

- knowledge and skills in the field of static and dynamic contact stresses, S-N curve for surface fatigue, safety factor, designing against surface fatigue failure.
- dynamic modelling of clutches for starting up, wear and endurance, energy balance and flow of heat.
- knowledge about law of gearing, involute features, tooth loading, minimum number of teeth, technique of profile shifting. Skills in calculating parameters of spur and helical gears. Ability to determine the profile shifting coefficients to avoid undercutting and to adjust centre distances in two stage gear trains.
- skills in determining bearing reactions for spur and helical gears
- theory and design of bevel and worm gears. Ability to calculate the geometry of this type gears.
- the AGMA and ISO approaches in designing gears against tooth bending and surface fatigue failure. Ability to determine safety factors for bending and surface teeth loading.

Grading criteria:

The final grade for the course is determined on the basis of the results of exam and the continuous assessment, i.e. the results from the regular tests.

The basic points of regulations associated with grading are as follows:

1. Only the student who is registered for this course can complete it.
2. The presence at the lectures and tutorials of the course is obligatory and **can be checked**.
3. There are the two ways of completing the course:
 - a). The first way is by passing the exam, which is held during the examination session. **But, to be allowed to attend the exam it is necessary to pass at least one regular test, or to get 3.0 grading points as a sum obtained from three regular tests***. The exam consists of two parts, theoretical (a couple of questions) and practical (1 to 3 problems). **To pass the exam it is necessary to get positive grades from both parts. *Grading points for the grades less than 3.0 can be in the range: <0, 2.875)!!!**
 - b). The second way is by getting positive grades from all three tests held during the course.
4. In extraordinary cases the Head of the Fundamentals of Machine Design Division takes the decision about completing the course.

Detailed contents:

Lubrication of sliding and rolling element bearings. Probabilistic modelling of endurance of rolling element bearings, selection of bearings and bearings systems for different levels of reliability. Cumulative damage hypothesis, variable loading on rolling element bearings. Designing for fluctuating, simple, multi-axial stresses in fatigue.

Static and dynamic contact stresses, safety factors in surface failure, designing to avoid surface failure.

Dynamic modelling of disc clutches, wear and endurance, energy balance and flow of heat.

Tooth gear theory, law of gearing, involute features, spur and helical gearing, loading on spur and helical gears, interference and undercutting, minimum number of teeth, profile shifting, contact ratio. Types of bevel and worm gears, design and calculations. Bearings reaction forces, bending and surface stresses in gears, AGMA* and ISO** approach and standards.

*AGMA – American Gear Manufacturers Association; **ISO – International Organisation for Standardisation.

Additional remarks:

Standard registration procedure is required. Handouts and additional materials (problems, supplements, objectives for chapters, etc.) are displayed on the course website:
<https://www.meil.pw.edu.pl/zpk/ZPK/Dydaktyka/Materialy-dla-studentow-Files-for-students/>

See also the "Aerospace Engineering Bachelor Program" at:

<https://www.meil.pw.edu.pl/eng/PAE2/Education/Aerospace-Engineering>

Course teacher

Dr hab. inż. Stanisław Bogdański

Course coordinator

Dr hab. inż. Marek Matyjewski, prof. uczelni

Head of FMD Division

Prof. dr hab. inż. Paweł Pyrzanowski