

**Technical University of Košice**  
**Faculty of Mechanical Engineering**  
**DEPARTMENT OF ENGINEERING FOR DESIGN OF MACHINES AND TRANSPORT EQUIPMENT**

Subject: **MACHINE DESIGN-TRANSMISSIONS**  
**(Code: 23005169)**  
Guarantee: **doc. Ing. Silvia MALÁKOVÁ, PhD., Ing.Paed.IGIP**  
Lecturer: **doc. Ing. Silvia MALÁKOVÁ, PhD., Ing.Paed.IGIP**  
Students: **1-st Study Year, Winter Semester**  
Volume: **2x45 min practices per week,**  
Completion: **Classified Credit**

**1. SCHEDULE OF LECTURES AND PRACTICES**

| Week | LECTURES                                                                                                                                                                                                     | PRACTICES                                                                                                                                                                                 | Study control process                         |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| 1.   | Study organization.<br>Introduction to the subject. Literature.<br>Mechanical transmissions - definition.<br>Kinematic ratios of mechanical transmissions.<br>Gear transmissions - division, basic concepts. | Information about exercise book, programs.<br>Information about programs, their schedule and evaluation.<br>Examples of schematic representation of the given gearboxes.                  |                                               |
| 2.   | Schematic representation of transmissions, description of kinematic parameters.<br>Geometry of spur gears with straight teeth.                                                                               | Spur gears with straight teeth, solution of examples - calculation of the main dimensions of the gear, meshing ratios, engagement duration.<br><br>Assignment of Program No. 1.           |                                               |
| 3.   | Basic comb, involute geometry. Production of involute gearing. Defining the path and duration of engagement. Conditions for correct gear engagement.                                                         | Helical gears, solution of examples - calculation of the main dimensions of the gear, meshing ratios, engagement duration.                                                                |                                               |
| 4.   | Undercutting of teeth. Determining the minimum number of teeth. Corrections of involute gears.                                                                                                               | Principles of calculation of correction of involute gear. Examples for calculating the minimum number of teeth.                                                                           |                                               |
| 5.   | Spur and helical gear sets, dimensional and force calculation, design.                                                                                                                                       | Force ratios of spur and helical gears - solving exercises.                                                                                                                               |                                               |
| 6.   | Helical gear sets, dimensional and force calculation, design.                                                                                                                                                | Bevel gears, solution of examples - calculation of the main dimensions of the gear and forces in the gearing.                                                                             | Submission of program No.1.<br><b>max.30%</b> |
| 7.   | Efficiency of gear transmissions.<br>Materials of gears. The essence of dimensioning and strength control of spur and bevel gear sets with involute gearing.                                                 | Preliminary design of the gear module based on performance parameters. Strength analysis of the gear teeth for a selected gear stage of the transmission.<br>Assignment of Program No. 2. |                                               |
| 8.   | Worm gear sets - basic concepts, types of worms. Geometry of a worm gear. Force ratios of a worm gear. Design of worm gears.                                                                                 | Calculation of the geometric parameters of a worm gear pair and force calculation for a worm gear pair – worked examples.                                                                 |                                               |
| 9.   | Planetary gears. The essence of the method of relative gear ratios. Conditions for the assembly of planetary gears.                                                                                          | Planetary gearboxes – calculation of gear ratio, force relationships – solving examples.                                                                                                  |                                               |

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|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 10. | Direct friction drives with parallel axes, kinematics, force ratios. Friction drives with variable gear ratio - variators. Indirect friction drives - belt drives. | Determination of basic dimensions and force conditions for bevel gears, worm gear sets, and planetary gear trains – solving examples. |                                                         |
| 11. | Chain drives. Types, design solutions. Credit test.                                                                                                                | Calculation of kinematic parameters for a given gearbox.                                                                              | Credit test<br><b>max.40%</b>                           |
| 12. | Gearboxes - types of gearboxes. Gearbox design - calculation of gear ratios, sawtooth and power diagrams. Industrial gearboxes - design solutions.                 | Chain and belt drives - design of a chain drive, sample example.                                                                      | Submission of program No.2.<br><b>max.30%</b>           |
| 13. | Automotive gearboxes - gearboxes with step change of gear ratio, design solutions.                                                                                 | Correction of the written credit test. Evaluation of the student's work.                                                              | Classified Credit.<br><b>max 100%</b><br><b>min 51%</b> |

## 2. LITERATURE

- [1] Richard G. Budynas, J. Keith Nisbett.: Shigley's Mechanical Engineering Design, Tenth Edition, Published by McGraw-Hill Education, 2 Penn Plaza, New York, NY 10121., 2015
- [2] Kyu-Jung Kim, Campbell Dinsmore: Machine Design Using the Mechanical Design Toolbox, Cognella Academic Publishing – 2021, 254 p.
- [3] Habershauer, H., Bodenstein, F.: Maschinenelemente. Springer Verlag Berlin(SRN), 2007.
- [4] Budynas, R.G., Nisbett, J.K.: Shigley's Mechanical Engineering Design. New York, The McGraw-Hill, Companies, 8th edition, 2006.
- [5] Joseph E. Shigley, Charles R. Mischke, Thomas H. Brown.: Standard handbook of machine design, Third edition, The McGraw-Hill Companies, 2004.
- [6] Selections from standards, Mechanical engineering manuals, STN, ISO, EN standards.

## 3. REQUIREMENTS FOR SUCCESFULL COMPLETION OF THE SEMESTER

1. **Attendance is mandatory.** Absence must be justified by an official form (confirmation from doctor, police, etc. with stamp, signature and date). Repeated absence will be reported to the responsible staff at the faculty management.
2. **Use of exercise book practices is mandatory.** Exercise book must have an A4 format with blank pages. Other requirements will be announced on practices.
3. **Independent and systematic work on programs.**
4. **Submission of programs according to the schedule in satisfactory quality.**
5. Completion of all assessed activities.

## 4. FINAL RATING

Program 1..... **max. 30%**  
 Program 2..... **max. 30%**  
 Credit test ..... **max. 40%**

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Overall Semester Credit..... **max. 100%**    **min. 51%**