MECHANISM AND ROBOT KINEMATICS

PROF. ANIRVAN DASGUPTA

Department of Mechanical Engineering

IIT Kharagpur

PRE-REQUISITES : Engineering Mechanics, Undergraduate Mathematics

INTENDED AUDIENCE : Mechanical, Electrical, Aerospace and Bio-Medical Engineering

INDUSTRIES APPLICABLE TO : Automobile and Aerospace industries, Automation and robotic device manufacturers, Bio-Medical device manufacturers

COURSE OUTLINE :

This course will be a foundation course in analysis of mechanisms and robots. After a brief introduction to the subject matter and terms, the audience will be taken from kinematic analysis of planar closed-loop chains to open loop chains. Under spatial kinematic chains, the analysis will cover closed-loop mechanisms, serial manipulators, and parallel manipulators. The course will dwell upon coordinate frames, Denavit-Hartenberg parametrization, coordinate transformations, direct and inverse kinematics, velocity and acceleration analysis, kinematic motion planning, singularities in kinematic chains, principle of virtual work and force analysis. The course will demonstrate various concepts by working out problems and exercises relevant to real life applications involving innovative mechanisms and robotic chains. The course is expected to help students and researchers in their basic understanding and use of kinematic analysis. This course will also pave way for more advanced courses on mechanism and robot dynamics and design

ABOUT INSTRUCTOR :

Prof. AnirvanDasGupta is a faculty in Mechanical Engineering at IIT Kharagpur since 1999. His interests are in the mechanics of discrete and continuous systems. Specifically, his current areas of research includes mechanics of inflatable structures, vibration induced transport, railway vehicle dynamics, and wave propagation in linear and non-linear media. He has extensively taught courses at undergraduate and postgraduate levels like Mechanics, Kinematics of Machines, Dynamics, Dynamics of Machines, Vibration Analysis, Wave Propagation in Continuous Media, and Railway Vehicle Dynamics.

COURSE PLAN :

Week 1: Introduction to Mechanisms and Robotics, Mobility Analysis-I

Week 2: Mobility Analysis-II, Displacement Analysis: constrained mechanisms and robots-I

Week 3: Displacement Analysis: constrained mechanisms and robots-II

Week 4: Displacement Analysis: constrained mechanisms and robots- III, Velocity Analysis: constrained mechanisms and robots-I

Week 5: Velocity Analysis: constrained mechanisms and robots-II

Week 6: Velocity Analysis: constrained mechanisms and robots-III

Week 7: Velocity Analysis: singularity and path generation,Acceleration Analysis, Force Analysis-I

Week 8: Force Analysis-II, Coordinate Transformations and kinematics of serial robots