Postgraduate Certificate in Mechanical Engineering

Robotics and Automation

Robotics and Automation are key areas of study in the Postgraduate Certificate in Mechanical Engineering. This explanation will cover some of the key terms and vocabulary related to these fields.

1. Robot: A robot is a programmable, automated machine designed to perform a variety of tasks with high precision, accuracy, and repeatability. Robots can be classified into different types based on their functions, such as industrial robots, service robots, and collaborative robots.
2. Automation: Automation refers to the use of technology and machines to perform tasks without human intervention. Automation can be achieved through various methods, including robotics, sensors, control systems, and software.
3. Industrial Robot: An industrial robot is a type of robot designed for manufacturing and industrial applications. These robots are typically programmed to perform tasks such as welding, painting, assembly, and material handling.
4. Servo Motor: A servo motor is a type of motor used in robotics and automation to provide precise position control. Servo motors are typically controlled by feedback systems that monitor the motor's position, velocity, and acceleration.
5. Control Systems: Control systems are used in robotics and automation to regulate the behavior of machines and systems. Control systems can be classified into open-loop and closed-loop systems, depending on whether or not they use feedback to regulate the system.
6. Sensors: Sensors are used in robotics and automation to detect and measure physical quantities, such as position, velocity, temperature, and force. Sensors can be classified into various types, including proximity sensors, vision sensors, and force sensors.
7. Artificial Intelligence (AI): Artificial intelligence (AI) refers to the development of intelligent machines that can think and learn like humans. AI is used in robotics and automation to enable machines to make decisions based on data and feedback.
8. Machine Learning (ML): Machine learning (ML) is a type of AI that enables machines to learn and improve their performance by analyzing data and feedback. ML algorithms are used in robotics and automation to enable machines to recognize patterns, classify objects, and make predictions.
9. Deep Learning (DL): Deep learning (DL) is a type of ML that uses artificial neural networks to analyze and process large amounts of data. DL algorithms are used in robotics and automation to enable machines to perform complex tasks, such as image and speech recognition.
10. Robot Operating System (ROS): The Robot Operating System (ROS) is an open-source software framework for robotics that provides a set of tools and libraries for building and programming robots. ROS is used in robotics and automation to enable machines to communicate and collaborate with each other.
11. Computer Vision: Computer vision refers to the ability of machines to interpret and understand visual information from the environment. Computer vision is used in robotics and automation to enable machines to recognize and identify objects, track movements, and navigate spaces.
12. Motion Planning: Motion planning refers to the process of determining the optimal path for a robot to

move from one point to another. Motion planning is used in robotics and automation to enable machines to navigate complex environments and avoid obstacles.
13. Kinematics: Kinematics is the study of motion without considering the forces that cause the motion. Kinematics is used in robotics and automation to describe the motion of robots and develop mathematical models to predict and control their behavior.
14. Dynamics: Dynamics is the study of the forces that cause motion. Dynamics is used in robotics and automation to develop models that predict and control the behavior of robots under different forces and loads.
15. Mechatronics: Mechatronics is the integration of mechanical, electrical, and computer engineering to design and build intelligent machines. Mechatronics is used in robotics and automation to develop machines that can perform complex tasks with high precision and accuracy.

Example:
Consider a manufacturing plant that uses industrial robots for assembly and welding tasks. The industrial robots are equipped with servo motors, sensors, and control systems to perform precise and accurate movements. The robots are programmed using the Robot Operating System (ROS) and use computer vision to recognize and identify objects on the assembly line. The robots use motion planning and kinematics to navigate the assembly line and avoid obstacles, while dynamics and mechatronics are used to develop mathematical models that predict and control the behavior of the robots under different forces and loads.

Challenge:
Program a simple industrial robot to perform a pick-and-place task using the Robot Operating System (ROS) and computer vision. The robot should be able to recognize and identify objects on the assembly line, plan a path to pick up the object, and place it in a designated location. The robot should also be able to avoid obstacles and adjust its movements based on feedback from sensors and control systems.

In conclusion, robotics and automation are fields that involve the use of technology and machines to perform tasks without human intervention. The key terms and vocabulary related to these fields include robots, automation, industrial robots, servo motors, control systems, sensors, AI, ML, DL, ROS, computer vision, motion planning, kinematics, dynamics, and mechatronics. Understanding these terms and concepts is essential for successful implementation and operation of robotics and automation systems.