Robotics	Code & No:	CS 464
	Credits:	3(3,0,1)
	Pre-requisite:	CS 320
	Co-requisite:	
	Level:	9/10

Course Description: An introduction to the fundamentals of robotics. Students will learn the fundamentals of robotics, including kinematics, inverse kinematics, Jacobian, velocity, configuration space, motion planning and path planning algorithms.

Course Aims:

1) Model the kinematics of robotic systems
2) Compute end-effector position and orientation from joint angles of a robotic system
3) Compute the joint angles of a robotic system to reach the desired end-effector position and orientation
4) Compute the linear and angular velocities of the end-effector of a robotic system from the joint angle velocities
5) Convert a robot's workspace to its configuration space and represent obstacles in the configuration space
6) Compute valid path in a configuration space with motion planning algorithms
7) Apply the generated motion path to the robotic system to generate a proper motion trajectory
8) Apply the learned knowledge to several robotic systems: including robotic manipulators, humanoid robots.

Course Learning Outcomes (CLOs):

1. Understand background of robotics and various types of robots
2. Study about physical structure , orientation of robots , joint angle movement

3. Study techniques for Computing the linear and angular velocities of the end-effector of a robotic system from the joint angle velocities
4. Able to apply the generated motion path to the robotic system to generate a proper motion trajectory
5. Apply the learned knowledge to several robotic systems: including robotic manipulators, humanoid robots.

No.	Topics	Weeks	Teaching hours
1	Introduction to Robotics	1	3
2	Representing positions and rotations	2	3

3	Rotational transformations and parameterizations of rotations	3	3
4	Homogeneous transformations, kinematic chains and DH convention	4	3
5	DH convention and forward kinematics	5	3
6	Inverse kinematics and angular velocity and Kinematics lab	6,7	6
7	The Jacobian matrix	8,9	6
8	Trajectory design and configuration space	10	3
9	Configuration space with examples and motion planning introduction	11	3
10	Motion planning: potential field and PRM ,Motion planning roadmap and motion planning review	12,13	6
11	Mobile robot, sensors and actuators	**14**	**3**
	Total	**14**	**42**

Textbook:

- Robot Modeling and Control by Mark M. Spong, Seth Hutchinso, and M. Vidyasagar (ISBN: 9780471649908)

Essential References:

- Robot Building for Beginners, 2nd Edition (Technology in Action) 2nd Edition by David Cook ISBN-13: 978-1430227489
- Introduction to Robotics by SK Saha , McGraw Hill publications **ISBN-10:** 0070140014,**ISBN-13:** 978-0070140011
- Robot Programming : A practical guide to behaviour based robotics, Joseph L Jones , McGrawHill company.