MULTI-FACULTY

INTENDED AUDIENCE : Undergraduate/graduate students interested in robotics
COURSE OUTLINE :
This course is a bridge-course for students from various disciplines to get the basic understanding of robotics. The mechanical, electrical, and computer science aspects of robotics is covered in this introductory course.

ABOUT INSTRUCTOR :
Prof. T Asokan is a Professor in the Department of Engineering Design, and currently the Head of the Department, at IIT Madras. He completed his B.Tech. and M.Tech. in mechanical engineering and received his Ph.D in Mechanical Engineering from the Indian Institute of Technology Madras. Prior to joining IIT Madras, he was with the Robotics Research Center, Nanyang Technological University, Singapore working in the area of robotic system development. He was awarded the Stanford-India biodesign fellowship by the Stanford University, USA in 2009 and has completed a post doctoral fellowship in medical device development at the Stanford University. He is currently the national secretary of The Robotics Society. He has more than 25 years of professional experience in research and teaching in the broad areas of Robotics, Product design, and Engineering System design. Dr Asokan has published more than 100 papers in International Journals and conferences and has filed 18 patents in India, USA, and Singapore. More details can be found at https://ed.iitm.ac.in/~asokan/

Prof Krishna Vasudevan is a professor in the department of electrical engineering at IIT Madras, with more than 25 years of professional experience. His area of specialization is drives and controls.

Prof. Balaraman Ravindran is currently an Professor in Computer Science at IIT Madras and Mindtree Faculty Fellow . He has nearly two decades of research experience in machine learning and specifically reinforcement learning. Currently his research interests are centered on learning from and through interactions and span the areas of data mining, social network analysis, and reinforcement learning.

COURSE PLAN :

Week 1**:** Introduction to robotics- History, growth; Robot applications- Manufacturing industry, defense, rehabilitation, medical etc., Laws of Robotics

Week 2**:** Robot mechanisms; Kinematics- coordinate transformations, DH parameters

Week 3**:** Forward kinematics, Inverse Kinematics

Week 4**:** Jacobians, Statics, Trajectory Planning

Week 5**:** Actuators (electrical)- DC motors, BLDC servo motors

Week 6**:** Sensors , sensor integration

Week 7**:** Control – PWM, joint motion control, feedback control

Week 8**:** Computed torque control

Week 9**:** Perception, Localisation and mapping

Week 10**:** Probabilistic robotics, Path planning, BFS; DFS; Dijkstra; A-star; D-star; Voronoi; Potential Field; Hybrid approaches

Week 11**:** Simultaneous Localization and Mapping

Week 12**:** Introduction to Reinforcement Learning