University of Macau
Faculty of Science and Technology
PHYS101 – Physics I
Syllabus
2nd Semester 2010/2011
Part A – Course Outline

Required course in Civil Engineering, Electrical and Electronics Engineering, and Electromechanical Engineering

Course description:

This is a general physics course for engineering students. Firstly, kinematics will be introduced including straight line and plane motion. Then, the causes of motion will be elucidated and summarize into laws of force. Concepts of energy and work will be discussed with conservation law. Draw an analogy between translational and rotational motion. Motion of fluids, properties of mechanical wave and laws of thermodynamics will also be studied.

Prerequisite:

MATH101 – Mathematical Analysis I

Textbook:

David Halliday, Robert Resnick, Jearl Walker, ***Fundamentals of Physics***, 8th ed. John Wiley & Sons, Inc.

Major prerequisites by topic:

1. Application of mathematical principal to the analysis of science problem.
2. Vector analysis and ordinary differential equations.

Course objectives:

1. Introduce to students one- and two-dimensional motion. [a, k]
2. Introduce to students Newton's three laws. [a, e, k]
3. Introduce to students concepts of energy and work. Conservation law of energy will be applied to solve problems. [a, k]
4. Introduce to students motions of rotation and rolling. Engineering problems will be solved by equilibrium of force and torque. [a, c, e, k, i]
5. Introduce to student simple harmonic motion and gravitation. [a, k]
6. Introduce to student static and dynamics fluid. [a, k]
7. Introduce to student types of wave and their properties. [a, k, i]
8. Introduce to student heat as energy and laws of thermodynamics. [a, k]

Topics covered:

1. Motion (*Chapter 2,4, 1.5 weeks*)
   - Displacement, velocity and acceleration
   - Uniform accelerated motion
   - Free fall body
   - Projectile motion
   - Uniform circular motion
   - Relative motion
2. Force (*Chapter 5-6, 1.5 weeks*)
   - Newton's first law
   - Newton's second law
   - Newton's third law

- Frictional force
- Centripetal force

3. Energy and Work (*Chapter 7-9, 2 weeks*)
- Work
- Kinetic energy
- Potential energy
- Conservation law
- Conservation of energy
- Kinetic energy, work and potential of a system of particles
- Impulse and momentum
- One dimensional elastic collision
- One dimensional inelastic collision
- Two dimensional collision

4. Rotation and Rolling (*Chapter 10-12, 2.5 weeks*)
   - Rotation with uniform angular speed
   - Kinetic energy of rotation
   - Moment of inertia
   - Torque
   - Newton's second law for rotation
   - Work and rotational kinetic energy
   - Angular momentum
   - Conservation of angular momentum
   - Equilibrium
5. Simple Harmonic Motion (*Chapter 15, 1 week*)
   - Force in simple harmonic motion
   - Energy in simple harmonic motion
   - Simple harmonic motion and uniform circular motion
6. Gravitation (*Chapter 13, 0.5 week*)
   - Newton's law of gravitation
   - Gravitation near earth's surface
   - Gravitational potential energy
   - Kepler's law
7. Fluids (*Chapter 14, 1 week*)
- Density and pressure
- Fluids at rest
- Pascal's principle
- Archimedes' principle
- Ideal fluids in motion
- The equation of continuity
- Bernoulli's equation

8. Wave (*Chapter 16-17, 2 weeks*)
- Wavelength and frequency
- The speed of traveling wave
- Principle of superposition
- Interference of waves
- Standing wave and resonance
- Sound wave
- The Doppler effect

9. Heat (*Chapter 18-20, 2 weeks*)
- Temperature
- Thermal Expansion
- The absorption of heat
- The first law of thermodynamics
- Heat transfer
- Avogadro's number
- Ideal gases

- Translational kinetic energy
- Mean free path
- The distribution of molecular speeds
- Specific heats
- The Second law of thermodynamics
- Entropy
- Entropy and the second law of thermodynamics

Class schedule and credits:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No / Duration of exam papers
Lecture	Tutorial	Practice				
4	2	0	14	84	5	1 / 3hrs

Contribution of course to meet the professional component:

This course prepares students to work professionally in engineering area.

Relationship to program outcomes:

This course primarily contributes to program outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science and engineering.
(e) an ability to identify, formulate, and solve engineering problems.
(k) an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

The course secondarily contributes to program outcomes that develop student abilities to:
(c) an ability to design mechanical system.
(i) an ability to recognize the need for, and to engage in lifelong learning.

Course content:

Maths	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total 100%
100	0	0	0	0	100

Course modulator:

Dr. Iat Neng Chan

Persons who prepared this description:

Dr. Sut Kam Ho, Dr. Iat Neng Chan, Prof. Pak Kin Wong

Part B – General Course Information

2nd Semester 2010/2011

Instructor: Dr. Sut Kam Ho Office: N312
Office Hour: by appointment Phone: (853) 83974362
Email: phoebeho@umac.mo

Assessment:

Final assessment will be determined on the basis of

Quiz	25%
Mid-term exam	35%
Final exam	40%

Grading System:

The credit is earned by the achievement of a grade from 'A' to 'D'; 'F' carries zero credit.

Grades are awarded according to the following system:

Letter Grades	Grade Points	Percentage
A	4.0 (Excellent)	93-100
A-	3.7 (Very good)	88-92
B+	3.3	83-87
B	3.0 (Good)	78-82
B-	2.7	73-77
C+	2.3	68-72
C	2.0 (Average)	63-67
C-	1.7	58-62
D+	1.3	53-57
D	1.0 (Pass)	50-52
F	0 (Fail)	Below 50

Comment:

The objective of the lectures is to explain the text material. Students are encouraged to look at the text prior to the lecture. Students who wish to succeed in this course should practice the suggested homework of each chapter.

Quizzes:

One mid-term exam will be held during the semester. There will be quiz in practice class every week.

Note:

1. Attendance of students will be recorded in every lecture class.
2. Course materials will be uploaded in webcourse and it can be accessed by *https://ummoodle.umac.mo/login*.
3. Report any mistake on grades within one week after announcement.

Appendix - Rubric for Program Outcomes

Rubric for (a)	5 (Excellent)	3 (Average)	1 (Poor)
Understand the theoretic background	Students understand theoretic background and the limitations of the respective applications.	Students have some confusion on some background or do not understand theoretic background completely	Students do not understand the background or do not study at all
Use a correct model and formulation correctly	Students choose a model correctly and properly apply correct techniques	Students choose a wrong model sometime, use a wrong formula, or a different technique	Students use a wrong model and wrong formula, or do not know how to model
Compute the problem correctly	Students use correct techniques, analyze the problems, and compute them correctly	Students sometime solve problem mistakenly using wrong techniques	Students do not know how to solve problems or use wrong techniques completely

Rubric for (c)	5 (Excellent)	3 (Average)	1 (Poor)
Design capability and design constraints	Student understands very clearly what needs to be designed and the realistic design constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Student understands what needs to be designed and the design constraints, but may not fully understand the limitations of the design constraints	Student does not understand what needs to be designed and the design constraints.
Process to meet desired needs	Student understands very clearly the process of the design	Student understands what the needs of the process design, but may not fully understand the limitations of the design constraints	Student does not understand the process.

Rubric for (e)	5 (Excellent)	3 (Average)	1 (Poor)
Identify applications in engineering systems	Students understand problem and can identify fundamental formulation	Students understand problem but cannot apply formulation, or cannot understand problem	Students cannot identify correct terms for engineering applications
Modeling, problem formulation and problem solving	Students choose and properly apply the correct techniques	Students model correctly but cannot select proper technique or model incorrectly but solve correctly accordingly	Students at loss as to how to solve a problem

Rubric for (i)	5 (Excellent)	3 (Average)	1 (Poor)
Research/ Gathering Information	Comprehensive collection of information on a subject, including state-of-the-art and background	Collects adequate information on a subject	Collects minimal information on a subject
Analysis/ Evaluation	Detailed analysis accounting for all the information, conclusions are well supported	Some analysis done but somewhat shallow; some supporting evidence	Analysis simply involves restating gathered information; claims not supported by evidence

Rubric for (k)	5 (Excellent)	3 (Average)	1 (Poor)
Use suitable technique in engineering practice	Student uses the technique to correctly analyze engineering problems, and understands the limitations of the technique.	Student uses the technique to correctly analyze engineering problems.	Student does not use the technique correctly and/or does not correctly interpret the results.