Devi Ahilya Vishwavidyalaya, Indore, India Institute of Engineering & Technology			**III Year B. Tech (Mechanical Engineering) (Full Time)**			
Course Code & Name	**Instructions Hours per Semester and Credits**					
5RMPC2: Dynamics of Machine	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**	**120**	**4**
	20	**10**	**20**	**70**		

Course Learning Objectives:

1. Apply principles of friction to analyze and design mechanical elements such as screw jacks, bearings, clutches, and friction drives.
2. Classify and evaluate braking systems and dynamometers**,** explaining their construction, working, and applications in vehicle propulsion and braking.
3. Perform dynamic force analysis in reciprocating engines using D'Alembert's principle, constructing turning moment diagrams, and assessing energy fluctuations with flywheels.
4. Differentiate and assess governor mechanisms, including centrifugal, gravity-controlled, spring-controlled, and inertia types, while interpreting their characteristics and frictional effects.
5. Design and balance rotating and reciprocating masses in single- and multi-cylinder engines, evaluating locomotive balancing, hammer blow, and conditions of balance in complex engine configurations.

Prerequisite(s): Theory of Machines, Strength of Materials, Applied Mathematics

COURSE CONTENT

UNIT-I

Friction in Screw threads: Screw Frictions and Screw jack. **Friction in Bearings**: Pivot and Collar Bearings, Journal Bearings, Thrust Bearings, Ball and Roller Bearings. **Friction in Clutches**: Single & Multi-plate Clutch, Cone clutch, Centrifugal Clutch. **Friction Drives**: Belt, Rope and Chain Drives

UNIT-II

Brakes: Introduction, Classification and Types of Brakes, Shoe/Block Brake, Band Brake, Band and Block Brake, Internal Expanding Shoe Brake, Disc Brake. **Dynamometer**: Introduction, Classification and Types of Dynamometers. Propulsions and Breaking of Vehicles.

UNIT-III

Dynamic Force Analysis: Inertia Force and Inertia Torque, D. Alembert's Principle. **Dynamic Analysis** in Reciprocating Engines: Gas Forces, Equivalent masses, Piston Efforts, Crank shaft Torque, turning moment diagrams, Fly wheels, fluctuation of energy and speed.

UNIT-IV

Governors: Introduction, Types and Classifications, Centrifugal Governors, Gravity Controlled and Spring Controlled Governors, Inertia Governors, Governor Characteristics and Effect of friction.

UNIT-V

Balancing of Rotating Masses: Static and Dynamic Balancing, balancing a Single Cylinder Engine, Balancing Multi-Cylinder Engines

Balancing of Reciprocating Masses: Primary and Secondary Balancing, Locomotive Balancing, Hammer Blow, Pitching and Swaying Couples, Conditions of Balance in V-Engine, Radial Engine and Multi-Cylinder in line Engines.

Course Outcomes:

CO. No.	CO	POs
CO1	Determine the Forces and Torques due to Friction in Bearings, Clutches and Belt Drives.	PO1, PO2, PO7
CO2	Determine the Forces and Torques due to Friction in Brakes ar Vehicle Propulsion.	PO1, PO2, PO3, PO5, PO7
CO3	Determine the Forces and Torques in Reciprocating Engines.	PO1, PO2, PO3, PO4, PO5, PO7
CO4	Determine the Forces and Torques in Governor Mechanisms.	PO1, PO2, PO3, PO4, PO5, PO7
CO5	Determine the unbalancing Forces / Torques in Engines and Machines and to balance this Forces/Torques.	PO1, PO2, PO3, PO4, PO5, PO7, PO8

Books Recommended:

[1]. Rattan S.S., *Theory of Machines*, Tata McGraw Hill Publishing Company Ltd., New Delhi, Second Reprint 2005.
[2]. Shigley J.E. and Uicker J.J., *Theory of Machines and Mechanisms*, McGraw Hill, Inc., 1995.
[3]. Thomas Bevan, *Theory of Machines*, CBS Publishers, and Distributors, 1984.
[4]. Ghosh A. and Mallick A.K., *Theory of Mechanisms and Machines*, Affiliated East-West Press Pvt.Ltd., New Delhi, 1988.
[5]. Rao J.S. and Dukkipati R.V., *Mechanism and Machine Theory,* Wiley-Eastern Limited, New Delhi, 1992.
[6]. John Hannah and Stephens R.C., *Mechanics of Machines*, Viva Low-Priced Student Edition, 1999.

CO-PO-PSO Relationship

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
5RMPC2 .CO1	3	2	-	-	-	-	2	-	-	-	-	3	3	3
5RMPC2 .CO1	3	3	2	-	1	-	2	-	-	-	-	3	3	2
5RMPC2 .CO1	3	2	3	1	2	-	2	-	-	-	-	3	3	2
5RMPC2 .CO1	3	3	2	2	2	-	3	-	-	-	-	3	3	2
5RMPC2 .CO1	2	3	2	1	2	-	3	1	-	-	-	3	3	3

List of Lab/Practical Assignments:

1. To determine the coefficient of friction between the surfaces of different materials by inclined plane method.
2. To determine coefficient of friction between leather belt and CI pulley by Simple & differential band brake method.
3. To determination the coefficient of friction between leather belt and wooden pulley by belt and pulley apparatus.
4. To determine the pressure distribution in the oil film of the journal bearing for various speeds and plot the curves, determine total load and tractional torque.
5. To determine the moment of inertia of objects using trifilar suspension method.
6. To determine the moment of inertia of connecting rod by compound pendulum method.
7. To determine characteristic curves of
   a. Speed v/s sleeve displacement.
   b. Controlling force v/s radius of rotation of the ball center, for Watt, Porter, Proell and Hartnell type governors.
8. To Perform balancing
   a. Static balancing of given weights by balancing apparatus.
   b. Dynamic balancing of given weights by balancing apparatus.
9. To determine the Brake Power using Rope Brake Dynamometer.
10. To determine the Slip and Creep in belt drive and to plot the various curves.
