

Fall 2023

## MATH 671-001, Fall 2023: Asymptotic Methods I

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THE DEPARTMENT OF MATHEMATICAL SCIENCES

## MATH 671: Asymptotic Methods I

### *Fall 2023 Course Syllabus*

**NJIT Academic Integrity Code:** All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

### COURSE INFORMATION

**Course Description:** Asymptotic sequences and series. Use of asymptotic series. Regular and singular perturbation methods. Asymptotic methods for the solution of ODEs, including: boundary layer methods and asymptotic matching, multiple scales, the method of averaging, and WKB theory. Asymptotic expansion of integrals, including Watson's lemma, stationary phase, Laplace's method, and the method of steepest descent.

**Number of Credits:** 3

**Prerequisites:** Math 645 or Math 545, and Math 656.

**Course-Section and Instructors:**

Course-Section	Instructor
Math 676-001	Professor Roy Goodman

**Office Hours for All Math Instructors:** [Fall 2023 Office Hours and Emails](#)

**Required Textbook:**

Title	<i>Applied Asymptotic Analysis</i>
Author	Peter David Miller
Edition	2006
Publisher	AMS
ISBN #	9780821840788, 0821840789

**Supplementary readings:** Will be posted on Canvas.

**University-wide Withdrawal Date:** The last day to withdraw with a W is **Monday, November 13, 2023**. It will be strictly enforced.

## POLICIES

**DMS Course Policies:** All DMS students must familiarize themselves with, and adhere to, the **Department of Mathematical Sciences Course Policies**, in addition to official **university-wide policies**. DMS takes these policies very seriously and enforces them strictly.

**Grading Policy:** The final grade in this course will be determined as follows:

Hand-in Homework	70%
Final Cumulative Exam	30%

Your final letter grade will be based on the following tentative curve.

A	88 - 100	C	62 - 67
B+	82 - 87	D	55 - 61
B	75 - 81	F	0 - 54
C+	68 - 74		

**Attendance Policy:** Attendance at all classes will be recorded and is **mandatory**. Please ensure you read and fully understand the **Math Department's Attendance Policy**. This policy will be strictly enforced. Attendance in all classes is expected. Absences from class may inhibit your ability to learn the material.

**Homework Policy:** Homework will be assigned and collected on the [course Canvas page](#). Here's what I expect of you and what you can expect of me. The homework is long and time-consuming because asymptotics is long and time-consuming, so there is no midterm exam.

- The purpose of homework is as a tool to help you learn, not as a way to punish you.
- Your job is to figure out how to solve the problems and then to communicate to me the solution and the steps necessary to obtain it.
- This involves two steps (1) Working it out. (2) Writing up the solution, in English, with explanations. You don't need to write every step of the algebra. You do need to explain it so that I can understand it.
- Homework needs to be neat enough for me to read. If I can't read it, I will return it. LaTeX is not necessary unless writing legibly is impossible for you.
- Each problem will be assigned a grade of Zero or One (no partial credit) but may be resubmitted as many times as needed until you get it right. I am not going to spend time trying to locate the exact line where you made a mistake but will provide guidance in fixing your mistakes, especially during office hours.

**Exams:** There will be a cumulative final exam during the final exam week. The final exam format is yet to be determined but will be the same for all students in the class. It will either be a written exam during the assigned exam period or an instructor-assigned project that is of interest to the student and may be related to their research:

Midterm Exam	TBA
Final Exam	December 17 - December 23, 2023

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the **Math Department's Examination Policy**. This policy will be strictly enforced.

**Makeup Exam Policy:** There will be **NO MAKE-UP EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

**Cellular Phones:** All cellular phones and other electronic devices must be switched off during all class times.

## ADDITIONAL RESOURCES

**Further Assistance:** For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for **Instructor Office Hours and Emails**.

**Accommodation of Disabilities:** The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you need an accommodation due to a disability, please contact the Office of Accessibility Resources and Services at [oars@njit.edu](mailto:oars@njit.edu), or visit Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

<https://www.njit.edu/accessibility/>

**Important Dates** (See: **Fall 2023 Academic Calendar, Registrar**)

Date	Day	Event
September 4, 2023	Monday	Labor Day
September 5, 2023	Tuesday	First Day of Classes
September 11, 2023	Monday	Last Day to Add/Drop Classes
November 13, 2023	Monday	Last Day to Withdraw
November 21, 2023	Tuesday	Thursday Classes Meet
November 22, 2023	Wednesday	Friday Classes Meet
November 23 to November 26, 2023	Thursday and Saturday	Thanksgiving Recess - Closed
December 13, 2023	Wednesday	Last Day of Classes
December 14, 2023	Thursday	Reading Day 1

December 15, 2023	Friday	Reading Day 2
December 17 to December 23, 2023	Sunday to Saturday	Final Exam Period

## Course Outline

WEEK 1	Overview, basic concepts and notations
WEEKS 2-3	Asymptotic expansions, basic estimates for sums and integrals
WEEKS 4-5	Watson's Lemma, Laplace's method, applications
WEEKS 6-7	Methods of Steepest Descent and Stationary Phase
WEEK 8	Perturbation Methods for Algebraic Problems
WEEKS 9-10	Linear second-order ODEs and special functions
WEEKS 11-12	Singular perturbations, WKB method, boundary layers
WEEKS 13-14	Miscellaneous Topics

*Updated by Professor R. Goodman - 8/16/2023  
Department of Mathematical Sciences Course Syllabus, Fall 2023*