Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 2005 HEAT AND MOTION (3,3,1)**

Course Aims: This course covers classical mechanics and thermodynamics pertaining to physical science and energy science applications. The concepts and theory of Newtonian mechanics will be introduced followed by applications to rigid body motions, wave propagation, and fluid dynamics. After presenting the laws of thermodynamics, energy flow and energy conversion mechanisms in various thermodynamic processes will be examined.

Pre-requisite: PHYS1005 Introduction to Green Energy or PHYS1006 Introduction to Physics or consent of instructor.

Course Reviewed by: Dr. Jue Shi and Prof. Michel A. Van Hove

Course Intended Learning Outcomes (CILOs):

No.	Upon successful completion of this course, students should be able to:
1	Explain the concepts and laws of Newtonian mechanics and thermodynamics.
2	Describe how waves and their energy propagate.
3	Examine rigid body motions, wave motions and motions involving fluids.
4	Calculate the energy flow and efficiency in heat engines and thermodynamic processes.
5	Discuss how heat and motion are associated with physical science and energy science applications.

Teaching & Learning Activities (TLAs)

CILOs	TLAs will include the following:
1-5	Students will learn the basic concepts and principles, and how to use them, by attending lectures. The lectures will include case studies related to, for example, how energy can be stored, transported and converted between different forms in flywheels, turbines, gas engines, hydropower, wind, tides, sea waves, sunlight, etc.
1,2, 5	Elevate the interests of students and enhance their understanding of abstract theories through in-class demonstrations and videos of real-life examples.
3, 4	Students will develop and practice their problem-solving skills in tutorial classes and homework assignments.

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Assessment Methods (AMs):

No.	Type of Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Homework assignments	20%	1-5	Homework assignments are designed to measure and guide the learning process of students.
2	Midterm examination	30%	1,2	A two-hour exam is designed to mainly assess the first two CILOS.
3	Final Examination	50%	1-5	Final Examination questions are designed to test how far students have achieved their intended learning outcomes.

Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
I. Dynamics of motion	1, 2, 3, 5	17
II. Motion of fluids	3, 5	6
III. Heat and thermodynamics	1, 4, 5	13

Textbook: R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers with Modern Physics, 8th Ed., Brooks Cole, 2010.

References:

1. D. Halliday, R. Resnick and K. S. Krane, Physics, Vol. 1, 5th Ed., Wiley, 2002.
2. L. A. Bloomfield, How things work - the physics of everyday life, 4th Ed., John Wiley & Sons, 2010.
3. R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lectures on Physics, The Definitive Edition, Volume 1, 2nd Ed., Addison-Wesley, 2005.
4. R. P. Olenick, T. M. Apostol, D. L. Goodstein, The Mechanical Universe: Introduction to Mechanics and Heat, Cambridge University Press, 2008.

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Course Content in Outline:

	Topic	**Hours**
I.	Dynamics of motion	17
	A. Kinematics of motion	
	B. Force, momentum and Newton's laws of motion	
	C. Work and energy	
	D. Conservation laws	
	E. Rotational motion	
	F. Oscillations and wave motions	
	G. The wave equation	
II.	Motion of fluids	6
	A. Fluid statics (water and air pressure)	
	B. Fluid dynamics (Bernoulli's equation and its application)	
III.	Heat and thermodynamics	13
	A. Temperature and the "zeroth" law of thermodynamics	
	B. Ideal gases and the equation of state	
	C. Heat and the first law of thermodynamics	
	D. Phase transition (specific heat, latent heat)	
	E. Thermodynamics processes	
	F. Energy flow mechanisms (conduction, convection and radiation)	
	G. Entropy and the second law of thermodynamics	
	H. Energy conversion and efficiency in heat engines and combustion cycles	