COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2022/2023 SEMESTER AUTUMN

Course title	*Physics*
Course Code	**MSM602ANEG**
Hours/Week: le/pr/lab	**2 Lectures, 2 Practices**
Credits	**5**
Degree Programme	**Biomedical Engineering**
Study Mode	***MSC***
Requirements	**Examination grade**
Teaching Period	**Autumn**
Prerequisites	**-**
Department(s)	**Automation**
Course Director	**Gergely Nyitray (PhD)**
Teaching Staff	**Gergely Nyitray (PhD)**

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

The aim of this course is to present the basic concepts of physics that students need to know for later courses and future careers. To emphasize that physics is a tool for understanding the real world. To teach transferable problem solving skils.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

Physics is the branch of science that describes matter, energy, space, and time in the most fundamental level. The goal is to find the most basic laws that govern the universe and to formulate those laws in the most precise way possible. The topics are as follows: Classical Mechanics, Thermodynamics, Electrodynamics, Optics and Modern Physics

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

	TOPICS
LECTURE	1. *topic* Introduction, Standards of Length, Mass, and Time, Dimensional Analysis, Modelling and Problem-Solving Strategy, Coordinate Systems, Average Velocity, Instantaneous Velocity, Particle Under Constant Velocity, Acceleration, Motion Diagrams, Freely Falling Objects, Two-Dimensional Motion with Constant Acceleration, Projectile Motion, Particle in Uniform Circular Motion, Tangential and Radial Acceleration 2. *topic* The Concept of Force, Newton's First Law, Mass, Newton's Second Law, The Gravitational Force and Weight, Newton's Third Law, Forces of Friction, Uniform Circular Motion, Nonuniform Circular Motion, Mechanical Systems and Environments, Work Done by a Constant Force, The Scalar Product of Two Vectors, Work Done by a Varying Force, Kinetic Energy and the Work–Kinetic Energy Theorem, Potential Energy of a System, Conservative and Non-conservative Forces 3. *topic* Potential Energy for Gravitational and Electric Forces, Linear Momentum, Isolated System, Collisions in One Dimension, Collisions in Two Dimensions, The Centre of Mass, Motion of a System of Particles, Angular Position, Speed, and Acceleration, Rigid Object Under Constant Angular Acceleration, Relations Between Rotational and Translational Kinetic Energy, Torque and the Vector Product

	4. *topic* Temperature and the Zeroth Law of Thermodynamics, Thermometers and Temperature Scales, Thermal Expansion of Solids and Liquids, Macroscopic Description of an Ideal Gas, The Kinetic Theory of Gases, Distribution of Molecular Speeds, Heat and Internal Energy, Specific Heat, Latent Heat, Work in Thermodynamic Processes, The First Law of Thermodynamics, Molar Specific Heats of Ideal Gases, Adiabatic Processes for an Ideal Gas, Molar Specific Heats and the Equipartition of Energy 5. *topic* Heat Engines and the Second Law of Thermodynamics, Reversible and Irreversible Processes, The Carnot Engine, Heat Pumps and Refrigerators, Alternative Statements of the Second Law, Entropy, Entropy and the Second Law of Thermodynamics, First-order Phase Transitions, Clausius-Clapeyron Equation, Phase Coexistence, Critical Points, Fluctuations and Stability, Non-equilibrium Thermodynamics, Local Entropy Production, Differential form of the Balance Equation, Linear Phenomenological Laws, Diffusion, The Principle of Minimum Production of Entropy 6. *topic* Properties of Electric Charges, Insulators and Conductors, Coulomb's Law, Electric Fields, Electric Field Lines, Motion of Charged Particles in a Uniform Electric Field, Electric Flux, Gauss's Law, Application of Gauss's Law to Various Charge Distributions, Conductors in Electrostatic Equilibrium, Conductors in Electrostatic Equilibrium, Electric Potential and Potential Difference, Potential Difference in a Uniform Electric Field, Electric Potential and Potential Energy Due to Point Charges 7. *topic* Electric Potential Due to Continuous Charge Distributions, Electric Potential Due to a Charged Conductor, Capacitance, Combinations of Capacitors, Energy Stored in a Charged Capacitor, Capacitors with Dielectrics, Electric Current, Resistance and Ohm's Law, Superconductors, Models for Electrical Conduction, Energy and Power in Electric Circuits, Sources of emf, Resistors in Series and Parallel, Kirchhoff 's Rules, The Magnetic Field, Motion of a Charged Particle in a Uniform Magnetic Field 8. *topic* Applications Involving Charged Particles Moving in a Magnetic Field, Magnetic Force on a CurrentCarrying Conductor, Torque on a Current Loop in a Uniform Magnetic Field, The Biot–Savart Law, The Magnetic Force Between Two Parallel Conductors, Ampère's Law, The Magnetic Field of a Solenoid, Magnetism in Matter, Faraday's Law of Induction, Motional emf, Lenz's Law, Induced emfs and Electric Fields, Inductance, RL Circuits, Energy Stored in a Magnetic Field 9. *topic* *Motion of an Object Attached to a Spring, Particle in Simple Harmonic Motion, Energy of the Simple Harmonic Oscillator, The Simple Pendulum, The Physical Pendulum, Damped Oscillations, Forced Oscillations, Propagation of a Disturbance, Travelling Wave, The Speed of Transverse Waves on Strings, Reflection and Transmission, Rate of Energy Transfer by Sinusoidal Waves on Strings, Sound Waves, The Doppler Effect, Waves in Interference, Standing Waves, Nonsinusoidal Wave Patterns* 10. *topic* Displacement Current and the Generalized Form of Ampère's Law, Maxwell's Equations and Hertz's Discoveries, Electromagnetic Waves, Energy Carried by Electromagnetic Waves, Momentum and Radiation Pressure, The Spectrum of Electromagnetic Waves, Polarization of Light Waves, The Nature of Light, The Ray Model in Geometric Optics, Dispersion and Prisms, Huygens's Principle, Total Internal Reflection, Optical Fibers 11. *topic* Images Formed by Flat Mirrors, Images Formed by Spherical Mirrors, Images Formed by Refraction, Images Formed by Thin Lenses, The Eye, Some Medical Applications, Conditions for Interference, Young's Double-Slit Experiment, Change of Phase Due to Reflection, Interference in Thin Films, Diffraction Patterns, Resolution of Single-Slit and Circular Apertures, The Diffraction Grating, Diffraction of X-Rays by Crystals 12. *topic* Blackbody Radiation and Planck's Theory, The Photoelectric Effect, The Compton Effect, Photons and Electromagnetic Waves, The Wave Properties of Particles The Double-Slit Experiment Revisited 13. *topic* The Uncertainty Principle, An Interpretation of Quantum Mechanics, A Particle in a Box 14. *topic* The Schrödinger Equation, Tunneling Through a Potential Energy Barrier, Early Structural Models of the Atom, The Hydrogen Atom, The Wave Functions for Hydrogen, Physical Interpretation of the Quantum Numbers, The Exclusion Principle and the Periodic Table, Atomic Spectra: Visible and XRay 15. *topic* Some Properties of Nuclei, Nuclear Binding Energy, Radioactivity, The Radioactive Decay Processes, Nuclear Reactions, The Engine of the Stars, The Fundamental Forces in Nature
PRACTICE	1. *topic* *Same as in the Lecture* 2. *topic* *Same as in the Lecture* 3. *topic* *Same as in the Lecture* 4. *etc.*
LABORATORY PRACTICE	1. *topic* 2. *topic* 3. *topic* 4. *etc.*

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Physics in General, Kinematics	4-87 [1]		
2.	Dynamics	97-260 [1]		
3.	Energy, Rotation	305-339, 390-405 [1]		
4.	Thermostatics	515-566 [1]		
5.	Thermodynamics	586-602 [1]		
6.	Electrostatics I	619-661 [1]	Homework I	(Optional)
7.	Magnetostatics, Electric Current	666-748 [1]		
8.	Electrodynamics	751-801 [1]		
9.	Oscillatory Motion, Waves	391-404 [1]		
10.	Electromagnetic Waves, Optics I	823-867 [1]	Homework II	(Optional)
11.	Optics II	879-927 [1]	Project Work	(Optional)
12.	Pre Quantum Mechanics	946-965 [1]		
13.	Quantum mechanics I	966-970 [1]		
14.	Quantum mechanics II	975-1008 [1]		
15.	Nucler Physics, Summary	1022-1054 [1]		

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Same as in the Lecture			
2.	Same as in the Lecture			
3.	Same as in the Lecture			
4.	Same as in the Lecture			
5.	Same as in the Lecture			
6.	Same as in the Lecture			
7.	Same as in the Lecture			
8.	Same as in the Lecture			
9.	Same as in the Lecture			
10.	Same as in the Lecture			
11.	Same as in the Lecture			
12.	Same as in the Lecture			
13.	Same as in the Lecture			
14.	Same as in the Lecture			
15.	Same as in the Lecture			

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

Attendance Sheet

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

***Course resulting in mid-term grade** (PTE TVSz 40§(3))*

***Mid-term assessments, performance evaluation and their ratio in the final grade** (The samples in the table to be deleted.)*

Type	Assessment	Ratio in the final grade
e.g..: Test 1	*eg. max 20 points*	*eg. 20 %*
e.g.: Test 2	*eg. max 30 points*	*eg. 30 %*
e.g.: home assignment (project documentation)	*eg. max 30 points*	*eg. 30 %*
…	*eg. max 15 points*	*eg. 20 %*

Opportunity and procedure for re-takes (PTE TVSz 47§(4))

The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Grade calculation as a percentage

based on the aggregate performance according to the following table

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

(The samples in the table to be deleted.)

Type	Assessment	*Weighting as a proportion of the pre-requisite for taking the exam*
1. *Sample Test 1 (optional)*		*0%*
2. *Sample Test 2 (optional)*		*0 %*
3. *Project Work (optional)*		*0%*
4.		

Requirements for the end-of-semester signature

(Eg.: mid-term assessment of 40%)

If the number of class absences does not exceed 30% of the contact hours. More than four absences will not be accepted.

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

In the case of five absences, the semester performance will not be evaluated. No further action will be taken on this matter.

Type of examination *(written, oral): Oral Exam*

Accumulated knowledge is tested on the one hand, during the examination period as an oral exam. On the other hand, project work can be given and their solutions are also acceptable. It is very important to emphasize that **the results of the project's work should be reported orally**. This means that the **students must be able to answer the questions connected to the project work** asked by the lecturer. **Failing this, the project work will not be accepted even if the solution is correct**. Submitting a project work is not compulsory, but if successfully completed is equivalent to the final exam.

The exam is successful if the result is minimum 40 %. *(The minimum cannot exceed 40%.)*

Calculation of the grade *(TVSz 47§ (3))*

The mid-term performance accounts for ***10*** %, the performance at the exam accounts for ***90*** % in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

[1.] Raymond A. Serway, John W. Jewett, Jr., Principles of Physics, Brooks/Cole, 2011, ISBN-13: 978-1-133-10426-1

[2.] Gambiattista, Richardson, Richardson: College Physics McGraw-Hill International Edition, 2007, ISBN-13 978-0-07-110608-5

RECOMMENDED LITERATURE AND AVAILABILITY

[3.] Gergely Nyitray: “Fundamental Laws, Equations and Models I”, ISBN-13-978-0-07-110608-5, available online

[4.] Gergely Nyitray: “Fundamental Laws, Equations and Models II”, ISBN-978-963-429-348-4, available online