

PHYS 3031
Mathematical Methods for Physics II
(3 credits)

Instructor

Z. Jason Yang

Office: Room 4458

Office Hour: 24 hours a day, 7 days per week, via email appointment

e-mail: phyang@ust.hk

phone: 2358-7485

Teaching Assistant

Keming Yu, e-mail: kyuam@connect.ust.hk

Time and Venue

- Lectures, Tuesday and Thursday 1:30 pm to 2:50 pm, Room 1527, Main Academic Building
- Tutorials, Thursday 18:00 - 18:50, Room 2304

The lectures will be conducted in-person only. Recorded video of each lecture will be available in course Canvas in time, usually within a day or two.

Textbook

Mathematical methods in the physical sciences, 3rd Ed., by Boas, Mary L, Wiley 2006

Reference

Mathematical Methods for Physicists, 7th Ed., by George B. Arfken, Hans J. Weber, and Frank E. Harris, Academic Press 2013

Canvas@ust.hk

Prerequisite

Math2121, Math2352, and Math2023 or Math2021, Phys 2124

Course Description

As the title suggests, PHYS 3031 is a course on the mathematics methods and techniques that are widely used in physics. It emphasizes more on solving practical physics problems than on proof of theorems that are mathematically important but have little applications in physics.

Course Content

1. Series
 - a. Test of convergence
 - b. Some uses of series
2. Taylor Expansion of Functions
3. Complex analysis
 - a. Analytic functions
 - b. Complex integrals
4. Gamma function, Beta function, and Delta function
5. Partial differential equations
 - a. Rectangular geometry
 - b. Spherical geometry
 - c. Cylindrical geometry

Learning Outcomes

On successful completion of the course the students are expected to be able to:

1. Apply the mathematical methods and techniques that are widely used in classical and quantum mechanics to given physics problems.
2. Judge whether a series is converging or diverging, and use series for relevant physics applications.
3. Examine the basic principles of complex variables and use Cauchy integral formula and residue theorem to perform certain types of integrals.
4. Solve second-order differential equations using series solution, with applications of Legendre and Bessel differential equations.

Assessment

Assessment and Grading

Assessment Task	Contribution to Overall Course grade (%)	Date
Homework	10%	10 assignments in Canvas#
Mid-Term	35% (2 hours)	12/Oct/2024*
Final examination	55% (3 hours)	

Homework will be collected at the end of the tutorial session following the assignment either in hard copy or in electronic form via email to the teaching assistant.

* Marks will be released within two weeks.

- The course will be assessed in the form of solving assigned mathematical problems. It will use criterion-referencing and grades will **not** be assigned using a distribution curve.
- During the examinations one may use an information sheet of any content with total surface area not exceeding a piece of A4 paper.
- Each home assignment will carry 1 % of the overall mark. Full marks will be given if each problem is solved in a satisfactory manner, regardless of correctness.

Final Grade Descriptors:

Grades	Short Description	Elaboration	Marks
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in analyze and problem-solving.	Above 83
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in analyze and problem-solving.	70 ~ 83
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in solving familiar problems.	50~70
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.	25~50
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.	Below 25

Mapping of Course ILOs to Assessment Tasks

The homework assignments and the examinations are all intended to assess the intended learning outcomes.

Course AI Policy

No AI assistance in mid-term and final examinations will be permitted.

Communication and Feedback

Each homework mark will be communicated to students via hardcopy. Answers will be posted after the homework due date and discussed in the tutorials. Students who have further questions may consult the instructor in a timely fashion.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to [Academic Integrity | HKUST – Academic Registry](#) for the University's definition of plagiarism and ways to avoid cheating and plagiarism.