Óbuda University **Bánki Donáth Faculty of Machinery and Safety Engineering**				**Institute of Mechatronics and Vehicle**	
Title and code of the subject: Diagnostics of Mechanical Systems **Credit value*: 3*** *Full time training, Year of education: 2018/2019. I. semester* ***BGRRD15NND***					
Programme of education: **Mechatronics in Engineering**					
Responsible:	**Dr. Szabó József Zoltán**	Teachers:	**Dr. Dömötör Ferenc,** **Dr. Szabó József Zoltán**		
Preliminary conditions (together with code):		Mechanics III. **BGRMN33NND,** Machine-Drawing, -Elements and -Structures III. **BGRMN33NND**			
Weekly hours:	Lecture: 2	Indoor practice: 0	Laboratory practice: 0	Consultation:	
Closure of the semester:	**Written examination**				

Subject

Goal of education: *Students have to learn the modern diagnostic methods, used in operation of machines and mechatronic systems and the instruments, and their applications*

Lectures:

Week of education	Topics
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.	**1st WRITTEN TEST – condition of acceptance (and part of exam)**
8.	**Teaching break**
9.	In situ balancing of rotating machinery. Basics of theory and practical applications, using VIBROTESTER test rig.
10.	Understanding shaft alignment. Theory and application. Misalignment in practice using the tool COMBI-LASER on the test rig VIBROTESTER
11.	Theory of electromagnetic waves. Methods of non destructive testing (NDT), like X-Ray, isotope radiation. Theory and practical applications. Understanding endoscopy. Theory and practice. Case histories.
12.	The role of thermography in diagnostics. Understanding non contacting temperature measurements. Theory of thermovision. Examples of practical application.
13.	Understanding noise diagnostics. Theory of sound. Noise measurement techniques with practical examples of application.
14.	**2nd WRITTEN TEST – condition of acceptance (and part of exam)**

Requirements for acceptance (tasks, written tests, essays, etc.)

Week of education	Successfully passing the two written tests during the weeks 7 and 14. Questions might be similar to those ones used during the lectures, including 5-6 essay type tasks. All instructions shall be available on the task lists of the tests.
	Additional tests (for reparation/correction) at a date/time mutually agreed with the students and teachers.

Points of view for the requirements, process and evaluation of the tests, calculation of the notes
Participation on the lectures and laboratory exercises is regulated by the TVSZ III: 23. §(1) – (4). During the period of lectures tasks can be reparated/corrected at dates/time shown above by students, participating on more than 60% of lectures and laboratory exercises. Acceptance shall be provided to the students, passing both written tests at least at "satisfactory" level, and made up his tasks if being absent with a good reason during the time of tests. A recommended note can be given to a student passing both written tests at least at a level of medium (3) during the normal occasions of tests. No recommended note can be given for a successful passing during the reparation/correction time. 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. 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.
Method of closing the semester (written and oral exam, etc.)
Written test with questions of essay type.
Recommended literature:
1. dr. Kégl T. - Szabó J.Z. : Műszaki diagnosztika; Főiskolai jegyzet BDMF 1994., 2003. 2. kiad. 2008 3.kiad. 2. Dr. Szabó József Zoltán: Műszaki diagnosztikai módszerek; Egyetemi jegyzet ÓE-BGK-3068, 2015 3. Materials of the lectures
Other study-aid literature:
Study aid literature available on the Moodle system (in various formats, including Power Point, etc.)
Quality Assurance of the subject: **Survey of the student opinions at the end of the lecture weeks**

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Responsible for the subject Director of Institute