



<b>1. Name of the subject</b>	<b>Noise, Vibration and Harshness of Vehicles</b>				
<b>2. Name in Hungarian</b>	Gépjárművek zaj,- és rezgésvizsgálata		<b>3. Role</b>	<b>szv</b>	
<b>4. Code of subject</b>	<b>BME...</b>	<b>5. Requirement</b>	<b>f</b>	<b>6. credit</b>	<b>2</b>
<b>7. Number of hours (correspondence course)</b>	<b>1 lecture</b>	<b>0 practical exercises</b>	<b>1 laboratory</b>	<b>8. Curriculum</b>	<b>jkl</b>
<b>9. Total hours required to complete the subject</b>					<b>60 hours</b>
<b>Contact hours</b>	28 hours	<b>Preparations</b>	14 hours	<b>Homework</b>	0 hours
<b>Written material</b>	4 hours	<b>Preparation for test</b>	14 hours	<b>Preparation for exam</b>	0 hours
<b>10. Responsible Department</b>	Department of Automotive Technologies				
<b>11. Responsible teacher</b>	Máté ZÖLDY, Dr. PhD				
<b>12. Teacher(s)</b>	Ferenc DÖMÖTÖR Dr. PhD				
<b>13. Preconditions</b>	-				
<b>14. Topics of the lectures</b>	Introduction to NVH (noise, vibration, harshness), i.e. basics of acoustics, vibrations and vehicle comfort. Measurement of acoustic features of vehicles by technical methods. Airborne and body born noise of vehicles and their combined effects. Structural noise of vehicles, full-body acoustics of vehicles. Introduction to vibrations of vehicles. Basics of vibration measurements and vibration analysis. Vibration diagnostics of various parts of vehicles, including gears, and bearings. Introduction to the torsional vibrations.				
<b>15. Topics of practical exercises</b>	-				
<b>16. Topics of Laboratory exercises</b>	Tools of noise, and vibration measurement. Numerical solution of problems connected to the topics of lectures. Noise measurement exercises of engines with internal combustion and electric motors in different circumstances of operation. Vibration measurement on the test rig of the Department (gear box and bearings). Measurement of torsional vibrations by modern instruments.				
<b>17. Expected results</b>	<p>a) Knowledge:</p> <ul style="list-style-type: none"> <li>- basics of NVH (noise, vibration, harshness),</li> <li>- sources of structural noise in vehicles, basics of full-body acoustics of vehicles,</li> <li>- basics of vehicle vibrations (measurement and analysis),</li> <li>- basics of torsional vibrations.</li> </ul> <p>b) Capabilities:</p> <ul style="list-style-type: none"> <li>- Capability to solve problems of type technical diagnostics using the above mentioned knowledge.</li> </ul> <p>c) Attitude:</p> <ul style="list-style-type: none"> <li>- Trying to be the best all time and give a high performance, and to work precisely without errors.</li> <li>- Keeping the rules of environment protection, health and safety. Cooperation with the colleagues.</li> </ul> <p>d) Autonomy and responsibility:</p> <ul style="list-style-type: none"> <li>- Feeling responsibility to keep always high standard of quality, keeping the ethical rules and norms during his job.</li> </ul>				
<b>18. Requirements, regarding notes of performance for the students</b>	According to the curriculum the student shall have no final exam, but a note for their performance during the term. A fundamental requirement for acceptance is to participate on the laboratory measurements, and submitting the report as needed. The reports shall be evaluated as accepted/refused only. They are not a basis for the final notes.				
<p>In order to promote the continuous learning during the term twice will be topic closing tests, and control essays. Tasks of the students shall be 50% special phenomena, physical laws of theory, and numerical solution of problems.</p> <p>Time available for elaboration of the tests is 2x60 minutes. Topics of the tests are the full material (lecture and practical exercises). Each of the tests must reach the threshold value individually (50% of the total scores, i.e. 25 out of 50 scores). Evaluation of the tests (final note for their job) shall be on the basis of the total scores as follows:</p>					

- 0 – 49 scores – failed (1),
- 50 – 59 scores – satisfactory (2),
- 60 - 69 scores – medium (3),
- 70 - 79 scores - good (4),
- 80 scores and over – excellent (5).

Each student has to identify himself/herself during the tests using their identity cards or equivalent (passport, driving license, etc.). During the test nobody can exit the room, except in serious health problems. If somebody leaves the room without reason, then he/she will be declared to fail the test with zero scores.

#### 19. Options for correction

At the end of the term, i. e. during the week after the term each student has the right to make up the shortages like this. The students have the right to re-sit one test, and to complete one laboratory exercise. The first retake of the test is free of charge, but in case it is not successful, then the second retake is subject to fees. The requirements for the retaken tests are the same as mentioned before in case of the original test.

#### 20. Lecture notes, books, literature

- [01] Beranek, L. L.: Zajcsökkentés. Műszaki Könyvkiadó, Budapest, 1967.
- [02] Domokos, E. – Horváth B. (szerk.): Környezetmérnöki Tudástár, 13. kötet, Zaj- és rezgésvédelem? Pannon Egyetem, Környezetmérnöki Intézet, Veszprém, 2011.
- [03] Bihari Z. (szerk.): Akusztikai és rezgéstani minősítés, Miskolci Egyetem, Gép- és Terméktervezési Tanszék, Miskolc, 2011.
- [04] Heckl, M. - Müller, H.A.: Taschenbuch der techn. Akustik, Springer Verlag Berlin, 1975.
- [05] Smetana, C: Zaj- és rezgésmérés. Műszaki Könyvkiadó 1975. Bp. 222.p.
- [06] Kováts A.: Zaj és Vibráció Diagnosztika jegyzet, Miskolci Egyetem.2008.
- [07] Dömötör F. (szerk.): Rezgésdiagnosztika I., Dunaújváros 2007.
- [08] Dömötör F. (szerk.): Rezgésdiagnosztika II., Dunaújváros 2010.
- [09] Tímár Peregrin L. (szerk.): Villamos gépek zaja és rezgése. MK, Bp.
- [10] P. Nagy József: A hangszigetelés elmélete és gyakorlata, Akadémiai Kiadó,
- [11] Kováts A.: Gépszerkezettan (Műszaki akusztika), Tankönyvkiadó, Bp.,1993.
- [12] Kováts A.: Zaj- és rezgésvédelem. - Veszprémi Egyetemi Kiadó, 2005.
- [13] Tarnóczy T.: Teremakusztika I.-II. Akadémiai Kiadó, Budapest, 1986.
- [14] Brüel & Kjaer termékkatalógusok.