COURSE SYLLABUS STEM Ed Abroad Program

Course Title: Physics for Engineers and Scientists II (including laboratory component)
Course Semester: Fall
University and Country: Adam Mickiewicz University; Poznan, Poland
Number of ECTS: 6 (lecture) and 2 (laboratory)
Course Designations for Transfer Credit: PY208/209 (NCSU), PHYS222 (ISU)

Content: Physics for Engineers and Scientists II is the second course in a two-semester sequence of introductory calculus-based physics courses. The focus is on electricity and magnetism.

Pre-requisites: University level first semester calculus with a grade of C- or better. Physics for Engineers and Scientists I with a grade of C- or better. Credit cannot be received for similar level Physics courses for Bioscience Majors or other introductory Physics courses taught without mathematics requirements.

Aims: By the end of this course, you will have acquired an overview of the general principles of physics and know how they apply to mechanics and physical interactions. You will be able to solve elementary physics problems systematically, logically, and quantitatively through the use of techniques based on algebra, trigonometry, calculus, and graphical methods.

The Learning Objectives for each exam will be posted on each section's web site prior to the first lecture of the sequence leading up to that exam and will serve as both a study outline and a summary of items to review. The Learning Objectives also includes the topics listed below in **Course Lecture and Laboratory Topics**. A student must know and apply to demonstrate mastery of the material listed in these topics as presented in this course.

Recommended Books: Giancoli, Physics for Scientists and Engineers with Modern Physics, Fourth Edition, Pearson/Prentice-Hall, © 2009

Teaching Staff: Dr. Hab. Anna Kowalewska-Kudłaszyk (Lecture) [annakow@amu.edu.pl] and Dr. Hab. Zbigniew Fojud (Laboratory) [zbigniew.fojud@amu.edu.pl] taught with consultation by Dr. Keith Warren (NC State University)

Grading System and Percentage Contribution

A. Lecture assessment

Lecture participation	5%
Continuous assessment (preparation for class)	5%
Homework	12%
Problem Sessions	10%
Exam (3 @16% each)	48%

Final Exam, Cumulative	30%
Total	100%

B. Laboratory assessment

Preparation for laboratories	34%
Laboratory reports	66%
Total	100%

AMU Grading system and scale

The grading system used at Adam Mickiewicz University, whose name is abbreviated as AMU or UAM, is as follows:

Tests, exams, homework assignments grading scale

5 100%-91%
4+ 90%-86%
4 85%-76%
3+ 75%-71%
3 70%-60%
2 59% and less

This translates into the following ECTS (European internationally recognized system) grading scale:

ECTS Grade	AMU grade	Definition
A	5.0	EXCELLENT – outstanding performance with only minor errors
B	4+ / 4.5	VERY GOOD – above the average standard but with some errors
C	4.0	GOOD – generally sound work with a number of notable errors
D	3+ / 3.5	SATISFACTORY – fair but with significant shortcomings
E	3.0	SUFFICIENT – performance meets the minimum criteria
FX	2.0	FAIL – some more work required before the credit can be awarded
F	2.0	FAIL – considerable further work is required

Hours: 3 Lecture hours and 1 Tutorial hour per week. The laboratory component consists of 11 topics listed below. Each laboratory has a duration of 2.5 hours.

Course Lecture and Laboratory Topics:

Week	Topics	Readings in Giancoli
1	Introduction Interactions & Motion	**1.1** Kinds of Matter **1.2** Detecting Interactions **1.3** Newton's First Law **1.4** Other Indicators of Interaction **1.5** 3D Vectors **1.6** SI Units **1.7** Velocity

COURSE SYLLABUS STEM Ed Abroad Program

2	Momentum Principle	**1.8** Momentum **1.9** Change of Momentum **2.1** System & Surroundings **2.2** The Momentum Principle **2.3** Applying Momentum Principle **2.4** Momentum with Changing Force **2.5** Iterative Prediction of Motion
3	Momentum Principle II	**2.6** Constant Force **2.7** Estimating Interaction Times **2.8** Physical Models **3.1** Fundamental Interactions **3.2** Gravitational Force **3.3** Gravity Near Earth's Surface **3.4** Reciprocity
4	Applying Momentum Principle	**3.5** Predicting Motion of Gravitational Interacting Objects **3.6** Electric Force **3.7** Strong Interaction **3.9** Predicting Complex Systems **3.10** Determinism **3.11** Conserving Momentum **3.12** Multiparticle Systems **3.13** Collisions
5	Contact Interactions	**4.1** Tarzan & the Vine **4.2** Balls and Springs **4.3** Tension Forces **4.4** Length of Interatomic Bonds **4.5** Stiffness of Bonds **4.6** Stess, Strain, Young's Modulus **4.7** Compression Forces **4.8** Friction **4.9** Speed of Sound **4.10** Derivative Form of MP **4.11** Analytical Solutions **4.12** Analytical Expression for Speed of Sound
6	Rate of Change of Momentum	**5.1** Identifying Forces on a System **5.2** Statics **5.3** Finding Rate of Change of Momentum **5.4** Curving Motion **5.5** Rate of Change of Direction **5.6** Why Does the Vine Break? **5.7** Problem Solving

7	Energy	6.1 The Energy Principle 6.2 Single Particle System 6.3 Work: Mechanical Energy Transfer REVIEW
8	Applying The Energy Principle	6.4 Update Form of Energy Principle 6.5 Change of Rest Energy 6.7 Work Done by Nonconstant Force 6.8 Potential Energy 6.9 Gravitatiional Potential Energy 6.10 Properties of PE 6.11 Energy and Separation 6.12 Applying Gravitational PE
9	Internal Energy	6.13 Gravitational PE Near Earth 6.14 Electrical PE 6.15 Mass of Multiparticle System 6.17 Initial and Final Systems 7.1 PE of Macroscopic Springs 7.2 PE of Pair of Neutral Atoms 7.3 Path Independence of PE 7.4 Internal Energy & Thermal Energy 7.5 Energy Transfer Due to Temperature Difference 7.6 Reflection: Forms of Energy 7.7 Power: Energy per Unit Time 7.8 Open and Closed Systems
10	Energy Quantization	7.9 Choosing the System 7.10 Energy Dissipation 7.11 "Conservative" Forces 8.1 Photons 8.2 Electronic Energy Levels 8.3 Effect of Temperature 8.4 Vibrational Energy Levels 8.5 Rotational Energy Levels 8.6 Other Energy Levels 8.7 Comparing Energy Level Spacings
11	Multiparticle Systems	9.1 Motion of the Center of Mass 9.2 Separating Multiparticle System Energy 9.3 Rotational Kinetic Energy 9.4 Point Particle System 9.5 Point Particle & Real Systems

12	Collisions	10.1 Internal Interactions 10.2 Elastic vs Inelastic Collisions 10.3 Head-On Collision of Equal Masses 10.4 Head-On Collisions of Unequal Masses 10.5 Frame of Reference 10.6 Scattering: 2D & 3D Collisions 10.7 Discovery of the Atomic Nucleus 11.1 Translational Angular Momentum 11.2 Rotational Angular Momentum 11.3 Translational + Rotational
13	Angular Momentum	11.4 The Angular Momentum Principle 11.5 Multiparticle Systems 11.6 Three Fundamental Principles 11.7 Systems with Zero Torque 11.8 Systems with Nonzero Torques
14	Entropy: Limits on the Possible	12.1 Statistical Issues 12.2 Statistical Model of Solids 12.3 Thermal Equilibrium REVIEW
15	Thermodynamics	12.4 Second Law of Thermodynamics 12.5 What is Temperature? 12.6 Specific Heat Capacity 12.7 The Boltzman Distribution REVIEW

LAB SCHEDULE for Physics I

Lab Week of Topic

1. Intro to labs
2. Free fall and acceleration
3. Uniformly accelerated motion
4. Impulse
5. Uniform circular motion
6. Work-Energy Theorem
7. Simple Harmonic Motion
8. Conservation of mechanical energy
9. Moment of inertia
10. Young's Modulus
11. Air resistance