INTRODUCTION TO ROBOTICS

DR. ASHISH DUTTA
Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 12 Weeks (18 Jan’ 21 - 09 Apr’ 21)

EXAM DATE : 25 Apr 2021

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : Basic Mathematics : matrices, differential equations

INTENDED AUDIENCE : Students (UG 3rd/4th year in Mechanical/Electrical/Computer Science), Teachers of engineering colleges, Industry professorial

INDUSTRIES APPLICABLE TO : All Manufacturing companies (TATA motors, Mahindra, Maruti, Hyundai, GE, GM, etc), IT companies (TCS, Infosys, etc), process industries using robotics

COURSE OUTLINE :
The course is intended as a first level introduction to robotics for students, teachers and industry personal. The course would cover the fundamental concepts and mathematics required to understand, analyze, design and control robotic manipulators for industrial applications or research. As robotics is a very wide field, after taking this course, students could then take more advanced courses/topics in focused areas like, motion planning, AI, unmanned vehicles, etc. Teachers could use this course to lay the foundation of other courses they teach involving robotics like, manufacturing automation, AI, Computer vision applications, etc.

ABOUT INSTRUCTOR :
Prof. Ashish Dutta obtained his PhD in Systems Engineering from Akita University, Japan, M.Tech from Jadavpur University and B.Tech from NIT Calicut. From 1994 to 2000 he was with the Bhabha Atomic Research Center, Mumbai where he worked on telemanipulator design and control for nuclear applications. Since 2002 he is with the department of mechanical engineering at IIT Kanpur, India. He was also a visiting professor in Nagoya University, Japan in 2006 and is currently a visiting professor at Kyushu Institute of Technology, Japan (2015 - ). His research interests are in the areas of humanoid robotics, motion planning in 3D, intelligent control systems and rehabilitation engineering.

COURSE PLAN :
Week 1: Introduction, Origin of automation, robot joints, classification of robots, work volume
Week 2: Vectors, spatial descriptions, rotation matrix, homogenous transformation matrix
Week 3: DH Parameters
Week 4: Forward Kinematics
Week 5: Inverse Kinematics
Week 6: Jacobian, Singularity, Manipulation ability
Week 7: Trajectory planning
Week 8: Statics and Dynamics of robotic manipulators
Week 9: Linear control of robot manipulators
Week 10: Force control
Week 11: Manipulator Mechanism Design
Week 12: Programming in VAL II