MEU 442: INTRODUCTION TO ROBOTICS

Syllabus:

Module I: (11 Hours)

Introduction to robotics, classification of robots, workspace analysis, Manipulator Kinematics: Convention for affixing frames to links – DH Representation, Derivation of Direct kinematic equations for various types of robots. Inverse Manipulator Kinematics: Solvability, algebraic vs. geometric, Pipers solution when three axes intersect, Examples of inverse manipulator kinematics, repeatability and accuracy.

Module II: (11 Hours)

Jacobians: Velocities and static forces: Linear and rotational velocity of rigid bodies, velocity propagation from link to link, jacobians, singularities, static forces in manipulators, jacobians in force domain, Cartesian transformation of velocities and static forces.

Module III: (10 Hours)

Trajectory Generation: General consideration in path description and generation, joint space schemes, collision free path planning, Robot programming.

Module IV: (10 Hours)

Sensing and vision – range sensors, proximity sensors, touch sensors, force and torque sensors – Low level and high-level vision. Robot intelligence and task planning.

Reference Books:

MEU 442: INTRODUCTION TO ROBOTICS

Course Schedule:

Module I: (11 Hours)
1. Introduction to robotics
2. Classification of robots
3. Workspace analysis
4. Manipulator Kinematics
5. Convention for affixing frames to links – DH Representation
6. Derivation of Direct kinematic equations for various types of robots.
7. Inverse Manipulator Kinematics: Solvability, algebraic vs. geometric
8. Pipers solution when three axes intersect
9. Examples of inverse manipulator kinematics
10. Repeatability and accuracy
11. Tutorial #1

Module II: (11 Hours)
1. Velocities and static forces: Linear and rotational velocity of rigid bodies
2. Velocity propagation from link to link
3. Jacobians,
4. Singularities
5. Static forces in manipulators
6. Tutorial #2
7. Jacobians in force domain
8. Cartesian transformation of velocities and static forces.
9. Tutorial #3
10. Introduction to Manipulator Dynamics
11. Different formulation methods (Newton-Euler’s and Lagrangian methods)

Module III: (10 Hours)
1. Introduction to Trajectory Generation
2. General consideration in path description and generation
3. Joint space schemes
4. Cubic Polynomial and Parabolic blend schemes
5. Tutorial #4
6. Introduction to Collision free path planning
7. Collision free path planning methods
8. Introduction to Robot programming
9. Types of Robot programming
10. Examples and present trends in robot programming

Module IV: (10 Hours)
1. Introduction to Robot Sensing
2. Range sensors
3. Proximity sensors and touch sensors
4. Force and torque sensors
5. Introduction to Robot Vision
6. Low level and high-level vision
7. Introduction to Robot actuators
8. Introduction to Robot Control
9. Robot intelligence and task planning
10. Recent developments in Robotics

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Evaluation Policy:

Test I (15) + Test II (15) + Assignment (15) + Mini Project (15) + End Semester (40) = Total (100) marks

Detailed split-up of marks

Test I : (From Module I and little bit of II) 15 marks
Test II : (From Module II and III) 15 marks
Writing Assignment 08 marks
Coding Assignment 07 marks
Mini Project
  Project completion and effort 05 marks
  Team work and coordination 03 marks
  Creativity and innovation 03 marks
  Presentation and Report 04 marks
End Semester (Entire course syllabus covered)
  Fundamentals of Robotics and Allied topics 20 marks
  Case study based on this course 20 marks

Grading Policy:

Absolute grades only will be considered to this course.

Grade Details:

S : 90 – 100 marks
A : 80 – 89 marks
B : 70 – 79 marks
C : 60 – 69 marks
D : 50 – 59 marks
E : 40 – 49 marks
F : 0 – 39 marks

For further Details contact Course instructor or Teaching Assistant:

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