institution’s plans to seek accreditation, including the expected timeline.

- Yes
- No

Will the proposed modification affect or lead to licensure or certification? If yes, identify the licensure or certification.

- Yes
- No

Explain how the program will prepare students for this licensure or certification.

If the program is an Educator Preparation Program, does the proposed certification area require national recognition from a Specialized Professional Association (SPA)? If yes, describe the institution’s plans to seek national recognition, including the expected timeline.

- Yes
- No