MECHANICAL AND MECHATRONIC ENGINEERING AND ADVANCED MANUFACTURING

Mechanical and Mechatronic Engineering and Advanced Manufacturing Department (http://www.csuchico.edu/mmem/)
O'Connell Center 419
530-898-5346
530-898-4070 (fax)
Email: mmem@csuchico.edu
Chair: Gregory Watkins

Insight

Manufacturing in the age of information and technology bears little resemblance to the assembly lines of yesteryear. Rather than being loud, dirty, and heavily reliant on manual labor, today's modern manufacturing environment is clean, quiet, and automated with robots and purpose-built machines handing repetitive tasks with speed and precision.

With the advent of Industry 4.0, today's manufacturing workforce needs cutting-edge skills in automation, sensing, programming, and robotics. Manufacturers also covet employees with knowledge and skills in project management, communication, leadership, and business economics.

This unique multidisciplinary program, rooted in hands-on technology education, ties together an understanding of the challenges and opportunities that modern manufacturing faces in creating tomorrow's industry leaders.

The program is built on a foundation of lower-division math, science, economics, business, and fundamental manufacturing concepts. Upper-division classes integrate that foundation into a unified body of knowledge with three primary areas of emphasis as applied to manufacturing:

- Robotics and automation
- Materials and manufacturing processes
- Business, communication, and management

The curriculum is applied in nature and includes significant hands-on laboratory experiences with modern, industrial-scale equipment. Technical, business, and management aspects are woven throughout the curriculum which concludes with a year-long, real-world, capstone experience.
Hallmarks of our program are:

- An applied, hands-on curriculum firmly grounded in fundamentals,
- Accessible faculty with significant industrial experience who provide superior teaching and mentoring both in and out of the classroom,
- Strong industry partnerships that provide students with opportunities to work on applied research and important real-world projects,
- Project-based learning where students apply fundamentals to solve real-world problems and develop teamwork skills,
- Accessible laboratory facilities that include modern industrial-scale equipment,
- Class sizes that encourage active student participation,
- Extensive opportunities for extracurricular activities and competitions.

The Advanced Manufacturing and Applied Robotics program is professionally accredited by The Association of Technology, Management, and Applied Engineering (ATMAE).

Experience

Student organizations. Advanced manufacturing students are active participants in the student chapters of professional organizations as well as department clubs and competition teams. These extra-curricular activities develop well-rounded individuals with leadership, managerial, social, and technical skills and are a hallmark of programs in the department. Current on-campus professional organizations and clubs include:

- Society of Manufacturing Engineers
- Society of Plastics Engineers
- Society of Women Engineers
- American Society of Mechanical Engineers
- American Institute of Mechatronic Engineers
- Engineers for Alternative Energy
- Materials Research Society
- SAE Baja competition team
- SAE Formula competition team
- Chico Rocketry and Aerospace Club

Scholarships. In addition to university-wide scholarships, manufacturing students are eligible for 12 to 15 manufacturing-specific scholarships each year. Individual awards range from $100 to $1,000 and are based on academic performance/improvement, participation in activities, leadership qualities, and/or financial need.

Internships. Many students take advantage of cooperative education/internship opportunities available through the Career Center's internship program. These are full-time, semester and/or summer positions with well-known companies. Participants gain professional experience, earning salaries of $2,500-$3,500 per month. Students can earn up to three units of academic credit for industrial internships which satisfy a technical elective requirement.

Engineering programs. The department also offers ABET accredited programs in mechanical engineering and mechatronic engineering. Many department faculty cross over and teach in all three programs. Students in advanced manufacturing and applied robotics have several courses in common with the engineering students during their first two years. Upper-division coursework diverges into the unique needs of the respective programs. Advanced manufacturing students also participate in the same Capstone Design Program where they work side by side with engineering students, as they will work side by side with engineers in industry.

Industrial support. The department and program enjoy the strong support of industry in the form of sponsored projects, funded research, donated materials and equipment, and of course, jobs for program graduates. The program's advisory board is made up of leaders in the manufacturing industry, ensuring that the program remains current to the needs of today's manufacturing workplace.

Outlook

The Society of Manufacturing Engineers reports that within the next 10 years, 3.5 million manufacturing jobs will become available, while 2 million may go unfilled due to the lack of skilled workers. This program provides a balance of technical, business, and management skills that prepare graduates for successful careers in today's modern manufacturing workplace.

Programs

Undergraduate

Bachelor's

- Advanced Manufacturing and Applied Robotics BS (https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/mechanical-mechatronic-engineering-advanced-manufacturing/advanced-manufacturing-applied-robotics-bs/)
- Mechanical Engineering BS (https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/mechanical-mechatronic-engineering-advanced-manufacturing/mechanical-engineering-bs/)
- Mechatronic Engineering BS (https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/mechanical-mechatronic-engineering-advanced-manufacturing/mechatronic-engineering-bs/)

Minors

- Manufacturing Minor (https://catalog.csuchico.edu/colleges-departments/college-engineering-computer-science-construction-management/mechanical-mechatronic-engineering-advanced-manufacturing/manufacturing-minor/)

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.

Advanced Manufacturing and Applied Robotics

AMAR 160 Manufacturing Processes **3 Units**
Typically Offered: Fall and spring
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. (005149)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division

AMAR 198 Special 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 specific topic being offered. This course may be repeated for a maximum of 21 units to be counted toward the major. 1 hour activity. (015894)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

AMAR 260 Applied Advanced Manufacturing **4 Units**
Prerequisite: AMAR 160 (with a grade of C- or higher), MATH 119 or MATH 120, MECH 100, PHYS 202A or PHYS 204A. Recommended: MATH 105.
Typically Offered: Spring only
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. (005212)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

AMAR 298 Special Topic **1 Unit**
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 specific topic being offered. This course may be repeated for a maximum of 21 units to be counted toward the major. 1 hour discussion. (015850)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

AMAR 300 Applied Mathematics and Programming for Advanced Manufacturing **3 Units**
Prerequisite: MATH 105 and MATH 119 or MATH 120, MECH 140 (may be taken concurrently).
Typically Offered: Fall only
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. (022127)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 316 Introduction to Plastics **3 Units**
Prerequisite: CHEM 107 or CHEM 111, MECH 210 (may be taken concurrently).
Typically Offered: Fall only
Survey of polymer chemistry, mechanical properties, and industrial processing of thermoplastics with emphasis on waste reduction and recycling. 3 hours laboratory, 2 hours lecture. (022071)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 318 Advanced Plastics & Composites **3 Units**
Prerequisite: AMAR 316.
Typically Offered: Spring only
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. (022070)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 347 Sustainable Polymer Composites **3 Units**
Prerequisite: MECH 210.
Typically Offered: Inquire at department
This course provides students an introduction to composite materials and processing by investigating 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. (021724)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 352W Industrial Management (W) **3 Units W, GW**
Prerequisite: GE Written Communication (A2) requirement, junior standing.
Typically Offered: Fall only
A study of effective industrial safety and supervisory management practices used in the manufacturing industry. Supervisory and managerial procedures used in industry by supervisors, managers, field and sales representatives, and inspectors. Instruction in communication, training, organization, ethics, conflict management, safety practices, and OSHA standards. Instruction in effective technical safety documentation - gathering, organizing, and reporting industrial safety data. 3 hours discussion. (005670)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment

AMAR 360 Computer Integrated Manufacturing **4 Units**
Prerequisite: AMAR 260, MECH 200.
Typically Offered: Fall only
A study of computer numerical control (CNC) machine tools used in the manufacture of engineered products. Integration of computer aided design and computer aided manufacturing (CAD/CAM) software. Course activities utilize industrial scale CNC machining centers and lathes. Advanced manufacturing topics such as toolpath optimization and factory floor integration are introduced. 3 hours laboratory, 3 hours lecture. (005278)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

AMAR 389 Directed Manufacturing Experience **1-3 Units**
Prerequisite: Approval of faculty internship coordinator prior to off-campus assignment.
Typically Offered: Fall and spring
Manufacturing experience in an industrial setting which provides an opportunity to apply academic learning to professional practice. Minimum duration of 400 hours of work under the direct supervision of an on-site manufacturing supervisor. On completion of the internship, a report prepared under the direction of a faculty member is required. This course is an elective for the BS in Advanced Manufacturing and Applied Robotics; a total of 3 units must be completed to receive elective credit. 3 hours supervision. (005294)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

AMAR 395 Manufacturing Laboratory Practice **1 Unit**
Prerequisite: AMAR 160.
Typically Offered: Fall and spring
Provides additional time in the manufacturing laboratories for completion of manufacturing and engineering course-related projects and assignments. 2 hours activity. (020682)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 7 units
Course Attributes: Upper Division

AMAR 398 Special Topic **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. 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. (005250)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

AMAR 399 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. 3 hours supervision. (005251)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

AMAR 420 Robotics for Advanced Manufacturing 4 Units
Prerequisite: EECE 344 or MECA 380.
Typically Offered: Fall only
An overview of robotics and its application to advanced manufacturing. Topics include vision, motion planning, mobile mechanisms, kinematics, dynamics, and sensors. Course activities will utilize industrial scale robots and associated hardware as well as modern simulation tools. This course will also introduce contemporary topics in robotics research and its application. 3 hours laboratory, 3 hours lecture. (022128)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

AMAR 440AW Capstone Design I 3 Units W, GW
Prerequisite: GE Oral Communication (A1) requirement; GE Written Communication (A2) requirement; AMAR 360; AMAR 458 (may be taken concurrently). Recommended: MECA 380.
Typically Offered: Fall and spring
Design methods applied to manufacturing systems in group design projects. Project definition, planning, and management. Design for manufacture, cost considerations, budgets, and teamwork. Oral and written presentation of design results. Initial stage of the capstone design project to be continued in AMAR 440B. 2 hours lecture, 3 hours supervision. (022124)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment

AMAR 440B Capstone Design II 3 Units
Prerequisite: AMAR 440AW.
Typically Offered: Fall and spring
Implementation of the capstone design project from AMAR 440AW including fabrication, testing, and evaluation of a working prototype. Impact of engineering solutions in global, economic, environmental, and societal context. Ethical and professional responsibilities in engineering including continuing self-education and career development. Must be taken the semester immediately following AMAR 440AW. 2 hours lecture, 2 hours supervision. (022125)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

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 464 Fluid Metallurgy 3 Units
Prerequisite: AMAR 160.
Typically Offered: Inquire at department
The course provides students a comprehensive overview of the study of metal casting technology. Students learn about the properties of casting allows, casting processes, pattern design, pattern making, mold making, core design, core making, heat treating, finishing of castings, and sand testing. 3 hours laboratory, 2 hours lecture. (005209)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 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

Mechanical Engineering

MECH 100 Graphics I **1 Unit**
Corequisites: MECH 100L.
Typically Offered: Fall and spring
Introduction to engineering graphics. Orthographic projection, auxiliary views, isometric views, dimensioning, tolerancing, drawing standards, working drawings, free-hand sketching, solid modeling. 1 hour discussion. (015811)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Lower Division

MECH 100L Graphics I Laboratory **1 Unit**
Corequisites: MECH 100.
Typically Offered: Fall and spring
Introduction to solid modeling using a parametric, feature-based application software, SolidWorks. Solid modeling of parts and assemblies, detail and assembly drawings. 3 hours laboratory. (020257)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Lower Division

MECH 140 Introduction to Design and Automation **2 Units**
Prerequisite: MATH 119 or GE Mathematics/Quantitative Reasoning Ready, first-year freshmen who successfully completed trigonometry and precalculus in high school can meet this prerequisite by achieving a score that meets department guidelines on the calculus readiness exam.
Typically Offered: Fall and spring
Introduces the design process and fundamentals of automation. Hands-on use of sensors, pneumatics, stepper motors, bearings, couplings, gears, belts, pulleys, and framing materials. Topics include AC and DC motor control, simple electrical circuits, machine controllers, PLC programming, testing and analysis of results, budgeting, and bills of materials. Teams design and build a proof-of-concept system to verify their design. 1 hour discussion, 3 hours laboratory. (005401)
Cross listing(s): MECA 140
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Lower Division

MECH 198 Special Topic **1-3 Units**
Typically Offered: Inquire at department
Special topic generally offered one time only. Different sections may have different topics. See the Class Schedule for specific topic being offered. 3 hours lecture. (005406)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

MECH 200 Graphics II **2 Units**
Prerequisite: MECH 100 and MECH 100L.
Typically Offered: Fall and spring
A study of advanced topics in Engineering Graphics. Concepts include drawing standards, geometric dimensioning and tolerancing, working drawings, model based definition, intermediate to advanced solid modeling, advanced assemblies, renderings, animations, equations, and design considerations. Preparation for advanced certifications in Engineering Graphics. 3 hours laboratory, 1 hour lecture. (015854)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Lower Division

MECH 208 Introduction to Technical Computing **2 Units**
Prerequisite: MATH 121. Recommended: PHYS 204A.
Typically Offered: Fall and spring
A foundation course in technical computing for engineering. Introduces commercial software commonly used in the solution of engineering problems. Application areas include kinematics and kinetics, fluid flow, thermal systems, and machine design. 3 hours laboratory, 1 hour lecture. (021113)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Lower Division

MECH 210 Materials Science and Engineering **3 Units**
Prerequisite: CHEM 107 or CHEM 111, PHYS 202A or PHYS 204A.
Corequisites: MECH 210L for MECA, MECH, and AMAR majors only.
Typically Offered: Fall and spring
Processing, structure, properties, and performance of engineering materials. Applied knowledge of material properties as engineering design parameters. Advanced manufacturing processes, including microfabrication are discussed. 3 hours discussion. (005402)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division

MECH 210L Materials Science and Engineering Laboratory 1 Unit
Corequisites: MECH 210 for AMAR, MECA, and MECH majors only.
Typically Offered: Fall and spring
Standards and procedures for materials testing. Hands-on experience with commonly used equipment for materials testing. Test data acquisition and integration for material properties. Presentation of test data and findings in technical reports. 3 hours laboratory. (021645)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Lower Division

MECH 298 Special 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 specific topic being offered. 3 hours lecture. (015855)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

MECH 306 Equation Solving Techniques 3 Units
Prerequisite: MATH 260, MECH 208. Recommended: PHYS 204A.
Typically Offered: Fall and spring
Numerical analysis, analytical methods, and equation solving techniques for mechanical engineering design. Structured problem formulation, parametric studies, introduction to programming concepts, and optimization for design. 2 hours activity, 2 hours lecture. (005413)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 308 Finite Element Analysis 3 Units
Prerequisite: CIVL 311 with a grade of C- or higher, MECH 306.
Typically Offered: Fall and spring
Development of finite element formulation from fundamental governing engineering equations. Coverage includes areas ranging from elasticity, vibration, and heat transfer to acoustics and composites. 3 hours lecture. (005439)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 320 Dynamics 3 Units
Prerequisite: CIVL 211 with a grade of C- or higher, MATH 260.
Typically Offered: Fall and spring
Kinematics and dynamics of mechanical systems composed of rigid bodies. Moments and products of inertia, forces of interaction, inertia forces and torques. Equations of motion of non-planar systems. 3 hours discussion. (005409)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 332 Thermodynamics 3 Units
Prerequisite: PHYS 204A.
Typically Offered: Fall and spring
Properties of substances, ideal gas equation of state, heat and work, first and second laws of thermodynamics, steady-state analysis of closed and open systems, entropy, gas and vapor power cycles, introduction to renewable energy sources. 3 hours discussion. (005414)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 338 Heat Transfer 4 Units
Prerequisite: CIVL 321, MATH 260, MECH 332. Recommended: MECH 306.
Typically Offered: Fall and spring
Conduction, convection, and radiation heat transfer; steady-state and transient analysis methods; numerical methods applied to conduction heat transfer; design of finned arrays, systems for electronics cooling, heat exchangers, and solar collectors. 2 hours activity, 3 hours discussion. (005448)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

MECH 340 Mechanical Engineering Design 4 Units
Prerequisite: CIVL 311 with a grade of C- or higher, MECH 100, MECH 100L, MECH 140, MECH 210, AMAR 160. Recommended: MECH 320.
Typically Offered: Fall and spring
Design and performance of machine components and systems subjected to both steady and variable loading conditions. Failure theories, reliability, use of codes and standards, and standard design practices are introduced. Also discussed are realistic constraints for design in economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability context. A grade of C- or higher is required to pass this course. 2 hours activity, 3 hours lecture. (005411)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

MECH 389 Industrial Internship 1-3 Units
Prerequisite: Approval of faculty internship coordinator prior to off-campus assignment.
Typically Offered: Fall and spring
Engineering experience in an industrial setting. Minimum duration of 400 hours of work under the direct supervision of an on-site engineering supervisor. On completion of the internship, a written report prepared under the direction of a faculty member is required. This course is an elective for the BS in Mechanical Engineering, a total of 3 units must be completed to receive elective credit. 9 hours supervision. (005454)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 398 Special 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 specific topic being offered. 3 hours lecture. (005424)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

MECH 399 Special Problems 1-3 Units
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
This course is an independent study of special problems offered for 1.0-3.0 units. See the department office for information on registering. 9 hours supervision. (005426)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

MECH 408 Modeling and Simulation **3 Units**
Prerequisite: MECH 200, MECH 308, MECH 338, MECH 340.
Typically Offered: Inquire at department
Computer modeling, simulation, and solution of engineering problems. Applications in mechanical, thermal, and fluid flow analysis. Emphasis on proper use of current commercial software and solution verification through traditional engineering analysis. 3 hours lecture. (021223)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 410 Advanced Materials Science and Engineering **3 Units**
Prerequisite: MATH 260, MECH 210. Recommended: CIVL 311.
Typically Offered: Inquire at department
Design, manufacture, and practical applications of advanced engineering materials. Failure analysis and prevention of material failure in mechanical design. Microfabrication of micromechanical devices. 3 hours discussion. (005428)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 424 Mechanical Vibrations **3 Units**
Prerequisite: MECH 320.
Typically Offered: Inquire at department
Free and forced vibrations of lumped parameter systems, transient vibrations, systems with several degrees-of-freedom. 3 hours discussion. (005437)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 430 Nanoscale Science and Engineering **3 Units**
Prerequisite: CHEM 111, MECH 210, and PHYS 204B, or consent of the instructor.
Typically Offered: Inquire at department
This course introduces students to the interdisciplinary field of nanoscale science and engineering including the areas of engineering, materials science, chemistry, and physics. The topics covered include advanced materials, synthesis and modification of nanomaterials, properties of nanomaterials, materials characterization, nanofabrication methods, and applications. It has three modules which are formal lectures, guest speakers, and projects. For the projects student learn to conduct a literature search on a given topic and are asked to present their project. They further have a chance to propose their own ideas for potential applications and are asked to give detailed methodology to execute the project. 3 hours discussion. (021952)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 9 units
Course Attributes: Upper Division

MECH 432 Energy Systems **4 Units**
Prerequisite: MECH 338.
Typically Offered: Fall and spring
Thermodynamics of power cycles, refrigeration, air-conditioning, and combustion processes; analysis, design, and testing of systems involving both conventional and renewable energy sources for power generation, heating, and cooling applications. 3 hours discussion, 3 hours laboratory. (005442)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Sustainable Course

MECH 433 Solar Energy Engineering **3 Units**
Prerequisite: CIVL 321; EECE 211 or EECE 215; MECH 338 (may be taken concurrently).
Typically Offered: Inquire at department
This introductory course covers the design and operation of solar photovoltaic (PV) and solar thermal systems. Foundational topics include solar radiation characteristics, solar materials, and heat transfer. Solar PV systems include cell operations, I-V characteristics, module design, maximum power-point tracking, charge controllers, batteries, inverters, design of grid-tied and off-grid systems, and system performance evaluation. Solar thermal systems include flat-plate collectors, concentrating collectors, passive and active solar water heating, solar space heating and cooling, and solar thermal power systems. 2 hours activity, 2 hours lecture. (021438)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Sustainable Course

MECH 435 Low Speed Aerodynamics **3 Units**
Prerequisite: CIVL 321, MATH 260. Recommended: MECH 306.
Typically Offered: Inquire at department
Flow around elementary shapes, concepts of flow circulation, lift and drag. Incompressible inviscid flows around thin airfoils and wings of finite span. 3 hours discussion. (005444)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 440AW Capstone Design I (W) **3 Units W, GW**
Prerequisite: GE Oral Communication (A1) requirement; GE Written Communication (A2) requirement; MECH 200; MECH 340 with a grade of C- or higher. Recommended: MECA 380, MECH 308, MECH 338.
Typically Offered: Fall and spring
Design methods applied to mechanical system in group design projects. Project definition, planning, and management. Design for manufacture, cost considerations, budgets, and teamwork. Oral and written presentation of design results. Initial stage of the capstone design project to be continued in MECH 440B. 2 hours lecture, 3 hours supervision. (005433)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment

MECH 440B Capstone Design II **3 Units**
Prerequisite: MECH 440AW. Recommended: MECA 380, MECH 308, MECH 338.
Typically Offered: Fall and spring
Continuation of the capstone design project from MECH 440AW including fabrication, testing, and evaluation of a working prototype. Impact of engineering solutions in global, economic, environmental, and societal context. Ethical and professional responsibilities in engineering including continuing self-education and career development. Must be taken the semester immediately following MECH 440AW. 2 hours lecture, 3 hours supervision. (005434)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECH 498 Special 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. 3 hours lecture. (005456)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

MECH 499 Special Problems **1-3 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
This course is an independent study of special problems offered for 1.0-3.0 units. See the department office for information on registering. 3 hours supervision. (005457)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

MECH 499H Honors Project **3 Units**
Prerequisite: Completion of 12 units of upper-division MECH courses, faculty permission.
Typically Offered: Inquire at department
Open by invitation to MECH majors who have a GPA among the top 5% of MECH students based upon courses taken at CSU, Chico. This is an "Honors in the Major" course; a grade of B or higher in 6 units of MECH 499H certifies the designation of "Honors in the Major" to be printed on the transcript and the diploma. If taken twice, prerequisite to the second semester is a grade of B or higher in the first semester. Each 3-unit course will require both formal written and oral presentations. 9 hours supervision. (005458)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

MECH 697 Independent Study **1-3 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
This course is a graduate-level independent study offered for 1.0-3.0 units. 9 hours supervision. (005476)
Grade Basis: Report in Progress: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

MECH 698 Advanced Topic **1-3 Units**
Prerequisite: To be established when course is formulated.
Typically Offered: Inquire at department
This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 9 hours supervision. (005475)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division

MECH 699P Master's Project **1-6 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
Independent study leading to a Master's Thesis of a special problem approved by student's graduate advisory committee. See the department office for registration procedure. 9 hours supervision. (005485)
Grade Basis: Report in Progress: CR/NC
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

MECH 699T Master's Thesis **1-6 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
Independent study leading to a Master's Thesis of a special problem approved by student's graduate advisory committee. See the department office for registration procedure. 9 hours supervision. (005483)
Grade Basis: Report in Progress: CR/NC
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

Mechatronic Engineering

MECA 140 Introduction to Design and Automation **2 Units**
Prerequisite: MATH 119 or GE Mathematics/Quantitative Reasoning Ready, first-year freshmen who successfully completed trigonometry and precalculus in high school can meet this prerequisite by achieving a score that meets department guidelines on the calculus readiness exam.
Typically Offered: Fall and spring
Introduces the design process and fundamentals of automation. Hands-on use of sensors, pneumatics, stepper motors, bearings, couplings, gears, belts, pulleys, and framing materials. Topics include AC and DC motor control, simple electrical circuits, machine controllers, PLC programming, testing and analysis of results, budgeting, and bills of materials. Teams design and build a proof-of-concept system to verify their design. 1 hour discussion, 3 hours laboratory. (005401)
Cross listing(s): MECH 140
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Lower Division

MECA 198 Special Topic **1-3 Units**
Typically Offered: Inquire at department
Special topic generally offered one time ony. Different sections may have different topics. See the Class Schedule for specific topic being offered. 3 hours lecture. (005652)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

MECA 298 Special 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 specific topic being offered. 3 hours lecture. (015849)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

MECA 380 Measurements and Instrumentation **3 Units**
Prerequisite: EECE 211 and EECE 211L or EECE 215; and CSCI 111, MECH 208 or AMAR 300.
Typically Offered: Fall and spring
Measurement of steady-state and dynamic systems using standard laboratory instruments. Topics include calibration and dynamic response of instruments, statistical treatment of data, and applied feedback control systems. Concepts are reinforced with hands-on laboratory exercises. 2 hours discussion, 3 hours laboratory. (005420)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECA 389 Industrial Internship **1-3 Units**
Prerequisite: Approval of faculty internship coordinator prior to off-campus assignment.
Typically Offered: Fall and spring
Engineering experience in an industrial setting. Minimum duration of 400 hours of work under the direct supervision of an onsite engineering supervisor. On completion of the internship, a written report prepared under the direction of a faculty member is required. This course is an elective for the BS in Mechatronic Engineering, a total of 3 units must be completed to receive elective credit. 9 hours supervision. (005659)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECA 398 Special 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. 3 hours lecture. (005653)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

MECA 399 Special Problems **1-3 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
This course is an independent study of special problems offered for 1.0-3.0 units. See the department office for information on registering. 9 hours supervision. (005654)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

MECA 440AW Capstone Design I (W) **3 Units W, GW**
Prerequisite: GE Oral Communication (A1) requirement; GE Written Communication (A2) requirement; EECE 315 (may be taken concurrently); EECE 344; MECH 200; MECH 340 with a grade of C- or higher. Recommended: MECA 380.
Typically Offered: Fall and spring
Design methods applied to mechatronic systems in group design projects. Project definition, planning, and management. Design for manufacture, cost considerations, budgets, and teamwork. Oral and written presentation of design results. Initial stage of the capstone design project to be continued in MECA 440B. 2 hours lecture, 3 hours supervision. (005656)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment

MECA 440B Capstone Design II **3 Units**
Prerequisite: EECE 315 and MECA 440AW. Recommended: MECA 380.
Typically Offered: Fall and spring
Implementation of the capstone design project from MECA 440AW including fabrication, testing, and evaluation of a working prototype. Impact of engineering solutions in global, economic, environmental, and societal context. Ethical and professional responsibilities in engineering including continuing self-education and career development. Must be taken the semester immediately following MECA 440AW. 2 hours lecture, 3 hours supervision. (005657)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECA 470 Introduction to Robotics Engineering **3 Units**
Prerequisite: CSCI 111 or MECH 208; MECH 320 (may be taken concurrently).
Typically Offered: Fall and spring
This course introduces students to robotic manipulation design and control. Students apply the concepts in computer simulation and a physical system. 2 hours activity, 2 hours lecture. (021920)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECA 482 Control System Design **3 Units**
Prerequisite: EECE 211 or EECE 215; MATH 260. Recommended: MECA 380, MECH 320; either CSCI 111 or MECH 208.
Typically Offered: Fall and spring
Modeling and simulation of dynamic system performance. Control system design for continuous systems using both analog and digital control techniques. 3 hours lecture. (005407)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

MECA 486 Motion and Machine Automation **4 Units**
Prerequisite: EECE 211 or EECE 215, MECH 340; EECE 482 or MECA 482 (may be taken concurrently).
Typically Offered: Spring only
Machine automation concepts in electrical circuits, precision mechanics, control systems, and programming. Motor sizing, gearing, couplings, ground loops, effective use of step motors, servo control loops, regeneration, networking, I/O, power supplies, vibration and resonance, mechanical tolerancing, linear bearings and drive mechanisms, and troubleshooting. Labs simulate application concepts such as point-to-point coordinated moves, registration, following, camming, and CAD-to-Motion by combining various motor technologies with various mechanical drive types. 4 hours activity, 2 hours lecture. (005655)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

MECA 498 Special 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. 3 hours lecture. (005660)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

MECA 499 Special Problems **1-3 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
Independent study of a special problem. See the department office for registration procedure. 9 hours supervision. (015851)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

MECA 499H Honors Project **3 Units**
Prerequisite: Completion of 12 units of upper-division EECE, MECH, or MECA courses, faculty permission.
Typically Offered: Inquire at department
Open by invitation to MECA majors who have a GPA among the top 5% of MECA students based on courses taken at CSU, Chico. This is an "Honors in the Major" course; a grade of B or higher in 6 units of 499H certifies the designation of "Honors in the Major" can be printed on the transcript and the diploma. If taken twice, prerequisite to the second semester is a grade of B or higher in the first semester. Each 3-unit course will require both formal written and oral presentations. 9 hours supervision. (005661)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

MECA 697 Independent Study **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. 3 hours lecture. (015838)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

MECA 698 Advanced Topic **1-3 Units**
Prerequisite: Specific to the topic being offered.
Typically Offered: Inquire at department
Advanced topic generally offered one time only. Different sections may have different topics. See the Class Schedule for specific topics being offered. 3 hours lecture. (015839)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division

MECA 699P Master's Project **1-6 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
Independent study of a special problem approved by student's graduate advisory committee. See the department office for registration procedures. 9 hours supervision. (015840)
Grade Basis: Report in Progress: CR/NC
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

MECA 699T Master's Thesis **1-6 Units**
Prerequisite: Approval of supervising faculty member.
Typically Offered: Inquire at department
Independent study leading to a Master's Thesis of a special problem approved by the student's graduate advisory committee. See the department office for registration procedure. 9 hours supervision. (015841)
Grade Basis: Report in Progress: CR/NC
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

Mechanical and Mechatronic Engineering and Advanced Manufacturing Department

The Faculty

David G Alexander 2014
Associate Professor
Doctor of Philosophy Univ Of Idaho

David G Alexander 2014
Vice-Chair
Doctor of Philosophy Univ Of Idaho

Nathan L Anderson 2014
Assistant Professor
Doctor of Philosophy Purdue Univ Main Campus

Hasan S Bank 2019
Assistant Professor
Master of Science Rutgers Univ New Brunswick

Scott D Brogden 2006
Lecturer
Master of Science CSU-Chico

Jeremy A Fishel 2020
Assistant Professor
Doctor of Philosophy Univ Of Southern Cal

Webster R Johnson 2010
Lecturer
Doctor of Philosophy University of Toronto

Harold A Koehler 2017
Lecturer
Bachelor of Science CSU-Chico

Matthew P Mione 2018
Lecturer
Bachelor of Science CSU-Chico

Joshua D Miranda 2014
Lecturer
Bachelor of Science CSU-Chico

Dennis M O'Connor 2015
Associate Professor
Doctor of Science Southern Illinois Univ-Carbond

Charles J Pooler 2011
Lecturer
Master of Science CSU-Chico

Nicholas G Repanich 2001
Lecturer
Bachelor of Science Cal Polytechnic St Univ-San Lu

Jason M Tancher 2017
Lecturer
Bachelor of Science CSU-Chico

Scott M Vanni 2009
Lecturer
Bachelor of Science CSU-Chico

Gregory K Watkins 2007
Chair
Doctor of Engineering Univ Of North Carolina At Char

Gregory K Watkins 2007
Professor
Doctor of Engineering Univ Of North Carolina At Char

Ozgul Yasar 2016
Assistant Professor

Doctor of Science Univ Of Cal-Riverside

Emeritus Faculty

Charles W Allen 1966
Emeritus

Leonard W Fallscheer
Emeritus
Master of Arts Cal St Univ-Chico

Joseph P Greene 1998
Professor
Doctor of Philosophy

Ronald W Hall 1969
Emeritus

Chuen H Hsu
Emeritus
Doctor of Philosophy Iowa St Univ

Gregory A Kallio
Emeritus
Doctor of Philosophy Washington St Univ

Ronald L Roth
Emeritus
Doctor of Philosophy Stanford Univ

Jimmy Tan-Atichat
Emeritus
Doctor of Philosophy Illinois Institute Of Technolo

Ramesh M Varahamurti 1984
Professor
Doctor of Philosophy Washington St Univ

Michael G Ward
Emeritus
Doctor of Philosophy Stanford Univ