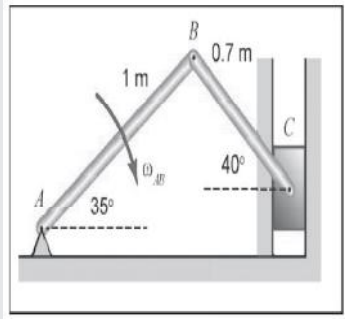
19ME204 MECHANISMS AND MACHINES



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Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
5	40	-	8	-	-

PRE-REQUISITE COURSE: Engineering Graphics and Design

COURSE DESCRIPTION AND OBJECTIVES:

This course mainly deals with the concepts of mechanisms and machines that are commonly deployed in industries. The objective of this course is to understand the basic mechanisms and analyse the motion and forces transmitted through various mechanisms and components of machines.

COURSE OUTCOMES:

Upon completion of the course the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand a structure, mechanism and machine.	1
2	Estimate velocity and acceleration of different links of a machine.	2,5
3	Analyse the inertia forces/inertia torques acting on different links of a machine.	2,5
4	Calculate the amount of unbalance mass in rotating and reciprocating machinery.	2
5	Determine resonant frequency of machine components.	2,3

SKILLS:

- ✓ *Differentiate structure, mechanism and machine.*
- ✓ *Compute velocity and acceleration of links in mechanisms.*
- ✓ *Evaluate inertia forces on a moving machine component using ADAMS.*
- ✓ *Calculate the mass required for balancing of rotating and reciprocating machine components.*
- ✓ *Identify resonant frequency of vibrating systems.*

UNIT- I **L-9**

INTRODUCTION: Classification of kinematic chains, Inversion of four bar mechanism, Velocity and acceleration of four bar mechanism, Davis & Ackerman steering gear mechanisms and their applications.

UNIT- II **L-9**

INTRODUCTION TO CAMS: Cam profile generation - uniform velocity, uniform acceleration and simple harmonic motion.

GEAR & GEAR TRAINS: Gear nomenclature, Expression for arc and path of contact, Condition for avoiding interference; Simple, compound, reverted and epicyclic gear train and its applications.

UNIT- III **L-9**

DYNAMIC FORCE ANALYSIS: Introduction, Analytical method to find displacement, velocity and acceleration of the piston; Forces acting on piston, connecting rod and crank; Balancing of rotating and reciprocating masses, Balancing of single and cylinder reciprocating engines, Gyroscopic effect and its applications.

UNIT- IV **L-9**

GOVERNORS: Watt, Porter and Hartnell governors; Performance characteristics of governors.

BRAKES & CLUTCHES: Block brakes, Band simple and different band brakes, ABS, Uniform pressure and uniform wear theories, Single and multi-plate clutches.

UNIT- V **L-9**

VIBRATIONS: Introduction, Free Longitudinal Vibrations, Damped Vibrations - logarithmic decrement; Transverse vibrations, Free Torsional vibrations, Whirling speed of shafts, Single and two rotor systems.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS: 30**

1. To demonstrate Kinematic links, pairs, chains, mechanisms, Inversion of four bar mechanisms.
2. To perform kinematic analysis of Four bar and It's inversions using SAM/COMSOL.
3. To plot velocity diagram for four bar and slider crank mechanism.
4. To study Davis steering gear mechanisms using SAM/COMSOL.
5. To plot the characteristic curves of Watt, Hartnell and Porter governor.
6. To study the Static and dynamic balancing of rotating masses using ADAMS.
7. To determine unbalance mass required for complete balancing of rotor system.
8. To calculate the critical speed of shafts.
9. To estimate radius of gyration and the moment of inertia of connecting rod experimentally.
10. To determine the natural frequency of 1DOF systems.
11. To evaluate amplitude and phase angle of asystem subjected to forced vibrations.

TEXT BOOKS:

1. John J. Uicker, Gordon R. Pennock & Joseph E. Shigley, "Theory of Machines and Mechanisms", 4th edition, Oxford University Press, 2014.
2. S. S. Rattan, "Theory of Machines", 3rd edition, Tata McGraw-Hill, 2017.

REFERENCE BOOKS:

1. Thomas Bevan, "Theory of Machines" CBS publications, 2005.
2. R.K. Bansal and J.S. Brar, "Theory of Machines", Revised edition, Laxmi Publications, 2016.
3. R.S. Khurmi and J. K. Gupta, "Theory of Machines", 15th edition, S.Chand Publications, 2005.