**Department of Mathematics**
**SA 405 - Advanced Mathematical Programming**
**Course Syllabus - Fall 2022**

## Course Coordinator - Assistant Professor Chris Lourenco

*email*: lourenco@usna.edu
*Office phone*: 410-293-6720
*Office*: CH 354

## Course Textbook

Deterministic Operations Research by David Rader (ISBN 978-0470484517)

## Course Description

## Instructor - Dr. Chris Lourenco

*EI*: Feel free to drop by if I am in my office. It's helpful to send an email to let me know you are coming so I will make sure to be available. Generally, I will be in my office in these times:

- Mondays: 1000-1040, 1530-1700
- Tuesdays: 1300-1700
- Wednesdays: 1000-1040, 1530-1700
- Thursdays: 1300-1700
- Fridays: 1530-1700

If you can't make it during the day, we can also do an evening EI session if needed. Please email or ask after class for an appointment. Evening EI will almost always be done via GoogleMeets.

## Course Description

This course covers a range of advanced topics in mathematical programming. Topics include integer programming modeling, branch-and-bound methods, integer programming theory and nonlinear optimization theory and algorithms. Students will also learn to use a set-based modeling language for an advanced integer programming solver. Topics will vary with instructor.

## Prerequisites

SA 305

## Course Objectives

By the end of this course, students will be able to:

- creatively and critically problem solve;
- successfully collaborate in groups;
- intuitively identify, creatively model, and solve (using software) a variety of real-world problems that can be formulated as integer linear programs;
- use Microsoft Excel and Python to develop a spreadsheet interface for a linked opti- mization model;
- understand the theoretical and computational difficulty of integer linear optimization, along with associated theoretical and algorithmic considerations and algorithms.

## Tentative course schedule

A tentative schedule of the class is as follows:

| Week | Topic |
|---|---|
| 1 | Linear Programming Review |
| 2 | Minimum Cost Network Flow Models |
| 3 | Shortest Path and Max Flow Models |
| 4 | Fixed Charge Models |
| 5 | Set Covering and Binary Logic Constraints |
| 6 | Review and Exam 1 |
| 7 | Combinatorial Models and Traveling Salesperson Problem |
| 8 | Vehicle Routing Models |
| 9 | Scheduling Models |
| 10 | Facility Location Models |
| 11 | Review and Exam 2 |
| 12 | IP Formulations |
| 13 | IP Formulations and Branch and Bound |
| 14 | Branch and Bound |
| 15 | Lagrangian Relaxation |
| 16 | Project and Review |