

1. Preamble

This course is to provide the Structural analysis knowledge of Friction, Gearing, cams & Vibration and techniques of linkages & their geometry. It introduces students to understand the Structural analysis of various Mechanical components at different load conditions.

2. Pre-requisite

1151AU101	Engineering Mechanics
1150ME202	Engineering Graphics

3. Links to other courses

- Vehicle Design & Data Characteristics
- Engine design and development
- Vehicle dynamics

4. Course Educational Objectives

Students undergoing this course are expected to

- To develop the basic components and layout of linkages in the assembly of system /machine.
- To develop knowledge about the undesirable effects of unbalance in rotors and engines.
- To develop skills of students in the Structural analysis of various Mechanical components.
- To serve as a pre-requisite course for other courses in UG and PG programmes, specialized studies and research.

5. Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
C01	Describe the concept of kinematic analysis of mechanism & degree of freedom.	K2
C02	Estimate the ratio of tensions and power transmission through belt and rope drive.	K3
C03	Compute and draw the Gear, Cam profile and its geometry.	K3
C04	Discuss the effects of Static and Dynamic balancing.	K2
C05	Explain the concept of vibration and its effects	K2

6. Correlation with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	M	M			M		M	L	H	H
CO2	H	H	H	M	M	M			M		M	L	H	M
CO3	H	H	H	M	M	M			M		M	L	H	M
CO4	H	H	H	M	M	M			M		M	L	H	H

CO5	H	H	H	M	M	M			M		M	L	M	M
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H- Strong; M-Medium; L-Low

7. Course content

UNIT – I: MECHANISMS

L-6 T-6

Machine Structure – Kinematic Link, Pair and Chain – Grueblers Criteria – Constrained Motion – Degrees of Freedom - Slider Crank and Crank Rocker Mechanisms – Inversions – Applications – Kinematic Analysis of Simple Mechanisms – Determination of Velocity and Acceleration.(Graphical Method)

UNIT – II: FRICTION

L-6 T-6

Surface Contacts – Sliding and Rolling Friction - Friction in Screw and Nut –Plate Clutch – Belt (Flat And V) and Rope Drives. Ratio of Tensions –Condition for Maximum Power Transmission – Open and Crossed Belt Drive.

UNIT – III: GEARING AND CAMS

L-6 T-6

Gear Profile and Geometry – Nomenclature of Spur And Helical Gears – Gear Trains: Simple, Compound Gear Trains and Epicyclic Gear Trains - Determination of Speed and Torque - Cams – Types of Cams – Design of Profiles – Knife Edged and Roller Ended Followers With and Without Offsets for Various Types of Follower Motions

UNIT – IV: BALANCING

L-6 T-6

Static and Dynamic Balancing – Single and Several Masses in Different Planes –Balancing of Reciprocating Masses- Primary Balancing and Concepts of Secondary Balancing – Single and Multi Cylinder Engines (Inline) – Balancing of Radial V Engine – Direct and Reverse Crank Method

UNIT – V: VIBRATION

L-6 T-6

Free, Forced and Damped Vibrations of Single Degree of Freedom Systems – Force Transmitted to Supports – Vibration Isolation – Vibration Absorption – Torsional Vibration of Shaft – Single and Multi-Rotor Systems – Geared Shafts – Critical Speed of Shaft.

Total: 60 Periods

8. Text Books

1. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co, New Delhi, 2013.
2. Ballaney.P.L, “Theory of Machines”,Khanna Publishers, New Delhi, 2014.
3. R.S.Khurmi“Theory of Machines”, Eurasia Publishing House, 2012

9. References

1. Rao, J.S and Dukupati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 2007.
2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, SatyaPrakasam, Tech. India Publications, 2009.
3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 2011.
4. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 2012.