

Course Name: Mechanical Engineering Group **Course Code:** ME/PT/PG/AE/MH

Semester: Fourth

Subject Title: Theory of Machines and Mechanisms **Subject Code:** 9050

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	Test	PR	OR	TW	Total
04	--	02	03	80	20	--	--	25@	125

Rationale:

It is a core Technology subject in Mechanical Engineering Discipline. Mechanical Engineering Diploma Holders often come across various mechanisms in practice. He should be able to analyze, identify and interpret various mechanisms and machines in day-to-day life. In maintaining various machines, a diploma technician should have sound knowledge of fundamentals of machine and mechanism. It will be helpful to technician to understand the mechanisms from operational point of view in better way. This subject imparts the facts, concepts, principles, procedure, kinematics and dynamics involved in different machine elements and mechanisms like lever, gear, cam, follower, belt, flywheel, brake, dynamometer, clutch, etc.

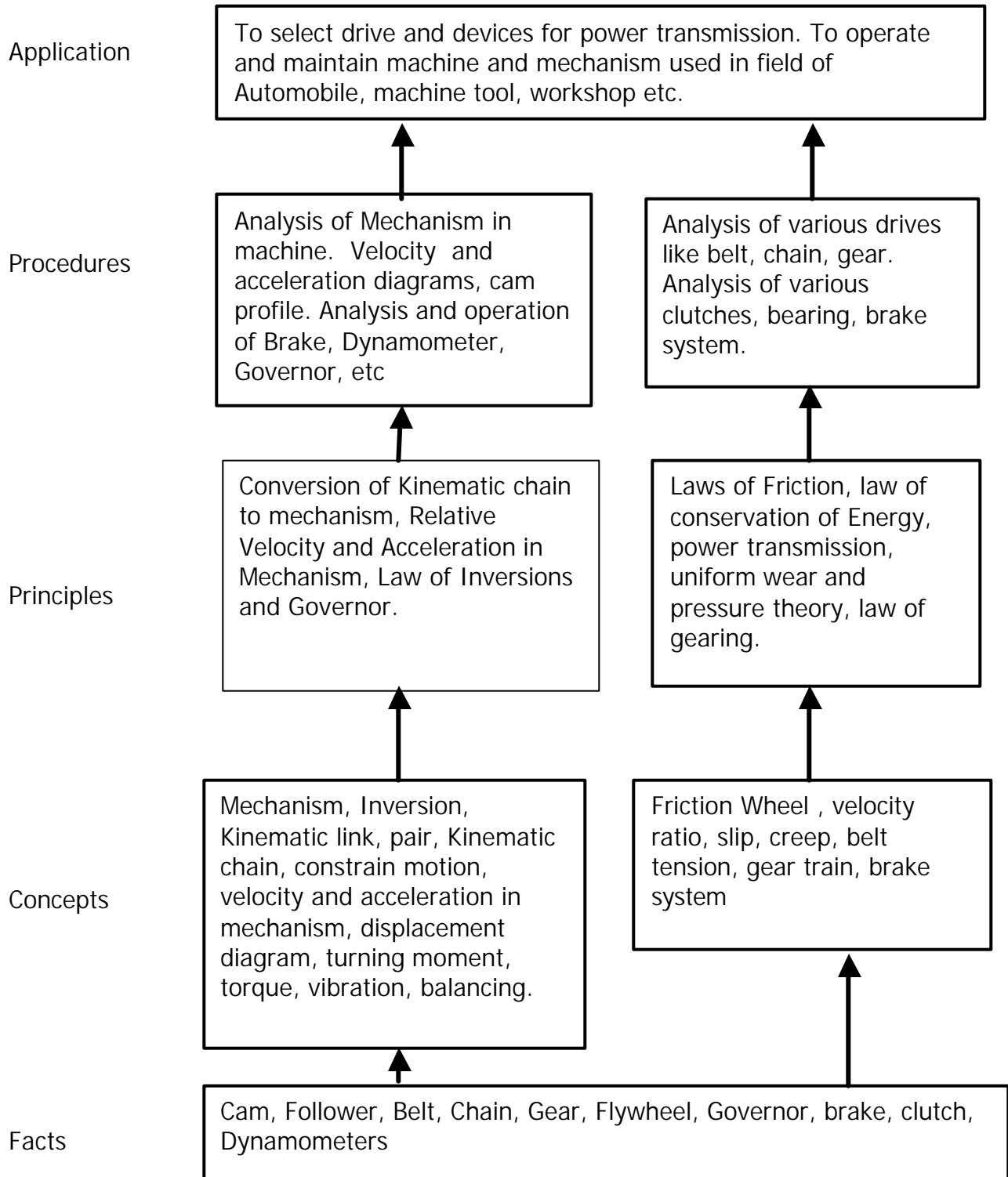
Detail knowledge of above-mentioned aspect with deep insight to the practical applications develops a professional confidence in them to become successful Engineer.

Objectives:

Student will be able to:

1. Know different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Select Suitable Drives and Mechanisms for a particular application.
4. Appreciate concept of balancing and Vibration.
5. Develop ability to come up with innovative ideas.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	HOURS	MARKS
1.	<p>Fundamentals and types of Mechanisms</p> <p>1.1 Kinematics of Machines: - Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure.</p> <p>1.2 Inversions of Kinematic Chain.</p> <p>1.2.1 Inversion of four bar chain, coupled wheels of Locomotive & Pentograph.</p> <p>1.2.2 Inversion of Single Slider Crank chain- Rotary I.C. Engines mechanism, Whitworth quick return mechanism, Crank and Slotted lever quick return mechanism.</p> <p>1.2.3 Inversion of Double Slider Crank Chain- Scotch Yoke Mechanism & Oldham's Coupling.</p> <p>1.3 Common Mechanisms</p> <p>1.3.1 Bicycle free wheel Sprocket mechanism.</p> <p>1.3.2 Geneva Mechanism.</p> <p>1.3.3 Ackerman's Steering gear mechanism.</p> <p>1.3.4 Foot operated air pump mechanism.</p>	12	16
2.	<p>Velocity and Acceleration in Mechanism</p> <p>2.1 Concept of relative velocity and relative acceleration of a point on link, angular velocity and angular acceleration, inter- relation between linear and angular velocity and acceleration.</p> <p>2.2 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple mechanisms. Determination of velocity and acceleration of a point on link by relative velocity method [Excluding coriollis components of acceleration].</p> <p>2.3 Analytical method [no derivation] and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism.</p>	09	10

3.	Cams and Followers 3.1 Concept, definition and application of Cams and Followers. 3.2 Classification of Cams and Followers. 3.3 Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation. 3.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).	08	10
4.	Power Transmission 4.1 Types of Drives – Belt, Chain, Rope, Gear drives & their comparison. 4.2 Belt Drives - flat belt, V– belt & 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 numericals) 4.3 Chain Drives – Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods of lubrication. 4.4 Gear Drives – Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for compound, reverted and simple epicyclic gear train, methods of lubrication, Law of gearing. 4.5 Rope Drives – Types, applications, advantages & limitations of Steel ropes.	14	16
5.	Flywheel and Governors 5.1 Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. 5.2 Governors - Types, concept, function and application & Terminology of Governors. 5.3 Comparison between Flywheel and Governor.	06	08

6.	<p>Brakes, Dynamometers, Clutches & Bearings</p> <p>6.1 Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer.</p> <p>6.2 Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake.</p> <p>6.3 Concept of Self Locking & Self energizing brakes.</p> <p>6.4 Numerical problems to find braking force and braking torque for shoe & band brake.</p> <p>6.5 Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometer.</p> <p>6.6 Clutches- Uniform pressure and Uniform Wear theories.</p> <p>6.7 Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch v) Diaphragm clutch. (Simple numericals on single and Multiplate clutch).</p> <p>6.8 Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numericals.</p>	12	16
7.	<p>Balancing & Vibrations</p> <p>7.1 Concept of balancing. Balancing of single rotating mass. Graphical method for balancing of several masses revolving in same plane.</p> <p>7.2 Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.</p>	03	04
Total		64	80

Practical:

Skills to be developed:

Intellectual Skills:

1. Understand working of free wheel mechanism of a bicycle, Geneva mechanism, steering gear mechanism etc.

2. Determine velocity and acceleration of links in a given mechanism
3. Analyse balancing of rotating masses in a single plane
4. Interpret interrelationship between components of various braking mechanisms
5. Understand concepts of vibrations in various machineries, their harmful effects and remedies
6. Compare various power transmission devices

Motor Skills:

1. Drawing of velocity and acceleration diagrams
2. Assembly and dismantling of brakes and clutches
3. Drawing of cam profiles from a given data for i. C . Engine
4. Drawing of velocity and acceleration diagram

Note -The Term work shall consist of Journal / lab manual and A-3 size sketch book.

List of Practical:

- 1) Find the ratio of time of cutting stroke to the time of return stroke for quick return mechanism of a shaper machine.
- 2) Sketch & describe working of bicycle free wheel sprocket mechanism.
- 3) Determination of velocity and acceleration by relative velocity method (four problems).
- 4) Determination of velocity and acceleration of piston of an I.C. engine's Slider Crank mechanism by Klein's construction, for different position of crank in between 0° and 360° . Represent graphically velocity verses crank angle and acceleration verses crank angle.
- 5) Draw the profile of radial cam for the given motion of follower. (At least four problems)
- 6) Determine the radius of rotation of flyball for different speed of governor and draw a graph between radius of rotation versus speed.
- 7) Dismantling and assembly of mechanically operated braking mechanism for two wheelers.
- 8) Determination of power transmitted by any belt drive using any one dynamometer.
- 9) Dismantling and assembly of multiplate clutch of two-wheeler.
- 10) Determine graphically balancing of several masses rotating in a single plane.

Learning Resources:

Books:

So. No.	Author	Title	Publication
01	Khurmi Gupta	Theory of machines	Eurasia publishing House Pvt. Ltd. 2006 edition
02	S.S.Rattan	Theory of Machine	McGraw Hill companies II Edition
03	P.L.Ballaney	Theory of machines	Khanna Publication
04	Timo Shenko	Theory of machines	Wiley Eastern
05	Jagdishlal	Theory of machines	Bombay Metro – Politan book ltd.
06	Ghosh - Mallik	Theory of machines	Affiliated East west press
07	Beven T.	Theory of machines	CBS Publication
08	J.E.Shigley	Theory of machines	Mc Graw Hill