module title: **Mechanics II**		
field of study: **Mechanical Engineering**	type of study: **full-time**	course code: **B5_10**
course: **Computer Modelling & Simulation**	degree: **Bachelor (BSc)**	year: **I** semester: II
type of classes: **lecture, tutorials**	hours per semester: **30L, 30T**	No of ECTS credits: **6**

MODULE DESCRIPTION

TARGETS

T1. Introduction to dynamics of a material point and dynamics of a rigid body.
T2. Ability to formulate and solve dynamics problems.
T3. Ability to analyse the obtained results.

PREREQUISITES & ADDITIONAL REQUIREMENTS

R1. Basic knowledge of mathematics.
R2. Basic knowledge of statics and kinematics of a material point.
R2. Basic knowledge in mathematical operations.
R3. Ability to use various sources of information.
R4. Ability to work independently and in a group.
R5. Ability to interpretation and presentation of obtained results.

LEARNING OUTCOMES

LO1. Gained theoretical knowledge about dynamics of rigid body and material point.
LO2. Ability to write and solve dynamical equations of motion.
LO3. Ability to introduce the d'Alembert principle, define energy and linear and angular momentum.
LO4. Ability to calculate mass moments of inertia.
LO5. Ability to define energy and linear and angular momentum in rigid body dynamics problems.
LO6. Ability to use Lagrange's equations to solve dynamics problems of a material point and rigid body.
LO7. Ability to formulate and solve free vibrations and forced harmonic vibrations of a single degree of freedom systems with viscous damping.

TEACHERS

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MODULE CONTENT

LECTURE	hours
L 1 – Newton's laws of motion. D'Alembert principle.	2
L 2 – Equations of motion in rectangular coordinates.	2
L 3 – Equations of motion in normal and tangential coordinates.	2
L 4 – Integrating the equations of motion.	2
L 5 – Linear momentum of a particle. Principle of conservation of linear momentum. Principle of impulse and momentum.	2
L 6 – Angular momentum of a particle about a point. Principle of angular momentum.	2
L 7 – Work of a force. Graphical representation of work. Power	2
L 8 – Principle of work and energy. Potential energy. Conservation of energy	2
L 9 – Vibration of a single degree-of-freedom system. Harmonic motion. Damped free vibrations.	2
L 10 – Driven damped harmonic oscillator.	2
L 11 – Lagrange's equations. Generalised coordinates. Constraints. Virtual work. Vibrations of the two-degree of freedom system	2
L 12 – Rigid body dynamics**.** Mass moment of inertia. Steiner's parallel-axis theorem.	2
L 13 – Angular momentum of a rigid body in circular motion. Conservation of angular momentum.	2
L 14 – Plane motion of a rigid body. Kinetic energy in plane motion.	2
L 15 – Principle of work and energy in plane motion. Conservation of energy.	2
total	**30**

TUTORIALS	
T 1 – Newton's laws of motion. D'Alembert principle.	5
T 2 – Integration of the equations of motion of a particle.	2
T 3 – Conservation of linear and angular momentum.	3
T 4 – Work of a force. Power.	3
T 5 – Principle of work and energy. Conservation of energy.	3
T 6 – Vibration of a single degree-of-freedom system.	2
T 7 - Mass moment of inertia. Steiner's theorem.	2
T 8 – Dynamics of a rigid body in a planar motion.	2
T 9 – Virtual work. Lagrange's equations.	3
T-10 - Analysis of plane trusses – analytical and numerical solution.	5
total	**30**

TEACHING TOOLS

1 - Computer presentation.
2 – Tutorials and problems to solve by students.

SOURCE LITERATURE

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
10. B.Skalmierski: Mechanika, Wydawnictwo Politechniki Częstochowskiej 2002 (t. 1 i 2).
11. J.Misiak: Mechanika techniczna, PWN Warszawa 1999 (t. I i II).
12. J.Leyko: Mechanika ogólna, PWN Warszawa 2006 (t. 1 i 2).
13. T.Niezgodziński: Mechanika ogólna, PWN Warszawa 2006.
14. Ryszard Buczkowski, Andrzej Banaszek: Mechanika ogólna w ujęciu wektorowym i tensorowym. Statyka, przykłady i zadania. WNT Warszawa, 2006.
15. Misiak J., Zadania z mechaniki ogólnej, część I, Statyka, WNT, Warszawa 2009
16. Misiak J., Zadania z mechaniki ogólnej, część II, Kinematyka, WNT, Warszawa 2009
17. Nizioł J., Metodyka rozwiązywania zadań z mechaniki, WNT, Warszawa 2009
18. Zbiór zadań z mechaniki ogólnej, pod red. Leyko J., Szmelter J., t. 1 Statyka, PWN Warszawa 1978
19. Zbiór zadań z mechaniki ogólnej, pod red. Leyko J., Szmelter J., t. 2 Kinematyka i dynamika, PWN Warszawa 1978
20. Giergiel J., Głuch L., Łopata A., Zbiór zadań z mechaniki, metodyka rozwiązań, AGH Kraków 2001
21. Mieszczerski I.W., Zbiór zadań z mechaniki, PWN, Warszawa 1971