



**CVM**  
**UNIVERSITY**

Aegis: Charutar Vidya Mandal (Estd.1945)

## FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

**Programme:** Bachelor of Technology (Mechanical Engineering)

**Semester:** V

**Course Code:** 202090504

**Course Title:** Theory of Machines

**Course Group:** Professional Core Course-VIII

**Course Objectives:** It is a fundamental course for Mechanical engineers to understand the construction and working principles of machine components. This course is essential to understand the motion, transmission of the motions and the forces responsible for the various motions.

### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

\* J: Jury; V: Viva; P: Practical

### Detailed Syllabus:

Sr.	Contents	Hours
1	<b>Static force analysis:</b> Newton's Laws of Motion, Applied and constraint forces, Free-body diagrams, Conditions for equilibrium, Static equilibrium, Equilibrium of two and three forces members, Force conventions, Free body diagram, Principle of virtual work, Friction forces, Static & Kinetic Friction, Tension, Normal Force.	6
2	<b>Dynamic force analysis of mechanisms:</b> Introduction, D'Alembert's principle, equivalent offset inertia force, dynamic analysis of slider crank mechanism, velocity & acceleration of piston, angular velocity & angular acceleration of connecting rod, engine force analysis, dynamically equivalent system, inertia of the connecting rod, inertia force in reciprocating engines.	8
3	<b>Turning moment diagrams and flywheel:</b> Turning moment and crank effort diagrams, Significance of flywheel, coefficient of fluctuation of speed and energy, energy stored in flywheel, Design of flywheels for engines and punching machines.	7
4	<b>Gyroscope:</b> Principle of gyroscope, Definition of axes, active and reactive couples; Roll, Yaw and Pitch motions; Gyroscopic effect in a rotor: Ship and Aero planes.	6



<b>5</b>	<p><b>Friction Devices: Clutches, Brakes</b>            Classification of clutches, torque transmission capacity, considerations for uniform wear and uniform pressure theory, single plate and multi-plate clutch, centrifugal clutch, Energy equation and thermal considerations.            Classification of brakes, Braking effect, Analysis of Brakes: Block Brake, Band Brake, Band and Block Brake, Internal expansion shoe brake; Braking analysis of four wheelers  <b>Dynamometer:</b>            Definition, Applications, Classification of Dynamometers, Analysis of Dynamometers: Prony brake, Rope brake, Hydraulic</p>	<b>13</b>
<b>6</b>	<p><b>Governors:</b>            Necessity of governor, Classification of Governors, working principle of centrifugal governors: watt and Porter Governors, Concept of control force, Control force diagram, Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor.</p>	<b>5</b>
<b>Total</b>		<b>45</b>

### List of Practicals / Tutorials:

<b>1</b>	Velocity diagram
<b>2</b>	Acceleration Diagram
<b>3</b>	Static Force Analysis of Mechanical System
<b>4</b>	Static force analysis of 4-bar mechanism and slider crank mechanism (Graphical Method)
<b>5</b>	Dynamic force analysis of 4-bar mechanism and slider crank mechanism (Analytical Methods)
<b>6</b>	Design of Flywheel for IC engine and Punch press.
<b>7</b>	Understanding of gyroscopic effect using motorized gyroscope.
<b>8</b>	Working principle of various brakes.
<b>9</b>	Working principle of various clutches.
<b>10</b>	Performance Analysis of centrifugal governors.

### Reference Books:

<b>1</b>	Theory of Machines by S S Rattan, McGraw Hill
<b>2</b>	Theory of Machines by R.S.Khurmi & J.K.Gupta, S.Chand & Co.Pvt.Ltd.
<b>3</b>	Theory of Machines by V P Singh, Dhanpat Rai & Co.
<b>4</b>	Theory of Machines by Dr. R. K. Bansal & Dr. J. S. Brar, Laxmi Publications Pvt. Ltd.
<b>5</b>	Theory of Machines by Sadhu Sigh, Pearson Education
<b>6</b>	Theory of Mechanisms and Machines by A Ghose and A K Malik, East West Press Pvt Ltd.
<b>7</b>	Theory of Machines by Thomas Bevan, 3rd Edition, CBS Publishers and Distributor
<b>8</b>	Mechanism and Machine Theory by Ambekar, Prentice Hall.
<b>9</b>	Theory of Machines and Mechanisms by J.Uicker, Gordon R Penstock & J.E. Shigley, Oxford.

### Supplementary learning Material:

<b>1</b>	<a href="https://nptel.ac.in/courses/">https://nptel.ac.in/courses/</a>
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**Pedagogy:**

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods

**Internal Evaluation:**

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying; N: Analyzing; E: Evaluating; C: Creating
R	U	A	N	E	C	
10	20	15	25	25	5	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Course Outcomes (CO):**

Sr.	Course Outcome Statements	%weightage
CO-1	Apply fundamentals of dynamics analysis to various mechanical systems.	25
CO-2	Turning moment and crank effort diagrams & Design flywheels for IC engines and punching press.	15
CO-3	Analyze effect of gyroscopic couple on vehicles, ships and aero planes.	20
CO-4	Understand the power transmitting devices like belt, rope, and chain drive.	20
CO-5	Understand basics related to friction and its practical application in mechanical engineering.	20

**Curriculum Revision:**

Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025