

Course outline for Physics 112: Mathematical Physics II

Francis N. C. Paraan*

National Institute of Physics

(Dated: January 12, 2019)

I. COURSE INFORMATION

Description: Mathematical methods for physicists II. Complex analysis, differential equations, and special functions. Fourier series and transforms.

References: Arfken 5th (AR), Brown & Churchill 6th (BC).

Prerequisite: Physics 111.

Credits: 3.0

Section: WFW (WF 1:00–2:30 PM).

Location: F209

Web: sand.nip.upd.edu.ph/physics112

II. CLASS POLICIES

Attendance: University Rules state that students that accumulate six or more absences may be given a failing grade (5.0) if they do not drop the course.

Quizzes: Quizzes will be given to check attendance.

Long Exams: There will be three long examinations of equal weights. These exams constitute 3/4 of the final grade. One make up exam replaces an exam

Raw score x	Point grade
$90\% \leq x \leq 100\%$	1.00
$85\% \leq x < 90\%$	1.25
$80\% \leq x < 85\%$	1.50
$75\% \leq x < 80\%$	1.75
$70\% \leq x < 75\%$	2.00
$65\% \leq x < 70\%$	2.25
$60\% \leq x < 65\%$	2.50
$55\% \leq x < 60\%$	2.75
$50\% \leq x < 55\%$	3.00
$45\% \leq x < 50\%$	4.00
$x < 45\%$	5.00

* fparaan@nip.upd.edu.ph

missed due to an excused absence. Further missed exams and unexcused missed exams will be given a grade of zero. Absences must be documented and justified as excused within one week of the student's return to class.

Problem Sets: Problem sets and quizzes make up the remaining 1/4 of the final grade. Late sets will not be given any credit. Solutions to all problem sets must be submitted: a grade of INC will be given if any problem set is not turned in.

Academic honesty: Any form of cheating in examinations or any act of dishonesty in relation to studies, such as plagiarism, shall be subject to disciplinary action.

III. LECTURE PLAN

First day of classes : F 11 Jan 2019.

0. Administrative. Complex numbers. [BC 1]
1. Complex functions, limits, continuity [BC 2]
2. Derivatives. Cauchy–Riemann equations. [BC 2]
3. Analytic functions. [BC 2]
4. Elementary functions 1: Three letter functions. [BC 3]
5. Elementary functions 2: Branches and branch cuts. [BC 3]
6. Contour integrals. Cauchy–Goursat theorem. Cauchy integral formula. [BC 4]
7. Fundamental theorem of algebra. Maximum moduli. [BC 4]
8. **First long exam:** F 15 Feb 2019.
9. Sequences and Taylor series. [BC 5]
10. Laurent series. [BC 5]
11. Singular points, poles, and residues. [BC 6]
12. Principal values. Improper integrals of rational functions. [BC 7]

13. Fourier integrals. Angular integrals. [BC 7]
 14. Indented paths. [BC 7]
 15. Integrations on branch cuts. [BC 7]
 16. Method of steepest descent. [AR 7]
 17. **Second long exam:** – W 10 Apr 2019.
 18. **Dropping deadline:** – H 11 Apr 2019.
 19. Power series solutions to ODEs. [AR 8]
 20. Gamma function. [AR 10]
 21. Bessel functions. [AR 11]
 22. Legendre and associated Legendre polynomials. [AR 12]
 23. Hermite functions. Quantum harmonic oscillator. [AR 13.1]
 24. Laguerre functions and associated Laguerre polynomials. [AR 13.2]
 25. Separation of variables. [AR 8]
 26. Spherical harmonics. [AR 12] Hydrogen atom. AR [13].
 27. **Third long exam:** F 10 May 2019.
- Last day of classes :** T 14 May 2019.