# INTRODUCTION TO ROBOTICS

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**TYPE OF COURSE :** New | Elective | UG/PG
**COURSE DURATION :** 12 Weeks (18 Jan' 21 - 09 Apr' 21)
**EXAM DATE :** 25 Apr 2021

**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