Chapter 3 Review Questions Answer Key

1. What is the difference between AC and DC electricity?

   A: Electrons can either flow in one direction, which we call direct current (DC) or it can flow back and forth in a circuit, which we call alternating current (AC).

2. One amp is equal to _____ electrons flowing past a measured point in 1 second.

   A: 6.25×10^{18}

3. What could happen if you reverse the polarity of DC components?

   A: With some components, such as switches or resistors, reversing the polarity of flow through the device has no effect. However, doing this to other components, such as solid-state devices or motors, can cause the component to run backwards, block electron flow, or even cause permanent damage to the device.

4. How would you connect a group of batteries to increase both the voltage and the amp-hours?

   A: It would be a combination of series groups of batteries for voltage and parallel connections of these groups to increase the amp-hours.

5. Describe what happens to AC power through one complete cycle.

   A: The AC power starts at zero, rises to a positive value, drops back to zero, falls to a negative value, and then rises to zero once more.

6. What is the difference between single-phase AC and three-phase AC?

   A: Single-phase AC is AC power that has one sine wave provided to the system via a single hot wire and returned on a neutral wire. Three-phase AC is AC power that has three sine waves 120° apart electrically.

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7. List at least three things to remember when dealing with hydraulic leaks.

   A: Hydraulic oil from a running system may be hot enough to burn skin, so try to avoid direct contact until you are sure it is safe. If a hydraulic oil puddle is uncontrolled, it can cover a much larger area than you might think. There are special barrier and damming devices that can help to control large spills. Leaks that generate an oil mist can also be a fire and breathing hazard. Most hydraulic oils are stable and take a lot of heat to ignite, except when dispersed as a mist in the air. Cleaning up hydraulic oil usually requires the use of some type of absorbing medium. You do not want to let hydraulic oil go down any drains connected to the sewer system as it is a contaminant and will wreak havoc at water treatment facilities or any natural waterways it might reach. When finished with the cleanup, make sure you dispose of any oil and oil soaked materials properly.

8. What do we have to be careful of when venting pneumatic power and how do we avoid these dangers?

   A: When we vent the used air, we need to be careful of two things: one, it is often a very loud process and two, we need to watch for small particles that can become airborne due to the pressure of the escaping air. Use a muffler.

9. Describe the operation of a pneumatic robot controlled by a drum.

   A: The pegs on the drum rotate around and make various combinations of contacts or actuators to control how the robot moves, with the timing controlled by the speed the drum rotated and peg placement. The cylinders extend until the robot hits a hard stop, preventing further motion. Because the cylinder is still

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under full pressure, this all but eliminates the issues encountered with mid-stroke positioning for air systems.

10. What is the function of the robot controller?

    A: The controller for the robot is the brains of the operation and the part of the robot responsible for executing actions in a specific order and timing, or under specified conditions.

11. What is the difference between an open-loop control system and a closed-loop control system?

    A: Open-loop control systems send out signals and assumes they are followed. Closed-loop systems get some form of feedback that verifies the commanded action occurred.

12. What is artificial intelligence in the context of robotics?

    A: The ability of a computer program to make decisions where there is no clear-cut right answer or to learn from previous events.

13. List four things the robot controller is responsible for.

    A: Possible answers include: power distribution, storing and executing program data, memory management, processing information from various sources, controlling servos, performing diagnostics, monitoring inputs and controlling outputs, and interfacing with other machines and networks exterior to the robot.

14. What are some of the things we can do with the teach pendant?

    A: The teach pendant allows the operator to view alarms, make manual movements, stop the robot, change the program or start a new program, and any of the other day-to-day tasks required of those that run robots.

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15. Why does the dead man's switch kill the robot's manual actions when released or pressed too hard?

    A: When something goes wrong, your reaction is often to either let go or grip the switch too tight, thus the reason these actions stop all movement.

16. What is the benefit of having more degrees of freedom in a robot?

    A: The more degrees of freedom (DOF) a robot has, the more complex and organic the movements.

17. How do we number the axes of an arm-style robot?

    A: We commonly start at the base and number outward toward the end-of-arm tooling.

18. What are the two main groupings of axes and what is the function of each?

    A: The major axes and the minor axes. The major axes are responsible for getting whatever tool we are using into the general area it needs to be in, while the minor axes are responsible for the orientation and positioning of that tool.

19. What do we call axes 4, 5, and 6 in most arm-style robots?

    A: Axis 4 is pitch, axis 5 is yaw, and axis 6 is roll.

20. Do we include external axes in our DOF count? Why?

    A: No. Since external axes are not part of the manipulator, we do not include them in our DOF count.

21. What is the best way to identify axis 1 in a delta-style robot?

    A: Use the teach pendant to manually move the robot in joint mode, which moves only one motion axis of the robot at a time, and moves axis 1.

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22. What is the recommended method to identify the axis of the robot when you encounter one you are not familiar with or you forget the conventional numbering methods?

    A: Simply put the robot in manual and use joint motion to identify each specific axis.

23. What are some of the key points to remember when solid-mounting robots?

    A: Make sure whatever holds the robot in place is robust enough to bear the forces and/or weight of the system. Make sure what you mount the robot on can handle the weight of the system *AND* whatever load it will be maneuvering. Make sure to check the security/tightness of any mounting hardware periodically, paying special attention to any wear noted. Crashes are conditions where the robot is subject to unexpected stopping or forces, so make sure to check the base when you are inspecting the system, especially for wall or overhead mounts.

24. What are gantry bases?

    A: The name comes from their similarity to the gantry robot as far as the movement is concerned and usually consists of a rigid track the robot moves back and forth along.

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