

# Course description

|                             |                      |                 |                  |
|-----------------------------|----------------------|-----------------|------------------|
| <b>Course abbreviation:</b> | KME/SKIN             | <b>Page:</b>    | 1 / 4            |
| <b>Course name:</b>         | Kinematics - Seminar |                 |                  |
| <b>Academic Year:</b>       | 2023/2024            | <b>Printed:</b> | 01.06.2024 11:17 |

|                                         |                        |          |          |                               |                 |
|-----------------------------------------|------------------------|----------|----------|-------------------------------|-----------------|
| <b>Department/Unit /</b>                | KME / SKIN             |          |          | <b>Academic Year</b>          | 2023/2024       |
| <b>Title</b>                            | Kinematics - Seminar   |          |          | <b>Type of completion</b>     | Pre-Exam Credit |
| <b>Accredited/Credits</b>               | Yes, 2 Cred.           |          |          | <b>Type of completion</b>     | Combined        |
| <b>Number of hours</b>                  | Seminar 2 [Hours/Week] |          |          |                               |                 |
| <b>Occ/max</b>                          | Status A               | Status B | Status C | <b>Course credit prior to</b> | NO              |
| <b>Summer semester</b>                  | 0 / -                  | 0 / -    | 0 / -    | <b>Counted into average</b>   | NO              |
| <b>Winter semester</b>                  | 0 / -                  | 4 / -    | 40 / -   | <b>Min. (B+C) students</b>    | 10              |
| <b>Timetable</b>                        | Yes                    |          |          | <b>Repeated registration</b>  | NO              |
| <b>Language of instruction</b>          | Czech, English         |          |          | <b>Semester taught</b>        | Winter semester |
| <b>Optional course</b>                  | Yes                    |          |          | <b>Internship duration</b>    | 0               |
| <b>Evaluation scale</b>                 | S\N                    |          |          |                               |                 |
| <b>No. of hours of on-premise</b>       |                        |          |          |                               |                 |
| <b>Auto acc. of credit</b>              | No                     |          |          |                               |                 |
| <b>Periodicity</b>                      | K                      |          |          |                               |                 |
| <b>Substituted course</b>               | None                   |          |          |                               |                 |
| <b>Preclusive courses</b>               | N/A                    |          |          |                               |                 |
| <b>Prerequisite courses</b>             | N/A                    |          |          |                               |                 |
| <b>Informally recommended courses</b>   | N/A                    |          |          |                               |                 |
| <b>Courses depending on this Course</b> | N/A                    |          |          |                               |                 |

## Course objectives:

To introduce students to the problems

- practical solution of selected kinematics point problems (linear and curvilinear motion)
- practical solution of selected kinematics problems of the body (planar and spatial motion)
- practical solution to the curvature trajectories of points and envelope
- practical solution of the kinematics of planar multibody system (analytical and graphical methods)

A kinematics seminar is recommended for KME/KIN. It adds and expands the substance discussed in the KME/KIN course through examples and practical examples.

## Requirements on student

Attendance at seminars is at least 75%. Develop a seminar work at the appropriate level.

## Content

- 1) Direct motion point investigation (uniform and even accelerated motion).
- 2) Uneven linear motion of the point, harmonic movement. Reversing motion solutions, technical applications.
- 3) Curvilinear motion of the mass point in the plane (centers of curvature from the definition of centripetal acceleration).
- 4) Curvilinear movement of a point in a space.
- 5) Investigation of flexural and torsional curvature of curves using Frenet's relations.
- 6) Application of basic decomposition of general plane body motion
- 7) Poles and set of poles, properties and calculations.
- 8) Investigating the centers of curvature of points trajectories and envelope.
- 9) Application of general decomposition of the general plane body motion
- 10) Composition of plane systems of bodies. Investigation of motion poles of multibody systems (pole theorem).
- 11) Examples of mechanical models and computer simulation of motion of selected basic mechanisms. Kinematic solution of planar mechanisms - examples.

- 12) Kinematic solution of planar mechanisms using analytical and graphical methods - practical examples.  
 13) Kinematic solution of toothed wheel systems (prototype and planetary systems).

## Fields of study

## Guarantors and lecturers

- **Guarantors:** Prof. Ing. Jiří Křen, CSc. (100%)
- **Seminar lecturer:** Prof. Ing. Jiří Křen, CSc. (100%), Prof. Ing. Jan Vimmr, Ph.D. (100%)

## Literature

- **Basic:** Rosenberg. *Kinematika*. PLzeň. VŠSE, 1980.
- **Basic:** Křen, J. *Řešené příklady z kinematiky I., II.* Skripta VŠSE Plzeň, 1986.
- **Recommended:** Meriam, J. L. *Engineering Mechanics. Volume 2, Dynamics*. 6th ed. Hoboken : John Wiley & Sons, 2007. ISBN 978-0-471-73931-9.
- **Recommended:** Rosenauer, N.; Willis, A. H. *Kinematics of mechanisms*. New York : Dover Publications, 1967.
- **Recommended:** Brát, V. - Rosenberg, J. - Jách, V. *Kinematika*. SNTL/ALFA Praha, 1987.
- **Recommended:** Hlaváč, Zdeněk; Vimmr, Jan. *Sbírka příkladů ze statiky a kinematiky*. 1. vyd. V Plzni : Západočeská univerzita, 2007. ISBN 978-80-7043-609-7.

## Time requirements

### All forms of study

| Activities                                       | Time requirements for activity [h] |
|--------------------------------------------------|------------------------------------|
| Contact hours                                    | 26                                 |
| Undergraduate study programme term essay (20-40) | 30                                 |
| <b>Total:</b>                                    | <b>56</b>                          |

## assessment methods

**Knowledge - knowledge achieved by taking this course are verified by the following means:**

Seminar work

**Skills - skills achieved by taking this course are verified by the following means:**

Seminar work

**Competences - competence achieved by taking this course are verified by the following means:**

Seminar work

## prerequisite

**Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:**

orientuje se ve vektorovém počtu

vysvětlit základy diferenciálního počtu

vysvětlit základy integrálního počtu

klasifikovat obecné vlastnosti funkcí matematické analýzy

**Skills - students are expected to possess the following skills before the course commences to finish it successfully:**

vypočítat skalární a vektorový součin vektorů

realizovat derivace funkcí matematické analýzy  
 řešit základní integrály funkcí matematické analýzy  
 charakterizovat základní typy lineárních diferenciálních rovnic

**Competences - students are expected to possess the following competences before the course commences to finish it successfully:**

N/A

#### teaching methods

**Knowledge - the following training methods are used to achieve the required knowledge:**

Seminar

**Skills - the following training methods are used to achieve the required skills:**

Seminar

**Competences - the following training methods are used to achieve the required competences:**

Seminar

#### learning outcomes

**Knowledge - knowledge resulting from the course:**

orientovat se v praktickém řešení kinematiky bodu  
 vysvětlit kinematiku tělesa (rovinný a prostorový pohyb)  
 klasifikovat rovinné soustavy těles  
 popsat analytické kinematické řešení vázané soustavy těles  
 identifikovat metody grafického kinematického řešení vázané soustavy těles (rychlosti)

**Skills - skills resulting from the course:**

řešit kinematické závislosti bodu (poloha, rychlost, zrychlení)  
 realizovat kinematickou analýzu pohybu tělesa (rovinný a prostorový pohyb)  
 charakterizovat křivosti trajektorií bodů a obálek  
 vypočítat kinematické závislosti pohybu vázané soustavy těles  
 analyzovat rychlostní poměry bodů a těles vázané mechanické soustavy (grafické metody)

**Competences - competences resulting from the course:**

N/A

N/A

#### Course is included in study programmes:

| Study Programme                 | Type of  | Form of   | Branch                          | Stage | St. plan v. | Year | Block                                          | Status | R.year | R. |
|---------------------------------|----------|-----------|---------------------------------|-------|-------------|------|------------------------------------------------|--------|--------|----|
| Computer Modelling in Mechanics | Bachelor | Full-time | Computer Modelling in Mechanics | 1     | 2020        | 2023 | Povinné volitelné předměty - skupina 3 (typ B) | B      | 2      | ZS |
| Computer Modelling in Mechanics | Bachelor | Full-time | Computer Modelling in Mechanics | 1     | 2023        | 2023 | Povinné volitelné předměty - skupina 3 (typ B) | B      | 2      | ZS |
| Engineering                     | Bachelor | Full-time | Automotive Industry Specialist  | 1     | 2020        | 2023 | Elective courses                               | C      | 2      | ZS |
| Engineering                     | Bachelor | Full-time | Programming of NC Machines      | 1     | 2020        | 2023 | Elective courses                               | C      | 2      | ZS |
| Engineering                     | Bachelor | Full-time | Quality Control                 | 1     | 2020        | 2023 | Elective courses                               | C      | 2      | ZS |

| Study Programme        | Type of  | Form of   | Branch                                               | Stage | St. plan v. | Year | Block            | Status | R.year | R. |
|------------------------|----------|-----------|------------------------------------------------------|-------|-------------|------|------------------|--------|--------|----|
| Mechanical Engineering | Bachelor | Full-time | Design Engineering of Power Machines and Equipment   | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Combined  | Design Engineering of Machines and Technical Devices | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Full-time | Design Engineering of Machines and Technical Devices | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Combined  | Engineering Materials and Manufacturing Technology   | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Full-time | Engineering Materials and Technology                 | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Full-time | Industrial Engineering and Management                | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Full-time | Mechanical Engineering                               | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Combined  | Mechanical Engineering                               | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |
| Mechanical Engineering | Bachelor | Full-time | Technology of Metal Cutting                          | 1     | 2020        | 2023 | Elective courses | C      | 2      | ZS |