

# PHY 2004 Quantitative Methods for Basic Physics I

## Course Description

Transcendental functions and their applications. Coordinate systems, vectors, rates of change and kinematics. Applications of calculus in classical mechanics. Methods for solving ordinary differential equations in mechanics and electric circuits. Partial differentiation and its applications in mechanics and thermodynamics.

## Course Content

	Topics	Highlights of Fundamental Concepts
1.	Transcendental functions of complex numbers	Logarithmic and exponential functions of complex numbers, complex trigonometric functions and hyperbolic functions
2.	Vectors	Basic vector algebra, Position as a prototype vector; representations of vectors in polar coordinates, cylindrical coordinates and spherical coordinates; scalar product, cross product and the Levi-Civita symbol; motion and trajectory in space: parametrized curves, conic sections; inversion, pseudovectors and pseudoscalars; index notations.
3.	Applications of calculus	Maxima and minima of functions, differentiation of vectors, solution of planetary motion, Dirac delta-function
4.	Ordinary differential equations	First-order differential equations; second-order differential equations: the method of reduction of order, equations with constant coefficients, the method of variation of parameters, physical examples in mechanics and electric circuits.
5.	Functions of two or more variables	Partial derivatives, chain rule, extremum values, Lagrange multipliers.

## Learning Outcomes

1.	Review the basic mathematical methods the student learnt and have a more in-depth understanding of their roles and applications in physics;
2.	earn a competent mathematical skill to formulate the simple physical problems in mathematical form, solve the physical problems by mathematical technique, and interpret the results physically;
3.	gain a sense of the relative importance of different physical quantities, and hence take suitable approximations in mathematical derivations;
4.	gain a coherent picture of how various mathematical methods can be combined in describing physical systems and solving physical problems;
5.	appreciate the important role of mathematics in physics, as well as its applications in various areas in physical sciences;
6.	generalize the applications of the mathematical methods you learnt in lectures to new situations;

## Learning Activities

Lecture		Tutorial		Exercise Class and Assignment		Laboratory		Project / Report		Presentation		Case study		Web teaching		Other 1 (specify)		Other 2 (specify)	
(hr / week)		(hr / week)		(hr / week)		(hr / week)		(hr in total)		(hr in total)		(hr in total)		(hr / week)		(hr in total)		(hr in total)	
in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class
2	4	1	2	1	4														
M	M	M	M	M	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	O	NA	OA

M: Mandatory activity in the course O: Optional activity NA: Not applicable

## Assessment Scheme

	Component	Description	Weight
1.	Assignments	The assignments will be graded by the TAs and the graded homework will be returned to the students. If you have enquiries concerning the grading, please feel free to contact the instructor or the TAs.	20%
2.	Quiz 1	Quiz 1 will be arranged within the first half of the semester. The details will be confirmed in lectures.	15%
3.	Quiz 2	Quiz 2 will be arranged within the second half of the semester. The details will be confirmed in lectures	15%
4.	Final Exam	The final exam. will be centrally arranged by the university.	50%

## Learning Resources

	Resource	Web link or ref no. in library
1.	G Stephenson, "Mathematical Methods for Science Students", 2nd ed, Prentice Hall, 1973	QA37.S815 1973
2.	M L Boas, "Mathematical Methods in the Physical Sciences", Wiley, 1983	QA37.2.B698 1983
3.	R L Finney, M D Weir, F R Giordano, "Thomas' Calculus", 10th ed, Addison-Wesley, 2001	QA303.T42 2001
4.	W E Boyce and R C DiPrima, "Elementary Differential Equations and Boundary Value Problems", New York: J. Wiley, latest ed.	QA372.B72 1992

## Feedback for Evaluation

1.	Simply approach the teacher personally if you have any comments and feedback on the course. If possible, please make an appointment before you come;
2.	send email to the teacher, give him a call, or come to his office, especially for issues that require immediate action;
3.	express your views in the course evaluation;
4.	express your views (or ask a student representative to help you convey the messages) in the staff-student consultation meeting held every year;

## Course Schedule

	Topics	Week No.	Activities / Readings / References
1.	Transcendental functions of complex numbers	1-2	
2.	Vectors	2-4	
3.	Applications calculus	5-7	
4.	Ordinary differential equations	7-10	
5.	Functions of two or more variables	11-13	

## Teachers' or TAs' Contact Details

Teacher's Name	Contact	Additional Information
CHENG Kai-Ming Teacher	Office : SC 219 Tel. no. : 3163 4076 Email : kmcheng@phy.cuhk.edu.hk Office hr :	<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li><li>•</li></ul>
TA's Name	Contact	Additional Information
To be arranged		

## Academic Honesty and Plagiarism

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details can be found at <http://www.cuhk.edu.hk/policy/academichonesty/>.

1.	After the course registration, the students are required to submit "Declaration of Honesty in Academic Work" declaring that they are aware of these policies, regulations and procedures. The form can be found at <a href="http://www.phy.cuhk.edu.hk/">http://www.phy.cuhk.edu.hk/</a> .
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## Facilities for Posting Announcements and Materials

1.	The course website ( <a href="http://www.phy.cuhk.edu.hk/course/2009-2010/1/phy2004">http://www.phy.cuhk.edu.hk/course/2009-2010/1/phy2004</a> ) contains the following useful information and resources: (a) All course materials, including lecture notes in Word and PDF format, assignments, suggested solutions of assignments and quizzes, classwork materials. The password for download will be given to the students in the first lecture. (b) A notice board for announcements of assignments, latest download, and important events (e.g. quizzes, classworks, tutorials, special lectures, and examination schedule). (c) Link to PHY 0241.
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