LASER-MATERIALS PROCESSING AND LASER-BASED MANUFACTURING GRADUATE CREDIT CERTIFICATE PROGRAM

The purpose of this program is to prepare engineers to integrate laser-materials processing into the concurrent design and manufacture of multiscale components and systems of the future. Its objective is to offer a multidisciplinary curriculum drawing upon the strengths of several engineering departments and the Applied Research Laboratory.

Effective Semester: Spring 2016
Expiration Semester: Fall 2020

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (http://gradschool.psu.edu/graduate-education-policies/). International applicants may be required to satisfy an English proficiency requirement; see GCAC-305 Admission Requirements for International Students (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-305-admission-requirements-international-students/) for more information.

Graduates in engineering, the sciences, or medicine who present a 3.0 grade-point average will be considered for admission. Exceptions to the minimum 3.00 GPA may be made for students with professional experience, special backgrounds, abilities, and interests. GRE scores are not required.

Certificate Requirements

Requirements listed here are in addition to requirements listed in Graduate Council policy GCAC-212 Postbaccalaureate Credit Certificate Programs (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-212-postbaccalaureate-credit-certificate-programs/).

To be awarded the Laser-Materials Processing and Laser-Based Manufacturing certificate, students must successfully complete with a grade of B or higher 12 credits of graduate course work including the following, or other courses approved in advance by petition.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ESC 540</td>
<td>Laser Optics Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>Select three of the following:</td>
<td></td>
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<tr>
<td>ESC 541</td>
<td>Laser-Materials Interactions</td>
<td></td>
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<tr>
<td>ESC 542</td>
<td>Laser-Integrated Manufacturing</td>
<td></td>
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<tr>
<td>ESC 543</td>
<td>Laser Microprocessing</td>
<td></td>
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</tbody>
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Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Learning Outcomes

1. LASERS, MATERIALS AND SAFETY: Safety principles and practices related to the operation of lasers and materials handling in regards to environmental, health and safety issues.
2. LASER OPTICS, SYSTEMS AND SUBSYSTEMS: Principles of optics used in laser systems; design and configuration of optical trains for use with lasers of varying wavelengths; integration of optics with sensing, control and feedback subsystems; selection of laser systems for laser-materials processing and laser-based manufacturing.
3. LASER ENERGY-MATERIALS INTERACTIONS: Physics of energy-materials interactions; laser interactions with powder and solid metals, ceramics, polymeric and composite materials; energy and mass transport; thermal modeling.
4. LASER PROCESS DESIGN AND MANUFACTURING METHODS: design of laser processes such as cutting, welding, drilling, surfacing, additive manufacturing, among others.
5. CHARACTERIZATION OF LASER MODIFIED MATERIALS AND PRODUCTS: Application of characterization techniques and measurements such as optical, scanning and transmission electron microscopy; hardness, mechanical and wear testing; among others, to optimize laser modified material microstructures, and their physical, chemical and optical properties. Identify optimal laser processing/manufacturing methods for controlling material fabrication and final product performance.

Contact

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