Courses Associated with Each Specialization Area in Mechanical Engineering and Applied Mechanics

The following courses are associated with each area of specialization. This list will be reviewed and revised by the Graduate Committee of MEAM. A student may use any list dated from the time of first attendance in the degree program (MS or PhD). Any 800-level course with an asterisk in front of it is a graduate-only course

Common Courses: These courses may be used for any one of the specialty areas (subject to approval of the Graduate Committee; Please consult with the area chair)

*MECH 801: Analytical Methods in Engineering I (3 cr) Lec 3
*MECH 802: Analytical Methods in Engineering II (3 cr) Lec 3
*MECH 890: Advanced Analysis of Mechanical Engineering Systems (3 cr) Lec 3
MECH 891: Special Topics in Engineering Mechanics (1-6 cr, max 6) Lec 3
Subject must be in the specified area
MECH 898: Laboratory and Analytical Investigations (1-6 cr, max 6, I, II, III) Lab
The project must be in the specified area
MECH 996: Advanced Laboratory and Analytical Investigations (1-12 cr, max 12)
Semester projects involving research into a specific problem in any major area of mechanical engineering

Specialty areas: The following are courses currently associated with each specific specialty area. A student may petition the Graduate Committee to use another course in place of a designated course. This list is effective as of April 6, 2026.

1. Thermal Sciences

MECH 803: Internal Combustion Engines (3 cr I, II) Lec 3, lab 2
MECH 804: Theory of Combustion (3 cr, I) Lec 3
MECH 805: Turbomachinery (3 cr) Lec 3
MECH 806: Air Conditioning Systems Design (3 cr) Lec 3
MECH 807: Power Plant Systems Design (3 cr) Lec 3
MECH 808: Heat Exchanger Design (3 cr) Lec 3
MECH 824 Laser Material Processing with Compressible Flow Perspective (3 cr) Lec 3
MECH 825 Solar Energy Engineering (3 cr) Lec 3
MECH 826 Heat Transfer at Nanoscales and in Ultrashort Time Domains (3 cr) Lec 3
MECH 831 Computational Heat Transfer and Fluid Flow (3 cr II) Lec 3
*MECH 881 Introduction to Nuclear Engineering (3 cr) Lec 3
MECH 850 Mechanical Engineering Control Systems Design (3 cr) Lec 2, lab 2
MECH 852 Digital Control of Mechanical Systems (3 cr) Lec 2, lab 3
MECH 853 Robotics: Kinematics and Design (3 cr) Lec 3
MECH 857 Mechatronic Systems Design (3 cr) Lec 3, lab 2
MECH 900 Advanced Thermodynamics (3 cr) Lec 3
MECH 904 Advanced Combustion Theory (3 cr) Lec 3

MECH 943 Machine Design (3 cr) Lec 2, lab 3
MECH 945 Probabilistic Design of Machine Elements (3 cr) Lec 3
MECH 950 Impact Engineering (3 cr) Lec 3
MECH 958 Advanced Mechatronics (3 cr) Lec 3, lab 2

2. Dynamics and Vibrations

MECH 842 Intermediate Kinematics (3 cr) Lec 3
MECH 844 Intermediate Dynamics of Machinery (3 cr) Lec 3
MECH 849 Advanced Dynamics (3 cr) Lec 3
MECH 853 Robotics: Kinematics and Design (3 cr) Lec 3
MECH 855 Vehicle Dynamics (3 cr) Lec 3
MECH 856 Dynamics of Internal Combustion Engines (3 cr I) Lec 3
MECH 857 Mechatronic Systems Design (3 cr) Lec 3, lab 2
* MECH 875 Introduction to Mechanical Vibrations (3 cr) Lec 3
MECH 915 Stress Waves in Solids (3 cr) Lec 3
MECH 958 Advanced Mechatronics (3 cr) Lec 3, lab 2

3. Computational Methods

MECH 831 Computational Heat Transfer and Fluid Flow (3 cr) Lec 3
*MECH 851 Introduction to Finite Element Analysis (CIVE 851) (3 cr) Lec 3
MECH 880 Numerical Methods in Engineering (3 cr) Lec 3
*MECH 888 Nonlinear Optimization in Engineering (IMSE *888) (3 cr) Lec 3
MECH 918 Fundamentals of Finite Elements (3 cr) Lec 3
MECH 932 Advanced Finite Element Methods (3 cr) Lec 3
MECH 950 Impact Engineering (3 cr) Lec 3
MECH 951 Advanced Topics in Finite Element Methods (3 cr)

4. Materials Engineering

MATL 860 Mechanical Aspects of Materials (3 cr) Lec 3
MATL 861 Materials Laboratory II (3 cr) Lab 6
MATL 862 X-ray Diffraction (3 cr) Lec 3
*MATL 864 Thin Films and Surface Engineering (3 cr) Lec 3
*MATL 865 Applied Physical Metallurgy and Design (3 cr) Lec 3
*MATL 866 Materials Selection for Mechanical Design (3 cr) Lec 2, lab 2
MATL 867 Principles of Powder Metallurgy (3 cr) Lec 2, lab 3
MATL 868 Failure Analysis: Prevention and Control (3 cr) Lec 2, lab 2
MATL 869 Physical Materials Systems (3 cr) Lec 3
MATL 870 Thermodynamics of Alloys (3 cr) Lec 3
MATL 871 Electron Microscopy of Materials (3 cr) Lec 2, lab 2
MATL 872 Kinetics of Alloys (3 cr) Lec 3
MATL 873 Corrosion (3 cr) Lec 3
MATL 874 Extractive Metallurgy (3 cr) Lec 3
* MATL 875 Glass and Ceramic Materials (3 cr) Lec 3

MATL 960 Materials Aspects of Fracture (3 cr) Lec 3
MATL 962 Imperfections in Crystals (3 cr) Lec 3
MATL 970 Advanced Thermodynamics of Materials (3 cr) Lec 3
MATL 972 Transformation in Materials (3 cr) Lec 3
MATL 997 Research Other Than Thesis (1-6 cr, max 6)
MATL 998 Advanced Materials Topics (1-3 cr per sem, max 9)
*MECH 843 Introduction to Piezoelectricity with Applications (3 cr)

5. Biomedical Engineering (several sections of courses are under 898)

MECH 836 Introduction to Continuum Biomechanics (3 cr) Lec 3
MECH 837 Biomedical Device Design (3 cr) Lec 3

CHME 873 Biochemical Engineering (3 cr) Lec 3
CHME 874 Advanced Biochemical Engineering (3 cr) Lec 3
CHME 896 Advanced Topics in Chemical Engineering Computation (Areas: Biomaterials and Biocompatibility, Tissue Engineering) (3 cr) Lec 3

BSEN 814 Medical Imaging Systems (3 cr) Lec 3
BSEN 816 Introduction to Biomaterials (3 cr) Lec 3
BSEN 818 Tissue Engineering (3 cr) Lec 3
BSEN 912 Advanced Ultrasound Imaging (3 cr) Lec 3
BSEN 935 Analysis of Engineering Properties of Biological Materials (3 cr) Lec 3

ENGR 815 Cognitive Ergonomics (3 cr) Lec 3
ENGR 816 Physical Ergonomics (3 cr) Lec 3

ECEN 850 Bioinformatics (3 cr) Lec 3
ECEN 863 Digital Signal Processing (3 cr) Lec 3
ECEN 898 Special Topics in Electrical Engineering IV (Biomedical related topics) (3 cr) Lec 3

6. Manufacturing

ENGR 830 Applied Statistics and Quality Control (3 cr) Lec 3
MECH 822 Industrial Quality Control (3 cr) Lec 3
MECH 870 Theory and Practice of Materials Processing (3 cr) Lec 3
EMGT 901 Total Quality Management Using Six Sigma Techniques (3 cr) Lec 3
MECH 921 Quality Engineering: Use of Experimental Design and Other Techniques (3 cr) Lec 3
MECH 925 Manufacturing and Dynamic Systems Modeling (3 cr) Lec 3
MECH 970 Advanced Manufacturing Processes (3 cr) Lec 3
MATL 865 Applied Physical Metallurgy and Design (3 cr) Lec 3

7. Fluid Mechanics

*MECH 810 Viscous Flow I (3 cr) Lec 3
*MECH 812 Viscous Flow II (3 cr) Lec 3
MECH 813 Aerodynamics (3 cr) Lec 3

MECH 814 Compressible Flow (3 cr) Lec 3
MECH 815 Two-Phase Flow (3 cr) Lec 3
MECH 816 Engineering Acoustics (3 cr) Lec 3
MECH 831 Computational Heat Transfer and Fluid Flow (3 cr) Lec 3
MECH 912 Advanced Topics in Fluid Dynamics (3 cr) Lec 3
MECH 916 Turbulent Flows (3 cr) Lec 3

8. Solid Mechanics

*MECH 843 Introduction to Piezoelectricity with Applications (3 cr) Lec 3
MECH 848 Advanced Mechanics of Materials (3 cr) Lec 3
MECH 852 Experimental Stress Analysis I (3 cr) Lec 2, lab 2
MECH 854 Introduction to Continuum Modeling (3 cr) Lec 3
MECH 910 Continuum Mechanics (3 cr) Lec 3
MECH 915 Stress Waves in Solids (3 cr) Lec 3
MECH 930 Mechanics of Composite Materials (3 cr) Lec 3
MECH 933 Theory of Elasticity I (3 cr) Lec 3
MECH 934 Theory of Elasticity II (3 cr) Lec 3
MECH 935 Nonlinear Mechanics (3 cr) Lec 3
MECH 936 Theory of Elastic Stability (3 cr) Lec 3
MECH 937 Theory of Plates and Shells I (3 cr) Lec 3
MECH 938 Theory of Plates and Shells II (3 cr) Lec 3
MECH 939 Viscoelasticity (3 cr) Lec 3
MECH 940 Fracture Mechanics (3 cr) Lec 3
MECH 941 Mechanics of Dislocations and Cracks (3 cr) Lec 3
MECH 942 Theory of Plasticity (3 cr) Lec 3
MECH 952 Experimental Stress Analysis II (3 cr) Lec 2, lab 3

9. Systems, Design and Controls

MECH 837 Biomedical Device Design (3 cr) Lec 3
MECH 842 Intermediate Kinematics (3 cr) Lec 3
MECH 845 Mechanical Engineering Design Concepts (3 cr) Lec 2, lab 3
MECH 850 Mechanical Engineering Control Systems Design (3 cr) Lec 2, lab 2
MECH 852 Experimental Stress Analysis I (3 cr) Lec 2, lab 3
MECH 853 Robotics: Kinematics and Design (3 cr) Lec 3
MECH 857 Mechatronic Systems Design (3 cr) Lec 3, lab 2
MECH 858 Digital Control of Mechanical Systems (3 cr) Lec 3
MECH 943 Machine Design (3 cr) Lec 2, lab 3
MECH 945 Probabilistic Design of Machine Elements (3 cr) Lec 3
MECH 950 Impact Engineering (3 cr) Lec 3
MECH 958 Advanced Mechatronics (3 cr) Lec 3, lab 2

10. Metallurgy

MATL 865 Applied Physical Metallurgy and Design (3 cr) Lec 3

MATL 867 Principles of Power Metallurgy (3 cr) Lec 3
MATL 874 Extractive Metallurgy (3 cr) Lec 3