Code	I.2.
Course Title (English)	. Engineering Physics-Mechanics I
Course Title (Polish)	Fizyka techniczna – Mech. tech. z wytrz. materiałów I
Credits	6 ECTS

Language of instruction **English**

Programme Computer Modelling and Simulation, Intelligent Energy, Biotechnology for Environmental Protection, Business and Technology

Type of studies BSc studies

Unit running the programme Institute of Mechanics and Machine Design Fundamentals

***Course coordinator** and academic teachers* **Jacek Przybylski, Assoc. Prof**., Jacek Przybylski**,** Assoc**.** Prof., (Lec.), Krzysztof Sokół, PhD. (Tut.)

Form of classes and number of hours

Semester	Lec.	Tut.	Lab.	Proj.	Sem.	Credit points
1	30	30	-	-	-	6

Learning outcomes The objectives of this course are designed to instruct engineering students in the principles of mechanics. Students will learn to describe forces as vector quantities; to analyse the equilibrium of concurrent force systems; to manipulate and simplify systems of forces and moments; to analyze the equilibrium of nonconcurrent force systems; to analyse simple structures; to apply the principles of dry friction to statics problems; to calculate centers of gravity and centroids and moments of inertia for simple shapes.
The objective of kinematics is to teach students how to calculate velocity, acceleration, position of particles and objects and especially to apply concepts of kinematics to particles and rigid bodies in two dimensions, specify the position, velocity and acceleration of a particle in 2-D motion using graphical, algebraic and vector methods; to differentiate a rotating vector; to apply concepts of relative velocity, angular velocity and instantaneous centre of velocity of rigid bodies.

Prerequisites Basic knowledge of differential and integration calculus, fundamental properties of vectors (representation of vectors using rectangular components, vector multiplication), Mathematics I

Course description LECTURE

Introduction to Mechanics. Brief History of Mechanics. Newtonian Mechanics.

STATICS.

Basic Operations with Force Systems. Introduction. Equivalence of Vectors. Force. Reduction of Concurrent Force Systems. Moment of Force About a Point. Moment of Force About an Axis. Couples. Changing the Line of Action of a Force.

Resultants of Force Systems. Reducing a Force System to a Force and a Couple. Definition of Resultant. Resultants of Coplanar Force Systems. Resultants of Non-Coplanar Force Systems.

Coplanar Equilibrium Analysis. Definition of Equilibrium. Free-Body Diagrams of a Body. Coplanar Equilibrium Equations. Writing and Solving Equilibrium Equations. Equilibrium Analysis for Single-Body Problems. Analysis of Composite Bodies. Free-Body Diagrams Involving Internal Reactions. Equilibrium Analysis of Composite Bodies Analysis of Plane Trusses. Description of a Truss. Method of Joints. Method of Sections.

Noncoplanar Equilibrium Analysis. Definition of Equilibrium. Free-Body Diagrams. Independent Equilibrium Equations. Writing and Solving Equilibrium Equations. Equilibrium Analysis.

Centroids and Distributed Loads. Centroids of Plane Areas and Curves. Centroids of Curved Surfaces,Volumes and Space Curves. Theorems of Pappus-Guldinus. Center of Gravity and Center of Mass.

Moments and Products of Inertia of Areas. Moments of Inertia of Areas and Polar Moments of Inertia. Products of Inertia of Areas. Transformation Equations and Principal Moments of Inertia of Areas. Mohr's Circle for Moments and Products of Inertia.

Dry Friction. Coulomb"s Theory of Dry Friction. Problem Classification and Analysis. Angle of Friction; Wedges and Screws. Disk Friction.

KINEMATICS.

Motion of a Particle in Three Dimensions. Position Vector, Velocity and Acceleration. Rectangular Components of Velocity and Acceleration. Tangential and Normal Components. Plane Motion of a Particle. Rotation of a Line in a Plane, Angular Velocity, and Angular Acceleration. Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration.

Planar Kinematics of a Rigid Body.

Rigid-Body Motion. Translation. Rotation About a Fixed Axis. Absolute General Plane Motion Analysis. Relative-Motion Analysis: Velocity. Instantaneous Center of Zero Velocity. Relative-Motion Analysis: Acceleration. Relative-Motion Analysis Using Rotating Axes.

TUTORIALS: see lecture content

LABORATORY
Not applicable

PROJECT
Not applicable

SEMINAR
Not applicable

Form of assessment Exam

Basic reference materials

1. Set of lecture notes and problems for individual solution (based on literature presented below). Handouts for tutorial classes.
2. Ferdinand Beer, Jr., E. Russell Johnston, Elliot Eisenberg, Phillip Cornwell, David Mazurek: "Vector Mechanics for Engineers", McGraw-Hill Science/Engineering/Math, New York, 2009
3. S.P.Nitsure: "Engineering Mechanics", Technical Publications, Pune, 2006
4. Russell C. Hibbeler: "Engineering Mechanics: Combined Statics & Dynamics", Mastering Engineering Series, Prentice Hall, 2009
5. Louis Brand: "Vectorial Mechanics", Wharton Press, 2007
6. J.L. Meriam, L.G. Kraige: "Engineering Mechanics" John Wiley&Sons, New York, 1987, Vol 1 - Statics, Vol 2 - Dynamics
7. R. Resnick, D. Halliday, K.S. Krane: "Physics", Vol 1, John Wiley&Sons, New York, Fourth Edition, 1992
8. Modern Physics: Classical Mechanics Video Lectures, Stanford Online Video Course: http://freevideolectures.com/Course/2293/Modern-Physics-Classical-Mechanics
9. Massachusetts Institute of Technology, Professor Walter Lewin's lectures http://ocw.mit.edu/OcwWeb/Physics/8-01Physics-IFall1999/VideoLectures/index.htm

Other reference materials

For Polish-speaking students:

1. B.Skalmierski: Mechanika, Wydawnictwo Politechniki Częstochowskiej 1998-2001 (t. 1-3)
2. I.W.Mieszczerski: Zbiór zadań z mechaniki. PWN Warszawa 1969
3. 4. J.Leyko: Mechanika ogólna, PWN Warszawa 2006 (t. 1 i 2)
4. 5. J.Leyko, J. Szmelter: Zbiór zadań z mechaniki ogólnej, PWN Warszawa 1976 (t. 1 i 2)
5. J.Misiak: Zadania z mechaniki ogólnej. Cz. I, II, III WNT Warszawa 2000
6. J.Nizioł: Metodyka rozwiązywania zadań z mechaniki, WNT Warszawa 2002
7. M.Niezgodziński, T.Niezgodziński: Zbiór zadań z mechaniki ogólnej, PWN Warszawa 2003
8. T.Niezgodziński: Mechanika ogólna, PWN Warszawa 2006
9. R. Buczkowski, A. Banaszek: Mechanika ogólna w ujęciu wektorowym i tensorowym. Statyka, Przykłady i zadania. WNT Warszawa, 2006

e-mail of the course coordinator and academic teachers	jacek.pr@imipkm.pcz.czest.pl, sokol@imipkm.pcz.czest.pl
Average student workload (teaching hours + individ.)	4 hours of teaching hours + 3 hours of individual work per week
Remarks:	
Updated on:04.04.2012	