COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2024/2025 SEMESTER SPRING

Course title	*Mechanics 2. - Dynamics*
Course Code	MSB078AN-EA-00, MSB078AN-GY-01
Hours/Week: le/pr/lab	2/2/0
Credits	4
Degree Programme	Civil Engineering BSc
Study Mode	Full-time schedule
Requirements	Exam
Teaching Period	Semester 4
Prerequisites	
Department(s)	Civil Engineering Department
Course Director	Kovácsné Dr. Vanya Csilla
Teaching Staff	Dr Adél Len

COURSE DESCRIPTION

The course gives an introduction into the fundamentals of dynamics: kinematics of the particle and of the rigid body, Newtonian mechanics, theorems of power and work, theorems of energy and conservation of energy, collisions as initial starting points of vibrations and vibrations of one degree of freedom systems. Dynamics gives a solid base for further civil engineering courses, like Structural dynamics and Seismic design.

SYLLABUS

1. GOALS AND OBJECTIVES

During the lectures the students learn the theoretical foundations, definitions, formulae and dynamical processes; during the practice they get familiar with the application of the theory, and obtain experience in solving problems and calculating physical and mechanical quantities.

2. COURSE CONTENT

	TOPICS
LECTURE	1. *topic: Kinematics of the particle (Fundamental concepts: Particle, Path, Degree of Freedom, Velocity, Speed, Acceleration, Graphical interpretation of kinematic quantities, Low of motion, Special types of motion)* 2. *topic: Kinematics of the rigid body (Fundamental concepts: Rigid body, Degree of freedom, Angular velocity, Angular acceleration, Kinematic pair of vectors, Reduced formula, Angular acceleration, Classification of motions: Instantaneous and finite motions)* 3. *topic: Kinetics of the particle (Axioms of Newton, Dynamics quantities, Moments of dynamic quantities, Basic law of dynamics, Conservation laws, Constrained motion)* 4. *topic: Kinetics of the rigid body (Newton's axioms for rigid body, Low of dynamics for rigid bodies, Planar motion)* 5. *topic: Collisions (Centric collisions, Maxwell-graph)* 6. *topic: One degree of freedom vibrating systems (Modelling 1DoF vibrations, Free vibrations, Damped vibrations, Excited – free and damped – vibrations)*
PRACTICE	1. *topic: Kinematics of the particle - exercises* 2. *topic: Kinematics of the rigid body - exercises* 3. *topic: Kinetics of the particle - exercises* 4. *topic: Kinetics of the rigid body - exercises* 5. *topic: Collisions: centric collisions, non-centric collisions, Maxwell-graph – exercises* 6. *topic: 1DoF vibrations: free, damped and excited systems - exercises*

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.	Introduction to Dynamics Kinematics of the particle Fundamental concepts: particle, path, degree of freedom, velocity, speed, acceleration Graphical interpretation of kinematic quantities Law of motion Special types of motion Kinematics of the rigid body Fundamental concepts: rigid body, degree of freedom	[1] page 5 – 19	Mathematical review [1] page 72 – 82	
3.	Kinematics of the rigid body Fundamental concepts: angular velocity, kinematic pair of vectors, reduced formula, angular acceleration Classification of motions: instantaneous and finite motions	[1] page 19 - 31		
5.	Kinetics of the particle Isaac Newton Axioms of Newton Dynamic quantities: force, linear momentum, derivative of linear momentum Moments of dynamic quantities: moment of the force, angular moment, kinetic moment Basic law of dynamics (D'Alambert law)	[1] page 32 - 41		
6.	Kinetics of the particle Conservation laws: conservation of the linear moment, conservation of the angular moment, conservation of mechanical energy Power of the force Work of the force Constrained motion Kinetics of the rigid body Newton's axioms for rigid body Low of dynamics for rigid bodies Planar motion Collisions Centric collisions Maxwell-graph	[1] page 41 – 61 [1] pages 62 – 69		
8.	Vibrations of single degree of freedom (1DoF) systems Types of 1DoF mechanical systems Modelling vibrating systems Free, undamped 1DoF harmonic vibrating systems Vertical, undamped vibrations in gravitational field	[2] pages 583-587 [3] pages 631 – 635		
10.	Vibrations of 1DoF systems Damping Free, damped, 1DoF harmonic vibrating systems Categories of excitations Harmonic force excitation Harmonic displacement excitation	[2] pages 587-590 [2] pages 600-606 [3] pages 651 – 659		

PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Kinematics of the particle - exercises	[4] 01_Practice.ppt		
3.	Kinematics of the rigid body - exercises	[4] 03_Practice.ppt	Multiple choice test Kinematics - Neptun	Week 5.
5.	Kinetics of the particle – exercises	[4] 05_Practice.ppt		
6.	Kinetics of the particle - exercises	[4] 06_Practice.ppt	Multiple choice test Kinetics - Neptun	Week 8.
8.	Vibrations of 1DoF systems – exercises **Mid-term exam (Kinematics, Kinetics, Collisions)**	[4] 8_Practice.ppt		
10.	Vibrations of 1DoF systems – exercises **Retake of the mid-term exam**	[4] 12_Practice.ppt		

3. ASSESSMENT AND EVALUATION

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

Attendance sheet. In case of illness, the student must present a medical certificate. It is the student's responsibility to make up for the missed class material.

ASSESSMENT

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

Type	**Assessment**	***Weighting as a proportion of the pre-requisite for taking the exam***
1. Multiple choice test – Kinematics	*Neptun task – Max. 100 points*	*Has to be completed in min. 40 %*
2. Multiple choice test – Kinetics	*Neptun task – Max. 100 points*	*Has to be completed in min. 40 %*
3. Mid-term exam	*Written exam*	*Has to be completed in min. 40 %*

Requirements for the end-of-semester signature

Kinematics, Kinetics multiple choice tests (result: min. 40%) and **Mid-term exam** (result: min. 40%).

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.

Mid-term exam: 10th week of the semester. Multiple choice tests 1st week of the exam period.

Type of examination *(written, oral):* *Oral 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 ***60*** %, the performance at the exam accounts for ***40*** % in the calculation of the final grade.

Type of examination	Performance in %	Required for the signature
Multiple choice test – Kinematics Theory	10%	YES
Multiple choice test – Kinetics Theory	10%	YES
Mid-term exam – Kinematics and Kinetics Practice (written)	40% (20% Kinematics + 20% Kinetics)	YES
Exam 1DoF vibrations (oral)	40%	NO

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

COMPULSORY READING AND AVAILABILITY

[1] Adél Len (2021): *Mechanics II. Dynamics – lecture notes*, University of Pécs, Faculty of Engineering and Information technology, Pécs – Availability: uploaded to the MS Teams group

[2] J.L. Meriam, L.G. Kraige (2003): Engineering Mechanics, Dynamics, Editor: John Wiley and Sons, Availability: https://oxvard.files.wordpress.com/2018/05/engineering-mechanics-dynamics-7th-edition-j-l-meriam-l-g-kraige.pdf

[3] R. C. Hibbeler: Engineering mechanics. Dynamics, Editor: Prentice Hall, 13th edition, Availability: https://www.academia.edu/43072240/Hibbler_ENGINEERING_MECHANICS_DYNAMICS_12th_EDITION

[4] Len Adél: Mechanics II. Dynamics – ppt slides of the theoretical lectures and practices, Availability: uploaded to the MS Teams group

RECOMMENDED LITERATURE AND AVAILABILITY

[5] Herbert Goldstein, Charles Poole, John Safko (2014): Classical Mechanics, Editor: Pearson, Availability: https://dokumen.tips/documents/classical-mechanics-3rd-edition-goldstein-pool-safko.html?page=2 (An edition from 1980 is found in the Library of the PTE Faculty of Sciences)

[6] Beer, F.P., Johnston, E. R., Mazurek D.F., Cornwell P.J., Eisenberg E.R. (2009): Vector Mechanics for Engineers: Statics and Dynamics, Editor: McGraw-Hill, New York

[7] William T. Thomson, 1996: *Theory of Vibration with application*, Springer Science and Business Media