ENGINEERING

Faculty: McLeskey, Head of Engineering Programs; Cullingsworth and Woolard.
(Department of Physics, Engineering, and Astrophysics)

Engineering is the practical application of mathematics and science in order to make structures, machines, products, systems, and processes which are useful to humankind. By combining the fundamentals of science with creative hands-on design and a strong background in the liberal arts, Randolph-Macon Engineers will gain the Technical, Problem-Solving, Communications, and Professional skills needed to succeed as practicing engineers or in graduate school. The Engineering major is designed to meet the requirements for ABET accreditation. Students wishing to complete the Engineering (ENGR) degree in 4 years are required to successfully complete PHYS 151 and MATH 131 during the first semester of their freshman year. Students who complete PHYS 151 during the sophomore year or who wish to double-major in another subject are encouraged to consider the Engineering Physics (EPHY) major. Students who major in Engineering (ENGR) may need to complete more than 120 credit hours in order to satisfy the major requirements.

- Engineering Major (https://catalog.rmc.edu/programs/engineering/engineering-major/)

ENGR 220 - CAE Design (4 Hours)
The creation and interpretation of graphical communication for engineering students. Two- and three-dimensional part and assembly representations. Dimensioning and tolerancing as a link between design and manufacturing. An introduction to solid modeling and virtual prototyping. Develop visual thinking and communication skills with assistance of computer modeling tools. Emphasis placed on creative design, the engineering design process, ethical design, application of physical laws, and hands-on virtual or physical projects. The course will impart proficiency in computer and graphical applications of fundamental and practical importance to engineering students. Programming in MATLAB will be introduced.
Prerequisite(s): EPHY 150, MATH 131

ENGR 320 - Engineering Thermodynamics (4 Hours)
Fundamental concepts of thermodynamics; first and second law of thermodynamics; entropy and equilibrium; equations of state; properties of pure fluids; molecular interpretation of thermodynamic properties; phase equilibria; work and heat; power cycles; chemical reactions. 4 hours.
Prerequisite(s): PHYS 152, MATH 132

ENGR 321 - Thermal Systems Design (3 Hours)
Fundamentals of heat transfer, thermodynamics and fluid mechanics applied to the analysis, design, selection, and application of energy conversion systems. Topics to be covered may include: heat balance calculations, hvac system design, fluid flow equipment, heat exchanger design, flow sheeting, and optimization.
Prerequisite(s): ENGR 320, EPHY 350, or Permission of Instructor

ENGR 331 - Mechanical Systems Design (3 Hours)
Basic principles of applied mechanics and materials employed for the design of machine elements and mechanical systems; state of stress, deformation and failure criterion is applied to bearings, brakes, clutches, belt drives, gears, chains, springs, gear trains, power screws and transmissions. 3 hours.
Prerequisite(s): EPHY 255, EPHY 300, or Permission of Instructor

ENGR 335 - Advanced Solid Mechanics (3 Hours)
Fundamentals of elastic and plastic behavior, fracture and fatigue, and composites. Topics to be covered may include: stresses and strains in two- and three-dimensional elastic problems, failure theories and yield criteria, design and analysis of load-carrying members, fatigue and fracture, energy methods, and stress concentrations.
Prerequisite(s): EPHY 300 or Permission of Instructor

ENGR 345 - Energy Conversion Systems (3 Hours)
Study of traditional and alternative systems used to generate electricity. Topics include combustion, coal-fired boilers, nuclear reactors, steam turbine blading, gas turbine combustors, turbo-generator design, internal combustion engines, solar thermal systems, photovoltaic devices, wind energy, geothermal energy and fuel cells. Additional topics of interest to the students may be discussed.
Prerequisite(s): ENGR 320, EPHY 350, or Permission of Instructor

ENGR 373 - Principles of Geotechnical Engineer (3 Hours)
This is an introductory soil mechanics course. The course begins with a discussion of geology and the physical properties of soils including: the origin of soil, grain size analysis, weight volume relationships, and soil plasticity and structure. This will be followed by soil classification and compaction, soil permeability, and analysis of seepage through soils. Soil stresses within a soil mass and acting on a soil mass will then be covered. These topics provide the framework for understanding soil compressibility, shear strength, lateral earth pressures and slope stability. Finally, the course will close with a discussion of soil bearing capacity, geosynthetics and field investigation techniques.
Prerequisite(s): EPHY 300

ENGR 400 - Solid Mechanics Lab (1 Hour)
Experiments will be conducted on fundamental principles of solid mechanics, materials, and dynamics. Topics covered include testing of materials for tensile, compression, bending, and torsional loads, vibrations, and material microstructure. C21:CC.
Prerequisite(s): ENGL 185

Corequisite(s): EPHY 300

Curriculum: CC

ENGR 401 - Fluid Mechanics Lab (1 Hour)
Experiments will be conducted on fundamental principles of fluid mechanics, thermodynamics, and heat transfer. Topics covered include hydrostatics, Thermal Expansion, the Bernoulli equation, impact jets, piping losses, aerodynamic force, heat pump thermodynamics cycles, heat exchangers, and convection heat transfer. C21:CC.
Prerequisite(s): ENGL 185

Corequisite(s): EPHY 350

Curriculum: CC

ENGR 420 - CAE Analysis (4 Hours)
Topics include review of kinematics/dynamics of commonly used planar mechanisms and programming techniques for motion simulation. Interdisciplinary projects will be assigned to assess students' design knowledge. Application of computer-aided techniques to the analysis of engineering problems utilizing linear algebra, computer calculations of matrices and numerical solution of governing differential equilibrium equations common to all fields of engineering. Students will be exposed to formulations of finite element (FE) methods of analysis. Emphasis is placed on practical aspects of structural FE modeling. Analysis programs such as MSC/PATRAN, MSC/NASTRAN and MATLAB are utilized.
Prerequisite(s): MATH 307, ENGR 220

ENGR 455 - Internship in Engineering (3 Hours)
Open to qualified students who seek an immersion experience in a setting consistent with their goals, preparation, and interests. Students are expected to complete goals agreed upon by themselves, their instructor, and their site supervisor. Application required; see Internship Program.
Prerequisite(s): permission of program director

ENGR 495 - Senior Design Seminar (3 Hours)
The senior capstone project in engineering will provide students the opportunity to work in teams on an original research and design project under faculty supervision. The first half of the course (ENGR 495) will focus on the completion of a proposal (including literature review and research/design plan) and development of a complete design report including design drawings, parts list, mathematical analysis, preliminary experiments, schedule, budget, and applicable engineering standards. The second half of the senior capstone project in engineering (496) will focus on prototype development and testing, iterative design modifications, and completion of the project including a final formal written report and oral presentation. Externally funded projects from outside partners (industry, non-profits, etc.) will be used where possible. C21:CS,EL.
Prerequisite(s): ENGR 420, EPHY 350

Curriculum: CS,EL

ENGR 496 - Engineering Capstone (3 Hours)
The senior capstone project in engineering will provide students the opportunity to work in teams on an original research and design project under faculty supervision. The first half of the course (ENGR 495) will focus on the completion of a proposal (including literature review and research/design plan) and development of a complete design report including design drawings, parts list, mathematical analysis, preliminary experiments, schedule, budget, and applicable engineering standards. The second half of the senior capstone project in engineering (496) will focus on prototype development and testing, iterative design modifications, and completion of the project including a final formal written report and oral presentation. Externally funded projects from outside partners (industry, non-profits, etc.) will be used where possible. C21:CS,EL.
Prerequisite(s): ENGR 495

Curriculum: CS,EL

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