

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 671: Asymptotic Methods I

Fall 2020 Graduate 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 simple 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 or departmental approval.

Course-Section and Instructors

Course-Section	Instructor
Math 671-001	Professor C. Muratov

Office Hours for All Math Instructors: [Fall 2020 Office Hours and Emails](#)

Textbook Materials: There is no required textbook for this course. Sources that are relevant to course material will be cited during the course and will be available in the NJIT library.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 9, 2020**. It will be strictly enforced.

FURTHER READING

- P. D. Miller, Applied Asymptotic Analysis, Graduate Studies in Mathematics, AMS, 2006.
- C. M. Bender and S. A. Orszag, Mathematical Methods for Sciences and Engineering I: Asymptotic Methods and Perturbation Theory, Springer, 1999.
- J. D. Murray, Asymptotic Analysis, Springer, 1984.
- M. H. Holmes, Introduction to Perturbation Methods, Springer, 2013.

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	30%
Midterm Exam	30%
Final Exam	40%

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure 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 in class every few weeks. Selected problems will be graded.

Exams: 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. Please read and understand the **Math Department's Examination Policy**.

Final Exam Period	December 15 - 21, 2020
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Makeup Exam Policy: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

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

ADDITIONAL RESOURCES

Accommodation of Disabilities: Disability Support Services (DSS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services at [973-596-5417](tel:973-596-5417) or via email at lyles@njit.edu. The office is located in Fenster Hall, Room 260. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Disability Support Services (DSS) website at:

- <http://www5.njit.edu/studentssuccess/disability-support-services/>

Important Dates (See: [Fall 2019 Academic Calendar](#), Registrar)

Date	Day	Event
September 1, 2020	T	First Day of Classes
September 5, 2020	S	Saturday Classes Begin
September 7, 2020	M	Labor Day
September 8, 2020	T	Monday Classes Meet
September 8, 2020	T	Last Day to Add/Drop Classes

November 9, 2020	M	Last Day to Withdraw
November 25, 2020	W	Thursday Classes Meet
November 26-29, 2020	R - Su	Thanksgiving Recess
December 10, 2020	R	Last Day of Classes
December 11 & 14 2020	F & M	Reading Days
December 15 - 21, 2020	T - M	Final Exam Period

Course Outline

Week	Topic
Weeks 1-2	Overview, regular and singular perturbations
Weeks 3-4	Notations, asymptotic expansions, basic estimates for sums and integrals
Weeks 5-7	Watson's Lemma, Laplace's method, method of stationary phase, steepest descent
Weeks 8-9	Linear second-order ODEs, WKB theory
Weeks 10-12	Method of averaging, homogenization, multiple scale expansions, self-similarity
Weeks 13-14	Variational methods

*Updated by Professor C. Muratov- 8/26/2020
Department of Mathematical Sciences Course Syllabus, Fall 2020*