



Graduate Student Manual

**Department of Automotive Engineering
(MS, PhD) Programs**

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Fall 2022

QUICK REFERENCE GUIDE

TOPIC (LISTED ALPHABETICALLY)

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INTRODUCTION

Welcome to the Department of Automotive Engineering (AuE) at Clemson University. We are happy to have you join the program and wish you success as you pursue your degree.

This manual has been prepared to inform you, a graduate student in the Department of Automotive Engineering, of the rules, procedures, and regulations that you will encounter during your time at Clemson University. In addition to the materials contained within this manual, graduate students are **required** to read the Graduate School Policies & Procedures Handbook for the current year. Both materials are linked below for further review.

(<http://catalog.clemson.edu/index.php?catoid=17/>)

(<https://www.clemson.edu/graduate/students/policies-procedures/index.html>)

If you have questions that cannot be answered by this manual, or the Graduate School materials provided above, then answer should be sought by reaching out to the automotive engineering program's Student Services Coordinator, the student's academic advisor, or the Graduate School. Students should preferably reach out to receive help in that order. Students must read this manual and are responsible for all rules, policies, and guidelines contained within. During orientation, students will be **required** to sign a form the end of a Tiger Training Module, that will be sent out prior to the beginning their first semester, confirming that they have read the manual.

GRADUATE PROGRAM COORDINATOR AND GRADUATE STUDENT SERVICES COORDINATOR

Members of the Graduate Research and Curriculum (GRC) Committee are responsible for the initiation of policies and procedures of the graduate program. The Graduate Program Coordinator, a faculty member, chairs the GRC. Ultimately, the responsibility of creating the policy lies with the faculty. The GRC is also responsible for enforcing, coordinating and implementing the rules and regulations of the graduate program. The Student Services Coordinator, a staff member, is the initial contact for graduate students arriving on campus. The Graduate Coordinator and Student Services Coordinator are the authorities on regulations and procedures pertinent to the graduate programs and should be contacted whenever questions or problems occur. Please refer to the "People" page from the Department of Automotive Engineering to learn more about the roles of the departments' faculty and staff members:

(<http://www.clemson.edu/cecas/departments/automotive-engineering/people/index.html>)

FACULTY ADVISOR

All MS and PhD students are **required** to have a faculty advisor. Non-thesis MS students are typically assigned one advisor and will receive the assignment during fall orientation. PhD students and MS thesis option students select an advisor based on their research interests. The faculty advisor is just that: an "advisor." It is the student's responsibility to develop an appropriate plan of study based on the guidelines of the academic program in which he/she is enrolled.

ADVISORY COMMITTEE, COMPOSITION

The student, in concert with the research advisor, will initiate a recommendation to establish the advisory committee. The advisory committee must consist of at least one Clemson University faculty member for the non-thesis MS degree, three faculty members for the MS degree with thesis, and four faculty members for the PhD degree. MS students opting for the non-thesis degree need only one committee member, just the advisor to review and approve your plan of study. The chair of the PhD advisory committee and the thesis option MS committee must come from AuE, and at

least one other voting member must be from AuE. The majority of voting members on the PhD advisory committee must comprise Clemson University faculty from the College of Engineering, Computing, and Applied Sciences and/or the College of Science who hold full-time, tenured or tenure-track positions. If a minor is declared, this area must be represented on the committee. Faculty emeriti, part-time visiting and other non-tenure-track faculty employed by Clemson University may serve on the advisory committee but may not serve as chair. Persons not employed by the University may serve on the advisory committee; if they serve as one of the voting members of the committee, they must be appointed to adjunct faculty status. All duly appointed committee members have full voting status on the outcomes of all examinations given by the committee. The major advisor will normally serve as the chair of the advisory committee. It is possible for co-chairs to direct the activities of the advisory committee. This special arrangement must be made with the consent of the dean of the Graduate School. The advisory committee should normally be appointed (with the GS2 Plan of Study form) before registration occurs for the second semester of graduate study. The advisory committee will approve the curriculum (plan of study), supervise the graduate program, administer the comprehensive and/or final examinations, and initiate the recommendation for awarding the degree. The graduate student is responsible for forming the advisory committee and keeping them apprised of his/her progress.

AUTOMOTIVE ENGINEERING GRADUATE PROGRAM & CURRICULUM

The AuE Graduate Program offers the following degree options. Please read corresponding sections for the respective curricular requirements for each option.

- Combined BS/MS Program (for Clemson CECAS undergraduates)
- MS in Automotive Engineering
 - Regular MS program (in person)
 - MS Online program
- Ph.D in Automotive Engineering

Combined BS/MS Program

Clemson undergraduate students have the option to declare they would like to do a combined BS to MS degree option using this special program coordinated via the Graduate School. Please review the information at the link below:

<https://www.clemson.edu/graduate/academics/fasttrack.html>

Students use Form GS6-Bachelor-to-Graduate (available at the link above) to request participation in the plan. All eligibility requirements are described on the website as well as on the form. Once you decide to apply, please coordinate with your undergraduate advisor to initiate the process. It is also important for you to become familiar with the AuE MS degree requirements described in this document (starting below).

AuE specific requirement for the program: Clemson undergraduates in the BS-MS program can have up to four 6000 level CECAS courses that they take as undergrads to count as technical electives towards their MS degree requirements in AuE. This means you take that many fewer courses from the MS degree requirements listed below. In other words, you only need to take 3 more technical electives with the thesis option, 5 more with the non-thesis internship options.

MS Degree in Automotive Engineering

The curriculum is designed as a post-BS degree program requiring a **minimum of 33 credit hours in total**. The degree program is offered both as a regular in-person program, as well as with online delivery. The descriptions below apply for both delivery modes, with differences/exceptions noted accordingly.

Students can choose one of three main options for their MS degree pathway. The two options are non-thesis options which require students to complete graduate coursework equivalent to 33 credit hours in addition to a minimum of six-months long internship either in industry (external internships), or on the “Deep Orange” vehicle prototyping project (internal internships) at the Carroll A. Campbell Jr. Graduate Engineering Center. See more on “Deep Orange” at <http://www.cuicardeeporange.com/>. The third option is a thesis option, which requires 27 credits of course work and a minimum of 6 credits of AuE 8910 MS Thesis Research (total of 33 graduate credits).

The MS curriculum options, and the corresponding requirements are depicted in the table below. Descriptions of each of the requirements (core, technical electives, internship or thesis follows the table.

	Internal Internship (Deep Orange Project)	External Internship	Thesis Option
Core Courses	<ul style="list-style-type: none"> • AuE 8700 Automotive Business Concepts • AuE 8810 Automotive Systems 		
Technical Electives	<ul style="list-style-type: none"> • AuE 8820- Systems Integration Methods • AuE 8830- Applied Systems Integration • 7 other technical electives 	<ul style="list-style-type: none"> • 9 Technical Electives 	7 Technical Electives
	Require one 1 elective course from outside the student’s chosen track area for breadth (included in total electives)		
Internship/Thesis	Deep Orange Project. (upto 3 semesters of INT8010, Zero Credits).	External internship (Min 2 semesters of INT8010, Zero Credits)	Write and Defend MS Thesis (Min 6 Credits of AuE 8910)
Minimum Total Credits to MS degree	33	33	33 Credits

Notes: 1) The Deep Orange option is not available for students enrolled in the AuE MS-Online program. 2) External internships may be waived for those already working fulltime while attending the MS program.

1) **Core Courses:** 6 credit hours (2 courses). Core courses are designed to provide basic competencies that every student graduating out of the program should possess. All newly

incoming students must register for the first two underlined courses if offered in their starting semester.

- a) AuE 8700 Automotive Business Concepts
- b) AuE 8810 Automotive Systems Overview

2) **Technical Electives:**

- a) AuE 8820, 8821 Systems Integration Methods (Required only if enrolled in Deep Orange)
- b) AuE 8830 Applied Systems Integration (Required only if enrolled in Deep Orange)
- c) A minimum of 27 credit hours (9 courses) if enrolled in the External Internship Option or 21 credit hours (7 courses) if enrolled in “Deep Orange” or in the Thesis option. Technical electives must be chosen to provide depth in a given track. At least 3 courses must be AuE courses in a given track and at least one technical elective must be from outside of your chosen track for breadth. The other courses can be from the same track, however, students taking classes outside a given track must pick courses that are complementary and should be selected in consultation with their faculty advisor and/or the student’s advisory committee. Track areas include the following:
 - i) Vehicle Manufacturing and Materials
 - ii) Vehicle Performance
 - iii) Advanced Powertrains and Drivelines
 - iv) Vehicle Automation and Electronics

See page 16 for the current list of technical courses by track area.

Business Courses: There will not be a strict requirement to take additional business courses beyond AuE 8700. However, a maximum of one additional business course can be taken to count towards your total elective credit requirements. Students can also select from MBA and MGT graduate courses for exposure to business topics, but the AuE department does not control the offering schedule or enrollment conditions for those courses. Additional business courses cannot be used to substitute for technical elective requirements for the MS degree; however, you can take them as overload.

- 3) **External Industrial Internship or Internal Internship/Deep Orange:** A minimum of 6 months of internships are required and can be domestic, international, or as part of the Deep Orange project at Clemson University. Students are encouraged to complete a continuous six-month internship to maximize their experience; however, it is acceptable to split the internship into parts as long as six months are completed. Students opting for external internships are responsible for finding their own internships; the department does not have a placement program. Students opting for and selected for the **Deep Orange students are required to remain with Deep Orange for the entire duration; that includes summer semesters. More details about Deep Orange Internships are given below.** Also, see timing table on [page 11](#).

Students on internships must sign up for the zero-credit course INT:8010: Graduate Internships offered by the Michelin Career Center. You can sign up for the course in multiple semesters, but it makes sense to do so only on your internship semesters. This course can also be used to satisfy continuous enrollment requirements of the Graduate School.

In general, students should not combine internships with course loads as doing so causes students to be unprepared for classes and does not give them the full in-depth experience of an internship that is the spirit of the requirement. A maximum of up to 1 credited course may be taken in your internship semester (in addition to INT 8010).

Students on the thesis option need not do internships.

- 4) MS Thesis Option:** The thesis option gives students the opportunity to 1) design and execute graduate research in an emerging or applied area related to automotive engineering, 2) Articulate research project objectives and engage in the scholarly process of making hypothesis and design experiments (physical or virtual) to test them. 3) Document the research process in the form of a thesis that should be structured according to a style or format approved or provided by the Graduate School. 4) Effectively present and defend their scholarly work in front of the advisory committee and their peers.

If you enroll in the MS thesis option, you must first find a faculty advisor and set up your thesis advisory committee (see section on Advisory Committee about makeup of committee). You must also sign up for AuE 8910 Master's Thesis Research under the faculty advisor for a minimum of 6 credit hours (distributed according to your semester course load and project needs).

You must get your thesis research proposal approved by your advisory committee and have the committee complete the Clemson Graduate School form [GS-Research Approval](#) form. You should work with your thesis advisor to prepare the thesis research proposal for committee review in a suitable format (written document or detailed presentation) as determined by your committee. The proposal must be approved prior to substantive work on the thesis.

The final thesis must be prepared in accordance with the Graduate School [formatting guidelines](#) available on the [Thesis and Dissertations](#) Page. You must defend the thesis to your committee and file the GS7M form with signatures of your advisory committee.

Finally, you should be aware of Graduate School deadlines regarding graduation and thesis/dissertation defenses for the semester you plan to graduate in. The Graduate School states you must hold your defense at least two weeks prior to the deadline for the submission of GS7M form or a minimum of 4 weeks prior to the commencement date for your graduation semester.

Course/Internship Waiver Requests:

The GRC reserves the right to consider requests for internship waivers and course waivers.

A student may apply to have the internship requirement waived if he/she can show documented proof of two years of work in the automotive and related industries. This work should normally be completed with a single company (could be in different divisions or departments). To apply for a waiver, the student should submit a waiver request form (found in the Appendix to this manual or at the link below, accompanied by a letter from the company from which the student was employed certifying his/her title and employment dates along with a one-page document, written by the student, detailing the type of work they performed, skills used (both engineering and other business skills) and how this prepared them for employment within industry. These documents should be submitted to the student's advisor for initial review. If the advisor approves, he/she will forward to the GRC for final approval. The graduate coordinator will contact the student and advisor with the GRC's final decision.

Waivers may also be considered for certain courses. The waiver request form must be completed and accompanied by documentation supporting the request and proposed substitutions for courses being waived. The total MS degree credit hour requirements must still be met.

The waiver request form can be found at the link below:

http://www.clemson.edu/ces/departments/automotive-engineering/documents/Waiver_Request.pdf

Internship Approval and Reporting Procedures

In addition to the information below, please refer to the internship section of the department's website for the current procedures regarding internship approval and reporting procedures:

<http://www.clemson.edu/ces/automotive-engineering/students/internships/index.html>

As stated above, all internship students are required to register for INT 8010: Graduate Internship in the semesters of their internship. Detailed information about the INT 8010 course is available at the website:

https://career.sites.clemson.edu/internship_programs/off_campus_internships/ccint_grad.php

- There is an intake form (Contact and Responsibilities Form) that you will need to complete about the employer and the opportunity once you sign up for the course.
- Students are required to complete internship reports as required in the INT 8010 course. Those reports include evaluation surveys (created by the AuE department) to be completed at by both the employer and the employee (student) in the semesters of your internship. See appendix for samples of the evaluation forms. These are not the official forms; those are found online and may include updates incorporated into the INT 8010 evaluations.
- Current versions of the surveys can be found at the following links:
(<https://www.surveymonkey.com/s/clemsonaueinterneval>),
(<https://www.surveymonkey.com/s/clemsonauestudentsurvey>)
- Grading for the internship course (Pass or Fail) is per its syllabus, incorporating input from the internship survey reports and faculty advisors involved in your internships (of internal).

Additional Guidelines for Industrial Internships

- Timing of the internship: External internships are, typically, but not always, scheduled to begin in the fourth semester (the second-year spring if joining the MS program in the Fall) and continue through to graduation in the second-year summer semester. You may also do external internships in the first-year summer. (However, there are some restrictions for international students who join the in-person MS program in the spring semester and plan to use CPT for their internship in the first-year summer. See more information about this in the paragraphs below about CPT).
- The hosting company (internship provider) should be an automotive OEM, a supplier (Tier I, II, III, etc.), a service provider to the automotive industry (IT support, simulation software, infrastructure, equipment supplier robotics, materials steel, paint), or a technical or research center/institute conducting research related to the automotive industry.

- Each internship opportunity will be evaluated by the automotive engineering faculty; students should not begin any internship opportunity without the written approval of the automotive engineering program faculty. To this end, they should provide their offer letter for the internship to their advisor for approval. Once approved, please inform the student services coordinator (forward your advisor-approved letter) and then you can sign up for the INT-8010 course.
- The internships do not carry any commitment from the student, or the sponsor, or the automotive engineering program of future employment, unless otherwise clearly indicated and a separate agreement was signed between the student and the internship provider.
- The financial compensation and other details are based on the internship provider offer letter. Most employers will not provide for any provisional expenses (such as mortgages in the US) for students. Any specific details or student special requirements or needs are considered to be the student responsibility to negotiate and include in the internship offer letter.
- The internships can be arranged through the automotive engineering program or independently by the student, as long as the internship provider meets and agrees to the automotive engineering and the Clemson University internship program regulations and procedures.
- CPT Information:
 - The internships for most international students are conducted through the Curricular Practical Training CPT program, and it is the student responsibility to ensure that he/she meets the CPT requirements and to keep a good standing in regard to their visa requirements and immigration status. Students are to communicate directly with the Office of International Services at Clemson University to review their specific situation. The Department of Automotive Engineering considers registration for internships (internal, external and Deep Orange via INT 8010) as full-time enrollment, indicated in section “Part III” on the Form IS-130, Request for CPT Authorization. Therefore, the Form IS-125, Request for Reduced Course Load, is not required. CPT Authorization must not extend past a student’s duration of study.
 - To obtain CPT approval, the IS-130 Request for CPT form should be filled out by the student after obtaining the offer letter from the employer. The IS-130 should then be signed off on by the student’s advisor (or Department Chair if the advisor is not available), and then finally, Section III completed by the Clemson Center for Career and Professional Development. It will then be uploaded into the iStart portal where the instructions will walk the students through the rest of the CPT request process.
 - Spring enrollees to the in-person MS program who participate in their degree-required internship in their first-year summer are only required to participate in one additional semester of degree-required internship to meet the internship requirements. For further details about this restriction that pertains to your specific situation, please contact the office of International Services.
 - The table below shows the options a student may use for planning the timing of their internships.

Fall Start

	Deep Orange	External Internship A	External Internship B
1st Fall	Coursework	Coursework	Coursework
1st Spring	Coursework	Coursework	Coursework

1st Summer	Internship		Internship
2nd Fall	Coursework	Coursework	Coursework
2nd Spring	Internship	Internship	Internship
2nd Summer	Internship	Internship	

Spring Start

	Deep Orange	External Internship A	External Internship B
1st Spring	Coursework	Coursework	Coursework
1st Summer	Internship		Internship
1st Fall	Coursework	Coursework	Coursework
2nd Spring	Internship	Coursework	Coursework
2nd Summer	Internship	Internship	Internship
2nd Fall	Coursework	Internship	Internship

- During the internship duration, the student is still considered a Clemson University student abiding by the Clemson University rules and regulations. The student will be considered a full-time student at the automotive engineering program.

Additional Guidelines for the Deep Orange Internship:

The Deep Orange internship is an internal internship alternative to the industry/external internships. As part of the Deep Orange project, each team member will demonstrate, conduct and document a unique engineering assignment as part of a large scope team project, typically leading to full vehicle prototypes. The sponsor will define and provide the higher-level goals and deliverables at the beginning of each semester. Within the Deep Orange team, each member will identify objectives, responsibilities, tasks, timelines, and deliverables within the first two weeks of the start of each semester based on the higher-level goals and deliverables. A Deep orange project typically involves a two-year period from concept definition to completion of the prototype. To complete the project, students are expected to do internships (register for INT 8010) for up to 3 semesters: first-year summer, second-year spring and summer. This applies whether you joined the MS program in the prior spring or fall semester. (See table above for the).

For more information on the Deep Orange project see <http://www.cuicardeeporange.com/>.

Procedures for Deep Orange Internships:

- The student must formally apply (letter, motivation, area of interest, copy of transcript, resume) for a Deep Orange internship during the semester that they enroll in AuE 8820: Systems Integration Methods. The application process for the Deep Orange project will be announced during the fall AuE 8810 course, and distributed to all students. Students should follow the announced procedures and deadlines in order to be considered for the program.
- If the student is selected for the Deep Orange internship they will receive an offer letter on Clemson University letterhead. The offer will include the following components:
 - Job description
 - Assistantship/scholarship information (if applicable)
 - Duration of internship
 - Direct supervisor contact information
- International students needing CPT approvals can found the relevant forms at International Services:

<http://www.clemson.edu/administration/ia/services/forms.html>. The IS 130 Request for CPT form can be signed by the student's advisor, but is often signed by the Deep Orange faculty lead for convenience. After the student and advisor (or Deep Orange faculty) have completed their sections, Section III should be completed by the Clemson Center for Career and Professional Development. It will then be uploaded into the iStart portal where the instructions will walk the students through the rest of the CPT request process.

- iv) The student will then register INT 8010 (zero-credits) during each of their internship semesters.
- v) The student will submit internship evaluation surveys by the last day of classes during all semesters when the INT8010 course is taken. The faculty advisor for DO will coordinate the grading of the students work in coordination with the INT 8010 course by completing the relevant surveys.

Once accepted to the Deep Orange internship, students are required to remain with Deep Orange for the entire duration of the project. Switching to external internships will not be allowed, except in the cases of being dismissed from DO for poor performance and other extenuating circumstances (and failure in the INT 8010). In only exceptional cases, GRC may decide to review and approve or disapprove switching requests via the waiver process.

In-House Internships (“Working for a Professor”)

In some instances, students may complete projects and work in a professor's lab for internship credits. The professor should give you a letter of offer of internship describing the activity and duration, even if it is not a paid internship. Then, the students forward this letter to the Student Services coordinator and proceed to sign up for INT 8010 in the semesters of their internship. Evaluation will then be completed by the professor in coordination with INT 8010 as described above. Consult with the professor you plan to work with before signing up for this option. The professor must give you an internship offer letter that describes the duties of the role as well as the proposed duration. If you are an international student, you may need CPT for this as well. To apply for CPT, follow the same instructions in the external internship section, instead using your advisor and Clemson Automotive Engineering as your supervisor and employer respectively.

Note: It may be more beneficial for you to opt for the thesis option instead of this in-house internship as it will reduce your course load, but you will need to plan ahead in terms of securing the thesis topic and finding an advisor.

Switching between Internships:

- Sometimes external internship availabilities and timings are unpredictable. If a student doesn't get an offer by start of spring of 2nd year (add/drop deadline for the spring semester), and this is their desired internship semester, then they can sign up with a professor designated as the AuE internship coordinator within the GRC as the temporary employer (as in-house internship), and enroll in the INT 8010 course. The student could later request to switch to external internship once an external offer is secured.
 - Note that the INT 8010 course has specific calendars design to ensure interns can meet total internship hours requirements, CPT approval purposes (for international students). Those calendars should be observed for CPT approval purposes. You should be aware of these calendars by visiting the course's website.

- The procedure to request the switch of internships (internal to external and vice versa, and externally between two companies) starts with obtaining a written approval from the internship supervisor/ manager that you are leaving. That approval and the advisor approved letter of offer the new internships should be forwarded to the Student Services Coordinator. You then register or update your registration for the INT 8010 course. You may also need to update the intake form (Contact and Responsibilities form) for the INT 8010 course.

Graduate Assistantships and Internships

Graduate assistants must be enrolled for a **minimum of nine credit** hours during spring and fall and **six credit hours** during the summer according to Graduate School regulations. Students using a graduate research assistantship as an internship must be registered for nine credit hours during the spring and fall and six hours during the summer.

All Internship Procedures – Review the latest procedure at <http://www.clemson.edu/ces/automotive-engineering/students/internships/index.html>

MS Online Program

The credit hour requirements for fully online MS degree are the same as that of the in-person MS program. The main exception is unavailability of the Deep Orange option for online students. See the curriculum table on [page 6](#) and the notes that follow. Furthermore, many lab intensive courses are generally excluded from online delivery (see the course schedule listing by semester and track area, on [page 18](#)).

Most courses will have online sections that are generally restricted to students admitted to the MS online program, provided there is sufficient enrollment in those sections.

Switching between online and in-person sections of courses will require special coordination and should not be assumed possible in many cases. It depends on several factors including enrollment, instructor availability, timing, etc.

PhD in Automotive Engineering

The Graduate School requires that a doctoral (Ph.D., Doctor of Philosophy) degree comprise a minimum of 30 credits beyond the master's degree, and at least 60 credits beyond the bachelor's degree. This supersedes the minimum requirements below; you may need more dissertation or course credits than the minimums stated below. The policy document is available at the website of the Graduate School (www.grad.clemson.edu).

For the AuE Ph.D. degree a minimum of 18 credit hours of dissertation (AuE 9910) are required, exclusive of any research credits earned at the master's level. Additional coursework may be required based on the student's preparation coming into the program or their needs for research work. See the specific minimum requirements for the three cases below (directly after BS, with MS from elsewhere, AUE MS from Clemson). Coursework leading to the Ph.D. degree is planned to give the student a comprehensive knowledge of his/her field of specialization and a mastery of the methods of research. The degree is not awarded solely on the basis of coursework completed, residence, or other routine requirements. The final basis of granting the degree is the student's grasp of the subject matter of a broad field of study, competence in planning and conducting research, and ability to express himself/herself adequately and professionally orally and in writing.

Track areas in Automotive Engineering:

- i) Vehicle Manufacturing and Materials
- ii) Vehicle Performance
- iii) Advanced Powertrains and Drivelines
- iv) Vehicle Automation and Electronics

The student and the advisory committee craft the PhD plan of study within the following framework:

A. PhD Degree Requirements for Students Starting Directly after a BS (a.k.a, PhD-Direct):

A minimum of 36 credit hours of course work and a minimum of 18 credit hours of dissertation composed as follows:

- 1) **Core Courses:** 6 credit hours (2 courses) as follows:
 - i) AuE 8700: Automotive Business Concepts
 - ii) AuE 8810, 8811: Automotive Systems: An Integrated Overview
- 2) **Technical Elective Courses:** 30 credits composed as follows: 3 AuE courses (9 credits) from your chosen track area and the rest as needed for your research preparation, selected in consultation with your advisor or advisory committee.
- 3) **Dissertation:** 18 credit hours minimum (AuE 9910).

Note: You will need 6 more credit hours in either dissertation or course work to meet the Graduate School's requirements of 60 credits post the BS degree.

B. PhD Degree Requirements for Students Starting with a MS from Outside of Clemson University Automotive Engineering.

A minimum of 12 credit hours of course work and a minimum of 18 credit hours of dissertation composed as follows:

- 1) **Core Courses:** 6 credit hours (2 courses) as follows: (In case of apparently equivalent courses already taken, requirement may be waived at request of student's advisory committee upon establishment of course equivalency. Course equivalency must be certified by the Graduate Research Committee):
 - i) AuE 8700: Automotive Business Concepts
 - ii) AuE 8810, 8811: Automotive Systems: An Integrated Overview
- 2) **Technical Elective Courses:** A minimum of 6 credit hours (2 courses) as needed for your research preparation, selected in consultation with your advisor or advisory committee.
- 3) **Dissertation:** 18 credit hours minimum (AuE 9910).

C. PhD Degree Requirements for Students starting with a MS in Automotive Engineering from Clemson University:

A minimum of 12 credits of course work and a minimum of 18 credit hours of dissertation composed as follows.

- 1) **Core Courses:** No requirement. The intent of this requirement was completed while achieving a MS in Automotive Engineering from Clemson University.
- 2) **Technical Elective Courses:** A minimum of 12 credit hours (4 courses) as needed for your research preparation, selected in consultation with your advisor or advisory committee.
- 3) **Dissertation:** 18 hours minimum (AuE 9910).

Note: MS-enroute to Ph.D. must first meet the MS requirements, and then the requirements for Case C apply.

ADDITIONAL REQUIREMENTS FOR PHD STUDENTS

PhD Qualifying Examination and GPA Requirement

Entering AuE students in the PhD program must maintain a cumulative GPA of at least 3.0 (in the AuE program). Students must have a cumulative GPA of at least 3.5 or have a cumulative GPA of at least 3.0 and be approved by their research committee to be allowed to take the qualifying exam; otherwise they will be dismissed from the PhD program.

The AuE PhD qualifying examination is given twice a year at the beginning of the fall and spring semesters (exact date to be decided each year) and consists of the following steps:

1. The student must identify and research a topic of their choosing in their field of interest. The topic of choice must be of a technical nature related to the field of automotive/transportation engineering and may be related to the student's current area of PhD research.
2. At the end of his/her first year of study in the Automotive Engineering Program, and no later, the student must present the results of his/her literature review to the faculty to the faculty of the Department of Automotive Engineering in the form of an oral presentation not to exceed 20 minutes in length followed by an oral exam on the research topic chosen, including core engineering disciplines applied. No written report will be required.

The purpose of the research presentation is to demonstrate the student's ability and potential to identify and conduct research, and to effectively communicate and defend their work. It is expected that each student will identify an area of research, present a comprehensive review of the appropriate literature and prior art, and identify opportunities for original contributions. The intent is not to present progress of the student's research project, but to evaluate the ability of the student to identify opportunities for research. Automotive Engineering faculty will orally examine the student on the presented research and associated technical topics, and will assign a grade of "Pass", or "Fail" at the end of the examination. Students judged to be a "Fail" on the first attempt will be given only one more opportunity, the following semester, to take the examination and obtain a "Pass" grade.

Only students achieving the grade of "Pass" will be allowed to continue in the AuE PhD program. If a student fails the AuE PhD Qualifying Examination (after at most two attempts), that student will be permitted to continue as an AuE Masters student but will be ineligible to continue or re-apply to the AuE PhD program.

Qualifying Exam Procedures

A. Criteria to Take the Qualifying Exam

1. GPA of at least 3.5 (or at least 3.0 with a waiver from committee)
2. GS2 Curriculum Plan of Study approved, submitted during the student's first semester; at the latest before scheduling the students Ph.D. qualifying exam
3. GRC-approved topic

B. Exam Preparation

- I. Topic—provide a descriptive title of the chosen topic.

II. Abstract—prepare a 1-page written overview of a research topic to provide the audience with a summary of the area studied, motivations for doing so, and research questions identified through the literature survey.

Items I and II are to be submitted by the student's advisor to the GRC (via e-mail to the graduate student services coordinator) before the university offices close for winter break for students attempting the qualifying exam in January and by the last day of summer I semester for students attempting the qualifying exam in August. *Students should use the academic calendar to determine the specific dates for each semester* http://www.registrar.clemson.edu/html/acad_cal.htm.

III. Presentation Document

State the overall objective of the research. Support the objective with one or more research questions based on comprehensive review of pertinent literature. Highlight the adverse consequences of the existing problem to motivate the research.

Prepare analysis of peer-reviewed literature and describe existing studies and theories that support and oppose the objective of your study. In other words, place the identified area in the context of current knowledge through a critical analysis of relevant peer-reviewed research reports. Be sure to include alternative methodological approaches that have been used by others who studied your problem, and highlight the shortcomings, current challenges and the missing fundamental knowledge (i.e., identify the research gaps). The type of study determines the kinds of questions you should formulate: Is there something wrong in society, theoretically unclear or in dispute, or historically worth studying? Is there a program, project, or product that needs evaluation? What would one create or produce intellectually by answering the identified research questions, and how will the new knowledge be of value to you and society?

Note: You are not expected to present a specific research proposal with experimental plans and timelines that commit to a specific research direction. The primary focus should be on synthesizing research gaps from the state of the art on your chosen topic.

C. Presentation

I. Presentation will be a maximum of 20 minutes in length

II. Faculty question and answer session is 10 minutes in length

Results of the exam will be communicated no later than one week following the candidate's presentation.

Comprehensive Examination/Dissertation Proposal

Each Ph.D. student is required to pass a Ph.D. comprehensive examination, which includes both a written research proposal and a presentation, covering the research work completed to date as well as a description of the remaining research work plan accompanied by a proposed timeline to completion. The written proposal should be submitted to the advisory committee at least 10 days before the scheduled date for the comprehensive exam.

Other comprehensive exam rules and regulations are available through the Graduate School's Policies and Procedures document located on the Graduate School's website (www.grad.clemson.edu). Search by "Comprehensive Examination" in the policy document. In the Department of Automotive Engineering the comprehensive examination may only be taken after an advisory committee has been selected, your plan of study has been approved using Form GS-2, and the qualifying examinations have been successfully completed. Successful completion of the comprehensive examination is documented by the GS5D form (Results of the Doctoral

Comprehensive Exam and Candidacy), as well as the GS-Research Approval Form (Advisory Committee Thesis/Dissertation Research Approval). Fully signed copies of both forms should be sent to Office of Enrolled Student Services, and to the AuE Department's Student Services Coordinator.

Dissertation

The automotive engineering PhD Dissertation must be cross-disciplinary in nature and pertain to automotive topics. Student must have approval of the topic and scope of their dissertation by their advisory committee.

Dissertation Defense/Final Oral Examination

Information relating to final oral examination scheduling and requirements is available through the Graduate School Announcements (www.grad.clemson.edu). Additional information can be obtained from the Graduate Student Services Coordinator.

COURSE OFFERINGS– INFORMATION FOR MS AND PHD STUDENTS

Note: Information in this section applies to both MS and PhD students unless otherwise noted. Course descriptions are available in the appendix, graduate catalog <http://www.grad.clemson.edu/catalog/> or on the AuE website <http://www.clemson.edu/ces/automotive-engineering/academic-programs/automotive-engineering-course-descriptions.html>.

This list is subject to change as new courses are introduced and some are phased out.

Core courses

AuE 8700 Automotive Business Concepts
AuE 8810 Automotive Systems Overview

Track Courses

Vehicle Manufacturing, Structures and Materials

AuE 6620 Digital Automotive Manufacturing
AuE 6930 Automotive Human Factors
AuE 6930 Lightweight Design Using Composites
AuE 8330 Automotive Manufacturing Systems Overview
AuE 8550 Structural Analysis Methods for Automotive Systems and Components
AuE 8570 Applied Optimization for Light-Weight Automotive Design
AuE 8580 Advanced Vehicle Structural Design
AuE 8650 Advanced Composites Manufacturing Processes
AuE 8690 Quality Control for Automotive Systems
AuE 8930 Automotive Applications for Laser Additive Manufacturing
AuE 8930 Automotive Circularity
AuE 8930 Deep Learning: Applications in Engineering
AuE 8930 Fundamentals of Injection Molding

Vehicle Performance

AuE 6080/4600 Vehicle Testing and Characterization
AuE 6081/6081 – Accompanying Lab

AuE 6600/4600 Dynamic Performance of Vehicles
AuE 8270 Automotive Control Systems
AuE 8290 Tire Behavior and Performance
AuE 8500 Stability and Safety Systems
AuE 8580 Advanced Vehicle Structural Design
AuE 8860 Vehicle Noise, Vibration, and Harshness
 AuE 8861- Accompanying Lab

Advanced Powertrains and Drivelines

AuE 6610/4610 Advanced and Electrified Powertrains
AuE 8150 Electric and Hybrid Powertrains
 AuE 8151 – Accompanying Lab
AuE 8160 Fundamentals of Engine Combustion and Emissions
 AuE 8161- Accompanying lab
AuE 8170 Alternative Energy Sources
AuE 8180: Engine System Analysis, Design and Experimentation
 AuE 8181- Accompanying lab
AuE 8190: Advanced Internal Combustion Engine Concepts

AuE 8270 Automotive Control Systems
AuE 8280 Fundamentals of Vehicle Drivelines and Powertrain Integration

Vehicle Automation and Electronics

AuE 6930 Automotive Human Factors
AuE 8220 Autonomy: Mobility and Manipulation
AuE 8240 Autonomous Driving Technologies
AuE 8260 On-Board Vehicle Diagnostics
AuE 8270 Automotive Control Systems Design
AuE 8350 Automotive Electronics Overview
AuE 8930 Autonomy: Science and Systems
AuE 8930 Computational Methods for Automotive Engineering
AuE 8930 Control of Cyber-Physical Systems
AuE 8930 High Performance Computing for Vehicle Autonomy Modeling and Simulation
AuE 8930 Perception and Intelligence
AuE 8930 Robust Predictive Control
AuE 8930 Scaled Autonomous Vehicles

Additional Courses for Deep Orange

AuE 8820 Systems Integration Methods (For MS, required only if enrolled in Deep Orange)
 AuE 8821- Accompanying Lab
AuE 8830 Applied Systems Integration (For MS, only if enrolled in Deep Orange)
 AuE 8831- Accompanying Lab

Thesis/ Dissertation Courses

AuE 8910 Master's Thesis Research
AuE 9910 Doctoral Dissertation Research

Other related courses from College of Engineering, Computing and Applied Sciences, chiefly Mechanical Engineering, Electrical and Computer Engineering and/or Computer Science, may

also be taken as electives to strengthen your specialization in consultation with your advisory committee.

COURSE SCHEDULES (by Semester and Track Area)

CORE COURSES	
Fall	Spring
AuE 8700 Automotive Business Concepts*	
AuE 8810 Automotive Systems: An Integrated Overview*	
VEHICLE PERFORMANCE TRACK	
Fall	Spring
AuE 6600 Dynamic Performance of Vehicles*	AuE 6080 Vehicle Testing and Characterization
AuE 6080 Vehicle Testing and Characterization	AuE 6081 Vehicle Testing and Characterization Lab
AuE 6081 Vehicle Testing & Characterization Lab	AuE 8290 Tire Behavior and Its Influence on Vehicle Performance*
AuE 8270 Automotive Control Systems Design*	AuE 8500 Automotive Stability and Safety Systems*
AuE 8580 Advanced Vehicle Structural Design*	AuE 8860 Vehicle Noise, Vibration, and Harshness* + Lab
VEHICLE MANUFACTURING, STRUCTURES AND MATERIALS TRACK	
Fall	Spring
AuE 6930 Lightweight Design Using Composites*	AuE 6620 Digital Automotive Manufacturing*
AuE 8330 Automotive Manufacturing, Process Development, Methods & Tools*	AuE 6930 Automotive Human Factors*
AuE 8570 Applied Optimization for Light Weight Automotive Design*	AuE 8550 Structural/Thermal Analysis Methods for Automotive Structure, Systems, and Components*
AuE 8580 Advanced Vehicle Structural Design*	AuE 8690 Quality Assurance for Automotive Manufacturing Systems*
AuE 8650 Advanced Composites Manufacturing Processes	AuE 8850 Vehicle Layout Engineering and Ergonomic Design
AuE 8651 Advanced Composites Manufacturing Processes Lab	AuE 8851 Vehicle Layout Engineering and Ergonomic Design LAB
AuE 8690 Quality Assurance for Automotive Manufacturing Systems*	AuE 8930 Automotive Circularity*
AuE 8930 Automotive Applications for Laser Additive Manufacturing	AuE 8930 Deep Learning: Applications in Engineering*

ADVANCED POWERTRAINS AND DRIVELINES TRACK	
Fall	Spring
AuE 6610 Advanced and Electrified Powertrains*	AuE 8160 Engine Combustion and Emissions
AuE 8150 Electric and Hybrid Powertrains	AuE 8161 Engine Combustion and Emissions LAB
AuE 8151 Electric and Hybrid Powertrains Lab	AuE 8170 Alternative Energy Sources*
AuE 8180 Engine System Analysis, Design, and Experimentation	
AuE 8181 Engine System Analysis, Design, and Experimentation LAB	
AuE 8190 Advanced Internal Combustion Engine Concepts*	
AuE 8270 Automotive Control Systems Design*	
AuE 8280 Fundamentals of Vehicle Drivelines and Powertrain Integration	
VEHICLE AUTOMATION & ELECTRONICS TRACK	
Fall	Spring
AuE 8220 Autonomy: Mobility and Manipulation*	AuE 6930 Automotive Human Factors*
AuE 8260 On-Board Vehicle Diagnostics & Reliability*	AuE 8240 Autonomous Driving Technologies*
AuE 8270 Automotive Control Systems Design*	AuE 8930 Autonomy: Science & Systems*
AuE 8350 Automotive Electronics Integration*	AuE 8930 Computational Methods for Automotive Engineering*
AuE 8930 High Performance Computing for Vehicle Autonomy, Modeling and Sim*	AuE 8930 Perception and Intelligence*
AuE 8930 Robust Predictive Control*	AuE 8930 Control of Cyber-Physical Systems*
AuE 8930 Scaled Autonomous Vehicles*	
DEEP ORANGE	
Fall	Spring
AuE 8330 Applied Systems Integration	AuE 8820 Systems Integration Concepts and Methods
AuE 8331 Applied Systems Integration LAB	AuE 8821 Systems Integration Concepts and Methods LAB
INTERNSHIPS & THESIS/DISSERTATION COURSES	
Fall	Spring
AuE 8910 Master's Thesis Research	AuE 8910 Master's Thesis Research
AuE 9910 Doctoral Dissertation Research	AuE 9910 Doctoral Dissertation Research
INT 8010 External Internship	INT 8010 External Internship

Courses marked (*) denote that the course is offered both in person and asynchronously online as part of the online MS degree program, provided there is sufficient enrollment in either the online section (MS online students only), or the in-person section.

POLICIES AND PROCEDURES

ACADEMIC POLICIES

Registration

Registration occurs online via iROAR. The Office of Registration Services provides information that you may refer to regarding the steps to be taken in the registration process. See the Registration

Services website at www.registrar.clemson.edu/portal/. If you have any further questions, please contact the Student Services Coordinator.

Particular attention should be paid to registration requirements. Students pursuing any phase of a graduate program must be registered. Students are expected to make continuous progress toward their degrees and, therefore, to be enrolled for graduate credits each semester during the academic year until requirements are completed.

Full-time student status is at least 9 hours. All AuE MS students should normally enroll in 12 hours for each fall and spring semesters during the academic year. Graduate research assistants and graduate teaching assistants are required to register for a minimum of 9 and a maximum of 12 credit hours during the academic year. The minimum registration for unsupported students is one (1) credit hour.

Near the middle of each semester, students will be notified of the time and procedure for on-line registration via iROAR. Students will be required to register for next semester's courses online at this time.

Students should have prepared a program of study with the counsel of their major advisor. This is accomplished by completing form GS-2 Graduate Degree Curriculum. The **GS-2 form must be submitted and approved prior to registration for the second semester of enrollment**. Students will be required to register for next semester's courses at this time. Any deviation from courses listed on GS-2 form requires submission and approval of a new GS-2. The GS-2 form is submitted electronically through iROAR (www.clemson.edu/graduate/students/forms.html?).

Note: Registration may be blocked if the GS2 form is not completed. Also, funding may be delayed if the GS2 form is not completed.

If you are not enrolled for more than one semester the Graduate School requires an Application for Re-Entrance. You must complete this form and return it to the Graduate School prior to registration. You may download this form at <http://www.clemson.edu/graduate/students/forms.html?>

Orientation for new students

All newly accepted students are **required** to complete the new student to do list through the Graduate School by visiting: <https://www.clemson.edu/graduate/students/new-student-to-do.html> All incoming students will also be required to attend the Department of Automotive Engineering Orientation, which is usually scheduled a day prior to classes. International students will be required to attend the Department of Automotive Engineering International Student Orientation, as well. The Student Services Coordinator will contact incoming students with orientation dates and additional information via email. All information will be sent to students' Clemson University registered usernames and email addresses.

Maximum credit loads

The University sets upper limits on the number of credits graduate students may earn in a given semester. They are specified in the Graduate School Policy Handbook at <http://www.clemson.edu/graduate/students/policies-procedures/index.html>. All requests for permission to exceed these limits must be requested by memo to the Chair of the Department of Automotive Engineering and the Dean of the Graduate School.

Incomplete coursework

A grade of Incomplete will be given only if you have not completed the course for some unavoidable reason that is acceptable to the instructor. Unless you complete the requirements for removal of the “I” grade within the time period stipulated by University policy, the Student Records Office will automatically change the I to an F. Extensions of the deadline for completing the coursework are granted only in extreme circumstances. Students who have Incompletes cannot graduate, even if the incomplete courses are not part of your GS2 plan of study. Special courses that constitute multi-semester projects are exempt from this rule. Incomplete grades for those courses may be given until the project is complete.

Auditing courses

Permission for a student to audit a particular graduate course is at the discretion of the department chair, the graduate program coordinator, and/or the instructor offering the course. The principal factors involved in granting permission are that the auditor must possess the necessary academic background and space must be available.

With approval, the following may audit courses without tuition (other fees apply):

- Graduate assistants
- Full-time undergraduate and graduate students (12 or more credit hours)
- Faculty and full-time staff
- South Carolina residents age 60 or over, provided they are not a full-time employee of Clemson University

Others who audit pay the applicable tuition rate. Students may not sign up to audit until the first day of class so that priority may be given to those taking course credits. The deadline to sign up to audit a course is the last day to register or add a class for that term. Normal drop deadlines also apply.

Students currently registered for courses may add an audit course or change one to audit status in iROAR. Other auditors must obtain a request to audit card from the Registrar's Office, 102 Sikes Hall, Box 345125, Clemson, SC 29634-5125.

Audited courses do not carry credit and the fact that a course has been audited is not noted on your official record. Graduate auditors are not required to take tests or exams. However, the instructor, at his/her own discretion, may demand the auditor's participation in class to whatever extent deemed desirable. You may not satisfy, by audit, a stated prerequisite for a graduate course. Additionally, you may not establish credit through examination in any course for which you were previously registered as an auditor.

Repeating a course

Under some circumstances, graduate students may repeat courses in which they received an F. If you repeat a course for which you received a grade of an F, the original grade is not dropped. The credit hours and grades from the original course and from the repeated course will all be counted in your GPA.

Continuous enrollment, leave of absence

Graduate students who do not maintain continuous enrollment are subject to the degree requirements and department regulations that are in effect upon their return. University facilities are only available to enrolled students. Note that you must meet minimum enrollment requirements to be eligible for financial support.

Withdrawing from a course

AuE graduate students should only drop courses in unusual cases. If you drop a course when you have an assistantship, and your course load drops below nine (9) credit hours, your assistantship may be revoked for that semester.

Withdrawing from the program/university

If for any reason you decide to withdraw from the program, inform your Major advisor, then the student services coordinator, who will inform you of the of the procedures to be followed to officially withdraw from the university. Failure to follow the procedures may result in you owing tuition and other fees to the university. This applies to both domestic and international students.

Automotive Engineering Lecture Series

The Department of Automotive Engineering sponsors a series of typically 6-9 lectures per year by scholars in various areas of automotive engineering. The Department also sponsors other seminars on an as-needed basis. Students are required to attend and participate in the student series. Additionally, the automotive engineering students are required to attend the cultural immersion seminars and workshops announced through the program's student services coordinator.

Since the primary purpose of graduate education is to foster scholarly development, all graduate students are required to attend the lectures and seminars in these series. Attendance will be taken.

Graduation Checklist

FORM/PROCESS	APPROXIMATE DEADLINE*
Submit your final GS2 to Enrolled Services	End of the semester prior to the semester when you plan to graduate
Submit GS5 to Enrolled Services	Six months prior to defense (signed upon competition of the comprehensive exam/proposal presentation)
Complete online application for diploma (Form GS4)	Within the first four weeks of the term in which you will graduate
Written notification of defense submitted to Enrollment Services	At least 10 days before your defense
Submit completed thesis/dissertation electronically for formatting review	Two weeks prior to graduation
All revisions requested by the Manuscript Review Office must be completed, submitted and reviewed	One week prior to graduation

This chart provides general guidelines.

Visit <http://www.clemson.edu/graduate/students/deadlines.html> for specifics.

Application for Diploma

You must submit a formal application for a diploma to the Graduate School. You must complete this form online in the first four (4) weeks of the semester in which you intend to graduate. Early submission is not accepted (e.g., do not complete the form in January if you do not plan to graduate until August or December, only if you plan to graduate in May). If you miss the deadline, you must contact Enrolled Services to receive a hard-copy version of the application; late fees will accrue at \$75 the first day after the deadline and an additional \$5 each business day thereafter. If you submit the form and, for some reason, do not graduate in that semester, you must re-submit in each term in which you hope to graduate thereafter.

If your name in the student database is not as you want it to appear on your diploma (e.g., due to marriage), you must contact Enrolled Services prior to submitting the Diploma Application form

online. Any degree/major changes via form GS2 must also be processed before you submit the Diploma Application. There is no fee to receive a diploma if you attend the graduation ceremony or agree to pick up your diploma in the Enrolled Services office in Sikes Hall. There is a \$10 fee assessed if you request that your diploma be mailed to you.

For more information, contact Enrolled Services:

<http://www.clemson.edu/graduate/contact/index.html>

If you choose to participate in graduation ceremonies, you should make arrangements for cap and gown purchase (or rental for Ph.D. gowns) at this same time. For deadlines and more information, see the Clemson University Bookstore's website at

www.clemson.edu/campus-life/campus-services/book-store/graduationitems.html.

Final Check-Out

When you leave the University due to graduation or any other reason, you must do the following pertaining to the department:

- Turn in all keys to the Graduate Student Services Coordinator.
- Be sure that any portion of the area that you occupied is clean and ready for another occupant. Please leave your office in the condition you would have liked to have found it originally.
- Return all borrowed materials (books, journals, etc.) to their appropriate location.
- Any outstanding indebtedness must be taken care of prior to your departure.
- Complete the check-out form that will be provided to you electronically.

ADMINISTRATIVE POLICIES

Student ID, User Name & E-Mail TigerOne Card

Clemson University is implementing the TigerOne Mobile ID as the official form of identification. Utilizing the TigerOne card is used for building access, printing, events, Tiger Stripe, Paw Points and more. The mobile ID is free of charge (a physical card can be purchased for a fee), and is available on Apple and Android devices.

For the procedure for obtaining your TigerOne Mobile ID, please visit:

<https://www.clemson.edu/campus-life/tigerone/>

Your Clemson User Name and E-mail

E-mail is frequently used as a form of communication. You are responsible for announcements, inquiries, requests, etc., made by e-mail from all representatives of the school. You should check your e-mail regularly and respond in a timely fashion. You will not be excused from assignments or deadlines because you failed to read your e-mail. If you are using the Clemson G-Mail, please be sure to forward your clemson.edu e-mails to this address. For info on your username, email, password, and two-factor authentication, please visit:

<https://ccit.clemson.edu/support/new-to-clemson/>

Program Cost

For current tuition and fees, see <http://www.clemson.edu/graduate/finance-tuition/index.html>.

Graduate assistants may choose to defer tuition and fees. This is accomplished easily on the day of registration. Persons in the fee assessment area will have a list of all graduate assistants. Anyone listed may sign a note to defer these costs, and these costs will be deducted from the first six (6) full paychecks of the semester.

Departmental Expectations for Graduate Work

The goal of the student should be to complete the degree requirements in a continuous manner, *i.e.* while the research is being conducted rather than waiting until the end of the program. One important point to note is that computer programs, data, discoveries, models, and other similar research elements developed by a Clemson graduate student are the property of Clemson University, not of the student.

Publications and equivalent methods for disseminating research results are expected of graduate students. As one measure of the quality of a Ph.D. degree is archival output, doctoral students in the department are expected to publish one or more archival journal papers during their research program.

INFORMATION FOR INTERNATIONAL STUDENTS

Financial Certification

International students must certify access to a minimum of one year's estimated expenses. Download Form IS-50 at <http://www.clemson.edu/administration/ia/services/forms.html> , or contact the Office International Affairs at (864) 656-3614.

Student visa

You are responsible for maintaining legal status with the US Department of Homeland Security during your studies. Form DS-2019 (J-1 exchange visitor visa certificate) is usually issued to students who are funded by their home government or by an international organization. If no organizational sponsor is involved, a Form I-20 (F-1 student visa certificate) is issued.

Social Security Number

Students who are working are eligible to apply for a social security number. You must be in the country for ten (10) business days before you can apply for a social security number. To obtain a Social Security Number, a designated representative (currently the Student Services Coordinator) will provide you with an Employment Verification Letter, and steps to take with that letter, in order to obtain approval from IS and gain an appointment with the Social Security Office. The representative will also help you complete the rest of your paperwork and give you the steps in order to book a meeting with International Employment on main campus, in the Administrative Services Building.

FINANCIAL SUPPORT

Financial support is awarded based on availability of funds and academic merit. Automotive engineering Ph.D. students are given priority for financial support. If a student changes his/her subject area after support has been extended, support eligibility is reviewed and funding may or may not be provided.

There are many types of funding, including Fellowships, Graduate Research Assistantships, Graduate Teaching Assistantships, Graduate Grading Assistantships, and Hourly Graders. While some of these involve reduced tuition and fees for the semesters you receive the appointments,

some of these such as hourly graders are not eligible to received reductions in tuition and fees. Graduate students remain eligible for financial support if they are (1) enrolled in full-time graduate studies, (2) in good academic standing, i.e., not on probation, and (3) making satisfactory progress toward their degree.

MS Graduate students must maintain a cumulative B average in all graduate-level courses (6000-level and above). Students who fail to meet these requirements become ineligible for graduation and are placed on academic probation. The probationary status remains in effect until nine additional semester hours of graduate credit have been attempted. Students whose cumulative GPA is below a 3.0 will not receive any state funds. Also, a student who receives an “F” during any semester is not eligible for state funds for the next semester. *Please note that the majority of MS students are self-funded as doctoral students are given priority when assistantships are awarded.*

Supported students are required to fill out tax forms (federal and state) and the I-9 form which verifies citizenship. Two forms of identification are needed to fill out the I-9 form properly, a valid driver's license, a social security card, a passport and/or a birth certificate. The tax forms and I-9 forms are usually distributed during orientation but frequently, funding may begin at other times during the semester. It suggested that you fill out all required forms in a timely manner. Paychecks cannot be distributed until all parties (Graduate School, International Office, Human Resources) have approved the paperwork.

Graduate Research Assistantships (GRA)

- GRA's are employed for up to a half-time basis (up to 20 hours per week) on a research project during a specified appointment period, as indicated on your offer letter.
- GRA's are employed to assist a professor in their research activities.
- Students must be enrolled full-time (9 credit hrs in fall and spring, 6 credit hours in summer) to receive funding.
- International students who have applied for or received their OPT should contact the Graduate Student Services Coordinator.

Graduate Teaching Assistantships (GTA), Grading Assistants (GGA) &/or Laboratory Assistantships (GLA)

- GTA's (GGA & GLA) are employed for up to a half-time basis (20 hours per week) to assist with the teaching of courses or labs in automotive engineering.
- GTA's (GGA & GLA) are responsible for grading lab reports and attending GTA (GLA) meetings as needed.
- Students must be enrolled full-time (9 credit hrs in fall and spring, 6 credit hours in summer to receive Assistantship funding.
- International students who have applied for or received their OPT should contact the Graduate Student Services Coordinator.

Graduate Fellowships Holders

- Students must be enrolled full-time (at least nine hours) in order to receive a fellowship and the in-state tuition rate. This requirement is university-wide. There are no waivers or exceptions.
- Information concerning the availability of fellowships, and specific application requirements, will be found on the department's website.

Hourly graders and other temporary employment

- Sometimes students may be hired on a temporary basis to help with grading in some courses, help in labs or even other departmental needs. These appointments do not come with tuition reduction.

Offer Letter

Your responsibilities and details of your financial support are included in your official offer letter from our Department Chair. This letter requires your signature indicating an acceptance of the terms. GTA's (GLA's) will be notified at a later date of their teaching duties (specific course, etc). To maintain your assistantship, students must complete the duties in a satisfactory manner and make satisfactory progress towards their degree.

Renewals: Students on assistantships should have their supervising faculty complete the Graduate School's Assistantship Evaluation form GS-GA 1 and sign it, and submit to the AuE Student Services Coordinator. This should be completed at least once a year, typically in the Spring. Your assistantship cannot be renewed for the next semester without completion of this form.

STUDENT EMPLOYMENT POLICIES

Clemson University uses several functions with-in Employee Self Service (ESS) to input, maintain and access payroll information. Please use the information below to learn how to access ESS, set-up and maintain your Direct Deposit accounts, make changes to your W-4 Tax Withholding Certificate, as well as how to view your on-line paystub and sign-up for an on-line W-2.

Accessing Employee Self Service

As a Clemson University employee, you will receive an employee User ID. If you are a student employee, this User ID is in addition to and is different from your student User ID. Your employee User ID will be used to log-in to computers, check e-mail, submit leave if applicable, and utilize ESS in the Human Resources (HR) database. With-in 24 hours of being input into the system as a hire, if your department does not provide you with your User ID, you can obtain your User ID by using the [On-line Phonebook](#) to look yourself up. Once you have obtained your User ID, you can then utilize ESS in the HR database. Your initial password is the last five digits of your SSN.

Setting Up Direct Deposit (Required)

All employees are required to have 100% of their net pay directly deposited into a bank account. As a new employee, you are responsible for entering your correct bank account information into the HR database via ESS. You can split your net pay in up to five (5) distributions. The distributions can be a mix of multiple financial institutions, as well as multiple checking and/or savings accounts. If you choose to use multiple bank accounts for direct deposit, the sum of the percentages of all accounts must equal 100%. If a mix of percentages and amounts is used with multiple bank accounts, the account with the lowest priority (highest Deposit Order) must have a deposit Type of "Balance".

The policy and step-by-step instructions on how to access ESS to input direct deposit information can be found at

http://www.clemson.edu/humanres/compensation/direct_deposit.html.

Changing Your Default W-4 Tax Withholding Certificate

Upon being hired, the system defaults your W-4 Tax Withholding Certificate to a marital status of **Single** with **0** exemptions. If you need to change the default, click [here](#) to access the W-4 panel in ESS, logging in with your **Employee User ID and password**.

If your tax situation requires a paper W-4 form, please search <http://www.irs.gov> for “W-4”, and complete the fillable PDF form, print, sign and return to Payroll in the Administrative Services Building. The state of South Carolina does not have a separate form. If you need to make a change applicable only to withholding for the state of South Carolina, please submit the IRS W-4 form indicating “South Carolina Only” in the margin.

On-line Paystub

Clemson University utilizes an on-line paystub as the method to report your earnings each payday. In the event you are no longer active, the system will generate a paper paystub, which will be sent to your home address listed in the HR database. Click [here](#) to access your on-line paystub, logging in with your **Employee User ID and password**.

On-line W-2

Active employees have the option to review their W-2's online, rather than having a hard copy W-2 printed and mailed. To sign-up for an electronic W-2, click here for [W-2/W-2c Consent](#), logging in with your **Employee User ID and password**. In January, you will receive a communication when the on-line W-2 (for prior year) is available. To view your W-2 on-line, click [here](#). For additional W-2 information, see <http://clemsont.edu/employment/compensation/w2/index.html>

Time Capture Tracking System

Student workers on assistantship must maintain a record of their hours in the university's time capture tracking system. Students will receive instructions on how to maintain their record. Those who are not in compliance can be penalized including loss of assistantship. Students employed in an hourly position will utilize Kronos to keep their time.

Paydays

Employees are paid twice a month; paydays fall on the 15th and the last day of the month.

Work injury protocol

In the event of severe injury/emergency, call 911 first, and then execute the below procedures. Should you be injured during the course of your employment responsibilities, you must immediately report the injury to your supervisor. Your supervisor should then immediately call the workers' compensation insurance company. Their medical manager will gather information about the accident and direct you to a healthcare facility or physician for treatment. No coverage will be provided for work-related claims unless reported by your supervisor before you receive medical treatment at the authorized provider.

Workload

The normal ½-time graduate assistantship workload is 20 hours per week (average). Students are sometimes hired for 25% (10 hours), 37.5% (15 hours) and 75% (30 hours) of full-time work, under appropriate circumstances. You should be aware of both your academic and work obligations, and are encouraged to discuss any problems with faculty. International students should

note that immigration laws place limits on the number of hours employed during the academic year. See <http://gradspace.editme.com/financialinformationindex> for more information.

Work product

Any work product, data generated, discoveries made, derivations developed, etc., in the course of your assistantship are the property of Clemson University.

Reduction of pay

Normally, your agreed-upon workload will be submitted as hours worked for each payroll period. However, if the amount of work you perform consistently deviates below the required workload, your pay will be reduced accordingly. Due to the procedure in which time sheets are currently used, it may be necessary to implement any pay reductions in the pay period following the one in which the work deficiency actually occurred. Pay also may be withheld from students who violate the vacation policy (see below).

Vacation policy

As a rule, graduate assistants do not accrue paid vacation time. Generally, graduate assistants work on the same calendar as faculty with 12-month appointments unless different work expectations are distinctly articulated in your offer letter. In the event of a death in your immediate family, illness of a close family member or personal illness or hardship, you may request up to four weeks leave without pay per semester and one week of leave without pay per summer session from your immediate supervisor.

Holidays

Graduate students are entitled to take as holidays the days on which the University is officially closed. Holiday schedule - <http://www.clemson.edu/employment/benefits/holiday.html>

Termination of pay

Pay for any session will end when you leave Clemson or are no longer available for work assignments. Normal termination dates for the spring and fall semesters for students not continuing into the next session is graduation day. Any deviations from these dates must be approved by your major advisor or the graduate program coordinator.

For more on assistantships, visit <http://clemson.edu/graduate/finance-tuition/student-employment/faqs.html>

UNIVERSITY POLICIES

DEPARTMENTAL POLICY ON ETHICS

The effectiveness of the research infrastructure throughout the world is based on the personal and professional integrity of the people involved. The basic assumption that is central to all research endeavors is that **researchers have done what they say they have done**. The Department of Automotive Engineering is part of that infrastructure and the research conducted here must withstand the highest scrutiny. Consequently, we must all ensure that our scholarly work is conducted and reported with the highest ethical standards. We must be careful in our record keeping and diligent in our efforts to attribute credit when we utilize the work done previously by others. In particular, we must guard against any activity that calls into question our integrity. In this regard, we affirm the following:

- Information in a research program will be truthfully presented,
- The work of others will never be misrepresented as our own,

- Information will be obtained only if access is authorized.

THE HONOR CODE

This Honor Code was initiated by engineering students in the College of Engineering and Science with the advice and approval from the faculty. The document reflects a mutual trust between the students and faculty at Clemson University. By living under the guidance of the Code, we are contributing to our personal success as well as the success of all engineers associated with the College of Engineering and Science.

As members of the College of Engineering and Science, we recognize that lasting excellence is achieved only through honor, demanding standards for personal integrity that reflect the standards of conduct expected of all engineers. All undergraduate and graduate engineering students, faculty members, and administrators in the College of Engineering and Science are expected to abide by the ethical standards defined herein. These standards are based on the following principles:

Engineers, both students and professionals, must be of honorable and trustworthy character. It is dishonest to claim credit for work, which is not the result of one's own efforts.

Students, faculty members, and administrators are bound by a mutual trust to uphold the principles and enforce the policies of the Honor Code. This makes it the duty and responsibility of all members of the College of Engineering and Science to report promptly any suspected violations of the Code.

The Honor Code establishes a standard of academic integrity. As such, this code demands a firm adherence to a set of values. This Honor Code requires that all graduate students exercise honesty and ethical behavior in all their academic pursuits, whether these undertakings pertain to study, coursework, research or teaching.

We recognized that our graduate students have very diverse cultural backgrounds. Because of this, the term ethical behavior is defined as conforming to accepted professional standards of conduct, such as codes of ethics used by professional societies in the United States. This regulates the behavior in which their professions are conducted. The knowledge and practice of ethical behavior is the full responsibility of the student. Graduate students may, however, consult with their advisor, department head, the International Student Office, or the Graduate School for further information of what is expected of them.

UNIVERSITY POLICY ON ACADEMIC MISCONDUCT

A university is a community of scholars dedicated to the free inquiry of knowledge and truth. It follows as a basic tenet that scholars will conduct themselves with integrity in academic pursuits. In instances where the academic standards may have been compromised, Clemson University has a responsibility to protect this process and to respond appropriately and expeditiously to charges of academic misconduct. Academic misconduct includes, but is not limited to, submission of fraudulent admission credentials, academic dishonesty, falsification of data in research and plagiarism in theses, dissertations or other final projects.

I. General

- A. Academic dishonesty includes giving, receiving or using unauthorized aid on any academic work.
- B. Plagiarism, a form of academic dishonesty, includes the copying of language, structure or ideas of another and attributing the work to one's own efforts.
- C. All academic work submitted for grading contains an implicit pledge and may contain, at the request of the instructor, an explicit pledge by the student that no unauthorized aid has been received.
- D. Academic dishonesty includes attempts to copy, edit or delete computer files that belong to another person or use Computer Center account numbers that belong to another person without the permission of the file owner, account number owner or file number.

II. Penalties

- A. A student guilty of the first offense of academic dishonesty typically will receive a grade of F for the course. In flagrant cases, the student may also be suspended for one or more semesters or may be permanently dismissed.
- B. A student guilty of the second offense of academic dishonesty will receive a grade of F for the course, will be suspended for one or more semesters and may be permanently dismissed. Suspension and dismissal require approval of the President of the University.

III. Procedures

Academic honesty is the individual responsibility of each student. Students should report violations of this policy either to the instructor of the affected course or to any member of the administration. When, in the opinion of an instructor, a student has committed an act of academic dishonesty, the following procedure must be followed:

1. The instructor will inform the student in private of the nature of the alleged charge of academic dishonesty and will simultaneously request in writing that the department chair verify from the registrar if the incident is a first offense.
2. When this information has been received, the instructor will notify the student in writing of the charge of academic dishonesty and the penalty recommended by the instructor and approved by the chair of the department in which the course is taught. The notification will further state that if the student regards the charge as unfair, the student has seven days from the date of receipt of notice to file a grievance with the Graduate Student Grievance Committee.
3. If no grievance is filed by the student, the instructor will forward copies of the written notification to the dean of the college and to the registrar.
4. Should the act of dishonesty not be in the college of the student's major, the registrar will notify the major department chair.

A charge of academic dishonesty in a course must be made within 45 calendar days of the date printed on the grade report for the semester or session in which the course is completed. For grades that replace an original grade of I (incomplete), the 45 days begin the day the I is converted to the final grade.

RACIAL HARASSMENT POLICY

It is the policy of Clemson University to conduct and provide programs, activities and services to students, faculty and staff in an atmosphere free from racial harassment. Racial harassment is any behavior that would verbally or physically threaten, torment, badger, heckle or persecute an individual because of his or her race.

Racial harassment of University faculty, staff, students or visitors is prohibited and shall subject the offender to appropriate disciplinary action.

Students who feel that they have been subjected to racial harassment can seek advice from the Office of Access and Equity, E-103 Martin Hall, <http://www.clemson.edu/campus-life/campus-services/access>.

SEXUAL HARASSMENT POLICY

Title VII of the Civil Rights Act of 1964, as amended, provides that it shall be unlawful discriminatory practice for any employer, because of the sex of any person, to discharge without just cause, to refuse to hire, or otherwise discriminate against any person with respect to any matter directly or indirectly related to employment. Harassment of any employee on the basis of sex violates this federal law. The Equal Employment Opportunity Commission has issued guidelines as to what constitutes sexual harassment of an employee under Title VII.

Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment when the following occurs:

1. submission to such conduct is made explicitly or implicitly a term or condition of an individual's employment or academic standing; or
2. submission to or rejection of such conduct by an individual is used as a basis for employment or for arriving at academic decisions affecting an individual; or
3. such conduct unreasonably interferes with an individual's work or academic performance, or creates an intimidating, hostile, or offensive working or academic environment.

Sexual harassment of University faculty, staff or students is prohibited and shall subject the offender to dismissal or other sanctions after compliance with procedural due process requirements. In the event a claim of sexual harassment arises, the claimant may use University grievance procedures that have been established for faculty, staff and students as appropriate. This policy also prohibits an employee from sexually harassing a superior and a student from sexually harassing a faculty member. Employees or students who feel they are victims of this form of discrimination are encouraged to consult the Office Access and Equity, E-103 Martin Hall, <http://www.clemson.edu/campus-life/campus-services/access>, for advice and assistance in resolving complaints.

In the event a graduate student wishes to appeal the resolution of the Office of Access and Equity, the student must submit a written request for an appeal to the dean of the Graduate School, who in turn will convene an ad hoc committee that will review the process and/or sanction. The committee membership will come from faculty and students already appointed to the Graduate Council.

AMOROUS RELATIONSHIPS

Amorous relationships that might be appropriate in other circumstances can be inappropriate when they occur between a faculty member, officer or supervisor of the University, and any student or subordinate employee for whom he/she has a professional responsibility.

Those in positions of authority inherently carry the element of power in their relationships with students or subordinates. It is imperative that those with authority neither abuse, nor appear to abuse, this power entrusted to them.

Officers, supervisors and members of the teaching staff should be aware that any romantic involvement with a student or subordinate employee could make them liable for formal action if a complaint is initiated. Even when both parties have consented to such a relationship, it is the officer, supervisor or faculty member who may be held accountable for unprofessional behavior. Difficulties can also arise from third parties who may feel that they have been disadvantaged by such relationships. Graduate assistants, resident assistants, tutors and undergraduate teaching assistants who are also professionally responsible for students, would be wise to exercise special care in their relationships with students they instruct or evaluate.

Any questions concerning these statements or Clemson University's Policy on Sexual Harassment should be directed to the Office Access and Equity, E-103 Martin Hall, <http://www.clemson.edu/campus-life/campus-services/access>

DRUGS

The use, possession, distribution, or dispensation of illegal drugs is strictly prohibited.

SMOKING

In the interest of the safety and health of all the occupants of our buildings, no smoking is allowed in any classroom, hallway, laboratory, office, outdoor patio, or other public spaces.

BUILDING ACCESS

You will be given card access for labs and other restricted areas. The card access issued to you is for your use exclusively. You must never give this card to anyone else, not even another graduate student. Failure to observe this rule may result in revocation of your access privileges. Unauthorized access to a University building is prohibited by South Carolina law.

SAFETY

Just as professional engineers are expected to follow their employers' safety regulations, so students are expected to follow the safety rules established by faculty members and lab staff. This includes the CGEC Equipment and Lab Policy and Emergency Plan. This information is shared during orientation and as routine updates are made.

STUDENT CUBICLES

Supported students will be assigned a cubicle during their time in the program, subject to availability. Students should keep the cubicles clean and free of unauthorized items, such as - space heaters, personal coffee makers, hot plates, refrigerators, and any other electrical food prep or storage devices. Prior to their graduation, students will receive specific information on when cubicle areas should be vacated and instructions for cleaning the area and returning keys. Items

left in cubicles may be discarded. For cubicle assignments, please contact the Graduate Student Services Coordinator.

KITCHEN CLEANLINESS

Students benefit from CGEC's kitchen areas and should take care to keep them as clean. All spills (regardless of location) should be wiped up immediately. Food placed in the refrigerators should be labeled with the student's name and the date it was placed in the refrigerator. Students will receive notices of periodic refrigerator cleanings. Prior to these cleanings, all items must be removed from the refrigerator. Any remaining items whether food, drink, or storage containers, will be discarded.

GENERAL INFORMATION

Housing

While Clemson does not offer university housing in the Greenville area, AuE staff have worked out special arrangements with apartment complexes near the CU-ICAR campus. Students will receive housing information from the Student Services Coordinator via email.

Remember to mention "CU-ICAR" when communicating with representatives from the complexes listed below. **Apartments are typically unfurnished. To inquire about an apartment, the fees and anything else contact the manager directly.**

Transportation

Limited bus service is available in the area surrounding the CU-ICAR campus. For the most current timetable look for information on the St. Francis-CUICAR shuttle at <http://www.greenvillesc.gov/1204/Schedules>

Weekday bus service is provided to Clemson at the Falls and Clemson's main campus. For details, visit

<https://www.clemson.edu/campus-life/parking/transit/index.html>

Greenville Information

Greenville is located on the Interstate 85 corridor and lies half-way between Charlotte, NC and Atlanta, GA. In recent years, Greenville has seen growth in both industry and new residents. In 2011, *Forbes Magazine* ranked Greenville 13th in their list of "Top Metro Areas for Young Professionals." *Relocate America* named Greenville to its list of the 10 best places to live in the US in 2011. For more, visit <http://www.greenvillesc.gov/> or <http://www.greenvillechamber.org>.

APPENDIX

Automotive Engineering Course Listings

Please refer to the University Catalogue for approved courses. For example, 8930 courses have yet to go through permanent approvals and so may not appear in this list.

■ **AUE 6080: Vehicle Testing and Characterization, 3cr. (2,0)**

This course provides hands-on laboratory experience in vehicle testing and characterization. It combines the instrumentation of vehicles and the acquisition and analysis of data for evaluating typical vehicle dynamics and powertrain performance on modern vehicles. Typical auto industry test instrumentation, equipment and processes are introduced. Preq: ENGR 1410 and ENGR 2080 and ME 3050. Coreq: AUE 6081 Lab

■ **AUE 6600: Dynamic Performance of Vehicles, 3cr. (3,0)**

Fundamental concepts in the dynamic behavior of ground vehicles, mainly two- and four-wheeled vehicles, are discussed. The application of dynamic systems modeling and analysis are stressed to bring understanding to ride performance, handling and straight-line running, as well as practical considerations in vehicle design. Preq: ME 3050 or consent of instructor.

■ **AUE 6610: Advanced and Electrified Powertrains, 3cr. (3,0)**

Addresses key aspects of automobile powertrain engineering, from government regulation to sub-system design. Powertrain operational requirements are discussed in the context of vehicle-level performance, fuel economy and emissions. The function, design, performance and engineering requirements of engines, transmissions, electric motors and high voltage batteries are described in detail.

■ **AUE 6620: Digital Automotive Manufacturing, 3 cr. (3,0)**

Detailed discussion of OEM-based manufacturing processes in automotive production, including sheet metal stamping, joining, painting and final assembly. Topics covered include the infrastructure, fundamentals of the processes, detailed analysis of the processes and material flow, cost analysis, latest developments, and considerations for various automotive body materials.

■ **AUE 6930: Automotive Human Factors, 3cr. (3,0)**

Analyses of automotive topics and research methods related to the interaction between vehicle users, vehicles and human performance. Through the use of research techniques used in the field of Human Factors, students design and conduct a project involving data collected from human participants.

■ **AUE 6930: Lightweight Design Using Composites, 3cr. (3,0)**

Lightweight design using composites will delve into the fundamental principles and applied engineering in the design of composites structures. Starting from mapping the design requirements, the course reviews the materials selection strategies and then explores various material models for composites modeling including multiscale modeling approaches and how those models are enabled in the performance prediction of composites structures. Further, the course explores different composites manufacturing processes from simulation standpoint and then couples the materials models with their process design and response

output to develop a manufacturing-to-response pathway. Overall, the composites design, modeling, process and response architectures at systems level will be explored that yields the optimal design of composites structures.

■ **AuE 8150: Electric and Hybrid Powertrains, 3cr. (2,3)**

The target audience for this course is graduate engineering students and professionals interested in working in the area of electric and hybrid vehicular powertrains and, more specifically, in the integration of low-level and high-level real-time implementable control for advanced vehicle powertrain architectures. The course focuses on the theory and techniques to build Hardware-in-the-Loop (HIL) Simulation for evaluating electric and hybrid powertrains components and architectures using power supplies, electrical loads, multimeters, and rapid control prototyping tools. Special emphasis is given to the electric principles and the use of such tools for component characterization, safely and efficiently interfacing electric machines and their controllers within the electric and hybrid powertrains, accommodating accessory loads in electric powertrains and conducting system diagnostics. Preq: AUE 8170. Coreq: AUE 8151.

■ **AuE 8160: Combustion and Emissions, 3cr. (2,3)**

Spark and compression ignition engines are investigated in terms of design, performance, and emissions. Exergy models. The theory of fuel air cycles are integrated with laboratory breakdown and dynamometer testing to correlate prevalent mathematical models with test results., Coreq: AUE 8161 (Lab)

■ **AuE 8170: Alternative Energy Sources, 3cr. (3,0)**

The demand for petroleum alternative propulsion sources has focused attention on hybrid vehicles with fuel cells, electric motors and battery packs, and internal combustion engines burning hydrogen and reformulated fuels. A comparison of performance, emissions, fuel efficiency, operational requirements, and vehicle configurations will be studied.

■ **AuE 8180: Engine System Analysis, Design, and Experimentation, 3cr.(3,0)**

This course explores internal combustion engine simulation, experimental analysis, and component design with a focus on thermodynamics, heat transfer, combustion and fluid dynamics. A term project integrates simulation software with experimental data analysis to allow students to design, build and test components. Preq: AUE 8160. Coreq: AUE 8181 (Lab)

■ **AuE 8190: Advanced Internal Combustion Engine Concepts, 3cr.(3,0)**

Examines novel modes of combustion in internal-combustion engines, and provides an in-depth study of the underlying phenomena and advanced engine systems required to translate the novel combustion concept into a viable technology. Advanced modeling and simulation tools aid in establishing a link between the fundamentals and system design decisions. Preq: AUE 8160.

■ **AuE 8220: Autonomy: Mobility and Manipulation, 3cr. (3,0)**

This course is intended to be a mathematical introduction to modeling, analysis, and control of robotic mobile manipulator systems. The first part of the course deals with the theoretical frameworks of modeling, analysis(kinematics and dynamics) and control of generic robotic mechanical systems, rooted in rich traditions of mechanics and geometry. The rest of the course will examine harnessing and enhancing the mobility and manipulation performance of articulated multi-body/robotic mechanical systems in the context of serial-chain and

parallel-chain manipulators, wheeled mobile robots (and hybrid combinations of these systems). Case-studies will be used to highlight this process of systematic performance (mobility and manipulation) evaluation and enhancement for exemplary robotic mechanical systems.

■ **AuE 8240: Autonomous Driving Technologies, 3cr. (3,0)**

This course introduces typical autonomous driving technologies covering autonomous vehicle basics, sensing, planning and controls for autonomous driving, connected vehicles, and machine learning for autonomous driving. The course also provides hands-on projects to apply fundamental knowledge to autonomous driving vehicles.

■ **AuE 8260: On-Board Diagnostics and Reliability, 3cr. (3,0)**

Discussion of legislated state, federal and international requirements. On-board automotive sensors to monitor vehicle operation, typical diagnostic algorithms. Analytical methods for designing fault-tolerant systems and assessing vehicle reliability, including safety critical systems and 'limp-home' modes. Use of handheld scanners and specialized diagnostic equipment to classify faults.

■ **AuE 8270: Automotive Control Systems Design, 3cr. (3,0)**

Derivation of models and design of control strategies for powertrain and chassis control modules, and integration into automotive platforms. Software design, sensor selection, system architecture, diagnostics, and reliability issues are also presented. Application to engine management, transmission and chassis systems with consideration of vehicle performance, safety and information provision.

■ **AuE 8280: Fundamentals of Vehicle Drivelines and Powertrain Integration, 3cr. (3,0)**

Vehicle powertrain arrangement, manual and automatic transmissions, automotive axles, 4-wheel and 2-wheel drives, design and manufacturing of gearing systems. Other topics such as powertrain control to address dynamics in gear shifting, engine balancing, fuel economy are addressed. Modeling and computer simulation is used extensively to analyze dynamic performance of various transmissions.

■ **AuE 8290: Tire Behavior and It's Influence on Vehicle Performance, 3cr. (3,0)**

In-depth analysis of the tire and its influence on vehicle performance. Including: design, construction, structural response, rolling resistance, force and moment generation and their behavior under dry/wet conditions are investigated. Tire models, their limitations, and their governing equations. Tire characteristics on vehicle handling and safety. Advanced control concepts in vehicle stability/braking.

■ **AuE 8330: Automotive Manufacturing: an Overview, 3cr. (3,0)**

This course presents an overview of vehicle manufacturing from an OEM perspective. Issues such as supplier integration, flexible manufacturing, and quality engineering methods and their applications to manufacturing are presented. Emphasis is placed on opportunities and challenges presented with automotive manufacturing in a global environment, integrated processes, product development, flexible and agile manufacturing, supplier integration.

■ **AuE 8350: Vehicle Electronics and IT: An overview, 3cr (3,0)**

This course presents an overview of vehicle electronics and IT and their impact on vehicle performance. The impact of the advent of electronics and computing on mechatronic systems integration, and vehicle reliability and warranty are discussed. Also discussed is testing and diagnostics, software standards for design and logistics, and man/machine interface.

■ **AuE 8500: Automotive Stability and Safety Systems, 3cr. (3,0)**

Discussion of passive/active systems and design philosophies. Investigation of stability issues associated with vehicle performance and the use of sensors and control system strategies for stability enhancement. Implementation and application to intelligent cruise control, lane departure warning systems, ABS, Traction Control, active steering systems, vehicle dynamic control systems are also discussed.

■ **AuE 8550: Structural Analysis Methods for Automotive Structure, Systems, and Components, 3cr. (3,0)**

Methods to analyze the response of the automotive structure, systems, and components to static, dynamic and thermal loading. Includes coverage of critical loading conditions and system response objectives. Analysis methods will focus on finite element approaches supplemented by simple computational methods when appropriate.

■ **AuE 8570: Applied Optimization for Light-Weight Automotive Design, 3cr. (3,0)**

The fundamental concepts of optimal design are presented and applied to automotive structures and components. The course provides an overview of optimum design problem formulation and methods for numerical solutions of unconstrained and constrained problems. Topological optimization is discussed for conceptual design, size and shape optimization for detailed design.

■ **AuE 8580: Applied Optimization for Light-Weight Automotive Design, 3cr. (3,0)**

Fundamental concepts for design and engineering of vehicle structures and components are presented. Design considerations for body structure integration with vehicle styling, effective body joint design, and computational modeling for structural vibration and component crush performance are considered. Multi-objective structural design optimization is discussed.

■ **AuE 8650: Advanced Composites Manufacturing Processes, 3cr. (3,0)**

Covers fundamental principles of advanced composites manufacturing processes, including matrix materials, fibers, preforms, processing, extrusion, injection molding, compression molding, filament winding pultrusion, resin transfer molding, liquid infusion techniques, combined with design, environmental issues, process modeling, material removal, assembly, joining, repair, inspection, quality assurance and recycling. Coreq: AUE 8651 (Lab)

■ **AuE 8660: Advanced Materials for Automotive Applications, 3cr. (3,0)**

An in-depth Study of the broad range of engineering materials used in the construction of motor vehicles. Inter-relations between materials microstructure, components manufacturing process and components service behavior.

■ **AuE 8670: Vehicle Manufacturing Processes I, 3cr. (3,0)**

In-depth analysis of main component and subsystem prototyping, fabrication assembly and integration processes used during production of automotive vehicles. Design for manufacturing, computer aided manufacturing, rapid tooling technologies, technology integration, and virtual assembly are also discussed.

■ **AuE 8690: Quality Assurance for Automotive Manufacturing Systems, 3cr. (3,0)**

Overview of manufacturing quality standards and process control for the automotive industry, including evolution of the quality movement, Lean Six Sigma framework, and quality system standards. Processes include Advanced Product Quality Planning and Production Part Approval Process, exercising tools such as Measurement Systems Analysis,

Statistical Quality Control, and Design of Experiments in industrially-based projects.

■ **AUE 8700 - Automotive Business Concepts**

This survey course explores concepts relevant to the global automotive domain including project management, business principles, economic principles, product development, marketing, human factors, future trends, professionalism, and ethics.

■ **AuE 8770: Light-Weight Vehicle Systems Design, 3cr. (3,0)**

Methodological approaches to weight trade-off during design of vehicle systems accounting for other functions, cost, safety, materials characteristics and manufacturing constraints. Includes topology optimization, multi-material approaches, and identification of function optimal materials and material combinations using multi-objective formulations.

■ **AuE 8800: Design/Manufacture Project Management, 3cr. (3,0)**

Management, leadership, socio-cultural and technical skills training for the successful management of an automotive development or research team. Problem identification, team dynamics, decision making, ethics, strategy setting, project planning, scope management and implementation, target costing, marketing, design methods, design for X concepts.

■ **AuE 8810: Automotive Systems- an integrated overview, 3cr. (3,0)**

Understanding of the vehicle as a complex system and interactions of the subsystems in terms of its performance. Topics discussed include propulsion systems, suspensions and steering systems, tire road interface, structural behavior and crash worthiness, materials and manufacturing, driver/occupants vehicle interactions, and onboard electronics. Modeling and simulation is used.

■ **AuE 8820: Systems Integration Concepts and Methods, 3cr. (3,0)**

Methods and tools to handle functional, geometric, production and IT integration. Managing performance trade-offs from the combination of systems designed for individual functions. Optimization methods, complexity, validation, signal, and IT design and testing methods, robustness, architecture, quality. Coreq: AUE 8821 (Lab)

■ **AuE 8830: Applied Systems Integration, 3cr. (2,3)**

Application of integration methods to practical and complex vehicle design and manufacturing systems. Prototyping, measurements, tolerancing and validation. Diagnosis and sensitivities, methods to diagnose sporadic software errors w/hardware in the loop, design reviews, FMEA on function, signal, geometry, production. Fault Tree analysis, innovation and change management, risk analysis, value analysis. Coreq: AUE 8831 (Lab)

■ **AuE 8850: Vehicle Layout Engineering and Ergonomic Design, 3cr. (2,3)**

Vehicle layout specifications and considerations related to exterior and interior design. Ergonomics methods and tools as related to occupant accommodation and driver function are presented. Issues of assembly and manufacturing ergonomics will also be covered. Case studies. Coreq: AUE 8851 (Lab)

■ **AuE 8860: Vehicle Noise, Vibration and Harshness, 3cr. (3,0)**

The application of engineering tools and specifications for noise, vibrations, and harshness. Sources, mitigation methods, complexity and influences on other vehicle functions. Design, simulation and validation methods. Coreq: AUE 8861 (Spring 2020) (Lab)

■ **AuE 8930: Advanced Vehicle Dynamics, 3 cr. (3,0)**

Lecture/seminar course examining automobile handling, control by the human driver, objective and subjective evaluation of handling, development of models for lateral and longitudinal dynamics, steering systems, etc. Students will select papers from the literature for detailed review and lead class discussions of the papers.

■ **AuE 8930: Automotive Perception and Intelligence, 3cr. (3,0)**

This course will introduce the fundamental technologies for autonomous vehicle sensors, perception and machine learning, from electromagnetic spectrum characteristics and signal acquisition, vehicle extrospective sensor data analysis, perspective geometry models, image and point cloud processing, to machine/deep learning approaches. We will also have hands on programming experience in vehicle perception problems through homework and class projects.

■ **AuE 8930: Autonomy Science and Systems, 3cr. (3,0)**

This seminar course is intended to survey the state-of-the-art- in the rapidly evolving field of varying-grades of autonomy for on-road and off-road ground-vehicles. This course will introduce students to both eh fundamental advances in science as well as technology behind the systems in a number of application arenas.

■ **AuE 8930: Computing and Simulation for Autonomy, 3 cr. (3,0)**

This course is designed to provide knowledge in the design and implementation of real-time parallel and high-performance computing (HPC), GPU computing, AI and edge-AI computing, autonomy stacks, and simulation technologies for autonomous robots and vehicle software systems. The students will achieve these learning objectives through extensive examples, homework, case and paper studies, and project design.

■ **AuE 8930: Automotive Applications of Laser Additive Manufacturing, 3 cr. (3,0)**

The pressing demands in sustainable developments underpin the exploitation of advanced, modern, and lean manufacturing technologies to realize the effective and efficient transformation from raw materials to end products. This course will make students acquainted with the working principles, skills, and applications of various up-to-date advanced manufacturing processes that employ laser beam, electron beam, ion beam, and chemical sources of energy. Emphases will be placed on the applications of laser additive manufacturing processes in various industries, particularly for the automotive industry. Topics in this course include additive manufacturing techniques and their applications, welding, process monitoring, laser/arc assisted machining, chemical and electrochemical machining, scientific selection rules of various metallic materials, and materials science related to the processing-microstructure-property relationship in as-built and heat-treated conditions. Through this course, students will gain comprehensive insights and well-rounded experience on the practical applications of the learned concepts.

■ **AuE 8930: Automotive Circularity, 3 cr. (3,0)**

The course aims to provide the purpose, philosophy and applications of enabling circularity within the automotive world via sustainable methods and life cycle engineering approaches to assess the product responsiveness to environmental responsibility while also learning the green design principles of typical products and processes. The course introduces basic concepts, analytical frameworks, and quantitative techniques for evaluating the environmental impacts and trade-offs in a systematic and holistic way that will enable the user for more informed decision-making. Particularly, the course will focus on life cycle

engineering (LCE) - an applied methodology for lifecycle analysis or lifecycle assessment (LCA). LCA is a well-established technique to compute the various material inputs and environmental releases from all activities associated with the lifecycle i.e., raw material extraction, processing, end use, and disposal, of a product or service. It will form the basis to develop well-informed engineering impacts in LCE. We will discuss the different approaches to LCA and their advantages and disadvantages. We will also discuss the applied LCA methods to derive LCE methodologies as a tool for engineering decision-making. Students will have the opportunity to perform an LCE of a technology or a product or a service of their choice and present their findings to the class.

■ **AuE 8930: Control of Cyber-Physical Systems, 3 cr. (3,0)**

This course highlights the central roles of control theory and systems thinking in developing the theoretical foundations of CPS. In particular, the course covers topics and tools for modeling, stability analysis and control design for large scale with particular focus on centralized, decentralized, and hierarchical control methods, and addresses topics related to structural and computational issues. Case studies of control of autonomous and connected vehicles, power systems, smart grid, traffic networks are considered throughout the course.

Students should note that the AuE 8930/4930/6930 course numbers is given to several classes in special topics. They should carefully review the course title and section, not just the number, to ensure they are registering for the proper class.

Employer's Feedback on Student – SAMPLE QUESTIONS

This is NOT the official form.

The official form is found at <https://www.surveymonkey.com/s/clemsonaueinterneval>

Ratings: When evaluating your student intern, please compare him/her with employees who are completing their first year of employment with your company. Please use a five-point rating scale with **one being the lowest** and **five being the highest** ranking possible.

NA – Not applicable or unable to evaluate, more information is needed to rate the student.

1 DID NOT MEET EXPECTATIONS – Student consistently failed to complete tasks or behave as expected.

A permanent employee who performed in this manner would be terminated.

3 MET EXPECTATIONS – Student consistently completed tasks and behaved as expected.

5 MET & EXCEEDED EXPECTATIONS Student met all expectations and exceeded expectations in some areas.

The performance parallels what is seen in high-performing permanent employees.

TECHNICAL KNOWLEDGE	NA	1 DID NOT MEET EXPECTATIONS	2	3 MET EXPECTATIONS	4	5 MET & EXCEEDED EXPECTATIONS
2.1 Engineering skills						
2.2 Math skills						
2.3 Science skills						
2.4 Software skills						
2.5 Hands-on skills						
2.6 Quality of work						
2.7 Quantity of work						
2.8 Ability to learn new information quickly						
2.9 Ability to apply information						
2.10 Ability to think critically						

COMMUNICATION	NA	1 DID NOT MEET EXPECTATIONS	2	3 MET EXPECTATIONS	4	5 MET & EXCEEDED EXPECTATIONS
2.11 Verbal						
2.12 Written						

PROFESSIONALISM	NA	1 DID NOT MEET EXPECTATIONS	2	3 MET EXPECTATIONS	4	5 MET & EXCEEDED EXPECTATIONS
2.13 Punctuality & attendance						
2.14 Time management, meets deadlines						

2.15 Ability to accept criticism						
2.16 Seeks assistance when necessary						
2.17 Trustworthiness, ability to maintain confidentiality						
2.18 Effective use of interpersonal communication						
2.19 Demonstrates initiative (self-starter)						
2.20 Ability to work in a team						

- List the main tasks/projects completed by this intern.
- Name two strengths or areas where the intern excelled.
- Name two weaknesses and give suggestions for improvement.
- If you have any other general comments about this student, please share them here.

Based on your experience with this student, would you be willing to hire another intern from Clemson's Department of Automotive Engineering?

No
 Yes

I would like to be contacted about recruiting at Clemson.

I am interested in interns permanent hires both

STUDENT EVALUATION OF INTERNSHIP EXPERIENCE

This is a **SAMPLE** and not the official form. The official form is found here
<https://www.surveymonkey.com/s/clemsonauestudentsurvey>

EVALUATION OF PREPARATION FOR THE INTERNSHIP

For the questions below, **think about how well your experiences in the Department of Automotive Engineering prepared you for the duties preformed in your internship.**

Ratings:

1 DID NOT PREPARE ME FOR THIS INTERNSHIP – Basic concepts and key skills were not covered during my time at Clemson. I was not prepared to meet the needs of this internship.

3 SOMEWHAT PREPARED ME FOR THIS INTERNSHIP – All of the basic concepts and skills were covered during my time at Clemson. Some additional instruction would have been helpful

5 COMPLETELY PREPARED ME Other than proprietary concepts related to my employer, I was well prepared for this internship.

	1 DID NOT PREPARE ME	2	3 SOMEWHAT PREPARED ME	4	5 COMPELETELY PREPARED ME
TECHNICAL SKILLS	-----	-----	-----	-----	-----
2.1 Engineering skills					
2.2 Math skills					
2.3 Science skills					
2.4 Software skills					
2.5 Hands-on skills					
COMMUNICATION	-----	-----	-----	-----	-----
2.6 Verbal					
2.7 Written					
PROFESSIONALISM	-----	-----	-----	-----	-----
2.8 Punctuality & attendance					
2.9 Ability to work effectively on a team					
2.10 Time management, ability to meet deadlines					

Continued on the following page

EVALUATION OF PREPARATION FOR THE INTERNSHIP

For the next section, **please think about your internship experience. To what degree did your internship help you learn new skills or further develop your existing skills?**

1 NO SKILL DEVELOPMENT – This internship offered no value when it came to learning or improving skills in this area.

3 SOME SKILL DEVELOPMENT – I learned some new skills or improved my existing knowledge in this area.

5 STRONG SKILL DEVELOPMENT – My skills and knowledge in this area were significantly improved through this internship experience.

	1 NO SKILL DEVELOPMENT	2	3 SOME SKILL DEVELOPMENT	4	5 STRONG SKILL DEVELOPMENT
TECHNICAL SKILLS	-----	-----	-----	-----	-----
3.1 Engineering skills					
3.2 Math skills					
3.3 Science skills					
3.4 Software skills					
3.5 Hands-on skills					
COMMUNICATION	-----	-----	-----	-----	-----
3.6 Verbal					
3.7 Written					
PROFESSIONALISM	-----	-----	-----	-----	-----
3.8 Time management, ability to meet deadlines					
3.9 Ability to accept criticism					
3.10 Effective use of interpersonal communication					
3.11 Ability to work on a team					

- Based on your experience with this site, would you recommend it to other students?
 No
 Yes
 Explain
- Name three things you wished that you learned in the Department of Automotive Engineering.
- Name the three most important things you learned during your internship. This does not have to be limited to technical knowledge.
- What do you wish you knew on your first day at this internship site?
- If you have any general comments about this internship, please share them here.
- Was this internship in your technical area? Why did you select this internship?

Acknowledgment Form

Reference only - A copy of this form will be distributed at orientation.

I have received an electronic copy (PDF) the Clemson University Department of Automotive Engineering Graduate Student Manual.

I understand that **I must read the manual and familiarize myself with the policies found there.** As a student in the Department of Automotive Engineering, **I must obey all the rules and policies outlined in the manual.**

Furthermore, I understand that faculty members have the right to set policies that govern their classrooms. I am expected to adhere to these rules as well as the policies outlined in the manual.

By signing below, I acknowledge that I have received the manual and am responsible for the information found within its pages.

Please print your name above

Please sign your name above

Date

This form is to be returned to the Graduate Student Coordinator.
All forms are to be returned by the end of the second week of classes.

A hard-copy version of this form will be distributed to students during orientation.



Automotive Engineering Waiver Request

INSTRUCTIONS FOR COMPLETING THIS FORM

(Please read all instructions and policies before completing this form)

All waiver requests are reviewed by the Graduate Research Committee (GRC). The GRC reserves the right to approve or disapprove waiver requests upon review. The student and their advisor will be notified once a final decision has been made by the GRC. Students should review the AuE Graduate Manual for waiver requirements prior to submission of the request form. All waiver request forms must be accompanied by justifiable documentation as mentioned in the AuE Graduate Manual.

Date: _____ **Semester/Year:** _____

Last Name: _____ **First Name:** _____ **MI:** _____

CUID#: _____ *Domestic* *International*

Type of Waiver:

Internship Waiver Business Course Waiver Additional Course Waiver

Reason for waiver request (brief description):

Student Signature: _____

Signature

Date

Advisor Signature: _____

Signature

Date

FOR GRC USE

Approved Denied GRC representative:

Date: _____