



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

THEORY OF MECHANISMS AND MACHINES								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AMED12	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisite: Engineering Mechanics								

I. COURSE OVERVIEW:

Mechanical devices are designed to have mobility to perform certain functions. The theory behind the study of Kinematics of Machine emphasizes to design machines by understanding the relationship between the geometry and the motion of various parts of machine. This course will provide the knowledge on how to analyze the motions and design synthesis of mechanisms to give required mobility. This includes relative motion analysis of gears by adopting analytical approaches to estimate displacement, velocity, and acceleration of links in a machine. This course is useful for balancing the four wheelers and Two wheelers to avoid skidding and reduce the vibrational damages.

II. COURSE OBJECTIVES:

The students will try to learn

- I. Kinematics from the geometric point of view to determine mobility, velocity and acceleration using graphical methods.
- II. The concepts of precision, static and dynamic forces of planer mechanisms by neglecting friction of aero planes, sea vessels, auto mobiles and various force members.
- III. The magnitude and direction of balanced mass for unbalanced rotary and reciprocating engines with the fundamentals of applied physics.
- IV. Mathematical modeling of various degree of freedom systems to interpret the various vibration parameters.

III. COURSE OUTCOMES:

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

- CO 1 Discuss the types of the kinematic synthesis for building a mechanism/Machine for mobility.
- CO 2 Illustrate the velocity and acceleration analysis of various mechanisms by relative velocity method and I Center method.
- CO 3 Illustrate the design function of gears and methods of evaluation for avoiding interference.
- CO 4 Discuss the Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero-planes and ships.
- CO 5 Determine the angle of heel to avoid upside down of a two-wheeler vehicle while taking in left and right turns
- CO 6 Determine the balanced mass and natural frequency for unbalanced rotary and reciprocating engines by analytical and graphical methods and equations of motion.

IV. COURSE CONTENT:

MODULE-I: MECHANISMS (09)

Mechanisms: Elements or links, classification, rigid link, flexible and fluid link, types of kinematic pairs types of constrained motion, kinematic chain, mechanism, machine, structure, inversion of mechanism, inversions of quadric cycle chain, single and double slider crank chains, mechanical advantage, Grubler's Criterion.

MODULE -II: VELOCITY AND ACCELERATION DIAGRAMS (10)

Velocity and acceleration, motion of link in machine, determination of velocity and acceleration, Graphical method,

application of relative velocity method, plane motion of body. Coriolis acceleration, determination of Coriolis component of acceleration.

MODULE -III: TOOTHED GEARS AND GYROSCOPIC EFFECT (10)

Law of gearing, condition for constant velocity ratio for transmission of motion, velocity of sliding, Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact of pinion and gear pinion and rack arrangements

Gyroscopes, effect of precessional motion on the stability of Aero-planes, Sea Vessel, Two-Wheeler and Four-Wheeler.

MODULE -IV: BALANCING (09)

Balancing: Balancing of rotating masses, single and multiple-single and different planes-balancing of reciprocating masses, primary and secondary balancing-analytical and graphical methods; unbalanced forces and couples, Locomotive balancing.

MODULE -V: MECHANICAL VIBRATIONS (10)

Free vibration, Damped Vibration, Forced vibration; Over damping, Critical Damping and Under Damping, Damping factor, Damping ratio, Vibration isolation and transmissibility, whirling of shafts, critical speeds, Torsional vibrations, Two and Three rotor systems.

V. TEXT BOOKS:

1. Thomas Bevan, "Theory of Machines", Pearson Education, 3rd edition, 2009.
2. S. S Ratan, "Theory of Machines", Tata McGraw-Hill, 4th edition, 2014.
3. R. L. Norton, "Kinematics and Dynamics of Machinery", McGraw-Hill, 1st edition, 2009.
4. P. L. Balleny, "Theory of Machines and Mechanisms", Khanna publishers, 49th edition, 2013.

VI. REFERENCE BOOKS:

1. J. S. Rao, R.V. Dukkipati, "Mechanism and Machine Theory", New Age Publication, 1st edition, 2013.
2. Uiker, Penock, Shigley, "Theory of Machines and Mechanisms", Oxford University Press, 4th edition, 2013.
3. R. S. Khurmi, Gupta, "Theory of Machines", S. Chand & Co, New Delhi, 14th edition, 2013.

VII. ELECTRONIC RESOURCES:

1. http://www.uobabylon.edu.iq/uobcolleges/ad_downloads/4_1293_515.pdf
2. http://ebooks.library.cornell.edu/k/kmoddl/toc_hartenberg1.html

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech-talk topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)