Introduction to Mathematical Physics

CATHOLIC UNIVERSITY OF KOREA

강 의 계 획 서

2016학년도 제1학기

교과목명	국 문	수리물리학입문			
	영 문	Introduction to Mathematical Physics			
과목번호-분반	02908-01	이수구분	제1전공선택	시간/학점	3/3
요일 및 시간 (강의실)	화7~8(V205), 목 7(V205)	수강대상		선수과목	
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Web Site			영어강의 유형		

1.교과목 개요

This class will review some basic mathematical skills which are important for physics. The class will focus on calculus (미적분), complex numbers (복소수), vectors(벡터) and matrices(매트릭스). Time permitting, some more advanced concepts may also be included. Although you may have seen most of these topics before, the class is intended to reinforce the core skills you will need for future courses in physics, as well as give an opportunity for you to study in English.

This will be a *flipped class* meaning that students will watch lectures online before the class and instead use class time to actively practice problem solving skills.

2. 강의목표

The main goal of this class is to reinforce the mathematics needed for later physics courses. There will be 10 topics of study throughout the semester, including

- integrating and differentiating functions in one dimension
- Taylor series
- solving equations with complex numbers
- vector algebra in two and three dimensions
- matrix transformations and solving simultaneous equations
- Eigenvectors and Eigenvalues and matrix diagonalization

More topics may be included based upon student abilities.

3. 강의방법

The key to acquiring skills in the mathematical techniques above is *practice*, and therefore most of the class time will be spent on actively solving problems. This will include a mixture of small-group work, demonstrations by the instructor, and mini-tests. Each topic will be introduced through online video lectures which students should watch prior to class. At the end of each topic there will be a mini-test (~50 minutes) based upon the problem solving sessions.

4. 평가방법

Attendance (10%)
Mini-tests (40%)
Mid-term exam (25%)
Final exam (25%)

5. 과제물

Homework: Weekly problem sheets. The homework will not be assessed, but is designed to help students prepare for the mini-tests.

6. 실험, 실습계획

7. 관련강의

8. 교재

도서명	출판사	저자	연도	교재여부
Mathematical methods in the physical sciences	Wiley	Mary Boas	1983	교재
Introductory mathematics: applications and methods	Springer	G. S. Marshall	1998	부교재

9. 강의일정 및 내용

주	기간	강의내용	참고자료	비고
1	2016-03-02 ~ 2016-03-08	Course Introduction		
2	2016-03-09 ~ 2016-03-15	1. Differentiation - Definition of a derivative in terms of limits and gradient of a graph. - Basic derivatives (x^n, sin x, log x, etc.) - Chain, product and quotient rules		
3	2016-03-16 ~ 2016-03-22	2. Applications of Differentiation - implicit differentiation - higher derivatives - finding maxima and minima - Newton's method for finding zeros of a function		
4	2016-03-23 ~ 2016-03-29	3. Taylor Series - Definition of Taylor series - Most common examples - Applications in physics and mathematics		
5	2016-03-30 ~ 2016-04-05	4. Integration - Integral as area under a curve, and definition in terms of limits - Fundemental theorem of calculus - integration by substitution, integration by parts - examples		
6	2016-04-06 ~ 2016-04-12	5. Complex numbers - i as solution to x^2 = -1 - addition, multiplication and division - The complex plane: modulus and argument of a complex number - exponential form, de Mouivre's theorem - solutions of z^n = w - log z, idea of a multivalued function, branches and cuts		
7	2016-04-13 ~ 2016-04-19	Review of the first five topics.		
8	2016-04-20 ~ 2016-04-26	Midterm Exam		
9	2016-04-27 ~ 2016-05-03	Review of mid-term exam.		
10	2016-05-04 ~ 2016-05-10	6. Vectors - Vector representation of points in 2D and 3D - vector addition and scalar multiplication - length, scalar product and vector product - applications: equation of a plane in 3D,		

주	기간	강의내용	참고자료	비고
		distance of a point from a line, etc.		
11	2016-05-11 ~ 2016-05-17	7. Matrices - Rotations as matrices in 2D - General linear transformations - Determinant and inverse in 2D		
12	2016-05-18 ~ 2016-05-24	8. Matrices in higher dimensions - Determinant and inverse in any dimension - Solving simultaneous equations		
13	2016-05-25 ~ 2016-05-31	9. Eigenvectors and Eigenvalues - Definition of Eigenvectors and Eigenvalues - Methods to find Eigenvectors and Eigenvalues - Diagonalization Formula - Applications in physics and mathematics		
14	2016-06-01 ~ 2016-06-07	10. Differentiation in higher dimensions - The gradient operator - Taylor series in 2D - Jacobian matrix and determinant		
15	2016-06-08 ~ 2016-06-14	Review of topics 6~10		
16	2016-06-15 ~ 2016-06-21	Final Exam		