

MECHANICAL ENGINEERING (ME-UY)

ME-UY 498X SPECIAL TOPICS IN MECHANICAL ENGINEERING (1-3 Credits)

Typically offered Fall, Spring, and Summer terms

The course covers topics of special interest in mechanical engineering to promote exposure to traditional and emerging issues in mechanical engineering not covered in the program's mainstay courses. |

Prerequisite: Adviser's approval.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: Yes

ME-UY 1012 Introduction to Mechanical Engineering (2 Credits)

Typically offered Fall and Spring

This course introduces students to the range of mechanical engineering and emphasizes the basic principles and devices for storing and using energy, directing motion and satisfying needs. Case studies look at design issues and related ethical and professional practice issues.

Emphasis is on a mindset of exploration. Engineering standards and standard parts. Teams work on and present two design challenges. |

Prerequisite: Only first-year students are permitted to enroll in this course.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

ME-UY 2112 COMPUTER AIDED DESIGN (2 Credits)

Typically offered Fall and Spring

The course covers sketching, drawing and computer-aided drafting.

Topics: Projection theory—multiview, axonometric, oblique. Auxiliaries, sections, isometrics, dimensions, fasteners, detail and assembly drawings. Introduction to blueprint reading. Overview of CIM and CAD integration with other CIM concepts. A design project incorporates developed skills in visualization, drawing techniques, standards and CAD.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

ME-UY 2123 Engineering Design Methods (3 Credits)

Typically offered Fall and Spring

Engineering graphics and its role in the engineering design process.

Visualization skills, the design process, design layouts and the blueprint as a tool for communication. The use of manual and computer-aided tools for the preparation of engineering drawings. Projection theory as it pertains to the generation of multi-view drawings: Orthographic, Auxiliary and Section views, Dimensioning and tolerancing. Fasteners.

An introduction to manufacturing processes and model making.

Introduction to FEA. Testing and evaluation. Prototyping and the use of the MakerSpace. Anti-Requisite: ME-UY 2112

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: Anti-requisite ME-UY 2112.

ME-UY 2213 Statics (3 Credits)

Typically offered Fall, Spring, and Summer terms

The course covers three-dimensional vector treatment of the static equilibrium of particles and rigid bodies. Topics: Equivalent force and couple systems. Distributed force systems. Static analysis of trusses, frames and machines. Friction, impending motion. Methods of virtual work. | Prerequisite: PH-UY 1013 and MA-UY 1024

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: PH-UY 1013 and MA-UY 1024.

ME-UY 2223 Dynamics (3 Credits)

Typically offered Fall, Spring, and Summer terms

The course explores three-dimensional treatment of the kinematics of particles and rigid bodies using various coordinate systems, Newton's laws, work, energy, impulse, momentum, conservative force fields, impact and rotation and plane motion of rigid bodies. | Prerequisite for Brooklyn Students: ME-UY 2213 | Prerequisite for Abu Dhabi Students: ENGR-UH 2011

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

ME-UY 2813 Introduction to Materials Science (3 Credits)

Typically offered Fall and Spring

Students in this course become familiar with atomic structure and bonding, atomic arrangement in crystals, crystal imperfections, mechanical behavior and failure of materials and binary phase diagrams. | Brooklyn Students: Co-requisite PH-UY 1013 | Abu Dhabi Students: Prerequisite ENGR-UH 2012

Prerequisite ENGR-UH 2012

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: Brooklyn Students: Co-requisite PH-UY 1013 | Abu Dhabi Students: Prerequisite ENGR-UH 2012.

ME-UY 3213 Mechanics of Materials (3 Credits)

Typically offered Fall, Spring, and Summer terms

The course examines the Concept of Stresses and Strains in two and three dimensions, Stress-strain relationships, Stress transformation, Strain transformation, Axial members, Torsion of shafts, Bending of beams. | Prerequisites for Brooklyn Students: ME-UY 2213 and MA-UY 1124 | Prerequisite for Abu Dhabi Students: ENGR-UH 2011

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

ME-UY 3231 Structures Practicum (1 Credit)

Typically offered Fall and Spring

The course covers elastic material phenomena, aspects of machines, and the experimental methods of strain and stress. | Prerequisite: ME-UY 3213, Co-requisite: ME-UY 3233, Anti-requisite: ME-UY 3211

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

ME-UY 3233 Machine Design (3 Credits)

Typically offered Spring and Summer

This course introduces students to fundamentals of machine elements, enabling them to employ this knowledge to design machines for various practical applications. The course begins with a brief review of stress, deformation and failure, followed by friction and wear.

Subsequently, loaded columns, pressurized cylinders and shafts are presented. Bearings, gears, screws, springs, brakes, clutches and belts are discussed. The course ends with an introduction to MEMS, Micro-Electro Mechanical Systems. | Prerequisite for Brooklyn Students: ME-UY 3213 | Prerequisite for Abu Dhabi Students: ENGR-UH 3210

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: Prerequisite for Brooklyn Students: ME-UY 3213 |

Prerequisite for Abu Dhabi Students: ENGR-UH 3210.

ME-UY 3243 Vibration Fundamentals & Design (3 Credits)*Typically offered Spring*

Many products are designed against vibration and shock specifications. This course outlines the theory in a simplified way, how it is applied in practical settings, and physical testing techniques (e.g., use of the instrumentation and equipment in the MakerSpace). | Prerequisites: PH-UY 1013, MA-UY 2034, and (CS-UY 1113 or CS-UY 1133). Anti-requisite: ME-UY 4223

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3311 Fluid Mechanics Laboratory (1 Credit)***Typically offered Spring and Summer*

The course covers fluid mechanics instrumentation and principles, and consists of a set of laboratory experiments designed to reinforce concepts presented in ME-UY 3313 Fluid Mechanics. In addition, this course involves team work, report writing and oral presentations. | Co-requisite: ME-UY 3313.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3313 Fluid Mechanics (3 Credits)***Typically offered Spring and Summer*

This course introduces fluid kinematics, hydrostatics and thermodynamics. Topics: Basic conservation laws in integral form for a control volume. Conservation of mass, momentum, angular momentum and energy for flow. Inviscid flow: Bernoulli's and Euler's equations. Viscous flow: flows in pipes and ducts, head loss and friction factor. | Prerequisite for Brooklyn Students: MA-UY 2114, Co-requisite: ME-UY 3333 | Prerequisite for Abu Dhabi Students: ENGR-UH 3710 and MATH-UH 1020

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3323 Energy Systems (3 Credits)***Typically offered occasionally*

This first course in power generation focuses on the analysis and design of energy-conversion systems. It will introduce students to fossil, nuclear and renewable-energy (including wind and solar) power plants with equal emphasis. Students gain a comprehensive and detailed understanding of the fundamentals of such systems and the issues related to their operation from economic, environmental and safety points of view. | Prerequisite: ME-UY 3333.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3333 THERMODYNAMICS (3 Credits)***Typically offered Fall, Spring, and Summer terms*

The course centers on properties of pure substances; concepts of work and heat; closed and open systems. Topics: Fundamental laws of thermodynamics. Carnot and Clausius statements of the 2nd law; entropy and entropy production; heat engines, refrigerators, heat pumps; efficiencies, coefficients of performance. | Prerequisite for Brooklyn Students: MA-UY 1124 | Prerequisite for Abu Dhabi Students: MATH-UH 1020

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** Prerequisite for Brooklyn Students: MA-UY 1124 |

Prerequisite for Abu Dhabi Students: MATH-UH 1020.

ME-UY 3411 Automatic Control Laboratory (1 Credit)*Typically offered Fall, Spring, and Summer terms*

The course covers system ID, modeling, identification and control of RC electrical network and a DC servo motor, modeling and control of a maglev system, rotary inverted pendulum and a coupled water tank system. | Prerequisite: ME-UY 3511. Co-requisite: ME-UY 3413.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3413 Automatic Control (3 Credits)***Typically offered Fall, Spring, and Summer terms*

The course examines dynamic system modeling, analysis and feedback control design with extensive, hands-on computer simulation. Topics: Modeling and analysis of dynamic systems. Description of interconnected systems via transfer functions and block/signal flow diagrams. System response characterization as transient and steady-state responses and error considerations. Stability of dynamical systems: Routh-Hurwitz criterion and Nyquist criterion. Graphical methods for dynamical system analysis and design: root locus and Bode plot. Computer-aided feedback control design for mechanical, aerospace, robotic, thermo-fluid and vibratory systems. | Prerequisite for Brooklyn Students: ME-UY 3513, Co-requisite: ME-UY 3411 | Prerequisite for Abu Dhabi Students: ENGR-UH 3110, Co-requisite: ME-UY 3411

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** Prerequisite for Brooklyn Students: ME-UY 3513, Co-requisite: ME-UY 3411 | Prerequisite for Abu Dhabi Students: ENGR-UH 3110, Co-requisite: ME-UY 3411.**ME-UY 3511 Measurement Systems Laboratory (1 Credit)***Typically offered Fall, Spring, and Summer terms*

The course covers electric measurements, data acquisition, passive and active filters for signal conditioning, temperature, position, velocity and acceleration measurements. | Co-requisite: ME-UY 3513.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3513 Measurement Systems (3 Credits)***Typically offered Fall, Spring, and Summer terms*

The course focuses on electrical circuits and components, filtering, dynamic measurement system response characteristics, analog signal processing, digital representation, data acquisition, sensors. Study of measurement systems via computer simulation. | Prerequisites for Brooklyn Engineering Students: PH-UY 2023, Co-requisite ME-UY 3511 | Prerequisites for Abu Dhabi Students: ENGR-UH 2019 | Co-requisite: ME-UY 3511

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 3713 MANUFACTURING SYSTEMS I (3 Credits)**

To be successful in the marketplace, a product must meet both customer needs and goals of performance, cost, quality, reliability, safety and the environment. The course addresses issues critical to the design of a product for manufacture and the methods that have been found to be successful in addressing these issues. The design process is studied and illustrated through class exercises and a term project. Selected manufacturing processes are studied. Economic feasibility, entrepreneurship and bringing products (and services) to the market are emphasized. | Prerequisites: PH-UY 1013 and MA-UY 1024.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No

ME-UY 3811 Materials Science Laboratory (1 Credit)*Typically offered Fall and Spring*

Students learn to characterize the microstructure and crystal structure of a material by optical and scanning electron microscopy and X-ray diffraction. The mechanical characterization is accomplished by hardness, tensile and yield strength, impact and fatigue testing. | Prerequisite: ME-UY 2813.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** ME-UY 2813.**ME-UY 4103 Senior Design I (3 Credits)***Typically offered Fall*

This is the first of two courses dedicated to the capstone design experience in mechanical engineering. In this first course, the students identify and define a project to design, build, and test. Following a product realization process, the preliminary design of their chosen project is completed along with some early prototyping. Building effective teams and communication skills are also emphasized. | Prerequisites: ME-UY 2112, Co-requisite: ME-UY 4214 and any 2 of the following (ME-UY 3233, ME-UY 3413 or ME-UY 4313)

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4113 Senior Design II (3 Credits)***Typically offered Spring*

This is the second of two courses dedicated to the capstone design experience in mechanical engineering and based on knowledge and skills acquired in earlier course work. Topics: Product design, development, building and testing prototype hardware, with an emphasis on teamwork. The Product Realization Process emphasizes incorporation of engineering standards and realistic constraints. The course concentrates on communication skills. | Prerequisites: ME-UY 4112

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** ME-UY 4112.**ME-UY 4213 Design and Fabrication of Composite Materials (3 Credits)**

The course introduces composite materials. Topics: Introduction to types of reinforcements and matrix materials. Various applications in mechanical engineering. Manufacturing of polymer, metal and ceramic matrix materials. Analysis of laminated composites for mechanical properties. | Prerequisites: MT-UY 2813, MT-UY 2811 and ME-UY 3213.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4214 Finite Element Modeling, Design and Analysis (4 Credits)***Typically offered Fall and Spring*

The analysis of complex static and dynamic problems involves three steps: selection of a mathematical model; analysis of the model; interpretation of the predicted response. The course deals with deriving analytical solutions and comparing them with Finite Element Analysis results. Students are required to use state-of-the-art commercial software. | Prerequisite for Brooklyn Students: ME-UY 3213, MA-UY 2114 and MA-UY 2034 | Prerequisite for Abu Dhabi Students: ENGR-UH 3210, MATH-UH 1020, MATH-UH 1023 and MATH-UH 1024

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4223 VIBRATIONS (3 Credits)***Typically offered occasionally*

Undamped and damped vibrating systems. Free vibrations. Harmonic, periodic and transient forces. Forced responses. Accelerometers. Two- and multi-degree-of-freedom systems. | Prerequisite for Brooklyn Students: ME-UY 3223 and MA-UY 2034 | Prerequisite for Abu Dhabi Students: ENGR-UH 2210 and MATH-UH 1024

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4311 Heat Transfer Laboratory (1 Credit)***Typically offered Fall and Spring*

The course covers heat-transfer instrumentation and principles and consists of a set of laboratory experiments designed to reinforce the concepts presented in ME-UY 4313 Heat Transfer. In addition, this course involves team work, report writing and oral presentation. | Co-requisite: ME-UY 4313

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4312 Thermo-Fluids Practicum (2 Credits)***Typically offered Fall and Spring*

The hands-on application of Fluid Mechanics and Heat Transfer principles to problems of practical interest. Basic instrumentation, data collection and post-processing, statistical analysis and report writing are introduced. This course consists of a set of real-world scenarios that challenge students, working in teams, to integrate and apply previously acquired basic knowledge in mechanical engineering and in particular the thermal-fluid sciences. | Prerequisite: ME-UY 3313, Co-requisite: ME-UY 4313, Anti-requisite: ME-UY 4311

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** ME-UY 3313, Co-requisite: ME-UY 4313, Anti-requisite: ME-UY 4311.**ME-UY 4313 Heat Transfer (3 Credits)***Typically offered Fall and Spring*

The course introduces modes of conduction, convection and radiation heat transfer. Topics: Analysis of multidimensional geometries for the conduction mode. Unsteady conduction. Numerical methods of analysis. Introduction to convection. Internal and external convection. Natural convection and boiling and condensation. Principles of radiative heat transfer. | Prerequisite for Brooklyn Students: ME-UY 3313 and ME-UY 3333 | Prerequisite for Abu Dhabi Students: ENGR-UH 2212 and ENGR-UH 3710

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4353 Internal Combustion Engines (3 Credits)***Typically offered occasionally*

The course covers introduction and definitions, engine-operating characteristics. Topics: Thermodynamics of internal combustion engines. Thermodynamics of combustion. Combustion in spark ignition engines. Design for performance and efficiency. Pollutant formation and controls, emissions tests. | Prerequisites: ME-UY 3313 and ME-UY 3333. Co-requisite: ME-UY 4313.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No

ME-UY 4363 Heating, Ventilation and Air Conditioning (3 Credits)*Typically offered occasionally*

This course reviews thermodynamic principles, psychrometric chart and psychrometric analysis, comfort air conditioning and indoor air quality, heating and cooling system, HVAC system design and equipment selection. | Prerequisites: ME-UY 4313.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4373 INTRO TO NUCLEAR ENGINEERING (3 Credits)***Typically offered Spring*

This is intended to be a required course for the Nuclear Engineering Concentration. It covers three basic areas: (a) reactor kinetics, as it pertains to neutron reaction associated with fissile materials, (b) power reactor systems, i.e. the various types of nuclear reactors in use and their basic operating principles, and (c) design principles for reactors and reactor systems. | Prerequisite: PH-UY 3103 Fundamentals of Applied Nuclear Physics

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4383 Introduction to Radiation Physics and Dosimetry (3 Credits)**

Theory and practice of Radiation and Health Physics. Atomic and nuclear structure, X-ray and gamma radiation, interaction of ionizing radiation with matter, and effects of ionizing radiation on living tissue. The course also introduces the principles of radiation detection, radiation measurement, and external and internal dosimetry. Cross listed with PH-UY 3503 | Prerequisite: PH-UY 3103

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4393 Nuclear Power Plant Systems (3 Credits)***Typically offered occasionally*

Principles of operation of pressurized and boiling water reactors. Overall unit and major components of nuclear plants. Reactor and moderator systems. Reactor control. Heat transfer systems. Water/steam systems, turbine, and feedwater pumps. Special safety systems and their operations under transient conditions. Protection of the public. | Prerequisite for Brooklyn Students: PH-UY 2033 | Prerequisite for Abu Dhabi Students: ENGR-UH 2012

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** Prerequisite for Brooklyn Students: PH-UY 2033 |

Prerequisite for Abu Dhabi Students: ENGR-UH 2012.

ME-UY 4623 Biomechanics (3 Credits)*Typically offered Fall*

Introduction to fundamental physiology and pathophysiology concepts. Basic biomechanical concepts applied to different anatomical systems. Fundamentals of the mechanism of control and response activated by mechanical stimuli in the body. Basic principles of locomotion and gait analysis. | Prerequisites for Brooklyn Students: ME-UY 3213 and BMS-UY 1004 | Prerequisites for Abu Dhabi Students: ENGR-UH 2012 and ENGR-UH 3210

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4633 Biomaterials (3 Credits)***Typically offered Fall*

This course covers the basic properties of biomaterials, biological systems in which biomaterials may be used, different categories of biomaterials, surface modification and sterilization techniques, and cell-biomaterial interactions. Applications include implants and medical devices, and tissue engineered devices for treatment of health conditions and disease. | Prerequisites for Brooklyn Students: ME-UY 2813 and BMS-UY 1004 | Prerequisites for Abu Dhabi Students: ENGR-UH 2012 and ENGR-UH 3120

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4643 Biofluid Mechanics (3 Credits)***Typically offered Spring*

This course elaborates on the application of fluid mechanics principles to major biological systems, in particular human organ systems. The course will provide an introduction to physiologically relevant fluid flow phenomena, underlying physical mechanisms from an engineering perspective. The focus of the course is on the integration of different fluid mechanics concepts to address relevant problems of the human body systems. Topics covered will include blood rheology, mechanics of circulation arterial wave propagation, oscillatory air and liquid flows and transport of suspended solutes, and how dysregulation of biofluid mechanics relates to disease. | Prerequisites for Brooklyn Students: ME-UY 3313 and BMS-UY 1004 | Prerequisites for Abu Dhabi Students: ENGR-UH 2012 and ENGR-UH 2212

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4653 Introduction to BioMEMS and Microfluidics (3 Credits)***Typically offered Spring*

This course targets to: (1) introduce fundamental design and microfabrication concepts of BioMEMS, microfluidics and lab-on-chip systems, (2) expose students to the relevant biomedical and biological applications. The course is divided into three main sections: (i) BioMEMS/Microfluidic materials and microfabrication, (ii) BioMEMS sensors and actuators, and (iii) Microfluidic and Lab-on-chip systems. | Prerequisites for Brooklyn Students: ME-UY 2813, ME-UY 3513 and BMS-UY1004 | Prerequisites for Abu Dhabi Students: ENGR-UH 2012, ENGR-UH 3120 and ENGR-UH 3110

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4713 MANUFACTURING SYSTEMS II (3 Credits)**

This course continues ME-UY 3713. It addresses techniques of manufacturing systems that can be applied to business processes in a variety of industries to address bottlenecks, simulation, economic computations, design process and applications. This course builds from the readings and emphasizes project work. The course depends on effective teamwork and focuses on project work and presentations. | Prerequisite: MN-UY 3713.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No

ME-UY 4853 Manufacturing Engineering and Processes (3 Credits)*Typically offered Spring*

This course introduces the manufacturing processes for fabricating components used in mechanical systems; casting processes; bulk metal deformation and sheet-metal forming processes; materials-removal processes; Joining and fastening processes; manufacturing automation; and integrated manufacturing systems. | Prerequisites for Brooklyn Students: ME-UY 2813 | Prerequisites for Abu Dhabi Students: ENGR-UH 3120

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4863 CORROSION & NON-DESTRUCTIVE EVALUATION OF MATERIALS (3 Credits)***Typically offered occasionally*

Mechanisms of corrosion and means to prevent corrosion; uniform corrosion, galvanic corrosion, pitting, leaching and corrosion in fresh water; protective coatings, cathodic protection and changes in design and environment to prevent corrosion. Non-destructive testing of materials; Penetrants, Magnetic, Radiography, Eddy Current and Ultrasonic techniques. Materials selection, failure analysis and prevention and design strategies for inspectability. | Prerequisite for Brooklyn Students: PH-UY 2023 | Prerequisite for Abu Dhabi Students: ENGR-UH 2012

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**ME-UY 4983 SPECIAL TOPICS IN MECH ENGR (3 Credits)***Typically offered occasionally*

ME-UY 4983 is special topics in mechanical engineering. The same course number (ME-UY 4983) has several different ME electives such as Advanced CAD, Intellectual property, finite volume method, automotive engineering, etc. They are separated by section numbers.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** Yes**ME-UY 4993 B.S. THESIS IN MECHANICAL ENGINEERING (3 Credits)***Typically offered Fall and Spring*

Honors College students can produce a BS Thesis on a topic of interest to them under faculty advisement. A research project is carried out in traditional and emerging areas of mechanical engineering. The course can be repeated for no more than six credits. | Prerequisites: Honors College status and adviser approval.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** Yes