

기본물리수학 (2018학년도 2학기)

Rudimentary Mathematical Methods of Physics (2018 Fall Semester)

- 과목 번호: 3348.203 (001)
- 과목명 및 학점: 기본물리수학, 3학점
- 담당 교수: 유재준 (56-508, 880-8934, jyu@snu.ac.kr)
- 과목 홈페이지: <http://phya.snu.ac.kr/jyu/mp-18/> (TBA)
- 담당 조교: (TBA)
- 강의실 및 강의시간: 56동 105호, 화목 오후 3:30 - 4:45

1. Course Description

이 교과목에서는 물리학에 필수적인 수학적 방법론을 물리현상을 기술하는 언어로서 배우고, 그 도구를 물리학에 이용하는 방법 등에 관한 훈련을 제공한다. 이 교과는 곡선좌표계, 벡터 해석, 상미분방정식과 선형대수학의 기초 내용을 중심 주제로 다룬다.

In this course, students will study mathematical methods necessary for the description of physical phenomena and be trained to learn their application to physics. Topics include curvilinear coordinates systems, vector calculus, and basic theory of ordinary differential equations and linear algebra.

This lecture consists of a series of Jupyter Notebooks (<http://jupyter-notebook.readthedocs.io/en/stable/>), which contains on-line study materials (including video lectures) and exercise/problem sets in a form of Jupyter scripts.

2. Course Objectives

Major topics to be discussed in this lecture includes:

- Vector Analysis
- Vector Analysis in Curved Coordinates and Tensors
- Determinants and Matrices
- Infinite Series
- Differential Equations

3. Course Objectives

Week 1: Overview

- Introduction to Jupyter (Python) Programming

Week 2: Vector Analysis I

- Definitions, Rotation of the Coordinate Axes
- Scalar and Vector Products
- Gradient, Divergence, and Curl

Week 3: Vector Analysis II & III

- Gauss' and Stokes' Theorems
- Potential Theory
- Gauss' Law, Poisson's Equation
- Dirac Delta Function

Week 4: Vector Analysis in Curved Coordinates and Tensors I & II

- Orthogonal Coordinates in R^3
- Differential Vector Operators
- Special Coordinate Systems:
- Circular Cylinder Coordinates
- Spherical Polar Coordinates

Week 5: Vector Analysis in Curved Coordinates and Tensors III & IV

- Tensor Analysis
- Contraction, Direct Product
- Quotient Rule
- Pseudotensors, Dual Tensors
- General Tensors

Week 6: Midterm Exam**Week 7:** Determinants and Matrices I, II & III

- Determinants
- Matrices
- Orthogonal Matrices
- Hermitian Matrices, Unitary Matrices
- Diagonalization of Matrices
- Normal Matrices

Week 8: Infinite Series I & II

- Fundamental Concepts
- Convergence Tests
- Alternating Series
- Algebra of Series
- Series of Functions
- Taylors' Expansion

Week 9: Infinite Series III & IV

- Power Series
- Elliptic Integrals
- Bernoulli Numbers, Euler-Maclaurin Formula
- Asymptotic Series
- Infinite Products

Week 10: Differential Equations I

- Partial Differential Equations
- First-Order Differential Equations
- Separation of Variables

Week 11: Differential Equations II

- Singular Points
- Series Solutions – Frobenius' Method
- A Second Solution

Week 12: Differential Equations III

- Nonhomogeneous Equation – Green’s Function
- Heat Flow, or Diffusion, PDE

Week 13: Final Exam**4. 시험 및 평가**

평가는 과제물과 중간, 기말 고사 시험 결과, 그리고 강의참여(출석)을 고려하여 이루어 질 것이며, 대강의 반영비율은 아래와 같다.

- 보고서 (과제물) ... 30%
- 중간고사 ... 30%
- 기말고사 ... 30%
- 출석 ... 10 %

5. 참고자료:

본 강의의 교재는 다음과 같으며, 강의 비디오 및 프로그래밍 등의 참고자료는 매 강의 주제에 따라 홈페이지를 통해 게시할 예정이다.

- 교재: George B. Arfken and Hans J. Weber, Mathematical Methods For Physicists (Sixth Edition or newer)
- Jupyter Notebooks <http://jupyter-notebook.readthedocs.io/en/stable/>
- 참고자료: 홈페이지를 통해 제공: <http://phya.snu.ac.kr/jyu/mp-18/>

6. 수강자 참고사항

본 강의는 물리학 전공과목으로 “수학 및 연습”, “고급수학 및 연습”, 또는 “미적분학 및 연습” 교과목의 사전 지식이 요구됩니다.