MECHANICAL ENGINEERING (MCEG)

MCEG 1002 Engineering Graphics
General course in the most important types of engineering drawings. A foundation course in lettering, geometrical exercises, orthographic projections, including auxiliary views, sections, pictorial representation. The computer is introduced as a drafting tool. Lecture and laboratory four hours. $25 per credit hour curriculum content fee.

MCEG 1011 Introduction to Mechanical Engineering
Prerequisite: Math ACTE score of 24 or higher, or grade of C or higher in MATH 1113, MATH 1914, or MATH 1203, or consent of instructor.
An introductory lecture/lab course to acquaint students with the technical aspects of mechanical engineering and professional responsibility. $25 per credit hour curriculum content fee.

MCEG 2013 Statics
Prerequisite: MATH 2924 and PHYS 2114.
Principles of statics, resultants, equilibrium, and analysis of force systems. Structure analysis, forces in space, friction, centroids, and moments of inertia. $25 per credit hour curriculum content fee.

MCEG 2023 Engineering Materials
Prerequisite: CHEM 2124.
A study of the mechanical and physical properties, micro structure, and the various testings of engineering materials (metals, plastics, woods, and concrete) from the viewpoint of manufacture and construction. $25 per credit hour curriculum content fee.

MCEG 2033 Dynamics
Prerequisite: MCEG 2013.
A continuation of MCEG 2013. Study of problems of unbalanced force systems. Kinematics and kinetics of rigid bodies. Work and energy, impulse and momentum. $25 per credit hour curriculum content fee.

MCEG 2203 Computational Methods in Engineering
Prerequisite: MCEG 1011 and MATH 2914.
An introduction to common computational methods, tools, and procedures used in the solution of common engineering problems. A standard solution methodology is introduced along with instruction in units systems, spreadsheet and calculator computations and the use of engineering software. $25 per credit hour curriculum content fee.

MCEG 3000 Engineering Internship/Research Experience
Cross-listed: ELEG 3000.
Offered: As needed.
Prerequisite: A minimum of 60 hours applicable toward the ATU Electrical/Mechanical engineering program requirements with a minimum 3.5 GPA; and acceptance in an Engineering Internship or Research Experience for Undergraduates Program.
A minimum of six weeks of supervised on-the-job training with a university research program, engineering firm, manufacturer, municipality, or company employing engineers. A written report is required within one week of internship completion. Students will also present their internship experience to an engineering class or at a student engineering RSO meeting.
Note: Satisfies College of Distinction requirement.

MCEG 3003 System Modeling and Analysis
Cross-listed: ELEG 3003.
Prerequisite: COMS 1013 or MCEG 2203 and MATH 3243.
Reduction of engineering systems to mathematical models; methods of analysis using computers; interpretation of numerical results; optimization of design variables. Examples are drawn from various engineering disciplines. $25 per credit hour curriculum content fee.

MCEG 3013 Mechanics of Materials
Prerequisite: MCEG 2013.
Fundamental stress and strain relationships, torsion, shear and bending moments, stresses and deflections in beams; introduction to statically indeterminate beams, columns, combined stresses, and safety factors. $25 per credit hour curriculum content fee.

MCEG 3023 Manufacturing Processes
Prerequisite: MCEG 2023 and 3013.
Morphological aspects of manufacturing processes, testing of engineering metals, metal working processes, metal forming processes, machining, non-destructive inspection methods, statistical process control, control charts, and total quality management concepts. $25 per credit hour curriculum content fee.

MCEG 3313 Thermodynamics I
Prerequisite: MATH 2924 and PHYS 2114.
An introduction to thermodynamics, including thermodynamic properties of pure substances, heat and work, the first and second laws of thermodynamics, and entropy with applications to power and refrigeration cycles. $25 per credit hour curriculum content fee.

MCEG 3333 Alternative Energy Systems
A study of the design and implementation of alternative energy sources in power production and other applications. Renewable sources are emphasized. $25 per credit hour curriculum content fee.

MCEG 3403 Machine Dynamics
Prerequisite: MCEG 2033 and MATH 3243.
The study of the relative motion of machine components, force systems applied to these components, the motions resulting from these forces, and their effect on machine design criteria. $25 per credit hour curriculum content fee.

MCEG 3413 Fundamentals of Mechanical Design
Prerequisite: MCEG 2033, 3013, and MATH 3243.
Analysis of machines and components through application of basic fundamentals and principles. $25 per credit hour curriculum content fee.

MCEG 3442 Mechanical Laboratory I
Prerequisite: MCEG 2023 and MCEG 3013.
A study of the basic materials testing procedures and instrumentation. Emphasis will be placed on proper laboratory techniques including data collection, data reduction, and report preparation. Lecture one hour, laboratory three hours. $40 course fee. $25 per credit hour curriculum content fee.

MCEG 3453 Energy Management
Prerequisite: MCEG 3313.
Energy management in commercial building and industrial plants. Utility rate structures. Sources of primary energy. Energy conversion devices. Prime movers of energy. Heat. Electricity. Lighting. HVAC Equipment. Building envelope. Electric motors. Estimating energy savings. Economic justification. Energy auditing. $25 per credit hour curriculum content fee.

MCEG 3503 Basic Nuclear Engineering
Prerequisite: MATH 2924, CHEM 2124 and PHYS 2114.
An introduction to atomic and nuclear processes and to nuclear science and engineering fundamentals, including the nature of nuclear radiation, the nuclear chain reaction, criticality, power reactor types, and applications of nuclear technology. $25 per credit hour curriculum content fee.

MCEG 3512 Radiation Detection Laboratory
Prerequisite: ASNT major and MCEG 3503 or MCEG 3523.
A study of each of the common kinds of nuclear radiation, including the detection and analysis methods and applications to nondestructive assays. Use of computers in analyses. Lecture one hour, laboratory three hours. $40 course fee. $25 per credit hour curriculum content fee.

MCEG 3523 Radiation Health Physics
Prerequisite: MATH 2914, CHEM 2124, or consent.
A study of the protection of individuals and population groups against the harmful effects of ionizing radiation. Included in the study is: (1) radiation detection and measurement, (2) relationships between exposure and biological damage, (3) radiation and the environment, (4) design criteria for processes, equipment, and facilities so that radiation exposure is minimized, and (5) environmental impact of nuclear power plants. $25 per credit hour curriculum content fee.

MCEG 3612 Manufacturing Laboratory
Co-requisite: MCEG 3023.
Prerequisite: MCEG 2023.
Students will conduct various hands-on activities associated with manufacturing processes using industry typical practices. One hour lecture, one hour lab. $40 course fee. $25 per credit hour curriculum content fee.

MCEG 3663 Engineering Internship
Prerequisite: Mechanical engineering major with junior standing and a minimum GPA of 2.75/4.000; MCEG 3013 and 3313.
Students will gain experiential learning in an industrial environment by participation in an engineering internship with an approved industry partner. Students will be required to participate in engineering project(s) under supervision of an engineer at the selected partner industry, complete written and oral reports. $25 per credit hour curriculum content fee.
Note: May not be repeated for credit.

MCEG 3991 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual or specialized study in advanced area under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 3992 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual or specialized study in advanced area under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 3993 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual or specialized study in advanced area under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 3994 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual or specialized study in advanced area under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 4043 Physical Metallurgy
Prerequisite: MCEG 2023, 3013, 3313.
This course provides the student with an in-depth background to the mechanisms and applications of dislocation motion, crystal plasticity, phase transformations and solidification processes. Common industrial and experimental processes are studied for both ferrous and non-ferrous materials. $25 per credit hour curriculum content fee.

MCEG 4053 Corrosion Principles
Prerequisite: MCEG 2023, 3013, 3313.
A study of the fundamental causes of corrosion and corrosion damage in metals and metallic components. Electrochemistry is used to explore the basic reactions governing environmental corrosion while thermodynamics and kinetics are used to investigate the rate of controlling steps of environmental attack. Includes an overview of techniques commonly used to control corrosion damage in industry and architecture. $25 per credit hour curriculum content fee.

MCEG 4202 Engineering Design
Cross-listed: ELEG 4202.
Prerequisite: Junior standing and MCEG 3013.
This course serves as the first part of a two course sequence in which the student completes a senior design project. Design methodologies and tools including real world design considerations such as environmental impact, engineering ethics, economics, safety, product costing and liability are introduced. Design for manufacture, project management, scheduling and proposal writing will be covered. Successful completion of this course shall require completion of a proposal for a senior design project being accepted by the faculty design project review process. $25 per credit hour curriculum content fee.

MCEG 4323 Power Plant Systems
Prerequisite: MCEG 3313 or consent.
Co-requisite or Prerequisite: MCEG 4403.
A study of the design and operation of steam electric power plant components and systems. Fossil and renewable energy plants are emphasized. $25 per credit hour curriculum content fee.

MCEG 4332 Thermal Systems Laboratory
Co-requisite: MCEG 4433, 4443.
Prerequisite: MCEG 3313, 4403.
Advanced laboratory experiments in heat transfer and thermal systems. Conduction, convection and radiation heat transfer phenomena, power and refrigeration cycle operation, psychrometrics. Lecture one hour, laboratory three hours. $25 per credit hour curriculum content fee.

MCEG 4343 Internal Combustion Engines
Prerequisite: MCEG 3313 and MCEG 4403.
A study of the operating and design principles of internal combustion engines. The course will cover combustion cycles, emissions, and performance analysis and testing. Lecture three hours with lab exercises. $25 per credit hour curriculum content fee.

MCEG 4403 Mechanics of Fluids and Hydraulics
Prerequisite: MCEG 2033, 3313, and MATH 3243.
A study of statics and dynamics of incompressible fluids. Major topics include the basic fluid flow concepts of continuity, energy and momentum, dimensional analysis, viscosity, laminar and turbulent flows, and flow in pipes. $25 per credit hour curriculum content fee.

MCEG 4413 Finite Element Analysis
Prerequisite: ELEG 2103, MCEG (ELEG)3003, and MCEG 3013.
Introduction to approximate methods using finite elements. Development of the finite element method using variational formulations. Applications include machine design, mechanical vibrations, heat transfer, fluid flow and electromagnetics. $25 per credit hour curriculum content fee.

MCEG 4423 Machine Component Design
Prerequisite: MCEG 3413.
Design and analysis of specific machine components including gears, clutches, springs, and bearings. $25 per credit hour curriculum content fee.

MCEG 4433 Thermodynamics II
Prerequisite: MATH 2934 and MCEG 3313.
A continuation of MCEG 3313. The study of thermodynamics is extended to the investigation of relations for simple substances, non-reacting mixtures, reacting mixtures, chemical reactions and a study of availability analysis. Power and refrigeration cycles are studied in more depth. $25 per credit hour curriculum content fee.

MCEG 4442 Mechanical Laboratory II
Prerequisite: MCEG 4403.
A study of fluid mechanics and thermodynamics experimentation techniques. Laboratory projects will be assigned with student responsibility for procedure development and test program implementation. Formal laboratory reports will be required. Lecture one hour, laboratory three hours. $25 per credit hour curriculum content fee.

MCEG 4443 Heat Transfer
Prerequisite: MCEG 4403.
Basic thermal energy transport processes, conduction, convection, and radiation, and the mathematical analysis of systems involving these processes in steady state and time dependent cases. $25 per credit hour curriculum content fee.

MCEG 4463 Heating, Ventilating, and Air-Conditioning Design
Prerequisite: MCEG 3313 or permission of instructor.
A study of the principles of human thermal comfort including applied psychometrics and air-conditioning processes. Fundamentals of analysis of heating and cooling loads and design of HVAC systems. $25 per credit hour curriculum content fee.

MCEG 4473 Mechanical Vibrations
Prerequisite: MCEG 2033, MATH 3243.
The study of free and forced vibration of single degree-of-freedom systems, response to harmonic, periodic and non- periodic excitations. Multi-degree-of- freedom systems and matrix methods are explored. Computational techniques for predicting system response continuous systems are introduced. $25 per credit hour curriculum content fee.

MCEG 4491 Mechanical Design Project I
Prerequisite: MCEG 3413 and MCEG/ELEG 4202.
First of a two part sequence of courses to complete a group project in mechanical engineering design. Emphasis will be placed on designing a mechanical system or sub-system with due regard for: safety, environmental concerns, reliability, longevity, ease of manufacturing, maintainability, and cost effectiveness. Both a written and oral report are required. $25 per credit hour curriculum content fee.

MCEG 4492 Mechanical Design Project II
Prerequisite: MCEG 3003, MCEG/ELEG 4202, MCEG 4491, senior standing, and consent of instructor.
Second of a two part sequence of courses to complete a group project in mechanical engineering design. Where appropriate, a team approach will be employed. Emphasis will be placed on designing a mechanical system or sub-system with due regard for: safety, environmental concerns, reliability, longevity, ease of manufacturing, maintainability, and cost effectiveness. Both a written and oral report are required. $50 course fee. $25 per credit hour curriculum content fee.

MCEG 4503 Nuclear Power Plants I
Prerequisite: MCEG 3503, MCEG 4403.
A study of the various types of nuclear reactor plants including the methods used for energy conversion. Relative advantages/disadvantages of various plant types investigated. $25 per credit hour curriculum content fee.

MCEG 4991 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 4992 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 4993 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 4994 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

MCEG 5043 Physical Metallurgy
Prerequisite: MCEG 2023, MCEG 3013, and MCEG 3313.
This course provides the student with an in-depth background to the mechanisms and applications of dislocation motion, crystal plasticity, phase transformations and solidification processes. Common industrial and experimental processes are studied for both ferrous and non-ferrous materials.
Note: May not be taken for credit after completion of MCEG 4043 or equivalent.

MCEG 5053 Corrosion Principles
Prerequisite: MCEG 2023, MCEG 3313, CHEM 2124.
This course provides the student with an introductory study on the principles, mechanisms and chemistry of material corrosion. The study will extend to material failures linked to corrosion processes and effects of environment on corrosion potential and kinetics.
Note: May not be taken for credit after completion of MCEG 4053 or equivalent.

MCEG 5323 Power Plant Systems
Prerequisite: MCEG 3313, MCEG 4403.
A study of the design and operation of steam-electric power plant components and systems. Fossil and renewable energy plants are emphasized.
Note: May not be taken for credit after completion of MCEG 4323 or equivalent.

MCEG 5343 Internal Combustion Engines
Prerequisite: MCEG 3313, MCEG 4403.
A study of the operating and design principles of internal combustion engines. The course will cover combustion cycles, emissions and performance analysis and testing. Lecture three (3) hours with lab exercises.
Note: May not be taken for credit after completion of MCEG 4343 or equivalent.

MCEG 5413 Finite Element Analysis
Prerequisite: ELEG 2103, MCEG (ELEG) 3003, and MCEG 3013.
Introduction to approximate methods using finite elements. Development of the finite element method using variational formulations. Applications include machine design, mechanical vibrations, heat transfer, fluid flow, and electromagnetics.
Note: May not be taken for credit after completion of MCEG 4413 or equivalent.

MCEG 5453 Energy Management
Prerequisite: MCEG 3313, MCEG 4403, MCEG 4443, or consent of instructor.
Energy management in commercial building and industrial plants. Utility rate structures. Sources of primary energy. Energy conversion devices. Prime movers of energy. Heat. Electricity. Lighting. HVAC Equipment. Building envelope. Electric motors. Estimating energy savings. Economic justification. Energy auditing.

MCEG 5463 Heating, Ventilating, and Air-Conditioning Design
Prerequisite: MCEG 3313.
A study of the principles of human thermal comfort including applied psychrometrics and air-conditioning processes. Fundamentals of analysis of heating and cooling loads and design of HVAC systems.
Note: May not be taken for graduate credit after completion of MCEG 4463 or equivalent.

MCEG 5473 Mechanical Vibrations
Offered: approximately, every other year.
Prerequisite: MCEG 2033, MATH 3243.
The study of free and forced vibration of single degree-of-freedom systems, response to harmonic, periodic and non-periodic excitations. Multi degree-of-freedom systems and matrix methods are explored. Computational techniques for predicting system response of continuous systems are introduced.
Note: May not be taken for credit after completion of MCEG 4473 or equivalent.

MCEG 5503 Nuclear Power Plants I
Prerequisite: MCEG 3503, MCEG 4403.
A study of the various types of nuclear reactor plants including the methods used for energy conversion. Relative advantages/disadvantages of various plant types investigated.
Note: May not be taken for credit after completion of MCEG 4503 or equivalent.

MCEG 5993 Special Problems in Engineering I
Prerequisite: Permission of instructor.
A individual or group study in an advanced area of engineering under the direction of a faculty advisor. May be taught in conjunction with an associated MCEG 4993 section.
Note: May not be taken for credit after gaining credit for a 4993 section with the same topic.

MCEG 6013 Continuum Mechanics
Offered: Once every two years.
Prerequisite: Graduate admission and MCEG 3013 or equivalent.
Development of field equations and generalized constitutive expressions for fluid and solid continua. Topics include: tensor analysis, kinematics, conservation of mass and momentum, and invariance and symmetry principles.

MCEG 6023 Elasticity
Offered: Once every two years.
Prerequisite: MCEG 6013.
Analysis of stress and strain in two and three dimensions, equilibrium and compatibility equations, torsion of non-circular members, and variational methods.

MCEG 6323 Energy Systems
Prerequisite: MCEG 4433, MCEG 4403 or permission of instructor.
A study of various energy sources and the production of usable energy from them. Conventional and alternative energy sources are covered as well as economic environmental concerns.

MCEG 6443 Advanced Heat Transfer
Co-requisite: MCEG 3313, 4403, 4443, or permission of instructor.
Prerequisites or A study of the advanced principles of heat transfer. numerical methods in heat transfer, advanced boundary layer theory, advanced thermal radiation topics, and heat exchangers.

MCEG 6881 Special Topics in Engineering
Prerequisite: Permission of instructor.
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

MCEG 6882 Special Topics in Engineering
Prerequisite: Permission of instructor.
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

MCEG 6883 Special Topics in Engineering
Prerequisite: Permission of instructor.
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

MCEG 6891 Independent Study
Prerequisite: Completion of 18 hours toward program requirements, approval of advisor.
Students will complete an engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to the student's program of study. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

MCEG 6892 Independent Study
Prerequisite: Completion of 18 hours toward program requirements, approval of advisor.
Students will complete an engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to the student's program of study. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

MCEG 6893 Independent Study
Prerequisite: Completion of 18 hours toward program requirements, approval of advisor.
Students will complete an engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to the student's program of study. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

MCEG 6894 Independent Study
Prerequisite: Completion of 18 hours toward program requirements, approval of advisor.
Students will complete an engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to the student's program of study. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

MCEG 6895 Independent Study
Prerequisite: Completion of 18 hours toward program requirements, approval of advisor.
Students will complete an engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to the student's program of study. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

MCEG 6896 Independent Study
Prerequisite: Completion of 18 hours toward program requirements, approval of advisor.
Students will complete an engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to the student's program of study. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

MCEG 6991 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

MCEG 6992 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

MCEG 6993 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

MCEG 6994 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

MCEG 6995 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

MCEG 6996 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.