## 3/4 B.Tech. FIFTH SEMESTER

**ME5T1** **DYNAMICS OF MACHINERY** **Credits: 4**

**Lecture:- 4 periods/week** **Internal assessment: 30marks**
**Tutorial : 1 periods/week** **Semester end examination: 70 marks**

---

**Objectives:**

1. Develop understanding of dynamic analysis like gyroscopic forces and moments, friction of fixed axis rotation of rigid bodies.
2. Determine the dynamic behavior principles and operations of clutches, breaks, dynamometers, flywheels and governers.
3. Relate static and dynamic balancing analysis as applied to machines.

**Learning outcomes:**

At the end of course the students will be able to:

1. Apply basic laws of friction to clutches, brakes and dynamometers
2. Describe the operation and perform basic analysis of flywheel and governers.
3. Perform static and dynamic balancing calculations for rotating and reciprocating machinery.
4. Recognize the gyroscopic and precession concepts to compute inertia forces in reciprocating parts.

**Pre-Requisites:**

Kinematics of Machinery

**UNIT – I**
**FRICTION AND FRICTION CLUTCHES:**
Introduction, uniform pressure, uniform wear theory, Pivot and Collar bearings.
Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

**UNIT - II**
**BRAKES AND DYNAMOMETERS:**
Radial Brakes-Simple block brakes, band brakes, Band and Block Brakes, Internal expanding brake, Braking of a Vehicle.
Dynamometers- Absorption and Transmission type.General description and methods of operation.

**UNIT – III**

**GOVERNORS:**

Introduction, Watt, Porter, Proell Governors, Spring loaded Governors- Hartnell, Hartung Governors, Sensitiveness of a Governor, Hunting, Isochronisms, Stability, Controlling Force Diagrams.

**UNIT – IV**

**GYROSCOPE:**

Precession, Gyroscopic Couple and its effect, Gyroscopic Effect on an Aero planes and Naval Ships, Stability of Two Wheel vehicle and Four Wheel vehicle.

**UNIT – V**

**INERTIA FORCES IN RECIPROCATING PARTS**:

Introduction, D-Alembert's Principle, Angular velocity and Angular acceleration of the Piston and Connecting rod, Forces on the Reciprocating parts of an Engine, Equivalent Dynamical system, Inertia force and Inertia Torque in a reciprocating Engine.

**UNIT – VI**

**TURNING MOMENT DIAGRAMS AND FLY WHEEL:**

Introduction, Single cylinder Double acting steam Engine, Four stroke cycle Internal Combustion Engine, Multi cylinder Engine -Fluctuation of energy.

Coefficient of fluctuation of Speed, Energy Stored in a Flywheel, Flywheel in Punching Press.

**UNIT –VII**

**BALANCING OF ROTATING ELEMENTS:**

Introduction, Static balancing, Dynamic balancing, Balancing of single unbalanced rotating mass, Balancing of Several Masses in the same planes, Balancing of Several Masses in Different planes.

**UNIT –VIII**

**BALANCING OF RECIPROCATING ELEMENTS:**

Primary, Secondary balancing of reciprocating masses. Analytical and Graphical methods.Unbalanced forces and couples- examination of "V", Multi cylinder in-line and radial engines for Primary, secondary balancing.

## Learning resources

**Text books:**

1. Theory of Machines, (3rd Edition) by S.S.Rattan ,Tata Mc.Graw Hill, New Delhi, ,2012
2. Theory of Machines, (5th Edition) by R.K.Bansal, Laxmi Publications(p) ltd. New Delhi, ,2010

**Reference books:**

1 Theory of Machines : Kinematics & Dynamics, by P.L. Ballaney, I.K.International Pvt. Ltd., New Delhi,2010

2 Theory of Machines, by B.V.R. Guptha, Khanna Publications, New Delhi,11th Edition,1980