



C.U.SHAH UNIVERSITY – Wadhwan City

FACULTY OF: - Technology and Engineering (Diploma Engineering)

DEPARTMENT OF: - Mechanical Engineering

SEMESTER: - IV **CODE:** - 2TE04TOM1

NAME OF SUBJECT: – Theory of Machines

Teaching & Evaluation Scheme: -

Subject Code	Name of the Subject	Teaching Scheme				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr	
<u>2TE04TOM1</u>	Theory of Machines	03	00	02	05	4	30	1.5	70	03	30	20	----	150

Objective: -

The course content for the students of mechanical engineering programme should be taught and implemented with the aim to develop various types of skills, so that students are able to acquire knowledge of theoretical principles for mechanisms and machines for clear understanding of concepts underlying engineering design. It gives inclination to apply this theoretical knowledge to the practical problems.

Prerequisites: -

Use principles of kinematics and dynamics to design and fabricate simple mechanism.

Course Outcomes: -

- Draw inversions and determine velocity and acceleration of different mechanisms.
- Construct different types of cam profile for a given data.
- Calculate loss of power due to friction in various machine elements.
- Solve problems on power transmission.
- Construct turning moment diagram.
- Calculate balancing mass and its position.
- Identify different types of vibration, its causes and remedies.

Course outline: -

Sr. No.	Course of contents	No. of Hours
1	Introduction Theory of machines: Introduction, need, scope and importance in design and analysis, Kinematics, kinetics and dynamics-concept and examples, Basic terminology related to machines and mechanisms-Kinematic Link or Element. Types of Links, Structure, Difference Between a Machine and a Structure, Kinematic Pair, Types of Constrained Motions, Classification of Kinematic Pairs, Kinematic Chain, Mechanism, Inversion of	05

	Mechanism, Types of Kinematic Chains- Four Bar Chain or Quadric Cycle Chain, Inversions of Four Bar Chain- Single Slider Crank Chain, Inversions of Single Slider Crank Chain- Double Slider Crank Chain, Inversions of Double Slider Crank Chain.	
2	Velocity and acceleration diagram(Relative Velocity Method) Velocity in Mechanisms -Introduction, Relative Velocity of Two Bodies Moving in Straight Lines, Motion of a Link, Velocity of a Point on a Link by Relative Velocity Method, Velocities in a Slider Crank Mechanism, Velocities in a four bar chain Mechanism Acceleration in Mechanisms -Introduction, Acceleration Diagram for a Link, Acceleration of a Point on a Link, Acceleration in the Slider Crank Mechanism, Acceleration in the four bar chain Mechanism, Klein's construction for single slider crank mechanism.	05
3	Cam and cam profile Introduction, functions and types of cams and cam followers, Types of motions and displacement for different types of cam and cam followers, Construct different types of cam profiles.	05
4	Friction Concept and laws of friction Appreciate the role of friction in thrust bearing, pivot bearing and collars considering - Uniform pressure and Uniform wear condition. Clutch- Functions, Types with sketches and working. Brakes- Functions, Types with sketches and working. Dynamometers- Types and operational working principles.	08
5	Power transmission Introduction, need and modes of power transmission, Types of power transmission. Belt Drive - types, terminology and standards/designation methods as per BIS/ISO, Belt speed-co-efficient of friction, velocity ratios and slip, Power transmitted by flat belt - tensions, centrifugal tensions, maximum tension, condition for transmitting maximum power and initial tension.(with derivations),numerical examples. Gear Drive -Gear trains, types, numerical examples and applications, Merits and demerits of power transmission drives.	08
6	Flywheel and governor Turning moment diagram-Concept, Its use for different machines, Fluctuations of energy, Co-efficient of fluctuation of speed and energy, Method to construct turning moment diagram, numerical examples. Flywheel -Functions and types, Moment of inertia and mass calculation of flywheel-numerical examples. Governor -Terminology types & functions.	06
7	Balancing and vibrations Balancing - Concepts and types of balancing, Effects of unbalanced masses, Balancing of revolving masses in same plane, Analytical and graphical methods to find balancing mass, Numeric examples, Balancing of reciprocating masses (No numerical examples). Vibration - Terminology, Effects, Causes, Remedies.	05

Suggested List of Exercises/Practicals

- **Preparatory Activity**
Interpret and write various course related SI units and their conversions, Recall and write scalar and vector quantities, Demonstrate various mechanisms.
- **Velocity and Acceleration**
Prepare one sheet on velocity and acceleration diagram for given mechanisms by **relative velocity method**.
Prepare one sheet on velocity and acceleration diagram for given mechanisms by **Klein's construction method**.
Prepare report showing necessary calculations for above.
- **Cam Profile**
Demonstrate working of any type of cam and followers.

Prepare one sheet on construction of cam profile for given data (with-without offset of knife edge, roller follower), Prepare report showing necessary calculations for above.

- **Demonstration of Clutch**

Identify different parts of a single plate disc clutch through disassembly, observe wear and tear due to friction and prepare report based on inspection criteria.

- **Demonstration of Power Transmission Systems**

Identify various power transmission systems by observing different machines and equipments used in mechanical engineering laboratory/workshop. For example- IC Engine test rig, Compressors, Machine tools, Elevators, etc. Sketch at least four mechanisms with labeling on each, Demonstrate working of each.

- **Balancing**

Prepare one sheet on balancing using graphical and analytical method for a given data.

- **Tutorials**

Solve examples on friction in bearings, power transmission systems, turning moment diagram, flywheel from given experimental data.

- **Mini Project And Presentation**

Compile information from internet related to various mechanisms/elements like piston, crank, connecting rod, cam, clutch, brake, flywheel, governor, or animation of mechanism etc. along with functions of each. Select any one mechanism (preferably that which is NOT part of syllabus) from mechanical laboratory/workshop/real life. Sketch the same. Take photograph of the same. Also record the movie of its working. Prepare subject related mechanism simple model. This has to be proposed by student/s and has to be approved by teacher.

Present the experience with power point presentation and model prepared at above.

Suggested List of Student Activities

- List the mechanisms which you are using in your day to day life. Sketch any three from these.
- Visit the market and collect the data of items which are used in any mechanisms. Data includes specifications, cost, applications, etc. Also name the mechanism/s in which such item/s is/are used.

Learning Outcomes: -

- Draw inversions and determine velocity and acceleration of different mechanisms.
- Construct different types of cam profile for a given data.
- Calculate loss of power due to friction in various machine elements.
- Solve problems on power transmission.
- Construct turning moment diagram.
- Calculate balancing mass and its position.
- Identify different types of vibration, its causes and remedies.

Suggested Learning Resources

(A) List of Books

- Theory of Machines, Jagdishlal, Metropolitan Book New Delhi, Company, Daryaganj, Delhi.
- Theory of Machines, S.S.Ratan, Tata McGraw Hill , New Delhi.
- Theory of Machines, Abdulla Shariff, Dhanpatray and sons, New Delhi.
- Theory of Machines , Shah & Jadvani, Dhanpatray and sons, New Delhi.
- Theory of Machines , A Ghosh and AK Malik, East West Press (Pvt) Ltd., New Delhi.
- Theory of Machines , R.S.Khurmi, S.chand, New Delhi.
- Theory of Machines , P.L.Bellaney, Khanna publication, NewDelhi.
- Theory of Machines , Joseph Edward Shigley, McGrawHill.

(B) List of Software/Learning Websites:

- <http://nptel.iitm.ac.in/video.php?subjectId=112104121>
- <http://www.technologystudent.com/gears1/gears7.htm>
- <http://kmoddl.library.cornell.edu/model.php?m=20>
- <http://www3.ul.ie/~kirwanp/whatisacamandfollowersyste.htm>
- <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/index.htm>
- http://elearning.vtu.ac.in/12/enotes/Des_Mac-Ele2/Unit6-RK.pdf
- en.wikipedia.org/.../Canadian_Committee_for_the_Theory_of_Machines...
- global.oup.com/.../theory-of-machines-and-mechanisms-978019537123...
- www.tequipment.com/Theory_of_Machines.aspx
- www.researchgate.net/.../0094-114X_Mechanism_and_Machine_Theory
- www.journals.elsevier.com/mechanism-and-machine-theory/
- journalseek.net/cgi-bin/journalseek/journalsearch.cgi?field=issn...
- site.iugaza.edu.ps/wp-content/.../IUGAZA%20TOM2012_CH1-2.pdf
- www.iftomm.org/
- www.wiziq.com/online-tests/44047-mechanical-theory-of-machine
- www.cs.ubc.ca/~murphyk/Teaching/CS340-Fall07/infoTheory.pdf

(B) List of equipments:

- Working Models / wooden/thermocool theoretical models of:
- Kinematic links and pairs.
- Single slider crank.
- Four bar chain.
- Types of cams, followers and cam/follower arrangements.
- Friction bearing- all types.
- Dynamometers - all types.
- Friction clutches - all types.
- Friction brakes - all types.
- Rope/belt – All types of flat and vee.
- Gear trains - all types.(Simple, compound, reverted, epicyclical).
- Balancing machines -Revolving masses, Reciprocating masses.
- Steam engine, internal combustion engine.
- Governors - all types.
- Vibration -spring and mass model.
- Any machine, having flywheel.