

COMPLEX VARIABLES

MTH 204, SEMESTER II, 2022-2023

COURSE INFORMATION

- **Instructor:** Dr. Sanjay Kumar Singh <sanjayks@iiserb.ac.in>
- **Office:** 210, Academic Building 1.
- **Email:** sanjayks@iiserb.ac.in.
- **Webpage:** <http://home.iiserb.ac.in/~sanjayks>.
- **Class Time:** Wed, Thu, Fri 10-11 AM (D-Slot).
- **Tutorial Class Time:**
- **Office Hours:** Wednesday 2-3 PM.

Learning Objectives. By extending the real number system to include $\sqrt{-1}$, one obtains the set of complex numbers, which possesses an algebraic structure similar to real numbers. This motivates us to study the calculus of functions of a complex variable. Though a generalization, this calculus has a striking difference from the calculus of a real variable, which leads to some surprising results. The course intends to highlight some of these important results. This course is a precursor to MTH 407 Complex Analysis-I and the material covered are also used widely in physical and engineering sciences. Course Contents

Syllabus: The official Course Syllabus is as given in the Course Contents booklet.

[http : //acad.iiserb.ac.in/pdf/mth.pdf](http://acad.iiserb.ac.in/pdf/mth.pdf)

Course Contents:

- Review of complex numbers, functions of one complex variable, limits and continuity, definition and examples of analytic functions, Cauchy-Riemann equations, the definition of a harmonic function, harmonic conjugates
- Representation of an analytic function as a power series, term by-term differentiation, elementary complex functions, and comparison with real counterparts
- Contour integration, statement of Goursat's theorem, proof of Cauchy's theorem in a disc, Cauchy's integral formulae
- Zero set of an analytic function, a form of an analytic function in a neighborhood of a zero, definition and examples of removable singularities, poles, essential singularities respectively, Laurent series expansion of a complex function
- Residues, residue theorem in a disc, evaluation of real integrals and improper integrals

Text Book: R. V. Churchill and J. W. Brown, Complex variables and applications, McGraw-Hill, 2003, **9th Indian Edition.**

Reference Books:

- Murray R. Spiegel, Theory and Problems of Complex Variables, Schaum's Outline Series (McGraw-Hill), 2009
- J. M. Howie, Complex Analysis, Springer-Verlag, 2004
- E.M. Stein and R. Shakarchi, Complex Analysis, Overseas Press (India) Pvt. Ltd. 2006

Assignment. There will be weekly assignments in this course. You can discuss and submit these assignments in tutorial classes. The assignments will be posted on the course webpage. You are encouraged to solve all problems given in the textbook.

Home work and class exercise. Every class you will get some homework you don't need to submit. You can discuss it with the tutors. Homework problems are important in exams.

Grading Policy: The grading policy for the 2022-23-II Semester is divided into the following components

- Attendance (5%)
- Surprise Quiz (5%)
- Quiz (10%)
- Mid Semester Examination (30%)
- Final Examination (50%)

Quiz: There will be two quizzes in the semester. The dates will be announced in the class.

- Quiz Date and Time: 02/02/2023.
- Quiz Date and Time: -/03/2023

Office Hours: By appt.

Important Note: : Exam problems will be based on assignments, home homework, and class exercises.

*. In case of any further questions regarding the course, please send me an email.