MECHANISM AND MACHINE DESIGN

PE- IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
AAEB43	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Mechanism and Machine Design is the branch of engineering science, which deals with the study of relative motion between the various parts of machine and forces which act on them which leads to design of machines and parts of a machine. This course also discuss the effects of gyroscopic couple and power transmitting elements such as belt drives, cam and followers, gears and gear trains which play key role in in automobile, aerospace and allied engineering industries, industrial automation, design and construction of modern automatic machines.

II. OBJECTIVES:

The course should enable the students to:

I The concepts on four bar, single and double slider mechanisms and their inversions in analyzing the relative motions of links for engineering applications.

II The kinematic analysis of planar mechanisms using instantaneous and relative velocity methods for describing the position, velocity and acceleration of movinglinks.

III The effects of gyroscopic couples and rotating masses in designing of aircraft andmachine components.

IV The mechanisms of power transmission among the shafts using cams, belts, toothed gearing and Gear trains in aerospace and aligned engineering industries.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the mechanisms and their inversions based on pairs and jointsand mobility of mechanisms using Grumbler's and Grashaf's criterion for studying motion of machine elements in engineering applications.	Apply
CO 2	**Analyze** the planar mechanisms for position, velocity and accelerationusing instantaneous center method and graphical approach.	Analyze
CO 3	**Choose** the uniform velocity, simple harmonic motion and uniform acceleration, maximum velocity and acceleration during outward and return strokes effect of gyroscopic precession on the stability of vehicles	Apply
CO 4	**Illustrate** the gear tooth geometry and appropriate gear train for power transmission at desired speeds and new design of gear boxes inengineering applications	Understand
CO 5	**Make use of** the effect of gyroscopic couple for stabilization of ship, Aero-plane, two and four wheeler vehicles during steering, pitching androlling.	Apply
CO 6	**Explain** the methods for reducing undesirable effects of unbalanced masse, when rotating same or different planes using graphical and analytical methods when rotating same or different planes using graphical and analytical methods.	Understand

IV. SYLLABUS:

MODULE-I	MECHANISMS & MACHINES	Classes: 08

Elements of links, classification, rigid link, flexible and fluid link, types of kinematic pairs, sliding, turning, rolling, screw and spherical pairs, lower and higher pairs, closed and open pairs, constrained motion, completely, partially or successfully constrained, and incompletely constrained, mechanism and machines, classification, kinematic chain, inversion of mechanism, inversion of quadratic cycle, chain, single and double slider crank chains..

MODULE-II	KINEMATIC ANALYSIS OF MECHANISMS	Classes: 10

Instantaneous centre of rotation, centroids and axodes, relative motion between two bodies, three centres in line theorem, graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.
Velocity and acceleration, motion of link in machine, determination of velocity and acceleration diagrams, graphical method, application of relative velocity method for four bar chain, analysis of slider crank chain for displacement, velocity and acceleration.

MODULE-III	BELT DRIVES, AND CAMS AND FOLLOWERS	Classes: 10

Belt Drives: Types of Belts, Material used for Belts, Types of Flat Belt Drives, Velocity Ratio of Belt Drive. Length of Open Belt Drive. Power Transmitted by a Belt. Ratio of Driving Tensions for Flat Belt Drive. Centrifugal Tension. Maximum Tension in the Belt. Initial Tension in the Belt.

Cams and followers, definition uses, types, terminology, types of follower motion, uniform velocity, simple harmonic motion and uniform acceleration, maximum velocity and acceleration during outward and return strokes.

MODULE-IV	GEARS AND GEAR TRAINS	Classes: 09

Gears And Gear Trains: friction wheels and toothed gears, types, law of gearing, condition for constant velocity ratio for transmission of motion, velocity of sliding, form of teeth, cycloidal and involute profiles, phenomena of interferences.

Gear trains: Introduction, types, simple and reverted gear trains, epicyclic gear train; Methods of finding train value or velocity ratio of epicyclic gear trains

MODULE-V	GYROSCOPIC COUPLE AND PRECESSION MOTION AND BALANCING OF ROTATING MASSES	Classes: 08

Angular Motion: Gyroscopes - Processional Angular Motion; Gyroscopic Couple; effect of precession motion on the stability of moving vehicles such as motorcycle - motorcar - aero planes and ships.
Balancing of Rotating Masses;. Balancing of a Single Rotating Mass By a Single Mass Rotating in the same plane; Balancing of a Single rotating mass by two masses rotating in different planes; Balancing of several masses rotating in the same plane; Balancing of several masses rotating in different planes.

Text Books :

1. Amithab Ghosh, Asok Kumar Malik, "Theory of Mechanisms and Machines", East West Press Pvt Ltd, 2001.
2. S.S Ratan, "Theory of Machines", Tata McGraw-Hill, 4th Edition, 2014.
3. J. S. Rao, R.V. Dukkipati "Mechanism and Machine Theory / New Age Publications", 1996.
4. P. L. Ballaney, "Theory of Machines", Khanna Publishers, 3rd Edition, 2003

Reference Books:

1. Dr Jagdish Lal, J. M. Shaw "Theory of Machines", 1st Edition, 1985.
2. Abdulla Sharif, Dhanpat Rai, "Theory of Machines", 5th Edition, 1987,
3. Neil Sclater, P. Nicholas, Chironis "Mechanisms and Mechanical Devices Sourcebook", New York McGraw-Hill, publications, 3rd Edition.1963
4. J. E. Shigley, R. Charles, Mischke,"Mechanical engineering and design", TMH,1st Edition, 2003.

Web References:

1. https://en, wikipedia.org/wiki/Mechanism_(engineering)
2. https://en, wikipedia.org/wiki/Machine_(mechanical)
3. https://en, wikipedia.org/wiki/Crank_(mechanism)

E-Text Books:

1. https://engineeringstudymaterial.net/ebook/mechanisms-and-mechanical-devices-sourcebook/
2. https://accessengineeringlibrary.com/browse/mechanisms-and-mechanical-devices-sourcebook-fifth-edition
3. https://www,amazon,com/Mechanisms-Mechanical-Devices-Sourcebook-Fourth-ebook/dp/B0062Y 79H0#navbar