

Robotics and Industrial Automation

- 1.1 Course Number: CS367
- 1.2 Contact Hours: 3-0-0 Credits: 9
- 1.3 Semester-offered: 3rd Year-Odd
- 1.4 Prerequisite: NA
- 1.5 Syllabus Committee Member: Dr. Sushum Biswas, Dr. Daya Sagar Gupta & Dr. Gargi Srivastava
2. **Objective:** The objective of this course is to impart knowledge about basic mathematics related to industrial robots for their control, design and application in robotics & automation Industries.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction to Robotics	Types and components of a robot, Classification of robots, Kinematics systems; Definition of mechanisms and manipulators, Degrees of Freedom	5
2	Robot Kinematics and Dynamics	Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Forward and inverse kinematics, Jacobian, Singularity, and Statics Dynamic Modelling: Forward and inverse dynamics, Equations of motion using Euler-Lagrange formulation, Newton Euler formulation	5
3	Sensors	Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations Vision applications in robotics	5
4	Robot Actuation Systems	Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators	5
5	RobotControl	Basics of control: open loop- closed loop, Transfer functions, Control laws: P, PD, PID Linear and Non-linear controls	4
6	Control Hardware and Interfacing	Embedded systems : Microcontroller Architecture and	4

		integration with sensors, actuators, components, Programming Applications for Industrial robot - programming in – VAL II	
7	AI in Robotics : Applications in unmanned systems, defense, medical, industries, etc.	AI in Robotics : Applications in unmanned systems, defense, medical, industries, etc.	4
8	Robotics and Automation for Industry 4.0	Robotics and Automation for Industry 4.0	4
9	Robot safety and social robotics.	Robot safety and social robotics.	4
		Total	40

4. Readings

4.1 Textbook:

Introduction to Robotics : J. Craig , Pearson

- Robot Dynamics and Control, Spong & Vidyasagar, Mc Graw Hill

- Robotics Engineering : R. Klafter, PHI

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4.2 Reference books:

- Robotics : Subir K Saha , Mc GrawHill

- Industrial Robotics : M. P. Groover, Ashish Dutta , McGraw Hill

5 Outcome of the Course: After the completion of this course, the students will be able to:

Perform kinematic and dynamic analyses with simulation.

Design control laws for a simple robot.

Integrate mechanical and electrical hardware for a real prototype of robotic device.

Select a robotic system for given industrial application