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| <b>Óbuda University</b><br><b>Bánki Donáth Faculty of Machinery and Safety Engineering</b>   |   |   | <b>Institute of Mechatronics and Vehicle</b> |  |
| <b>Title and code of the subject: Diagnostics of Mechanical Systems</b>  |   |   | <b>Credit value: 3</b>                       |  |
| <i>Full time training, Year of education: 2021/2022. II. semester BGRRD15NND, BMEMDE6BNE</i>   |   |   |  |  |
| Programme of education: <b>Mechatronics in Engineering</b>   |   |   |  |  |
| Responsible:   | <b>Dr. Szabó József Zoltán</b>  |   | Teachers:                                    | <b>Dr. Dömötör Ferenc,<br/>Dr. Szabó József Zoltán</b> |
| Preliminary conditions (together with code):   |   | Mechanics III. <b>BGRMN33NND</b> ,<br>Machine-Drawing, -Elements and -Structures III. <b>BGRMN33NND</b> |  |  |
| Weekly hours:  | Lecture: 2  | Indoor practice: 0  | Laboratory practice: 0                       | Consultation:  |
| <b>Closure of the semester:</b>  | <b>Written examination</b>  |   |  |  |
| <b>Subject</b>   |   |   |  |  |
| <b>Goal of education:</b> <i>Students have to learn the modern diagnostic methods, used in operation of machines and mechatronic systems and the instruments, and their applications</i> |   |   |  |  |
| <b>Lectures:</b>   |   |   |  |  |
| <b>Week of education</b>   | <b>Topics</b>   |   |  |  |
| 1.   | General introduction about the details of the subject and the requirements. Basics. System-Element-Process. Understanding diagnostics. Industrial production and diagnostics. Connections between maintenance and diagnostics. Methods and processes of diagnostics. Systems of mechatronics in the industry. |   |  |  |
| 2.   | Value reduction processes of the systems of mechatronics. The most common faults in mechatronics, typical ways of failures.   |   |  |  |
| 3.   | Basics of maintenance and diagnostics – part I. Traditional maintenance strategies, and ways of operation. Run to failure, planned preventive maintenance, condition monitoring based maintenance strategies.   |   |  |  |
| 4.   | Basics of maintenance and diagnostics – part II. Modern maintenance philosophies: RCM, TPM, TQM, RBI.   |   |  |  |
| 5.   | Theory of vibration – part I. Understanding vibrations. Damped and undamped vibrations. Time of period, frequency, amplitude and phase, time signal and frequency spectrum. Understanding FFT Fast Fourier Transformation. Application of FFT in the diagnostics.   |   |  |  |
| 6.   | Theory of vibration – part II. Processing of vibration signals. Instruments of vibration measurements. Faults monitored by vibration diagnostics. Case histories and measurement practices using vibration analyser and VIBROTESTER test rig.   |   |  |  |
| 7.   |   |   |  |  |
| 8.   | In situ balancing of rotating machinery. Basics of theory and practical applications, using VIBROTESTER test rig.   |   |  |  |
| 9.   | Understanding shaft alignment. Theory and application. Misalignment in practice using the tool COMBI-LASER on the test rig VIBROTESTER  |   |  |  |
| 10.  | <b>Teaching break 14. april</b>   |   |  |  |
| 11.  | Theory of electromagnetic waves. Methods of non destructive testing (NDT), like X-Ray, isotope radiation.   |   |  |  |
| 12.  | Theory and practical applications. Understanding endoscopy. Theory and practice. Case histories.  |   |  |  |
| 13.  | The role of thermography in diagnostics. Understanding non contacting temperature measurements. Theory of thermovision. Examples of practical application.  |   |  |  |
| 14.  | Understanding noise diagnostics. Theory of sound. Noise measurement techniques with practical examples of application.  |   |  |  |

| <b>Requirements for acceptance</b> (tasks, written tests, essays, etc.)   |  |
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| <b>Week of education</b>  | <b>2 essays on the given topic in groups of 4-6 students</b> |
| Week 9.<br>5th April 2021   | the deadline for submitting the first essay                  |
| Week 14.<br>13th May 2021   | the deadline for submitting the second essay                 |
| <i>Points of view for the requirements, process and evaluation of the tests, calculation of the notes</i>   |  |
| <p>At the instructions and order of the Rector of Óbuda University. In the next 2020/2021 2nd semester:</p> <ul style="list-style-type: none"> <li>- there will be no contact lessons at all (no lecture, and no exercises),</li> <li>- there will be no written class-room tests either.</li> </ul> <p>However, the “internal value” of the education must not be less, then before. Consequently, the volume of the material shall not be less either. You will get everything as a help, but you need to learn on your own. For this purpose you will be provided learning material weekly. Instead of the tests you will have to write two essays. The topics of the essays are listed in the attached lists. Your performances shall be evaluated on the basis of these two essays.</p> <p>The essays have to be worked out in groups. These groups have been built up by Dr. Ferenc Dömötör és Dr. Szabó József Zoltán randomly on the basis of alphabet sequence. Also, the leaders of the groups have been selected randomly. You are allowed to move from one group to another on the basis of mutual agreement, but the number of students in a group must not be more than 6 in each group. Also, the group leaders can be replaced by volunteers, if the selected leaders do not accept their position. Please, remember, that the evaluation of the group performance shall be on the basis of a supposed equal job. This means, that all members of the group shall be given the same marks at the end of the schoolyear. There will be no investigation who in the group did more and who did less. That is out of question.</p> <p>The deadline of the first essay is 5th April 2021. The deadline of the second essay is 13th May. The essays have to be uploaded to the MOODLE system, and at the same time sent to by Email at the address: ferenc.domotor60@gmail.com.</p> <p>Unacceptable note shall be given to the student missing from more than 40% of the lectures, or not passing the written tests neither during normal, nor reparation/correction time, or both tests are unacceptable.</p> <p>The methods of reparation/correction after the weeks of lectures is regulated by the Regulations of the Education (Tanulmányi Ügyrend) III: 6.1.(3)/III.6.2.(3). In all cases not mentioned here the regulations of the Óbuda University (Óbudai Egyetem Tanulmányi és Vizsgaszabályzata, valamint Tanulmányi Ügyrendje) are applicable.</p> |  |
| Method of closing the semester (written and oral exam, etc.)  |  |
| Written test with questions of essay type.  |  |
| <b>Recommended literature:</b>  |  |
| <ol style="list-style-type: none"> <li>1. Learning Materials of the lectures, and Videos in Moodle system</li> <li>2. dr. Kégl T. - Szabó J.Z. : Műszaki diagnosztika; Főiskolai jegyzet BDMF 1994., 2003. 2. kiad. 2008 3.kiad.</li> <li>3. Dr. Szabó József Zoltán: Műszaki diagnosztikai módszerek; Egyetemi jegyzet ÓE-BGK-3068, 2015</li> <li>4.</li> </ol>  |  |
| <b>Other study-aid literature:</b>  |  |
| Study aid literature available on the Moodle system (in various formats, including Power Point, etc.)   |  |
| <b>Quality Assurance of the subject:</b>  |  |
| <b>Survey of the student opinions at the end of the lecture weeks</b>   |  |

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Responsible for the subject

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Director of Institute