Course Descriptions -
Rose-Hulman/Foundation-Coalition Sophomore Engineering Curriculum

Curriculum Structure

The Rose-Hulman / Foundation Coalition Sophomore Engineering Curriculum consists of eight courses (30 credit hours) taken over the three quarters of the sophomore year. As shown below the courses are listed as either mathematics (MA) or engineering science (ES) courses:

FALL QUARTER . . . . . 12 Credit Hours
MA 221 Differential Equations & Matrix Algebra I (4)
ES 201 Conservation & Accounting Principles (4)
ES 203 Electrical Systems (4)

WINTER QUARTER . . . . . 10 Credit Hours
MA 222 Differential Equations & Matrix Algebra II (4)
ES 202 Fluid & Thermal Systems (3)
ES 204 Mechanical Systems (3)

SPRING QUARTER . . . . . 8 Credit Hours
MA 223 Statistics for Engineers (4)
ES 205 Analysis & Design of Engineering Systems (4)

TOTAL . . . . . 30 Credit Hours

Curriculum Goals

This set of courses has been designed so that students who participate in this program should

- develop a strong background in engineering science,
- develop an understanding of modeling,
- be able to apply a common problem-solving approach built around the application of conservation and accounting principles and constitutive relations,
- continue to develop effective communication skills,
- be proficient in applying standard statistical procedures and quality control concepts,
- develop a strong background in mathematics,
- be encouraged to be inquisitive and self-motivated learners,
- develop an appreciation for engineering as a profession and begin to develop an identity as an engineer,
- be able to work effectively in teams and recognize the importance of individual responsibility in team efforts,
- be able to apply computer tools appropriately,
- be comfortable working with ambiguity,
- be familiar with the overall design process,
- be able to locate and retrieve both technical and non-technical information,
- be introduced to safe and effective use of instruments,
- appreciate the role of creativity in engineering,
- develop a recognition of the benefits of the new curriculum, and
- be encouraged to have fun learning.

Each course in the curriculum has been developed around a set of course goals and objectives that support these seventeen curriculum goals

ES 201 Conservation & Accounting Principles 4R-0L-4C
F,W Pre: MA 113, PH 111 Co: MA 221
A common framework for engineering analysis is developed using the concepts of a system, accounting and conservation of extensive properties, constitutive relations, constraints, and modeling assumptions. Conservation equations for mass, charge, momentum and energy, and an entropy accounting equation are developed. Applications taken from all engineering disciplines stress constructing solutions from basic principles.

ES 202 Fluid & Thermal Systems 2 2/3R-1L-3C
W,S Pre: ES 201 with a grade of C or better
Conservation and accounting equations applied to fluid and thermal systems. Fluid and thermodynamic properties of pure substances. Open and closed systems hydrostatics. Dimensional analysis. Mechanical energy balance and pipe flow. Lift and drag.

ES 203 Electrical Systems 3R-3L-4C
F,W,S Pre: MA 113, PH 113
Circuit elements. Kirchhoff's laws. Equivalent circuits and voltage and current dividers. Operational amplifiers. First, second, and higher order circuits. Transient and steady-state behavior. AC circuits and power.

ES 204 Mechanical Systems 2 2/3R-1L-3C
W,S Pre: ES 201 with a grade of C or better Co: ES 202
Conservation and accounting equations applied to mechanical systems. Kinematics and kinetics of particles in space and of rigid bodies in plane motion.

ES 205 Analysis & Design of Engineering Systems 3R-3L-4C
S,F Pre: ES 202, ES 203 with a grade of C or better, ES 204, MA 222
Conservation and accounting principles are used to model engineering systems comprising mechanical, electrical, fluid, and thermal elements. Dynamic behavior and performance criteria are characterized in the time and frequency domains. Topics include block diagrams, deriving and solving differential equations of motion, experimental parameter identification and model validation, teaming, and reporting engineering results.

MA 221 Differential Equations and Matrix Algebra I 4R-0L-4C
F, W, S Pre: MA 113 or permission of mathematics department head
Basic matrix algebra with emphasis on understanding systems of linear equations from algebraic and geometric viewpoints, including the least squares process and eigenvalues and eigenvectors. First order differential equations including basic solution techniques and numerical methods. Second order linear, constant coefficient differential equations, including both the homogeneous and non-homogeneous cases. Introduction to complex arithmetic, as needed. Applications to problems in science and engineering.

MA 222 Differential Equations and Matrix Algebra II 4R-0L-4C
F, W, S Pre: MA 221
Solution of systems of first order linear differential equations by eigensystems and investigation of their solution structure determined by eigensystems. Phase portrait analysis and classification and stability of critical points for linear and nonlinear systems. Laplace transforms. Solving small systems of first order linear differential equations by Laplace transforms. Series solutions. Fourier series. Applications to problems in science and engineering.

MA 223 Engineering Statistics I 4R-0L-4C
F, W, S Pre: MA 112
This is an introductory course in statistical data analysis. Topics covered include descriptive statistics, introduction to simple probability concepts, and random variables (including their linear combinations and expectations). The Central Limit Theorem will be presented. Hypothesis testing and confidence intervals for one mean, one proportion, and one standard deviation/variance will be covered as well as hypothesis testing and confidence intervals for the difference of two means. An introduction to one factor analysis of variance and simple linear regression will be presented. A computer package will be used for statistical analysis and simulation. Experimental data from a variety of fields of interest to the science and engineering majors enrolled will also be used to illustrate statistical concepts and facilitate the development of the student's statistical thinking. A student cannot take both MA 223 and MA 382 for credit.