ADVANCED MECHANISM DESIGN
(Elective-I)

Subject Code: 13ME2109

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Pre requisites: Theory of machines

Course Educational Objectives:
1. To introduce fundamentals of kinematics of mechanism
2. To familiarise the student with the mathematical formula associated with the motion parameters of mechanisms
3. To inculcate the concept of planar mechanism synthesis
4. To introduce the Denavit – Hartenber of notation for spatial mechanisms

Course Outcomes:
The student will be able to
1. identify the kinematic chain in a given machine
2. analyze a complex mechanism for displacement velocity and acceleration
3. synthesise dimensionally a mechanism for a given task
4. analyze the static and dynamic forces on a mechanism
5. estimate the motion parameters of a robot using D-H notation

UNIT– I

Introduction – review of fundamentals of kinematics - analysis and synthesis – terminology, definitions and assumptions – planar, spherical and spatial mechanisms' mobility – classification of mechanisms – kinematic Inversion – Grashoff`s law

Position and displacement – complex algebra solutions of planar vector equations – coupler curve generation velocity – analytical methods - vector method – complex algebra methods – Freudenstein's theorem

UNIT– II

Planar complex mechanisms - kinematic analysis - low degree complexity and high degree complexity, Hall and Ault`s auxiliary point method – Goodman's indirect method for low degree of complexity mechanisms

Acceleration – analytical methods – Chase solution - Instant centre of acceleration. Euler-Savory equation - Bobillier construction

UNIT – III

Synthesis of mechanisms: Type, number and dimensional synthesis – function generation – two position synthesis of slider crank and crank-rocker mechanisms with optimum transmission angle – three position synthesis – structural error – Chebychev spacing - Cognate linkages – Robert-Chebychev theorem – Block's method of synthesis, Freudenstein's equation.

UNIT – IV

Static force analysis of planar mechanism – static force analysis of planar mechanism with friction – method of virtual work.

Dynamic force analysis of planar mechanisms - Combined static and inertia force analysis.

UNIT – V

Kinematics analysis of spatial revolute-Spherical-Spherical-Revolute mechanism – Denavit-Hartenberg parameters – forward and inverse kinematics of robotic manipulators.

TEXT BOOK :

1. Amitabh Ghosh and Ashok Kumar Mallik, "*Theory of Mechanisms and Machines*",3e, EWP, 1999.

REFERENCES:

1. Shighley Joseph Edward and Uicker John Joseph , "*Theory of Machines and Mechanism*" ,2e, McGraw Hill,1985.

2. Arthur G. Erdman and G.N. Sandor, "*Advanced Mechanism Design: Analysis and Synthesis*", Vol. I, PHI, 1984.

3. Arthur G. Erdman and G.N. Sandor, "*Advanced Mechanism Design: Analysis and Synthesis*", Vol. II, PHI, 1984.