ME381: DYNAMICS OF MACHINERY
CREDITS = 5 (L=3, T=0, P=2)

Course Objective:

To teach the students the concepts of vibration analysis of one, two and multi degree of freedom systems and analysis of cam dynamics.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Marks Distribution				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	5	70	30	30	20	150

Course Content:

Sr. No.	Topics	Teaching Hrs.
1	**Introduction to Mechanical Vibrations:** Periodic and Simple harmonic motion, Degree of freedom (DoF), Equation of motion – Newton's law of motion and Energy method, General solution, Natural frequency, Causes, advantages and disadvantages of vibrations, Types of vibrations, Basic elements and lumped parameters.	06
2	**Vibration of Systems with Single DoF (Linear and Torsional):** Undamped free vibrations, Equivalent system, Damped vibrations, Different damping models, Viscus damping coefficient, Damping factor and different types of damping conditions, Logarithmic decrement, Damped natural frequency, Forced undamped and damped systems, Analytical solution of forced vibrations with harmonic excitation and vector representation, Magnification factor, Phase difference, Transmissibility, Vibration isolation, Effect of base excitation.	08
3	**Vibration of Systems with Two DoF:** Equations of motion for linear, rectilinear and rotational systems, Concept of node, Vibrations of two and three rotor systems, Torsionally equivalent system, Geared system.	06

4	**Vibration of Continuous Systems (Free Vibrations):** General wave equation of transverse vibration of string, Longitudinal vibration of rod or bar, Transverse vibration of beam, Torsional vibration of shaft, Different numerical methods (Dunkerley, Rayleigh, Stodola, Holzer), Whirling speed of the shaft and its significance. **Vibration measurement, Different vibration measuring instruments.	08
5	**Vibration Measurement:** Introduction to vibration measurement and analysis devices: Vibrometer, velocity pickup, accelerometer, FFT analyser.	06
6	**Cam Dynamics:** Forces in rigid systems, Mathematical models, Response of uniform motion undamped cam mechanism, Analytical method, Position error, Follower response by Phase Plane method, Jump and cross over shock, Spring surge, Wind up, Johnson's numerical analysis.	08
	Total	**42**

Reference Books:

1. Rattan S. S., 'Theory of Machines', Tata McGraw-Hill, 4th edition, 2014.
2. Singh V. P., 'Mechanical Vibrations', Dhanpat Rai & Co., 4th edition, 2014.
3. Rao S. S., 'Mechanical Vibrations', Pearson Education, 4th edition, 2004.
4. Bansal R. K., Brar J. S., 'Theory of Machines', Laxmi Publication (P) Ltd., 4th edition, 2004.
5. Haideri F., 'Dynamics of Machinery', Nirali Publication, 10th edition, 2010.
6. Norton R. L., 'Kinematics and Dynamics of Machinery', McGraw-Hill, 2010.
7. Ghosh A., Mallik A. K., 'Theory of Mechanisms and Machines', East-West Press, 3rd edition, 2008.

Course Outcomes (COs):

1. Formulate the equation of motion of the dynamic systems.
2. Analyze the single DoF systems.
3. Analyze the two DoF systems.
4. Evaluate the vibratory behavior of continuous systems.
5. Decide the use of proper vibration measurement instrument/s.
6. Examine the effect of jump speed on cam-follower system.