



# ENGINEERING TECHNOLOGY—MECHANICAL ENGINEERING TECHNOLOGY

BACHELOR OF SCIENCE

## PROGRAM DESCRIPTION

The Mechanical Engineering Technology (MET) program is designed for those who want an engineering-related career with a hands-on, practical approach. The emphasis in the MET program is placed on understanding how engineering principles are applied in practice rather than on the mathematical methods used in the derivation of new technologies. At the same time, the program goes beyond the teaching of current procedures, so that the graduates are enabled to adapt to the changing needs of industry. Graduates find careers in many technological fields, including plant operations and management, quality assurance, product and manufacturing systems design, testing and evaluation, technical sales, and environmental testing and enforcement.

CSUS offers primarily the upper division portion of the MET program. Most students take the first two years at a community college. Building on a foundation in natural science, mathematics, computer science, drafting, manufacturing processes, and lower division technology courses, the student comes to CSUS to develop more fully an understanding of the properties of engineering materials, the design of mechanisms, the selection of machine components, energy and power technology, and the behavior of fluids and hydraulic machinery.

Students may also take additional courses in either Business Administration or Computer Science toward a minor. A minor broadens the student's career base and offers the opportunity for continued learning through graduate study.

## FACULTY

Frederick Reardon, *Coordinator*

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## FEATURES

The Mechanical Engineering Technology program is the only one of its kind offered by a state university in northern California. It is accredited by the Engineering Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET).

Each student has a faculty advisor who meets with him/her at least once each semester to discuss academic progress, plan the following semester, explain University regulations, and answer questions about the Mechanical Engineering Technology program. General Education advising for all students is done by the Academic Advising Center.

Most classes have enrollments of less than 30, allowing for close interactions between students and faculty. Laboratory classes, which provide practical experience, normally have fewer than 20 students.

In addition to regular coursework, many students participate in special projects, such as the design competitions sponsored by national engineering professional societies, the American Society of Mechanical Engineers and the Society of Automotive Engineers.

Students may wish to take the Fundamentals of Engineering (formerly Engineer-in-Training) examination during their senior year. Successful completion of this examination is the first step toward registration as a Professional Engineer in the State of California.

## CAREER POSSIBILITIES

Product Design • Manufacturing Systems Design • Product Testing and Evaluation • Plant Operations/Management • Quality Assurance • Technical Sales • Field Engineering • Environmental Testing/Enforcement • Energy Management • Aerospace Operations

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## ADMISSION

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The first two years of the MET program can be completed at a community college. Students who have completed most of the lower division courses listed below may apply for admission to the University and will be classified as pre-majors. All pre-majors must apply at the Mechanical Engineering Technology Program office for transfer to the major. A complete set of transcripts will be needed for evaluation. Students must complete all lower division preparation before being admitted to the major. Students will not be admitted to any upper division MET courses without being admitted to the major.

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## MAJOR REQUIREMENTS • BS

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Total units required for BS: 135

Total units required for Major: 57 upper division

Total units required for Pre-major: 42 lower division

**Courses in parentheses are prerequisites.**

### A. Required Lower Division Courses (Pre-major)

Lower division requirements should be taken at a community college and completed before beginning upper division work.

#### 1. Basic Science and Mathematics (27 units)

- (3) Math Elective (such as college algebra or higher)
- (6) Differential and Integral Calculus \* (such as CSUS MATH 26A and 26B)
- (3) Statistics\* (such as CSUS STAT 1)
- (5) General Chemistry\* with a lab (CHEM 6A)
- (8) Physics\* — mechanics and heat with a lab and Physics\* — electricity and magnetism with a lab (such as CSUS PHYS 5A and PHYS 5B)
- (2) FORTRAN or other programming language (such as CSUS CSC 16)

\* Courses in these areas may be used to fulfill up to 9 units of general education requirements if the courses are specified as general education by the institution in which they are taken.

#### 2. Lower Division Technology (15 units)

- (6) Drafting, including three units of descriptive geometry and computer graphics, three units of mechanical drafting.\*\*
- (6) Manufacturing Processes, including at least three units of metal shop primarily devoted to machine tool processes — balance can be welding, foundry, sheet metal, non-destructive testing, electronic fabrication or quality control.\*\*
- (3) Properties of Engineering Materials (such as ENGR 45)

**Note:** Additional lower division courses may be required to complete a minor in either Business Administration or Computer Science.

\*\* Some courses in these areas are not offered at CSUS.

#### 3. General Lower Division Education (27 units)

The General Education and graduation requirements at CSUS are 54 units of coursework in the following areas: Communications; Science; Arts and Humanities; Social Sciences; and Self Development. Eighteen of these units are satisfied by required courses in the MET curriculum, the remaining 36 units of general education are specified below.

The 24 units in the area of Communications, Humanities, and Social Sciences stipulated by the National Accreditation Board for Engineering and Technology are covered by the CSUS General Education requirements.

The 27 units of General Education courses in the lower division must include:

- (3) English Composition (such as CSUS ENGL 1A)
- (3) Oral Communications
- (3) ENGL 20, Expository Writing

Recommended additional courses:

- U.S. History
- U.S. and California Government
- Life Science
- Economics (such as CSUS ECON 1A)
- Arts, Humanities, or Foreign Languages

**Note:** A second year foreign language course (2A or equivalent) may also satisfy 3 units of GE when the course is being taken to comply with the CSUS foreign language requirement. Students should consult with an advisor for exact GE eligibility of these courses.

### B. Required Upper Division Courses (Major) (57 units)

MET Courses are offered only once a year. Students should plan to begin the upper division during the Fall semester. Students will not be enrolled in upper division MET courses unless all required lower division preparation (Basic Science and Math and Lower Division Technology) has been satisfactorily completed. The Writing Proficiency Examination (WPE) is a prerequisite for MET 151; therefore students are encouraged to take the WPE in the first semester of the junior year.

#### 1. First Semester Junior Year (15 units)

MET courses listed below are offered in Fall only.

- (3) MET 110 Statics
- (3) MET 141 Fluid Mechanics & Machinery
- (3) MET 150 Electric Circuits & Equipment
- (3) MET 164 Advanced Design Drawing
- (3) MET 173 Computer Applications in MET

#### 2. Second Semester Junior Year (17 units)

MET courses listed below are offered in Spring only.

- (2) ENGR 140 Engineering Economics (ENGR 17, 30 or CSC 130)
- (3) MET 101 Graphics & Communications (MET 164)
- (3) MET 111 Dynamics (MET 110, 173)
- (3) MET 112 Strength of Material (MET 110, 173)
- (3) MET 140 Thermodynamics for Engineering Technology (MET 141)
- (3) MET 151 Measurements for Engineering Technology (MET 140, 141, 173; MET 141 may be taken concurrently Writing Proficiency Exam)

#### 3. First Semester Senior Year (18 units)

MET courses listed below are offered in Fall only.

- (3) MET 142 Advanced Thermodynamics Technology (MET 140, 141)
- (3) MET 166 Machinery Design (MET 112, 164)
- (2) MET 190\* Senior Project I (senior status; MET 101 or equivalent)
- (1) ENGR 194 Career Development for Engineers & Engineering Technologists
- (3) Upper Division Technical Elective
- (3) Upper Division Technical or Business Administration Elective
- (3) General Education course

#### 4. Second Semester Senior Year (16 units)

MET courses listed below are offered in Spring only.

- (3) MET 165 Kinematics of Machinery (MET 111, 164)
- (1) MET 191\* Senior Project II (MET 190)
- (3) Upper Division Technical Elective
- (3) Upper Division Technical or Business Administration Elective
- (3) General Education course
- (3) General Education course

#### Technical Electives

MET 170	Computer-Aided Drafting
MET 172	Applied Computer-Aided Drafting
MET 178	Computer-Aided Manufacturing
MET 195	Industrial Internship
MET 199	Special Problems
ME 131	Quality Assurance
ME 136	Numerical Control Programming
ME 138	Concurrent Product and Process Design
ME 143	Vehicle Design
ME 153	Thermodynamics of Combustion Engines
ME 156	Heating & Air Conditioning System

#### Business Administration Elective\*\*

OBE 118	Legal Environment of Business II
OBE 130	Business Communications
OBE 150	The Management of Contemporary Organizations
OBE 153	Management of Human Resources
OBE 157	Industrial Relations
MGMT 120	Principles of Marketing
MGMT 133	Business Finance
MGMT 171	Distribution Management
MGMT 180	Operations Management
MGMT 183	Operations Systems Design

\*\*Select from these electives or other business courses approved by the student's advisor.

#### 5. Upper Division General Education (9 units)

The 9 units of general education listed in the major must be selected according to University general education requirements. Nine of these units must be upper division courses including 3 units of advanced study.

\* MET 190 and MET 191 may be used as 3 units to satisfy upper division GE requirements in Area E.

**Note:** Business Administration or Computer Science courses can be applied both to the MET major and to a minor. A minimum of nine additional upper division units are required for either minor. The 24-unit Business Administration minor and the 18-unit Computer Science minor both require appropriate selection of lower division courses. Students interested in a minor should contact the appropriate department office for additional information.

#### Cooperative Education

Students are encouraged to participate in the Cooperative Education Program which provides alternate periods of study at the University and practical work experience as junior mechanical engineers in industry or government for pay. Most participants of the Co-op plan will complete one six-month work period in their junior year and the other in their senior year. Academic credit is granted for successful completion of the Co-op phase. Applications for the program are available from the Cooperative Education Program office in the Engineering Building, room 1204.

## UPPER DIVISION COURSES

#### 101. Graphics and Communications in Engineering Design.

Interrelation and application of knowledge and skills from previous courses to the solution of realistic problems. Emphasis on problems involving machine elements and systems of machine elements. Practice in the techniques of descriptive writing and the methods of preparing and presenting technical data; a variety of problems will be introduced to provide opportunities for the student to develop precision in statements and in graphic presentation. Lecture three hours. **Prerequisite:** MET 164. Spring only. 3 units.

**110. Statics.** Force system and equilibrium conditions with emphasis on engineering problems covering structures, machines, distributed forces and friction. Emphasis on equilibrium of coplanar force system; analysis of frames and trusses; non-coplanar force system and centroids and moments of inertia. Lecture three hours. Fall only. 3 units.

**111. Dynamics.** Kinematics of particles and rigid bodies; dynamics of a particle, systems of particles and rigid bodies; central force fields, orbits and trajectories; computer solutions. Emphasis on kinetics and kinematics of particles; and 2 dimensional rigid bodies. Lecture three hours. **Prerequisites:** MET 110, 173. Spring only. 3 units.

**112. Strength of Materials.** Practical application of structural calculations for sizing bolts, rivets, shafts, beams, trusses and columns; computer solutions of related problems. Lecture three hours. **Prerequisites:** MET 110, 173. Spring only. 3 units.

**140. Thermodynamics for Engineering Technology.** Elements of thermodynamics including first and second laws for closed and open systems; with applications to power plants and refrigeration systems. Lecture three hours. **Prerequisite:** MET 141. Spring only. 3 units.

**141. Fluid Mechanics and Machinery.** Theoretical principles of compressible and incompressible fluid behavior with applications to practical situations. Course topics include basic principles and operation of fluid machinery, and measurement of flow, pressure and viscosity. Lecture three hours. Fall only. 3 units.

**142. Advanced Thermodynamics Technology.** Applications of the principles of thermodynamics and heat transfer to the operation of power plants and refrigeration equipment; introductions to psychometrics, combustion and compressible flow. Lecture three hours. **Prerequisites:** MET 140, 141. 3 units.

**150. Electrical Circuits and Equipment.** Fundamentals of electric circuits and components including resistive, inductive and capacitive circuits; rectifiers, transformers, generators, and motors. Principles and practice in the use of electrical machinery. Lecture two hours, laboratory three hours. Fall only. 3 units.

**151. Measurements for Engineering Technology.** Theory and practice of the application of basic temperature, acceleration, pressure, flow, force, and strain instrumentation to engineering technology problems. Lecture two hours, laboratory three hours. **Prerequisites:** MET 140, 141, 173, and passing of Writing Proficiency Exam; MET 141 may be taken concurrently. 3 units.

**164. Advanced Design Drawing.** Preparation of working drawings, including assemblies, details and parts lists. Selected drafting topics including geometric tolerances, threaded fasteners, application of welding symbols and production notes. Traditional and computer-aided drafting (CAD) techniques. Lecture one hour, laboratory six hours. Fall only. 3 units.

**165. Kinematics of Machinery.** The analysis of the function of machine components. Emphasis on the kinematics of motion and the elements of kinetics. Practice in the design of linkages, cams and reduction systems. Computer solutions of kinematic problems. Lecture two hours, laboratory three hours. **Prerequisites:** MET 111, 164. Spring only. 3 units.

**166. Machinery Design.** Introduction to fatigue with applications to the design of mechanical systems incorporating gears, bearings, clutches, brakes and couplings. Computer solutions of related problems. Lecture two hours, laboratory three hours. **Prerequisites:** MET 112, 164. Fall only. 3 units.

**170. Computer-Aided Drafting.** Application of three-dimensional representation techniques as used in a typical large CAD software package. Fundamentals of working with a CAD software system for creating, storing and modifying engineering drawings. Introduction, discussion and use of typical CAD input/output hardware. Comparison of important differences among engineering computer graphic systems. Lecture two hours, laboratory three hours. **Prerequisites:** MET 164. Fall only. 3 units.

**172. Applied Computer-Aided Design.** Application of software packages for analysis of stress, deflection and vibration. Brief introduction to finite element theory with emphasis on model building; software operation; applications of finite element analysis and comparison of results with experimental and theoretical values; theories of failure; and 3 dimensional states of stress. Lecture three hours. **Prerequisites:** MET 112, 170. Spring only. 3 units.

**173. Computer Applications in Mechanical Engineering Technology.** Introduction to application of computers to technology problems; advanced programming in FORTRAN/BASIC focusing on mechanical design applications; use of software packages, use of microcomputers in technology. Lecture two hours, laboratory three hours. **Prerequisites:** MET 10 and 2 units computer programming; MET 110 may be taken concurrently. Fall only. 3 units.

**178. Computer-Aided Manufacturing.** An overall view of factory automation and Computer-Aided Manufacturing, including Group Technology, Flexible Manufacturing Systems, Automated Inspection and Testing, Machine Vision for Inspection, Computer-Aided Process Planning, artificial Intelligence Applications in Manufacturing, and Computer Networks for Manufacturing. Lecture three hours. **Prerequisite:** ME 37. 3 units.

**190. Senior Project I.** Problem solutions in Mechanical Engineering Technology through team effort, supervised study and guided investigations. Part I includes problem definition, conceptualization of solution, project planning and detailed design. Lecture one hour, laboratory three hours. **Prerequisites:** MET 101 and senior status. Fall only. 2 units.

**191. Senior Project II.** Continuation of the project begun in MET 190. Part II includes fabrication and assembly of equipment testing and evaluation, and reporting. Laboratory three hours. **Prerequisite:** MET 190. Spring only. 1 unit.

**195. Industrial Internship.** Supervised work experience in industry or government, which can be considered of equal sophistication and value to senior courses in mechanical engineering technology, may be substituted for one to twelve units of senior mechanical engineering technology courses. **Note:** open to seniors in mechanical engineering technology and only through prior arrangement between the instructor and the company or agency. Graded Credit/No Credit. 1-3 units.

**196. Experimental Offerings in Engineering Technology.** When a sufficient number of qualified students apply, one of the staff will conduct a seminar in some topic of engineering technology. May be repeated for credit with permission of advisor. 1-4 units.

**199. Special Problems.** Individual projects or directed reading. **Note:** open only to those students who appear competent to carry on individual work. Admission to this course requires approval of an instructor and the student's advisor. May be repeated for credit. 1-3 units.