COURSE CODE	DYNAMICS OF MACHINERY	L	T	P	C
1151ME110		2	2	0	3

1. Preamble

This course provides the concepts and techniques of force analysis and balancing. It introduces the concepts of vibrations, governors, gyroscopes and develops problem solving skills in engineering problems.

2. Pre-Requisite

Kinematics of Machinery 1151ME105

3. Links to Other Courses

Design of Transmission Systems 1151ME114

4. Course Educational Objectives

Students undergoing this course are expected to:

- Develop the knowledge of complex algebra, vector method, graphical methods and computational skills of the students in the areas of dynamics.
- Gain knowledge in areas of vibration analyses, balancing unbalanced machines, stabilization of ships, aero planes, bomb sights and guided missiles.

5. Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Understand the mathematical principles to perform dynamic force analysis on machine components.	K3
CO2	Describe the various methods for balancing of rotating and reciprocating masses.	K3
CO3	Analyze free vibration of various systems	K3
CO4	Solve problems related to forced vibration systems.	K3
CO5	Illustrate the functioning of various types of governors & gyroscope and their applications.	K3

(K3-Apply)

6. Correlation of COs with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M										L	M	L
CO2	H	M										L	M	L
CO3	H	M	L									L	M	L
CO4	H	M	L									L	M	L
CO5	H	M	L									L	M	L

H- High; M-Medium; L-Low

7. Course Contents

UNIT I FORCE ANALYSIS **L- 6 T-6**

Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D'Alembert's principle - The principle of superposition - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels.

UNIT II BALANCING **L- 6 T-6**

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines

UNIT III FREE VIBRATION **L- 6 T-6**

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration critical speeds of simple shaft - Torsional systems; Natural frequency of two and three rotor systems

UNIT IV FORCED VIBRATION **L- 6 T-6**

Harmonic Forcing - Forcing caused by unbalance -Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation. Flow induced vibration

UNIT V MECHANISMS FOR CONTROL **L- 6 T-6**

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors – Characteristics - Effect of friction - Controlling Force. Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes

Total: 30+30 = 60 Periods

8. Text Books

1. Thomas Bevan, "Theory of Machines", Pearson education, Noida, 5th Edition, 2013.
2. Ratan, S.S., "Theory of Machines", Tata McGraw Hill publishing company Ltd., 3rd Edition, 2011.
3. Balaguru S, "Dynamics of Machines", Cengage Learning, New Delhi, 6th Edition, 2018.

9. References

1. Khurmi R.S. "Theory of Machines" S.Chand & Co.,. Delhi, 2013
2. B.L. Balleney, "Theory of Machines", Khanna Pub. Delhi, 2012
3. Shigley J.E and Uicker J.J "Theory of Machines and Mechanisms," McGraw Hill ISE,2011.
4. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", New Age Intl., New Delhi, 2nd Edition, 2012.