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Theory of Machines & Mechanisms — Complete Syllabus

BTEUP Diploma in Mechanical Engineering • 5th Semester • Session 2026–27
Subject 5.2 (Theory) • Total 100 Marks • 4 Credits

About this document: Theory of Machines & Mechanisms is subject 5.2 of the 5th semester of the Diploma in Mechanical Engineering. It is a theory subject common to the Mechanical Engineering (Production) and Mechanical Engineering (Automobile) sub-branches. This document gives the complete unit-wise syllabus, the examination scheme and the reference books from the official curriculum.

Examination Scheme

Code	Paper	Type	L – P	Credits	Internal	External	Total
5.2	Theory of Machines & Mechanisms	Theory	4 – 0	4	Theory 40	Theory 60 (3 hrs)	100
Theory of Machines & Mechanisms Total				**4**	**40**	**60**	**100**

What This Subject Aims To Do

To make diploma students conversant with the principles related to the design of components and machines, and the application of these principles for designing: the kinematics of mechanisms, cams, power transmission, flywheels and governors, brakes, clutches and bearings, and the balancing of rotating masses and vibrations.

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Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks
1	Introduction to Mechanisms and Machines; Cams and Followers	10	12
2	Power Transmission	12	12
3	Flywheel and Governors	10	12
4	Brakes, Dynamometers, Clutches & Bearings	12	12
5	Balancing & Vibrations	12	12

Total: 56 periods, 60 marks (external theory). Each unit carries 12 marks in the external theory paper, as per the suggested distribution of marks in the official syllabus.

Unit 1 — Introduction to Mechanisms and Machines; Cams and Followers (10 Periods, 12 Marks)

Topics: Introduction of Mechanism and Machine, Basic elements: Link, Pairs, Chains, Inversions, different types of mechanisms, Displacement, velocity and acceleration of plane mechanisms. Cams and Followers: Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; Drawing of profile of radial cam with knife-edge and roller follower.

In simple words: What mechanisms and machines are, how links, pairs and chains work, and how cams give a follower its chosen motion, with the displacement diagrams and cam profiles drawn from them.

Unit 2 — Power Transmission (12 Periods, 12 Marks)

Topics: Basics of Power Transmission. Belt Drives: Flat belt, V-belt and its applications; Material for flat and V-belt; Angle of lap, Belt length, Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numerical). Chain Drives: Advantages and Disadvantages; Selection of Chain and Sprocket wheels; Methods of lubrication. Gear Drives: Gear terminology; Types of gears and gear trains, their selection for different applications; Train value and Velocity ratio for simple and compound gear train, law of gearing; Rope Drives: Types, applications, advantages and limitations of Steel ropes.

In simple words: How power moves from one shaft to another: belts (length, slip, creep, tension ratio, maximum power), chains, gears and gear trains, and steel rope drives.

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Unit 3 — Flywheel and Governors (10 Periods, 12 Marks)

Topics: Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine; Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance. Governor Types and explanation with neat sketches (Centrifugal: Watt and Porter); Concept, function and applications and Terminology of Governors; Comparison between Flywheel and Governor.

In simple words: The flywheel smooths speed within one cycle; the governor holds the mean speed steady when the load changes. The turning moment diagram shows where the flywheel stores and releases energy.

Unit 4 — Brakes, Dynamometers, Clutches & Bearings (12 Periods, 12 Marks)

Topics: Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of (i) shoe brake, (ii) Band Brake, (iii) Internal expanding shoe brake, (iv) Disc Brake; Concept of Self Locking and Self energizing brakes. Clutches: Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of Single plate, Multiplate, Centrifugal and Cone clutch. Bearings: (i) Simple Pivot, (ii) Collar Bearing, (iii) Conical pivot.

In simple words: How machines stop (brakes), how their power is measured (dynamometers), how the engine is connected and disconnected (clutches), and how thrust loads are carried (pivot and collar bearings).

Unit 5 — Balancing & Vibrations (12 Periods, 12 Marks)

Topics: Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane. Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.

In simple words: Why rotating parts must be balanced, how to balance one mass and several masses in a plane, and what causes vibration in machines, what harm it does and how it is cured.

Course Outcomes

- CO1: Explain the fundamentals and kinematics of mechanisms, links, pairs, and chains.
- CO2: Explain cams and followers, their motions, displacement diagrams, and draw cam profiles.
- CO3: Analyze and select power transmission systems including belts, chains, gears, and ropes.

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- CO4: Analyze the concepts, applications, and analysis of flywheels and governors.
- CO5: Explain the construction, working, and applications of brakes, clutches, and bearings.
- CO6: Analyze balancing of rotating masses and understand causes, effects, and remedies of vibrations.

Reference Books (as listed in the syllabus)

- Theory of machines – S. S. Rattan, Tata McGraw-Hill publications.
- Theory of machines – R. K. Bansal, Laxmi publications.
- Theory of machines – R. S. Khurmi and J. K. Gupta, S. Chand publications.
- Dynamics of Machines – J. B. K. Das, Sapna Publications.

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Source: IRDT Kanpur NEP-2020 curriculum for the Diploma in Mechanical Engineering (Production), effective session 2026-27, approved by the Board of Technical Education, U.P. Lucknow in the C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text. Please confirm with your own polytechnic for any local changes.

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