

# POLITECHNIKA KRAKOWSKA IM. TADEUSZA KOŚCIUSZKI

## KARTA PRZEDMIOTU

obowiązuje studentów rozpoczynających studia w roku akademickim 2022/2023

Wydział Mechaniczny

Kierunek studiów: Mechanika i Budowa Maszyn

Profil: Ogólnoakademicki

Forma studiów: stacjonarne

Kod kierunku: M

Stopień studiów: I

Specjalności: Computational Mechanics (Mechanika obliczeniowa- w języku angielskim)

### 1 INFORMACJE O PRZEDMIOCIE

|                                         |                       |
|-----------------------------------------|-----------------------|
| NAZWA PRZEDMIOTU                        | General mechanics     |
| NAZWA PRZEDMIOTU<br>W JĘZYKU ANGIELSKIM | General mechanics     |
| KOD PRZEDMIOTU                          | WM MIBM oIS B8 22/23  |
| KATEGORIA PRZEDMIOTU                    | Przedmioty kierunkowe |
| LICZBA PUNKTÓW ECTS                     | 4.00                  |
| SEMESTRY                                | 1                     |

### 2 RODZAJ ZAJĘĆ, LICZBA GODZIN W PLANIE STUDIÓW

| SEMESTR | WYKŁAD | ĆWICZENIA | LABORATORIUM | LABORATORIUM<br>KOMPUTERO-<br>WE | PROJEKT | SEMINARIUM |
|---------|--------|-----------|--------------|----------------------------------|---------|------------|
| 1       | 15     | 30        | 0            | 0                                | 0       | 0          |

### 3 CELE PRZEDMIOTU

**Cel 1** Learning the basic laws of mechanics in the field of statics, kinematics and dynamics.

**Cel 2** Acquiring the ability to free from ideal constraints and save the equilibrium conditions for elements and the system of connected elements modeled as rigid solids.

- Cel 3** Acquiring the ability to determine the limit values of forces in the event of loss of equilibrium for issues including friction (models containing solids and systems of connected rigid bodies).
- Cel 4** Acquiring the ability to determine the path and parameters describing the movement of a material point or a selected point of a rigid body (velocity, acceleration, normal velocity component, tangent component of velocity, trajectory curvature radius) as a function of time.
- Cel 5** Acquiring the ability to apply the principle of equivalence of kinetic energy and work for a material point and a rigid body.

## 4 WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I INNYCH KOMPETENCJI

- 1 Knowledge of vector calculus and the basics of differential and integral calculus.

## 5 EFEKTY KSZTAŁCENIA

- EK1 Wiedza** The student knows the definitions of mechanical quantities and the basic principles and theorems of mechanics.
- EK2 Wiedza** The student understands theorems in the field of statics, kinematics and dynamics.
- EK3 Umiejętności** The student is able to build physical models of simple mechanical systems and write down the system of equilibrium conditions (systems without and with friction).
- EK4 Umiejętności** The student is able to describe the movement of a material point in the Cartesian system and describe the movement of a rigid body in rotational motion.
- EK5 Umiejętności** The student is able to analyze the movement of a material point using the principle of equivalence of kinetic energy and work.

## 6 TREŚCI PROGRAMOWE

| ĆWICZENIA |                                                                                                                        |                  |
|-----------|------------------------------------------------------------------------------------------------------------------------|------------------|
| LP        | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                 | LICZBA<br>GODZIN |
| <b>C1</b> | Release from constraints and dividing into subsystems and equilibrium conditions for systems of elements on the plane. | 7                |
| <b>C2</b> | Release from constraints and equilibrium conditions for the spatial element.                                           | 4                |
| <b>C3</b> | Equilibrium conditions for systems taking into account friction.                                                       | 4                |
| <b>C4</b> | Description of the movement of a material point in the Cartesian system.<br>Rotational motion of a rigid body.         | 8                |
| <b>C5</b> | The use of the principle of equivalence of kinetic energy and work for a material point.                               | 7                |

| WYKŁAD    |                                                                                                                                                                                                                                            |                  |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP        | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                     | LICZBA<br>GODZIN |
| <b>W1</b> | Mechanics as a part of physics. Classical mechanics. Mechanics fields.                                                                                                                                                                     | 1                |
| <b>W2</b> | Models in mechanics. Body models. Load models. Models of boundary conditions (constraints).                                                                                                                                                | 2                |
| <b>W3</b> | Moment of force in relation to the pole and moment of force in relation to the axis - methods of determination, properties. A pair of forces. A moment of a pair of forces.                                                                | 1                |
| <b>W4</b> | Reduction of the system of forces to the simplest form. Principal vector, principal moment. Equilibrium conditions.                                                                                                                        | 2                |
| <b>W5</b> | Non-ideal constraints. Dry friction. Rolling friction.                                                                                                                                                                                     | 1                |
| <b>W6</b> | Reference coordinate systems. Relativity of the description of the movement. Fixed system, movable system. Cartesian system, curvilinear system. The concept of time.                                                                      | 1                |
| <b>W7</b> | Description of the movement of a material point. Position, velocity and acceleration vector. Jerk. Tangent and normal components of acceleration. Rotational motion of a rigid body. Angular velocity vector, angular acceleration vector. | 2                |
| <b>W8</b> | Equation of motion of a material point. Record of forces in the equation of motion. Methods of solving the equation in the case of motion along a straight line.                                                                           | 3                |
| <b>W9</b> | Displacement force work. Kinetic energy. Potential force field. Potential energy. The principle of equivalence of kinetic energy and work.                                                                                                 | 2                |

## 7 NARZĘDZIA DYDAKTYCZNE

**N1** Lectures.

**N2** Blackboard exercises.

## 8 OBCIĄŻENIE PRACĄ STUDENTA

| FORMA AKTYWNOŚCI                                                                                 | ŚREDNIA LICZBA GODZIN<br>NA ZREALIZOWANIE<br>AKTYWNOŚCI |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <b>Godziny kontaktowe z nauczycielem akademickim, w tym:</b>                                     |                                                         |
| Godziny wynikające z planu studiów                                                               | 45                                                      |
| Konsultacje przedmiotowe                                                                         | 5                                                       |
| Egzaminy i zaliczenia w sesji                                                                    | 10                                                      |
| <b>Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:</b> |                                                         |
| Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury                               | 60                                                      |
| Opracowanie wyników                                                                              | 0                                                       |
| Przygotowanie raportu, projektu, prezentacji, dyskusji                                           | 0                                                       |
| <b>SUMARYCZNA LICZBA GODZIN DLA PRZEDMIOTU WYNIKAJĄCA Z<br/>CAŁEGO NAKŁADU PRACY STUDENTA</b>    | <b>120</b>                                              |
| SUMARYCZNA LICZBA PUNKTÓW ECTS DLA PRZEDMIOTU                                                    | 4.00                                                    |

## 9 SPOSOBY OCENY

### OCENA FORMUJĄCA

**F1** Test.

**F2** Exam on the effects of the knowledge area.

**F3** Exam on the effects of the skills area.

### OCENA PODSUMOWUJĄCA

**P1** Weighted average of forming scores.

### WARUNKI ZALICZENIA PRZEDMIOTU

**W1** Class attendance in accordance with the Study Regulations at CUT.

**W2** Positive summative assessment.

### KRYTERIA OCENY

| EFEKT KSZTAŁCENIA 1 |                                                                    |
|---------------------|--------------------------------------------------------------------|
| NA OCENĘ 2.0        | The student does not meet the requirements for the grade 3.0.      |
| NA OCENĘ 3.0        | The student obtained 50% of the points required for the grade 5.0. |

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 3.5        | The student obtained 65% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.0        | The student obtained 80% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.5        | The student obtained 90% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 5.0        | The student defines the concepts of a moment of force in relation to a pole and an axis, a pair of forces; knows the axioms of statics; knows the models of bodies and boundary conditions; knows the definitions of speed, acceleration, angular velocity, angular acceleration; knows Newton's laws of motion; defines the concepts of displacement force work, force field potential, kinetic and potential energy; knows the principle of equivalence of kinetic energy and work. |
| EFEKT KSZTAŁCENIA 2 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| NA OCENĘ 2.0        | The student does not meet the requirements for the grade 3.0.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| NA OCENĘ 3.0        | The student obtained 50% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 3.5        | The student obtained 65% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.0        | The student obtained 80% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.5        | The student obtained 90% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 5.0        | Student defines different types of coordinate systems; interprets the concept of space and time; is able to interpret the model of dry friction; can interpret the concepts of tangential acceleration and normal material point.                                                                                                                                                                                                                                                     |
| EFEKT KSZTAŁCENIA 3 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| NA OCENĘ 2.0        | The student does not meet the requirements for the grade 3.0.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| NA OCENĘ 3.0        | The student obtained 50% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 3.5        | The student obtained 65% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.0        | The student obtained 80% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.5        | The student obtained 90% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 5.0        | The student is able to properly build the physical model of the system, save the equilibrium conditions and determine the loads at the moment of loss of equilibrium for systems with friction.                                                                                                                                                                                                                                                                                       |
| EFEKT KSZTAŁCENIA 4 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| NA OCENĘ 2.0        | The student does not meet the requirements for the grade 3.0.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| NA OCENĘ 3.0        | The student obtained 50% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 3.5        | The student obtained 65% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NA OCENĘ 4.0        | The student obtained 80% of the points required for the grade 5.0.                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                     |                                                                                                                                                          |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 4.5        | The student obtained 90% of the points required for the grade 5.0.                                                                                       |
| NA OCENĘ 5.0        | The student is able to calculate the speed and acceleration of a material point and a point in a mechanism or a rigid body in rotation.                  |
| EFEKT KSZTAŁCENIA 5 |                                                                                                                                                          |
| NA OCENĘ 2.0        | The student does not meet the requirements for the grade 3.0.                                                                                            |
| NA OCENĘ 3.0        | The student obtained 50% of the points required for the grade 5.0.                                                                                       |
| NA OCENĘ 3.5        | The student obtained 65% of the points required for the grade 5.0.                                                                                       |
| NA OCENĘ 4.0        | The student obtained 80% of the points required for the grade 5.0.                                                                                       |
| NA OCENĘ 4.5        | The student obtained 90% of the points required for the grade 5.0.                                                                                       |
| NA OCENĘ 5.0        | The student is able to write down the principle of equivalence of kinetic energy and work for a material point and a rigid body in translational motion. |

## 10 MACIERZ REALIZACJI PRZEDMIOTU

| EFEKT KSZTAŁCENIA | ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓŁOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU | CELE PRZEDMIOTU | TREŚCI PROGRAMOWE                                  | NARZĘDZIA DYDAKTYCZNE | SPOSOBY OCENY |
|-------------------|--------------------------------------------------------------------------------|-----------------|----------------------------------------------------|-----------------------|---------------|
| EK1               | M1_W02<br>M1_W16                                                               | Cel 1           | W1 W2 W3 W4<br>W5 W6 W7 W8<br>W9                   | N1                    | F2 P1         |
| EK2               | M1_W02<br>M1_W16                                                               | Cel 1           | C1 C2 C3 C4 C5<br>W1 W2 W3 W4<br>W5 W6 W7 W8<br>W9 | N1 N2                 | F2 F3 P1      |
| EK3               | M1_U17                                                                         | Cel 2 Cel 3     | C1 C2 C3 W1<br>W2 W3 W4 W5                         | N1 N2                 | F1 F3 P1      |
| EK4               | M1_U17                                                                         | Cel 4           | C4 W6 W7                                           | N1 N2                 | F1 F3 P1      |
| EK5               | M1_U17                                                                         | Cel 5           | C5 W8 W9                                           | N1 N2                 | F1 F3 P1      |

## 11 WYKAZ LITERATURY

### LITERATURA PODSTAWOWA

- [1] | Nizioł J. — *Metodyka rozwiązywania zadań z mechaniki*, Warszawa, 2014, WNT
- [2] | Leyko J. — *Mechanika ogólna. T.1 Statyka i kinematyka*, Warszawa, 2007, Wydawnictwo Naukowe PWN
- [3] | Leyko J. — *Mechanika ogólna. T.2 Dynamika*, Warszawa, 2013, Wydawnictwo Naukowe PWN
- [4] | Misiak J. — *Mechanika ogólna. T.1. Statyka i kinematyka*, Warszawa, 2013, WNT
- [5] | Misiak J. — *Mechanika ogólna. T.2. Kinematyka i dynamika*, Warszawa, 2013, WNT

### LITERATURA UZUPEŁNIAJĄCA

- [1] | Beer F.B., Russel Johnston E Jr. — *Vector mechanics for engineers, statics*, New York, 1988, McGraw-Hill
- [2] | Beer F.B., Russel Johnston E Jr. — *Vector mechanics for engineers, dynamics*, New York, 1988, McGraw-Hill
- [3] | Awrejcewicz J. — *Classical mechanics: statics and kinematics*, New York, 2012, Springer Science + Business Media
- [4] | Hendzel Z., Żylski W., Wojciechowski B. — *General mechanics: statics*, Rzeszów, 2019, Oficyna Wydawnicza Politechniki Rzeszowskiej

## 12 INFORMACJE O NAUCZYCIELACH AKADEMICKICH

### OSOBA ODPOWIEDZIALNA ZA KARTĘ

prof. dr hab. inż. Marek, Stanisław Kozień (kontakt: [marek.kozien@pk.edu.pl](mailto:marek.kozien@pk.edu.pl))

### OSOBY PROWADZĄCE PRZEDMIOT

- 2 mgr inż. Gabriela Chwalik-Pilszyk (kontakt: [gabriela.chwalik@pk.edu.pl](mailto:gabriela.chwalik@pk.edu.pl))
- 5 prof. dr hab. inż. Marek Stanisław Kozień (kontakt: [marek.kozien@pk.edu.pl](mailto:marek.kozien@pk.edu.pl))
- 6 dr inż. Łukasz Łacny (kontakt: [lukasz.lacny@pk.edu.pl](mailto:lukasz.lacny@pk.edu.pl))
- 7 dr inż. Waldemar Łatas (kontakt: [waldemar.latas@pk.edu.pl](mailto:waldemar.latas@pk.edu.pl))
- 8 dr inż. Daniel Ziemiański (kontakt: [daniel.ziemianski@pk.edu.pl](mailto:daniel.ziemianski@pk.edu.pl))

## 13 ZATWIERDZENIE KARTY PRZEDMIOTU DO REALIZACJI

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(miejscowość, data)

(odpowiedzialny za przedmiot)

(dziekan)

PRZYJMUJĘ DO REALIZACJI (data i podpisy osób prowadzących przedmiot)

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