

Advanced Robotics Principles

Robotics · Practice Test · 25 Questions

1. In a robotic arm, what is the primary function of a Denavit-Hartenberg (D-H) parameter set?

- A) To calculate motor torque efficiency
- B) To describe the geometric relationship between adjacent links
- C) To calibrate the tactile sensor feedback loop
- D) To determine the maximum electrical power consumption

2. Which control loop architecture calculates the error as the difference between the setpoint and the measured process variable?

- A) Open-loop control
- B) Feed-forward control
- C) PID control
- D) Bang-bang control

3. What is the purpose of the 'Jacobian matrix' in robotic manipulator kinematics?

- A) To map joint velocities to end-effector velocities
- B) To determine the material fatigue of the robotic chassis
- C) To optimize the wireless signal transmission frequency
- D) To store the memory addresses of the firmware

4. In sensor technology, what physical phenomenon does an LVDT (Linear Variable Differential Transformer) measure?

- A) Light intensity
- B) Displacement
- C) Atmospheric pressure
- D) Chemical composition

5. Which type of motor is most commonly used in robotics for high-precision positioning where the rotation is divided into individual steps?

- A) Brushed DC motor
- B) Induction motor
- C) Stepper motor
- D) Universal motor

6. What is the term for the set of all possible positions and orientations an end-effector can reach?

- A) Configuration space
- B) Workspace
- C) Singularity point
- D) Joint limit zone

7. In inverse kinematics, what is a 'singularity' in a robotic arm?

- A) A configuration where the robot loses one or more degrees of freedom
- B) The exact moment the battery power depletes
- C) A state where the robot exceeds its maximum speed
- D) The point where the robot reaches its maximum load capacity

8. Which communication protocol is most frequently used for intra-robot communication between microcontrollers and sensors due to its 'master-slave' I2C-like efficiency?

- A) USB 3.0
- B) RS-232
- C) CAN bus
- D) HDMI

9. What does the 'Degrees of Freedom' (DoF) of a robotic system represent?

- A) The number of independent joints or axes of movement
- B) The voltage range of the power supply
- C) The number of lines of code in the software
- D) The speed of the processor

10. In an H-bridge motor driver circuit, what is the primary purpose of the 'flyback' (or freewheeling) diodes?

- A) To increase the current flow
- B) To protect the circuit from voltage spikes when the motor stops
- C) To convert DC to AC current
- D) To measure the rotational speed

11. Which type of robot configuration is specifically defined by three prismatic joints aligned with Cartesian axes?

- A) SCARA robot
- B) Delta robot
- C) Gantry robot
- D) Articulated robot

12. What is the primary function of an encoder in a robotic joint?

- A) To convert electrical signals into physical heat
- B) To provide feedback on the position or speed of the motor
- C) To increase the gear ratio of the transmission
- D) To act as a secondary power source

13. Which control strategy focuses on the response of the system based on the history (integral) and the rate of change (derivative) of the error?

- A) Proportional control
- B) PID control
- C) On-Off control
- D) Logic gate control

14. What is the main advantage of a SCARA (Selective Compliance Assembly Robot Arm) robot design?

- A) High flexibility in all six directions
- B) Rigidity in the vertical axis while being compliant in horizontal planes
- C) Ability to operate underwater
- D) Minimal requirement for electrical shielding

15. In computer vision for robotics, what is the 'Canny' algorithm primarily used for?

- A) Color correction
- B) Edge detection
- C) Image compression
- D) Facial recognition

16. Which mechanical component is used to convert the high-speed, low-torque output of a motor into low-speed, high-torque motion?

- A) Transistor
- B) Gearbox
- C) Potentiometer
- D) Capacitor

17. What does 'PWM' stand for in the context of robotic motor speed control?

- A) Pulse Width Modulation
- B) Power Wave Modulation
- C) Phase Wire Measurement
- D) Proportional Weight Monitor

18. In robot path planning, what is the 'A*' (A-star) algorithm primarily designed to solve?

- A) Collision detection
- B) Shortest path finding
- C) Motor heat dissipation
- D) Sensor calibration

19. Which type of sensor detects the presence of an object without physical contact by using an electromagnetic field?

- A) Limit switch
- B) Inductive proximity sensor
- C) Force transducer
- D) Strain gauge

20. What occurs in a 'deadlock' state within a multi-robot system?

- A) Batteries are fully drained
- B) Each robot is waiting for another to perform an action, resulting in total inactivity
- C) The sensors provide faulty data
- D) The communication frequency exceeds the threshold

21. What is the primary purpose of a 'Watchdog Timer' in a robot's embedded system?

- A) To record the time of operation
- B) To reset the system if the software hangs or freezes
- C) To measure the battery discharge rate
- D) To act as a secondary CPU

22. Which law defines the relationship between force, mass, and acceleration, essential for calculating robot dynamics?

- A) Ohm's Law
- B) Newton's Second Law
- C) Hooke's Law
- D) Kirchhoff's Law

23. What is a 'cobot' designed to do?

- A) Operate independently in space without human oversight
- B) Work collaboratively with humans in a shared workspace
- C) Function solely in hazardous chemical environments
- D) Perform surgical tasks with zero human supervision

24. Which material is most commonly used for robotic structural links due to its high strength-to-weight ratio?

- A) Lead
- B) Aluminum alloy
- C) Pure copper
- D) Oak wood

25. In the context of robotic gripper design, what is 'under-actuation'?

- A) A system with more actuators than joints
- B) A system where there are fewer actuators than degrees of freedom
- C) A system that requires no power to function
- D) A system that relies entirely on magnetic adhesion