Subject Guide – Fundamentals of Vehicle and Component Assessments

Shortened Name	FVCA	**Semester**	2-2022
Class Time (weekly)	Thur, 13-16	**Lecture hours**	3h x 15w
Subject Code	090125212	**Assignment and self-study**	5h x 15w
ECTS credits	6	**Preparation for exam**	30
KMUTNB Credits	3(3-0-6)	**Total working hours/semester**	150

1 Revision date of this document, reasons for revision

- 29.03.2023

2 Course description

Understanding of principle and conceptual design of vehicle from the source of energy to wheel through the proportion drive-train system, Basic Knowledge of vehicle performance based power and energy to overcome friction loss through vehicle drive-train system, Vehicle stability in ride and handling analysis

3 Lecturer

- Asst. Prof. Dr Saharat Chanthanumataporn

4 Expected learning outcomes (in accordance with the MAE program ELOs)

Primary LOs (primary content of class, knowledge is explicitely evaluated (for example, by exams), larger share of overall grade)

- Ability to apply the fundamental knowledge, to analyze and identify advanced automotive engineering problems as well as to develop the mathematical models for analyzing (GELO 1)
- Knowledge and understanding of principles, techniques and methodology of automotive safety and assessment (SELO 1)
- Knowledge and understanding of scientific fundamentals relevant for automotive engineering and design (SELO 2)
- Knowledge of the State-of-the-Art *of selected examples* of technical systems and technologies in the field (SELO 3)
- Knowledge of applicable laws, guidelines, regulations in automotive field (SELO8)

Secondary LOs (not primary content of class, but implicetly taught by application, for example by project work or assignments. Is evaluated, lower share of overall grade)

- Ability to write a professional-quality report on a research or problem-solving project (GELO 3)
- Ability to present a project in front of a professional audience (GELO 6)
- Knowledge and understanding of scientific fundamentals relevant for automotive engineering and design (SELO 2)
- Knowledge of the State-of-the-Art *of selected examples* of technical systems and technologies in the field (SELO 3)

Note: These ELOs correspond to the Program ELOs (referenced in parantheses) but are specifically worded for this course by omissions and additions (in *italics*).

5 Assessment

Each student will be individually assessed based on the performance on assignments, a project and written exams, with the overall grade resulting from the shares as below:

Evaluated items	shares
Midterm exam, 180 minutes, on content of “unit # 1-5” of the class	35%
Final exam, 180 minutes, on content of “unit # 6-10” of the class	35%
Seminar: 60-minute presentation of current research interest	30%
Total	**100%**

- Both exams are closed book and paper-based
- Each student has to propose one journal paper (to be presented in seminar) for approval by week 9.

6 Teaching materials

- Power-Point presentations for lectures, handed over as reference and learning material
- Exercise-assignments for each week’s topic
- Solutions for exercise-assignments, handed over one week after exercise

7 Books and references

- Automotive engineering fundamentals by Richard Stone and Jeffrey K. Ball
- Fundamentals of Vehicle Dynamics by Thomas D Gillespie
- Theory of Ground Vehicles by JY Wong
- Vehicle Dynamics: Theory and Application by Reza N. Jazar
- Automatic Transmissions and Power Trains by William R. Crouse
- Chassis Handbook: Fundamentals, Driving Dynamics, Components, Mechatronics, Perspectives (ATZ/MTZ-Fachbuch) by Bernhard Heißing and Metin Ersoy
- The Automotive Chassis by Genta Giancarlo and Morello L.

The book is not required to take part in the course but recommended background reading.

8 Course schedule

Week	Date	Activity, Class Title (unit number)	Evalu-ation %	Class Hours
1	12/01	Introduction & Overview of fundamentals of vehicle and component assessments		3
2	19/01	Vehicle structure test		3
3	26/01	Chassis & engine dynamometer I		3
4	02/02	Chassis & engine dynamometer II		3
5	09/02	Measurement of heat generation in lithium-ion battery of EV		3
6	16/02	Measurement of heat generation in lithium- ion battery of EV (Experiment)		3
7	23/02	**Midterm Exam**	35%	
8	02/03	Development and assessment of EV battery thermal management system		3
9	09/03	Development and assessment of EV battery thermal management system (Experiment)		3
10	16/03	Development and assessment of EV battery thermal management system (Experiment)		3
11	23/03	No class (tggs seminar)		
12	30/03	Technique and facilities for crash test		3
13	06/04	No class (Chakri day)		
14	13/04	No class (Songkran day)		
15	20/04	Assessment of Electric Tuk Tuk		6
16	27/04	Assessment of Anti-lock Braking System (ABS) Assessment of Autonomous Emergency Brake (AEB)		6
17	04/05	**Final Exam**	35%	
18	11/05	**** Seminar ****	30%	3
		(Sums)	100%	45

9 Content details

Unit #	Title	Lesson (L) Contents
1	Introduction & Overview of fundamentals of vehicle and component assessments	• Definitions: Test – Evaluation - Assessment • History of automotive testing • Overview and process of vehicle and components testing
2	Vehicle structure test	• Review: vehicle structure • Load and force applied to the vechicle structure • Vehicle structure stiffness testing
3	Chassis & engine dynamometer I	• Introduction to Type approval process and dynamometer • Review: road load calculation • Coast-Down Procedure and calculation
4	Chassis & engine dynamometer II	• Emission measurement equipment, procedure and calculation
5	Measurement of heat generation in lithium-ion battery of EV	• Overview: electric vehible battery and heat generation theory • Fundamental of thermodynamics • Concept idea and experimental setup of battery heat generation evaluation
6	Development and assessment of EV battery thermal management system	• Overview and review: battery thermal management system • Concept idea and experimental setup of battery thermal management system evelopment and assessment
7	Technique and facilities for crash test	• Overview: Crash safety assessments (facility and equipment) • Standard full-scale-crash and sled test • Concept idea and experimental setup of an alternative low cost sled test

8	Assessment of Electric Tuk Tuk	• 4 Safety Assessments based on Thai industrial standard institute regulation:
		  • Service brake performance
		  • Parking brake performance
		  • Rollover stability performance
		  • Electrical Isolation resistance (Dry and Flood)

9	Assessment of Anti-lock Braking System (ABS)	• Assessment of Anti-lock Braking System (ABS) based on R13H: Brake Regulations for Passenger Vehicles
10	Assessment of Autonomous Emergency Brake (AEB)	• Assessment of Autonomous Emergency Brake (AEB) based on TEST PROTOCOL – AEB systems, EUROPEAN NEW CAR ASSESSMENT PROGRAMME

10 Details on the evaluation of Expected Learning Outcomes

		MT-Exam	Final Exam	Project			
				Quality of paper	Quality of slides	Presen-tation	
		35%	35%	10%	10%	10%	
GELO1	Ability to apply the fundamental knowledge, to analyze and identify advanced automotive engineering problems as well as to develop the mathematical models for analyzing	10%	10%				**20%**
SELO1	Knowledge and understanding of principles, techniques and methodology of automotive safety and assessment	10%	10%				**20%**
SELO2	Knowledge and understanding of scientific fundamentals relevant for automotive engineering and design	5%	5%	2.5%	2.5%		**15%**
SELO3	Knowledge of the State-of-the-Art of selected examples of technical systems and technologies in the field	5%	5%	2.5%	2.5%		**15%**
SELO8	Knowledge of applicable laws, guidelines, regulations in automotive field	5%	5%				**10%**
GELO3	Ability to write a professional-quality report on a research or problem-solving project			5%	5%		**10%**
GELO6	Ability to present a project in front of a professional audience					10%	**10%**