Subject Code: 01ME1601
Subject Name: Dynamics of Machine - II
B. Tech. Year - III (Semester - 6)

Type of course : Under Graduate

Prerequisite : Higher order ODE, PDE, and Kinematics of Mechanism

Rationale : Understanding the basic of vibration & balancing and analysis of vibration in mechanical system.

Course outcome :

After learning the course, the students will be competent

1. To analyse unbalance force and bearing reaction force in rotating mass and its effects.
2. To analyse unbalance force in reciprocating engine and its effects.
3. To analyse natural frequency of free undamped vibrating system and develop methods to overcome its ill effects.
4. To analyse natural frequency of free and forced damped vibrating system and measure to avoid its ill effects.
5. To study various vibration measurement technique.

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks			Practical Marks		
Theory	Tutorial	Practical	C	ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	**Rotating Mass Balance:** Understanding static and dynamic balancing, Investigation of effect of unbalance rotating mass (Single & Multi plane), Methods for measuring unbalance force & mass. Bearing reactions.	04
2	**Balancing of Reciprocating Mass:** Balancing of slider crank chain mechanisms, Modelling real system for static and dynamic analysis. Inertia force, disturbing force and torque, **Balancing of Multi Cylinder Engines:** Analysis of Multi Cylinder In-line Engines: Direct and Reverse crank method, optimized configuration of in-	12

	line engine. **Balancing of Radial Engine:** Evaluation of V and radial engine, Analytical & Graphical methods.	
3	**Fundamental of Mechanical Vibrations:** Vibration and oscillation, Reason for generation of vibration, Parameters of Vibration - spring, mass, damper, Damper models, Motion – periodic, non-periodic, harmonic, non- harmonic, Degree of freedom, static equilibrium position, Vibration classification. **Free Undamped Single Degree of Freedom Vibration System:** Longitudinal, transverse, torsional vibration system, Methods for formulation of differential equations by Newton, Energy, and Rayleigh's Method, **Free Damped Single Degree of Freedom Vibration System:** Viscous damping, Under, Critically & Over damped System, Damping Factor, Logarithmic decrement;	**04** **12**
4	**Forced Vibration:** Undamped Forced vibrations, Damped Forced Vibration, Equivalent viscous damping; Externally Applied forces due to unbalanced masses. Vibration Isolation and Transmissibility: Force Transmissibility, Motion Transmissibility	**10**
5	**Vibration Measurement:** Basic of vibration measurement and analysis Instruments used: Vibrometer, velocity pickup, accelerometer, FFT analyzer.	**

Distribution of Theory Marks

R Level	**U** Level	**A** Level	**N** Level	**E`** Level	**C** Level
10	**20**	**25**	**25**	**10**	**10**

Legends: R: Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

List of Experiment :

1. Study and confirm relation between the period of oscillation and length of pendulum for simple.
2. Study and confirm relation between the period of oscillation of compound pendulums.
3. Experimental analysis of Free Un-damped longitudinal Vibration of single degree of freedom system
4. Experimental analysis of Free Un-damped torsional vibration of single degree of freedom system
5. Experimental analysis of Free Un-damped torsional vibration of two rotor system
6. Experimental analysis of Damped torsional vibration
7. Balancing of rotating mass in different plane.
8. Experimental analysis of forced vibration
9. Experimental analysis of forced damped vibration
10. To verify Dunkerley's theorem for lateral vibration

11 To find first few natural frequencies of a cantilever by impact test in virtual Lab

12 To determine critical speed of the shaft and study effect of shaft diameter and end conditions on the same.

Major Equipment :

1. Universal Vibration machine
2. Static and Dynamic balancing Apparatus
3. Whirling of shaft

Reference Books :

1. S S Rao, Mechanical Vibrations, Pearson.
2. R L Norton, Kinematics and Dynamics of Machinery, McGraw-Hill.
3. J. Uicker, Gordon R Penstock & J.E. Shigley, Theory of Machines and Mechanisms, Oxford.
4. V. P. Singh, Mechanical Vibration
5. R L Norton, Design of Machinery, McGraw-Hill.
6. A. G. Ambekar, Mechanical vibrations and noise engineering

List of Open-Source Software/learning website :

1) www.nptel.ac.in
2) www.coursera.org
3) www.edx.org