

OR/MA 504 Course Syllabus

OR/MA 504 – Introduction to Mathematical Programming

Spring 2026

3 Credit Hours

Course Description

Basic modelling concepts from linear programming, mixed integer linear programming, nonlinear programming, and dynamic programming.

Coverage Details

This course introduces fundamental theoretical concepts in deterministic optimization. Its primary focus is on understanding business problems, translating them into appropriate mathematical formulations, and developing efficient solution techniques.

Topics covered include:

- Basic modeling approaches
- Linear and mixed-integer linear programming
- Multi-criteria optimization
- Relaxation and decomposition methods
- Metaheuristic techniques
- Dynamic programming for discrete optimization problems
- Methods for solving unconstrained and constrained nonlinear optimization problems

To ensure practical application, course activities will involve implementing these concepts using Python, SAS Optimization, or other mathematical programming tools.

Learning Outcomes

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

- Define the basic components and characteristics of the featured classes of mathematical programming models.
- Construct numerical and symbolic formulations of deterministic optimization problems.
- Use mixed integer linear programming techniques to model various types of logic restrictions.
- Detect special structures in mathematical programming models with discrete decision variables and leverage these insights to select appropriate optimization techniques for expediting their solution.
- Understand the capabilities, limitations, and trade-offs of general-purpose optimization techniques defined for specific classes of optimization problems.
- Use computer tools to solve the featured classes of mathematical programming models.

Course Structure

The material in the course is delivered by face-to-face lectures and reinforced through active learning and participation in in-class exercises.

The course will have homework assignments, two exams, and a project. The projects will be done in teams. Homework assignments will be done individually. There will be a mid-term exam and a final exam. See Grading section for details.

Course Policies

Texting and cell phone use are not allowed in class. In addition, no eating and drinking is allowed in the classroom.

Course Administration: All materials, assignments and grades will be distributed via Moodle, which will also be used for announcements to the class. Moodle will also be used to submit assignments. It is the student's responsibility to become familiar with Moodle and to access it in a timely manner; see particularly the regrade policy below.

Computer Usage: You will be expected to use computer tools throughout the semester for homework and the project. The course will have a Moodle site, which will be used for announcements, grades, etc. and most other communication with students.

Homework: Homework will be assigned roughly each week. Students can collaborate on homework but must submit the names of those with whom they worked. Note, however, that collaboration provides many opportunities for learning, but learning does not take place when one student does the work and others copies it. Homework will be submitted via Moodle. Late homework will not be accepted since solutions will be posted as soon as submission closes.

Project: The purpose of the project is to expose you to open-ended, ill-structured real-world applications of the concepts and methods learned in class. Students will work on these in groups of at most (TBD). Teams will choose any real-world issue, model it as a mathematical optimization problem, and submit it in the form of a formal technical report. The report will be graded for organization, presentation, and English in addition to technical content.

Instructors

Subramanian Pazhani (spazhan) - *Instructor*

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Phone: +18147532955

Office Location: Fitts-Woolard Hall

Office Hours: Mondays and Wednesdays and 4:00 - 4:45 pm

Office Hours are by appointment. All office hours will be via Google Meet. Google Meet link will be provided.

Course Meetings

Lecture

Days: Th

Time: 6:00pm - 8:45pm

Campus: Engineering Building 2

Location: 01230

This meeting is required.

Course Materials

Optional Textbooks

Operations research: applications and algorithms - *Winston, Wayne L.*

Edition: Fourth edition

ISBN: 978-0534380588

Operations research applications - *A. Ravi Ravindran*

Edition: First edition

ISBN: 978-0429143717

Multiple Criteria Decision Making in Supply Chain Management - *A. Ravi Ravindran*

Edition: First edition

ISBN: 978-0367782948

Optimization in Operations Research - *R. L. Rardin*

Edition: Second edition

ISBN: 978-0134384559

Supply Chain Engineering: Models and Applications

Edition: Second edition

ISBN: 978-1000923995

Requisites and Restrictions

Prerequisites

This course will assume knowledge of ISE 501 or another suitable undergraduate/graduate course that covers basic linear programming modeling skills and the simplex method.

Co-requisites

None.

Restrictions

None.

Transportation

This course will not require students to provide their own transportation.

Safety & Risk Assumptions

None.

Grading

Grade Components

Component	Weight	Details
Homework Assignments (total of 6-8 scheduled)	20	Late submissions will lead to 20% reduction in score. Scoring scale: 0 (0%) - Did not turn in homework 1 (40%) - Homework turned in, but very little effort 2 (70%) - Homework turned in, significant effort, but still some significant errors 3 (85%) - Homework turned in, solutions mostly correct (some insignificant errors) 4 (100%) - Homework turned in, solutions to all problems correct
Course Project	20	Late submissions will lead to 20% reduction in score. Projects will be done in teams (max. 4 students / team). Evaluation: (i) 50% for approach and originality of the work, (ii) 50% for analysis, results, and clarity of presentation.
Mid-term exam	30	Thursday, March 5, 2026 - 6:00 PM - 8:30 PM. Take home examination.
Final Exam	30	Thursday, April 30, 2026 - 7:00 PM - 9:30 PM. In-class examination.

Letter Grades

This Course uses Standard NCSU Letter Grading:

97 ≤	A+	≤	100
93 ≤	A	<	97
90 ≤	A-	<	93
87 ≤	B+	<	90
83 ≤	B	<	87
80 ≤	B-	<	83
77 ≤	C+	<	80
73 ≤	C	<	77
70 ≤	C-	<	73
67 ≤	D+	<	70
63 ≤	D	<	67
60 ≤	D-	<	63

Requirements for Credit-Only (S/U) Grading

Performance in research, seminar and independent study types of courses (6xx and 8xx) is evaluated as either "S" (Satisfactory) or "U" (Unsatisfactory), and these grades are not used in computing the grade point average. For credit only courses (S/U) the requirements necessary to obtain the grade of "S" must be clearly outlined.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>. Since all case studies, homework assignments and exams are an integral part of the learning experience auditing of this class will not be permitted.

Policies on Incomplete Grades

If an extended deadline is not authorized by the Graduate School, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-03>. Additional information relative to incomplete grades for graduate students can be found in the Graduate Administrative Handbook in Section 3.17.G at <http://www.ncsu.edu/grad/handbook/index.php>

Late Assignments

Assignments will not be accepted after the due date unless approved by the instructor

Attendance Policy

For complete attendance and excused absence policies, please see <http://policies.ncsu.edu/regulation/reg-02-20-03>

Attendance Policy

You are expected to be in class. You should note that in-class assignments will be made and considerable material not directly from the book will be presented in class. Failure to attend class will severely limit your maximum possible grade.

For complete attendance and excused absence policies, please see <https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/>

Absences Policy

You are expected to be in class. You should note that in-class assignments will be made and considerable material not directly from the book will be presented in class. Failure to attend class will severely limit your maximum possible grade.

Excused absences will be granted based upon the university policy on excused absences which can be found at http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.3.php

Makeup Work Policy

Any work missed during an unexcused absence cannot be made up unless approved by the instructor.

Additional Excuses Policy

None.

Academic Integrity

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Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02) (<https://policies.ncsu.edu/regulation/reg-11-35-02/>).

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>

Discussions are encouraged, but do not copy from other's work, use your own language and images.

Honor Pledge

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Digital Course Components

Students may be required to disclose personally identifiable information to other students in the course, via digital tools, such as email or web-postings, where relevant to the course. Examples include online discussions of class topics and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (NCSU REG 02.20.01) (<https://policies.ncsu.edu/regulation/reg-02-20-01/>)

Non-Discrimination Policy

NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or <https://oied.ncsu.edu/divweb/>. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Institutional Equity and Diversity (OIED) at 919-515-3148.

Additional NC State Rules and Regulations

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

Equal Opportunity and Non-Discrimination Policy Statement <https://policies.ncsu.edu/policy/pol-04-25-05> with additional references at <https://oied.ncsu.edu/divweb/policies/>

Code of Student Conduct <https://policies.ncsu.edu/policy/pol-11-35-01>.

Course Schedule

NOTE: The course schedule is subject to change.

Part 0: Course Introduction and Overview

Part 1: Introduction to Mathematical Programming

Part 2: Linear Programming

Part 3: Multi-Criteria Optimization

Part 4: Discrete Optimization

Part 5: Dynamic programming

Part 6: Metaheuristics – Genetic Algorithms, Simulated Annealing, Ant Colony Optimization

Part 7: Non-linear programming