BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI- HYDERABAD CAMPUS

SECOND SEMESTER 2018-2019

(COURSE HANDOUT PART II)

Date:07/01/2019

In addition to part-I (general handout for all courses in the time-table), this handout provides the specific details regarding the course.

Course No.:   ME F343

Course Title: MECHANICAL VIBRATIONS

Instructor-in-charge: Dr.G.R.Sabareesh

1.   Scope and Objective: This course is designed to acquaint the students with topics in vibrations and acoustics. The emphasis is on application to common engineering situations. The main aim of the course is to prepare students to tackle complex and frontier technological problems in vibrations. The analysis of increasingly complex system has been instrumental in the usage of concepts like Lagrange equations and generalized coordinates. Introduction to acoustics as well as noise and vibration measurements are added to the course.

2.   Text Book:

T1. "Theory of Vibrations with Applications", William T. Thomson, Marie Dillon Dahleh and ChandramouliPadmanabhan, Pearson, Sixth Ed.
T2. "Vibration and Acoustics- Measurement and Signal Analysis", Sujatha, TMH Pvt Ltd

Reference Books:

R1. "Mechanical Vibrations", Singiresu S Rao, Pearson, 4th Ed.
R2. "Mechanical Vibrations - Theory and Application", Francis S. Tse, Ivan E. Morse and Rolland T. Hinkle, Allyn and Bacon Inc. London, 1983.
R3. " Introduction to Acoustics", Robert D Finch, Eastern Economy Edition

3. Course Plan:

Lecture Nos.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1-3	Brief review of fundamental concepts of vibration	Introduction to Vibration: Basic concepts of Vibration, Oscillatory Motion, Harmonic motion, Periodic Motion, Elementary parts of Vibrating systems, Degree of freedom, Discrete and continuous systems	T-1-CH-1, R1-CH-1
4-6	Understand the causes and reasons for vibration and why vibrations die out. Analysis of simple vibrating systems	Vibration analysis, spring mass and damping elements in a vibrating system, Types of damping, Harmonic analysis	T-1-CH-1, R-1,CH-1
7-10	Modeling of vibrating systems natural and undamped. Effect of damping on systems in	Single dof free undamped vibration systems ,Single dof free damped vibration systems , Coulomb damping	T-1-CH-2, R-1 CH-2

Lecture Nos.	Learning Objectives	Topics to be covered	Chapter in the Text Book
		vibration, Other types of damping and energy loss	
11-17	Forced system analysis. Need for Vibration isolation and critical speed and resonance	Single dof forced vibration systems, Vibration isolation, support motion, rotary unbalance, whirling of shafts, sharpness of resonance Structural damping, energy dissipated by damping, equivalent viscous damping	T-1-CH-3, R-1-CH-3
18-24	Two and more dof systems modeling and analysis, Matrix methods and forced multi dof systems	Multi dof free vibration systems, Normal modes, initial conditions, coordinate coupling, decoupling Matrix formulation, Eigen values and vectors, Multi dof forced harmonic vibration, Orthogonality relations	
25-28	Vibration of continuous systems,	Continuous Systems- Vibration of string, rods, bars and beams	T-1CH-5, R-1-CH-5,6
29-33	Introduction to Acoustics	Terminology used in acoustics- Important Acoustic Quantities and relations- Velocity of sound, characteristic impedance, energy density Sound wave propagation in 1-D	T-2 R.3
34-38	Equation (plane waves) & 3D wave equation	Sound propagation in 3-D space- the 3-D Wave Equation Sound level measurement Reverberation time measurements	T-2 R.3
39-42	Measurement of Noise and Vibration Vibration Measurement Principles	Vibration measuring instruments Data Acqusition fundamentals, Basic Statistics- Mean, Std dv etc ibration/Noise Measurements in - Turbine Blades, Evaluation of damping characteristics of tubes, Vibration/Noise Measurements in -Floor vibration measurements, study of sound from a power plant	T-2 R.3

4. Evaluation Scheme:

Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester Test	90 min	25	14/3 9.00 - 10.30AM	CB
Tutorial Evaluation	10 min	10	Tutorial Hour	OB
Quiz	10min	10		CB
Term Paper		15		OB
Comprehensive Exam	180 min	40	08/05 FN	CB

5. Chamber Consultation Hour: To be announced in the classroom.

6. Notices: All notices concerning this course will be displayed on Mechanical Engineering Department NoticeBoard/ CMS.Besides this, students are advised to visit regularly**CMS** (institute's web based course managementsystem) for latest updates.

7. **Make-up Policy**:Make-up shall be given only to the genuine cases with prior intimation.<u>No make-up will be given for the quiz/tutorial evaluation</u>.

8. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Dr.G.R.Sabareesh
ME F343