

## ANALYSIS AND SYNTHESIS OF MECHANISM

<b>CourseCode</b>	20ME6402	<b>Year</b>	II	<b>Semester</b>	II
<b>Course Category</b>	HONORS	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	4	<b>L – T – P</b>	3 – 1 – 0	<b>Prerequisites</b>	
<b>Continuous Internal Evaluation</b>	30	<b>Semester End Evaluation</b>	70	<b>Total Marks</b>	100

**Course Outcomes:** Upon successful completion of the course, the student will be able to

	<b>Statement</b>	<b>Skill</b>	<b>BTL</b>	<b>Units</b>
<b>CO1</b>	Understand the fundamentals of kinematics, linkage synthesis, relative position, velocity and acceleration of links, and coupler curves.	Understand	L2	1,2,3,4,5
<b>CO2</b>	Apply kinematics geometry to formulate and solve constraint equations to design linkages for specified tasks.	Apply	L3	2,3
<b>CO3</b>	Synthesis of multi-DOF systems using coupler curves	Apply	L3	5
<b>CO4</b>	Analyse relative position, velocity and acceleration of various four bar linkages.	Analyse	L4	2,4

**Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	3	2							1		2	3	2
<b>CO2</b>	3	3	2	2						1		2	3	2
<b>CO3</b>	3	3	2	2						1		2	3	2
<b>CO4</b>	3	3	2							1		2	3	2

**Syllabus**

<b>UNIT</b>	<b>Contents</b>	<b>Mapped COs</b>
<b>I</b>	<b>Kinematics of Mechanisms:</b> Introduction – kinematics and kinetics - Mechanisms and machines- applications of kinematics- identification of need, background research, Detailed design prototyping and testing, production. <b>Kinematics fundamentals:</b> Introduction, Degrees of Freedom (DOF), types of motion, links, joints and kinematic chains, Determining Degree of Freedom in Planar Mechanisms and in Spatial Mechanisms. Mechanisms and structures.	<b>CO1</b>
<b>II</b>	<b>Graphical linkage synthesis:</b> Introduction synthesis, Function, path, and motion generation, Dimensional synthesis, two position synthesis, three position synthesis with specified moving pivots. Quick return mechanisms. <b>Position Analysis:</b> Introduction coordinate systems position and displacement – Coordinate transformation. Translation, and rotation, Graphical position Analysis of linkages, The Four bar slider crank position solution, Position of any point on a linkage, Transmission angles, extreme values of the transmission angle.	<b>CO1, CO2, CO4</b>

<b>III</b>	<p><b>Analytical linkage synthesis:</b> Introduction, types of kinematic synthesis, Precision points, Two position motion generation by analytical synthesis, Three position motion generation by analytical synthesis, Synthesis for a specified fixed pivot location, Centre point and circle point circles, Four and five position analytical synthesis, Analytical synthesis of a path generator with prescribed timing analytical synthesis of Four bar function generator, Precision point methods.</p>	<b>CO1, CO2</b>
<b>IV</b>	<p><b>Velocity Analysis:</b> Introduction-definition of velocity, Graphical velocity analysis, instant centres of velocity, velocity analysis with instant centres, angular velocity ratio, Mechanical Advantage, using instant centres in linkage Design, The Four bar inverted slider crank.</p> <p><b>Acceleration Analysis:</b> Introduction definition of Acceleration Graphical Acceleration analysis, Analytical solutions for acceleration analysis, and the Four bar pin jointed linkage the Four bar slider-crank, Coriolis acceleration. The Four bar inverted slider crank.</p>	<b>CO1, CO4</b>
<b>V</b>	<p><b>The Euler Savary Equation and Cubic of Stationary Curvature:</b> The Euler Savary equation and the Inflection circle, The cubic of stationary curvature.</p> <p><b>Coupler Curves:</b> Coupler curves of four bar mechanism, Cognates of four bar mechanism, Designing optimum straight-line four bar linkages, single and double dwell linkages.</p>	<b>CO1, CO3</b>

### Learning Resources

#### Text books

- 1.Design of Machinery by RL. Norton, Tata McGraw Hill, 2009
- 2.[Theory of Machines by S. S. Rattan](#), Tata McGraw-Hill Education, 2014

#### Reference books

- 1.Mechanical Engineering Design by Shigley et al., Tat McGraw Hill, 2011
- 2.Mechanism Design by Arthur g Erdman Prentice Hall of india,1988
- 3.Amitabh Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines. E.W.P.Publishers
- 4.Theory Of Machines And Mechanisms By [P. L. Ballaney](#), [Kanna](#), 2003.