### ADVANCED MANUFACTURING AND APPLIED ROBOTICS (AMAR)

See Course Description Symbols and Terms (https://catalog.csuchico.edu/academic-standards-policies/course-description-symbols-terms/) for an explanation of course description terminology and symbols, the course numbering system, and course credit units.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Description</th>
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<tbody>
<tr>
<td>AMAR 160</td>
<td>Manufacturing Processes</td>
<td>3 Units</td>
<td>A modern introduction to fundamental manufacturing practices as well as cutting-edge industrial manufacturing process advancements. Hands-on practice in traditional and advanced manufacturing methods. Integration of Life Cycle Assessment and Reduce, Reuse, Recycle principles. 2 hours discussion, 3 hours laboratory.</td>
</tr>
<tr>
<td>AMAR 198</td>
<td>Special Topic</td>
<td>1-3 Units</td>
<td>Special topic generally offered one time only. Different sections may have different topics. See the Class Schedule for specific topic being offered. This course may be repeated for a maximum of 21 units to be counted toward the major. 1 hour activity.</td>
</tr>
<tr>
<td>AMAR 260</td>
<td>Applied Advanced Manufacturing</td>
<td>4 Units</td>
<td>Industrial applications of subtractive and additive manufacturing. Traditional and advanced material removal techniques including the physics of metal-cutting, cutting-tool materials and geometry, conventional and semi-automatic machine tools, and electrical discharge machining (EDM). Additive manufacturing topics include 3D printing, rapid prototyping, and emerging additive manufacturing, processes and technologies. Also includes cost estimating and power management as applied to industrial scale manufacturing. 3 hours laboratory, 3 hours lecture.</td>
</tr>
<tr>
<td>AMAR 298</td>
<td>Special Topic</td>
<td>1 Unit</td>
<td>Special topic generally offered one time only. Different sections may have different topics. See the Class Schedule for specific topic being offered. This course may be repeated for a maximum of 21 units to be counted toward the major. 1 hour discussion.</td>
</tr>
<tr>
<td>AMAR 300</td>
<td>Applied Mathematics and Programming for Advanced Manufacturing</td>
<td>3 Units</td>
<td>An introduction to programming and mathematical concepts encountered in advanced manufacturing. Mathematical concepts are presented in the context of their application to industrial automation and robotics. Students will learn modern programming tools and constructs common to the industry. Mathematical and programming concepts are applied in weekly laboratory exercises. 2 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 316</td>
<td>Introduction to Plastics</td>
<td>3 Units</td>
<td>Survey of polymer chemistry, mechanical properties, and industrial processing of thermoplastics with emphasis on waste reduction and recycling. 3 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 318</td>
<td>Advanced Plastics &amp; Composites</td>
<td>3 Units</td>
<td>An introduction to composite materials and processing. Topics include thermoplastic and thermoset composites, glass and carbon fiber reinforcements, biobased polymers and natural fibers, core materials, tooling, and thermoset processing equipment. 3 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 347</td>
<td>Sustainable Polymer Composites</td>
<td>3 Units</td>
<td>Survey of polymer chemistry, mechanical properties, and industrial processing of thermoplastics with emphasis on waste reduction and recycling. 3 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 370</td>
<td>Introduction to Advanced Manufacturing</td>
<td>3 Units</td>
<td>An introduction to advanced manufacturing concepts and practices. Topics include advanced manufacturing systems, computer-aided design and manufacturing, and industry standards. 3 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 371</td>
<td>Advanced Materials and Processes</td>
<td>3 Units</td>
<td>An introduction to advanced materials and processes. Topics include materials selection, design for manufacturing, and life cycle assessment. 3 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 372</td>
<td>Advanced Manufacturing Systems</td>
<td>3 Units</td>
<td>An introduction to advanced manufacturing systems. Topics include computer-aided design, computer-aided manufacturing, and manufacturing systems design. 3 hours laboratory, 2 hours lecture.</td>
</tr>
<tr>
<td>AMAR 373</td>
<td>Advanced Manufacturing Processes</td>
<td>3 Units</td>
<td>An introduction to advanced manufacturing processes. Topics include advanced manufacturing systems, computer-aided design and manufacturing, and industry standards. 3 hours laboratory, 2 hours lecture.</td>
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</tbody>
</table>

**Prerequisites**:
- MATH 105 and MATH 119 or MATH 120, MECH 140 (may be taken concurrently).
- AMAR 198
- AMAR 316

**Typically Offered**:
- Fall only
- Spring only
- Fall only
- Spring only
- Fall only
- Spring only
- Fall only
- Spring only
- Fall only
- Spring only
- Fall only
- Spring only
- Fall only
- Spring only
- Fall only
- Spring only

**Grade Basis**: Graded

**Repeatability**: You may take this course for a maximum of 3 units

**Course Attributes**: Upper Division
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<th>Grade Basis</th>
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<tr>
<td>AMAR 352W</td>
<td>Industrial Management (W)</td>
<td>3</td>
<td>GE Written Communication (A2) requirement, junior standing.</td>
<td>Fall only</td>
<td>Upper Division; Writing Course; Graduation Writing Assessment</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 360</td>
<td>Computer Integrated Manufacturing</td>
<td>4</td>
<td>AMAR 260, MECH 200.</td>
<td>Fall only</td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 389</td>
<td>Directed Manufacturing Experience</td>
<td>1-3</td>
<td>Approval of faculty internship coordinator prior to off-campus assignment.</td>
<td>Fall and spring</td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 395</td>
<td>Manufacturing Laboratory Practice</td>
<td>1</td>
<td>AMAR 160.</td>
<td>Fall and spring</td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 398</td>
<td>Special Topic</td>
<td>3</td>
<td>To be established when course is formulated.</td>
<td></td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
</tr>
<tr>
<td>AMAR 399</td>
<td>Special Problems</td>
<td>1-3</td>
<td>Approval of supervising faculty member.</td>
<td></td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 420</td>
<td>Robotics for Advanced Manufacturing</td>
<td>4</td>
<td>EECE 344 or MECA 380.</td>
<td>Fall only</td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 439</td>
<td>Capstone Design I</td>
<td>3</td>
<td>GE Oral Communication (A1) requirement; GE Written Communication (A2) requirement; AMAR 360; AMAR 458 (may be taken concurrently). Recommended: MECA 380.</td>
<td>Fall and spring</td>
<td>Upper Division; Writing Course; Graduation Writing Assessment</td>
<td></td>
<td>Graded</td>
<td></td>
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<tr>
<td>AMAR 440B</td>
<td>Capstone Design II</td>
<td>3</td>
<td>AMAR 440AW.</td>
<td></td>
<td>Upper Division</td>
<td></td>
<td>Graded</td>
<td></td>
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</table>
AMAR 451  Quality Management  3 Units
Prerequisite: OSCM 306 or faculty permission; MATH 105 or MATH 108 for Business majors only.
Typically Offered: Fall and spring
The study and application of the quality management process in both the manufacturing and service sectors of the economy. Topics include process analysis and improvement, statistical process control, cost of quality, quality measurement, and quality in the global marketplace. 3 hours lecture. (005784)
Cross listing(s): OSCM 451
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 454  Advanced Laboratory Practices  2 Units
Prerequisite: Faculty permission.
Typically Offered: Fall and spring
Provides qualified students an opportunity to do individual special interest study and practice toward gaining proficiencies in the student's area of specialization. 6 hours independent study. (005279)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

AMAR 458  Project Management  3 Units
Prerequisite: Senior standing.
Typically Offered: Fall only
This course familiarizes students with techniques for managing technical projects while they design, plan, and implement a manufacturing project through the mock-up stage. Students work in groups on projects of mutual interest to gain experience in planning and updating schedules. Students learn to define requirements, estimate and manage resources, and structure decisions and trade-offs. Discussion includes global project management and supply chain responsibility. Emphasis is placed on group dynamics in communication and problem solving. 3 hours lecture. (005291)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 460  Robotic Manufacturing Systems  4 Units
Prerequisite: AMAR 420.
Typically Offered: Spring only
A continuation of robotics and its application to advanced manufacturing. Implementation of smart manufacturing systems on the factory floor. Practical automation workflows based on parametric modeling, scripting, simulation, and optimization. Course activities will utilize industrial scale robots and associated hardware. This course will also introduce contemporary topics in robotics research applied to machine learning and artificial intelligence. 3 hours laboratory, 3 hours lecture. (022129)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

AMAR 477  Nanoscale Device Manufacturing  3 Units
Prerequisite: EECE 315 or MECH 210.
Typically Offered: Spring only
This course introduces the manufacturing processes for various classes of nanoscale devices from logic/memory semiconductors to nano-electro-mechanical systems (NEMS). Study of processes including photoresist lithography, ingot growth, ion implantation, chemical vapor deposition, atomic layer deposition, and molecular beam epitaxy. Course covers the fundamental performance barriers for each material/device type and perform defect analyses to assess how defects either improve or degrade these materials. Also covered are financial aspects of nanoscale manufacturing including capital equipment costs, the financial history of these industries, return on investment, amortization, and case studies of both industry failures and successes. 3 hours lecture. (021768)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 498  Advanced Topic  1-3 Units
Prerequisite: To be established when course is formulated.
Typically Offered: Inquire at department
Special topic generally offered one time only. Different sections may have different topics. See the Class Schedule for the specific topic being offered. This course is normally taught by professionals from the field. This course may be repeated for a maximum of 21 units to be counted toward the major. 1 hour discussion. (005308)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

AMAR 499  Special Problems  1-3 Units
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
Independent study of a special problem. See department office for registration procedure. 9 hours supervision. (015852)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division