SYLLABUS:

Date / Revision 23 May 2015 / 02 May 2017 / PP
Faculty Engineering
Study Program Mechanical Engineering (MEE)

SUBJECT: Mechanical Vibration

1 Basic Information

1.01	**Subject Name**	**Mechanical Vibration**
1.02	**Semester**	5
1.03	**Level**	3
1.04	**SKS**	3
1.05	**Mandatory / Curriculum**	D-11
1.06	**Subject Code**	MVIB
1.07	**Subject Code**	INE-D-MVIB-5124
1.08	**Year**	2017
1.09	**Quality Control**	Final Test, OFSE, see evaluation
1.10	**Limitations**	Min 12 and Max 32 students in one class
1.11	**Combined with**	01:AUE
1.12	**Pre-requisite**	Statics and Mechanics of Materials, Kinematics and Dynamics of Machines
1.13	**Responsible**	Prof.Dr.Djoko Karmiadji
1.14	**Revision**	15-05-2017/pp

2 Description of Subject

The subject introduces the fundamental of vibration in mechanical systems, such as the importance of the study, basic concept, classification and procedure of analysis. Single, two, and multi degree of freedom systems are then introduce along with the free, harmonically excited, and vibration under general forcing condition. Determination of natural frequencies and mode shapes, continuous systems, vibration control Measurement and applications, numerical integration methods in vibration analysis are then followed to complete the course.

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3 Objectives

- Indicate the importance of study of vibration, various classifications of vibration, state the steps involved in vibration analysis, define harmonic motion and different possible representations of harmonic motion.
- Derive the equation of motion of a single-degree-of-freedom. Compute the natural frequency, damped frequency, logarithmic decrement, and time constant. Determine whether a given system is stable or not.
- Find the responses of undamped and viscously damped single-degree-of-freedom systems subjected to different types of harmonic force, including base excitation and rotating unbalance.
- Derive transfer functions of systems governed by linear differential equations with constant coefficients.
- Understand the characteristics of transient response, such as peak time, overshoot, settling time, rise time, and decay time, and procedures for their estimation.
- Formulate the equations of motion of two-degree-of-freedom systems, of multidegree-of-freedom systems.
- Find the approximate fundamental frequency of a composite system in terms of the natural frequencies of component.
- Derive the equation of motion of a continuous system from the free-body diagram of an infinitesimally small element of the system and Newton s second law
- Design vibration and shock isolations for systems with fixed base as well as vibrating base.
- Understand the various types of transducers, vibration pickups, and frequency measuring instruments.
- Know the various aspects of machine-condition monitoring.
- Solve the vibration problems of continuous systems using the finite difference method.

4 Competency

After having the course, students are expected to:

- Able to indicate the importance of study of vibration
- Able to determine degree of freedom of a mechanical structure
- Able to find the response of a mechanical system.
- Able to derive transfer functions of systems

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

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6 Evaluation

5.1	**Absence maximum**	25%
5.2	**Participation in Discussion**	05 Points
5.3	**Homework / Classwork**	05 Points
5.4	**Presentation /Simulation**	10 Points
5.5	**Daily Quiz**	20 Points
5.6	**Final Examination**	60 Points
	Total	100 Points

7 Text Book and Reference

1	**Main Text Book:** **"***Mechanical Vibrations, 5th edition, 2016*", **Authors**: Singiresu S. Rao, Publisher: Prentice Hall, **ISBN**: 978-0-13-212819-3 (978-0-13-212819-3

8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1	**Fundamentals of Vibration**	Ch1	
2	**Free Vibration of Single-Degree-of-Freedom Systems**	Ch2	
3	**Harmonically Excited Vibration**	Ch3	Quiz
4	**Vibration Under General Forcing Conditions**	Ch4	
5	**Two-Degree-of-Freedom Systems**	Ch5	
6	**Multidegree-of-Freedom Systems**	Ch6,	Quiz
6,7	**Determination of Natural Frequencies and Mode Shapes**	Ch7	
8	**MIDTERM SEMESTER BREAK**		
9-10	**Continuous Systems**	Ch8	Quiz
11-12	**Vibration Control**	Ch9	
13	**Vibration Measurement and Applications**	Ch10	
14-15	**Numerical Integration Methods in Vibration Analysis**	Ch 11	Quiz
16	Silent WEEK		
17, 18	Final Examination		

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