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 vibration, Other types of damping and energy loss | | |  | | --- | | Single dof free undamped vibration systems ,Single dof free damped vibration systems , Coulomb damping | | T-1-CH-2,  R-1 CH-2 |
| 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.No make-up will be given for the quiz/tutorial evaluation.

**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**