

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DYNAMICS OF MACHINES

Course Code	18ME53	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.
- To know the concepts of modelling mechanical systems using spring, mass and damper elements.
- To compute the natural and damped frequencies of free 1-DOF mechanical systems
- To analyze the vibrational motion of 1-DOF mechanical systems under harmonic excitation conditions.

Module-1

Static force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism, shaper mechanism. **Dynamic force analysis:** D'Alembert's principle, analysis of four bar and slider crank mechanism, shaper mechanism.

Module-2

Balancing of Rotating Masses: Static and Dynamic Balancing, Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia Effect of crank and connecting rod, Single cylinder Engine, Balancing in multi cylinder-inline engine (primary and secondary forces), V-type engine, Radial engine – direct and reverse crank method.

Module-3

Governors: Types of Governors; Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic Couple on plane disc, ship, aeroplane, Stability of two wheelers and four wheelers.

Module-4

Free vibrations: Basic elements of vibrating system, Types of free vibrations, Longitudinal vibrations-Equilibrium method, D'Alembert's principle, Energy method, Rayleigh's method. Determination of natural frequency of single degree freedom systems, Effect of spring mass, Damped free vibrations: Under damped, over damped and critically damped systems. Logarithmic decrement.

Module-5

Forced vibrations: Undamped forced vibration of spring mass system, Damped forced vibrations, Rotating unbalance, Reciprocating unbalance, Vibration isolation, Support motion (absolute and relative motion), Transverse vibration of shaft with single concentrated load, several loads, uniformly distributed load, Critical speed.

Course Outcomes: At the end of the course, the student will be able to:

- CO1: Analyse the mechanisms for static and dynamic equilibrium.
- CO2: Carry out the balancing of rotating and reciprocating masses
- CO3: Analyse different types of governors used in real life situation.
- CO4: Analyse the gyroscopic effects on disks, airplanes, stability of ships, two and four wheelers
- CO5: Understand the free and forced vibration phenomenon.
- CO6: Determine the natural frequency, force and motion transmitted in vibrating systems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Theory of Machines: Kinematics and Dynamics	Sadhu Singh	Pearson	Third edition 2019.
2	Mechanism and Machine Theory	G. Ambekar	PHI	2009
Reference Books				
1	Theory of Machines	Rattan S.S.	Tata McGraw-Hill Publishing Company	2014
2	Mechanisms and Machines- Kinematics, Dynamics and Synthesis	Michael M Stanisic	Cengage Learning	2016