Study Away Guide for EGR 220, EGR 290, EGR 374 & MTH/SDS 220

This document is intended to help engineering majors and their advisors identify appropriate courses at other universities that will satisfy the core requirements for the engineering majors. Herein, Smith faculty delineate the criteria used to determine equivalence in order to promote transparency. Please review these guidelines before submitting the Departmental Transfer of Credit (TOC) form for one of the courses listed below. These guidelines are intended to increase your chances of getting approval.

EGR 220 Engineering Circuit Theory
With EGR 220L

An equivalent circuits class must cover RLC circuits, sinusoidal steady state, some frequency response, be offered through an EE or ECE program, and include a hands on lab (e.g., not computer simulations of circuits)

EGR 290 Engineering Thermodynamics

- 3 in class hours per week for approximately 14 weeks (or an equivalent combination)
- Calculus II pre-requisite
- Core Topics
    - Properties of a Pure Substance
        - Phase boundaries, P-v-T relations, property tables, states & phase changes
    - First Law of Thermodynamics
        - Control volume (open), control mass (closed), work terms, heat transfer terms, internal energy, enthalpy, specific heat
    - Second Law of Thermodynamics
        - Thermal efficiency and COP, reversible and irreversible processes, Carnot Cycle, heat engine, refrigeration
    - Entropy
        - Clausius Inequality, entropy as a property, entropy changes for states and processes, entropy generation
- In depth exploration of topic(s) that apply the fundamental principles listed in core topic above - Examples include:
    - Cycles
    - Gas Mixtures
    - Phase and Chemical Equilibrium
    - Advanced Thermodynamic Relations

EGR 374 Fluid Mechanics
With EGR 374L

Requirements for a substitute course for EGR 374:
1. Offered at a college or university in an engineering department
2. Designed for engineering students who are typically in year 3
3. Includes a substantial laboratory component
4. Covers at least the topics underlined and the sub-topics listed below.

Fluid Properties
- Intensive and extensive properties
- Ideal Gas Law
- Viscosity and shear stress
- Physical meaning of laminar and turbulent flow

Hydrostatics
- Derivation and use of the Hydrostatic Law (differential and integral forms)
- Forces and moments on objects due to pressure (magnitude and direction)
- Buoyancy and Archimedes Principle

Integral Analysis
- Application of the Reynolds Transport Theorem to mass, momentum, and energy
- Flow characteristics (steady, uniform, frictionless, incompressible)
- Bernoulli Equation (energy and head forms)
- Vector notation and manipulation

Dimensional Analysis
- Concept and application of dimensional analysis
- Dimensionless numbers (Re, Fr, C_d)
- Use of scale models to study fluid flows

Pipe Flow
- Boundary layer, entrance region, fully-developed, laminar and turbulent flow
- Head loss and pressure changes

Immersed Body Flow
- Flat plat boundary layer thickness and viscous drag calculations
- Drag and lift, including drag and lift coefficients

Lab Component
Provides students the opportunity to execute experiments, make quantitative measurements, assess sources of error and draw conclusions from data.

MTH/SDS 220 Introduction to Probability and Statistics

The following criteria are used to verify that a course taken to satisfy the statistics requirement for the EGR major (hereafter "COURSE") is satisfactory:
- Rigor: COURSE must be at or above the level of *rigor* of MTH/SDS 220. This is the primary criteria.

- Statistical reasoning: COURSE must include *statistical* topics like hypothesis testing, confidence intervals, and regression -- not just *probability* topics like random variables, distributions, and expected value.

Exception: students who have earned a 4 or 5 on the AP statistics exam can waive these requirements. They can fulfill their statistics requirement by taking any **non-introductory** course in probability **or** statistics.

SDS faculty will use the following set of questions to guide their thinking on whether a course meets the above criteria. Normally, a replacement course would satisfy all or nearly all of these questions.

- Does COURSE cover most or all of the topics listed in the description for MTH/SDS 220?
    - An application-oriented introduction to modern statistical inference: study design, descriptive statistics; random variables; probability and sampling distributions; point and interval estimates; hypothesis tests, resampling procedures and multiple regression.

- Does COURSE include linear regression as a topic in the syllabus?
- Does COURSE use a comprehensive textbook?
- Does COURSE include any prerequisites (e.g., calculus) that indicate mathematical maturity?
- Is COURSE for statistical practice (like MTH/SDS 220) and not just for statistical concepts (like SDS 107)?
- Does COURSE explicitly mention the use of a statistical computing environment like R, SPSS, Stata, JMP, or SAS (i.e., something beyond Excel or TI calculators)?
- Does COURSE include the word "business" in the course title or textbook? Smith College does not give credit for business classes.

EGR majors should **consult this document first**, and then present a syllabus (preferably electronic) to the SDS study abroad advisor. Although MTH/SDS 220 is a 5-credit course, the number of credits is not a determining factor.