Tárgytematika / Course Description
Drivetrain development for racing applications

AJNM_BMTA028

Tárgyfelelős neve / Teacher's name: dr. Hanula Barna Gábor
Félév / Semester: 2024/25/2
Beszámolási forma / Assesment: Vizsga
Tárgy heti óraszáma / Teaching hours(week): 2/0/0/0
Tárgy féléves óraszáma / Teaching hours(sem.): 0/0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

As part of a project, students can acquire practical engineering competencies while designing a drivetrain optimized for racing purposes. The course aims to support the documentation of this project work and the execution of the project tasks, providing assistance for the preparation of theses, student research papers, and other scientific or engineering work.

TANTÁRGY TARTALMA / DESCRIPTION

The course is taught through lectures and a design project. The project task supports the understanding and application of theoretical knowledge.

Week 1: Introduction, overview of the semester

Week 2: Lecture – Vehicle Power Transmission: Longitudinal Vehicle Dynamics (Wheel Power and Traction Force Characteristics, Gear Ratio Distribution Principles)

Week 3: Lecture – Power Transmission Design, Vehicle Dynamics, and Gearbox Design

Collecting basic data of the selected vehicle
Drafting the drivetrain layout

Week 4: Lecture – Gearshift Calculations, Analysis of Gearshift Diagrams

Inputting vehicle data and performance diagrams
Creating gearshift diagrams
Loss calculations, acceleration, and top speed calculations

Week 5: Lecture – Race Track Model Development, Lap Time Simulation, and Optimization Possibilities

Weeks 6-11: Consultation sessions / Individual project work

Weeks 12-13: Documentation and submission of the semester project

Submission deadline: Week 13 of the study period, Wednesday 23:59

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

By Week 2: Selection of a vehicle and entry of its basic data into the provided table.
By Week 3: Submission of a two-sheet Excel file containing the selected vehicle's basic data, performance diagram, and drivetrain layout.
By Week 7: Completion of an Excel file including vehicle acceleration calculations and selection of a race track.
By Wednesday of Week 13 (23:59): Submission of the completed semester project.
Late submission policy:
1-day delay: 10 points deducted from the final score.

All submissions must be made through the **SZElearning** system.

Tasks and Scoring:

Excel Table Preparation – 80 points

Basic Data, Gear Ratios, Performance and Torque Curves, Resistances – (5 points)
Theoretical Top Speed Calculation – (5 points)
Realistic Top Speed Calculation – (5 points)
Sawtooth Diagram Presentation (original and optimized for acceleration/top speed) – (5 points)
Acceleration Calculation (original) – (10 points)
Acceleration and Top Speed Optimization – (10 points)
Race Track Model Development – (10 points)
Lap Time Simulation (Original Version) – (15 points)
Lap Time Optimization – (15 points)
Optimize the gearbox ratios and/or final drive ratio for the selected race track.
Simulate one lap using the factory gear ratios (with all other parameters unchanged).
Analyze potential improvements in straight-line sections and optimize the gear ratios accordingly.
Perform another lap simulation using the optimized gear ratios.
No other parameters may be changed during this optimization.
Optionally, a third lap simulation can be conducted with reduced weight and other parameter modifications, but the primary focus should be on evaluating the effect of gear ratio changes.
Document all findings in the project report.

Project Documentation (Excel table and 4-5 page report) – 20 points

Brief Task Description
Summary of Final Results in Table Format:
Relative and absolute changes in acceleration and top speed (e.g., additional km/h, acceleration time; percentages relative to initial values)
Lap time simulation results

Achieving at least a sufficient level for each subtask is a prerequisite for success.

Evaluation and Final Grade:

The evaluation of subtasks and the final grade will be determined as follows, with the possibility of a pre-assigned grade:

90-100% – Excellent (5)
80-89.9% – Good (4)
65-79.9% – Satisfactory (3)
50-64.9% – Pass (2)
0-49.9% – Fail (1)

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

AJÁNLOTT IRODALOM / RECOMMENDED MATERIAL

Suggested literatures:

Gillespie, T. D.: Fundamentals of vehicle dynamics, SAE Inc. (1992)

Adrian Newey – How to Build a Car

Hungarian:

Dezsényi - Emőd - Finichiu: Belsőégésű motorok tervezése és vizsgálata, Tankönyvkiadó, 1990.

Bagány Mihály: Belsőégésű motorok, Kecskeméti Főiskola, egyetemi tananyag, 2011. (szabadon hozzáférhető, letölthető)

Vas Attila: Belsőégésű motorok szerkezete és működése, Szaktudás Kiadó Ház Rt., 2005

Dr. Lévai Zoltán: Gépjárművek szerkezettana, internetes jegyzet, http://www.lezo.hu/szerkezettan/szerkezetek.html (2015)