



**PRE-ENGINEERING COURSE**

KIR JÓSEF NEMZŐTÉRT



## Pre-Engineering Course

The Budapest University of Technology and Economics (BME) is one of the leading universities in Europe and a member of CESAER (Conference of European Schools for Advanced Engineering Education and Research), with a high admission standard.

The Hungarian secondary schools have very high level final exam in mathematics and physics, one of the highest in the world, as it has been proved through international competitions. Very often, there is a gap between the Hungarian and foreign students' secondary school's education program as far as the preparation for engineering studies are concerned. Many students are not trained enough to solve complex problems.

Therefore the Pre-Engineering Course is designed to help students develop the basic skills necessary to successfully pursue engineering studies at the Budapest University of Technology and Economics or any other engineering or science-oriented university with high academic standards.

The program lasts one academic year and offers intensive instruction in mathematics, physics, and English language. In addition, students are introduced to conceptual approaches in engineering.

New students at the Budapest University of Technology and Economics take a required Placement Test on the week before the academic year starts (see the Academic Calendar). Based on the results of this test, students will either be accepted into the first semester of the undergraduate program (B.Sc.), or will be instructed to the Pre-Engineering Course prior to the undergraduate program.

Students who think they would benefit from the profound preparation of the Pre-Engineering Course may simply register for the Pre-Engineering Course (without taking the Placement Test).

Exams are given at the end of each semester of the Pre-Engineering Course. Students who achieve at least good results at the end of the second semester can begin their first year engineering studies at the Budapest University of Technology and Economics without taking the Placement Test.

Students who will not continue their studies at the Budapest University of Technology and Economics can take any of the individual subjects on a credit basis. Acceptance of the credits depends on the student's home institution.

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**Central Study Office**

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Office: Building R.  
Program Co-ordinator: Ms. Gyöngyi Tamás

## Description of Subjects

### Description of 1<sup>st</sup> Semester Subjects (Fall)

#### Introductory Physics I

##### Mechanics

Principles and concepts of classical physics. Vector and scalar quantities. Motion in one and two dimensions. Projectiles. Newton's laws. Conservative and dissipative forces. Equilibrium of rigid bodies. Levers, pulleys. Torque, circular motion, angular acceleration, moment of inertia. Linear and angular momentum. Work and energy. Energy of rotational motion, work of spring. Laws of conservation. 2 hours of lectures with demonstrational experiments and problem solving practice 4 hours/week.

##### Electricity

Fundamental phenomena of electrostatics. Electric charge, field strength. Electric potential and voltage. Electric polarization. Capacitors. Energy of the electric field. Electric current. Electric power. Electric circuits. Magnetic field produced by current. Electromagnetic induction. Self induction. Transformers. Alternating current. Electrical oscillations. Electromagnetic waves. 2 hours of lectures with demonstrational experiments and problem solving practice 4 hours /week.

#### Introductory Mathematics I

##### Algebra

Real numbers and algebraic expressions. Fundamental laws, identities. Equations in one variable: linear and quadratic equations. Applications to word problems. Quadratic formula, relationship between roots and coefficients, the discriminant. Radical equations, extraneous roots. System of equations in two or more variables. Word problems. Exponents, integer and fractional. Laws of exponents. 4 hours /week.

##### Geometry

Elements of geometry: circumference and area of geometric figures, surface area and volume of geometrical solids. Right triangle trigonometry. Law of cosines and sines. To solve a triangle. Trigonometric identities, equations. 4 hours/week.

#### Compulsory English for Pre-Eng. Students I.

(0 credit)

### Description of 2<sup>nd</sup> Semester Subjects (Spring)

#### Introductory Physics II

##### Vibration, Waves, and Thermodynamics

Elastic properties of materials, vibrational motion. Simple and physical pendulum. Wave motion. Transverse and longitudinal waves. Interference. Standing waves. Polarization of transverse waves. Sound waves. Thermodynamics: temperature and the behavior of gases, the ideal gas law, specific and molar heat capacity, first and second laws of thermodynamics, entropy, Carnot theorem and conservation of energy, refrigerators and heat pumps. 2 hours of lectures with demonstrational experiments and problem solving practice 4 hours /week.

##### Optics and Atomic Physics

Optics: fundamental concepts of optics; reflexion, refraction, dispersion of light; coherence of light; light as electromagnetic wave; interference, diffraction, polarization; holograms. Atomic physics: photoelectric effect; wave particle dualism; hydrogen atom model. 2 hours of lectures with demonstrational experiments and problem solving practice 4 hours/week.

#### Introductory Mathematics II

##### Algebra

Factoring. Sets: definition, notations, subset. Operations with sets. Wenn diagrams. The set of real numbers, intervals. Linear and quadratic inequalities. Functions: definition, domain and range of a function. Properties of functions. Inverse of a function. Exponential and logarithmic functions and equations. Absolute value, equations and inequalities involving absolute values. Sequences. Arithmetic and geometric progressions. Geometric progression with an infinite number of terms. 4 hours/week.

##### Geometry

Coordinate system. Distance and midpoint formula. To sketch a graph. Equations of a line. The circle. Quadratic functions and parabolas. Ellipse and Hyperbola. Trigonometric functions. Complex numbers. Complex algebra. 4 hours/week.

#### Computer Algebra

Introduction. What is Maple? The Command window. The Maple Syntax. Mathematical functions. The Maple Packages. Data types and operations. Expression sequences, arrays, sets. Plot structures. Basic plotting. Solving equations exactly and approximately. Preparing report with Graphs, comments. Applications. 2 hours/ week.

## **Compulsory English for Pre-Eng. Students**

(0 credit)

## **Elective subjects (2<sup>nd</sup> Semester)**

### **Computing**

General informations about computers and peripheral devices. Algorithms and programs. PASCAL Programming Language. 2 hours/week.

### **Engineering Drawing**

Rules and conventions of engineering drawing. Descriptive geometry. 2 hours/week.

### **Advanced Algebra**

Functions (definition, domain, range, graph, zeros). Operations on functions. Power functions, polynomials. Graph of polynomials and rational functions using zeros and asymptotic behaviour at infinity. Limit of functions. Calculating limits. Convergent, divergent sequences. Calculating limits of sequences. Monotonic, bounded sequences. 2 hours/week.