

EML2322L Background Research Quiz

Answer the questions using [background research information presented on the course website](#). You are assigned to work with [ONE other student](#) on this quiz (please only submit one copy). Circle all correct answers on multiple choice questions (i.e. each may have more than one correct answer). Only clearly written responses will be graded. Please staple pages together before submission.

Which of the following statements is (are) true?

- A. the simplest type of electric DC motor is the brushless-type
- B. brushed-type motors are less efficient than brushless motors
- C. brushed-type motors are more expensive than brushless-type
- D. the rotating portion of an electric motor is called the armature or rotor
- E. the part of a brushed motor that reverses polarity each half turn is called the sequencer

Which of the following statements is (are) true?

- A. brushed motors can easily control speed and torque without the use of an electronic speed control (ESC) unit
- B. brushed-type motors are compatible with the control box used for the course project
- C. brushless-type motors are compatible with the control box used for the course project
- D. servo-type motors are compatible with the control box used for the course project
- E. stepper-type motors are compatible with the control box used for the course project

Linear actuators use screw-type mechanisms to convert _____ electric motor output to _____ motion.

What power source do the laboratory control boxes use? _____

The control box must attach using _____ mounting flange(s) and cannot be used to _____ other parts of the robot.

Name #1: _____

Lab Periods (e.g. T5-6): _____

Name #2: _____

Lab Periods (e.g. T5-6): _____

The laboratory controllers provide _____ relay and _____ proportional channels of control.

Relay control is either _____ or _____, meaning it can cause a motor to rotate _____ or _____ at the rated speed of the motor.

Proportional control can vary the _____ and _____ of a motor.

Proportional controls are often used for:

Which of the following statements is (are) true?

- A. three wheel platforms possess the fewest wheels required for balance without a complex systems of sensors and logic.
- B. simple four wheel platforms without complex suspension systems can experience traction issues three wheel platforms do not
- C. three wheel platforms offer superior stability at higher speeds
- D. tracks offer superior traction on harder surfaces, like concrete
- E. none of the above

Circle the design action that results in a more stable robot geometry:

- A. increase / reduce the CG height
- B. minimize / maximize the distance between the CG location and the roll axes
- C. decrease / increase the mass of the robot

Which of the following statements is (are) true?

- A. differential steering is less complex than rack & pinion steering
- B. differential steering is less controllable than rack & pinion steering at higher speeds
- C. differential steering is used in most modern automobiles produced in the last 20 years
- D. for best maneuverability the steering wheels should be positioned closer to the item(s) being manipulated

Caster wheels have their own mounting axle and are typically free to pivot about a second, nearly _____ axis.

Which is the most common type of wheel for lighter weight robotic platforms, like those built in this course?

- A. pneumatic wheel
- B. semi-rigid wheel
- C. solid wheel

Plastic on concrete has a friction coefficient that is roughly half / twice that of rubber on concrete.

Last semester several robot designs were unable to traverse the ramps leading into the arena.

Circle the design action(s) that would have helped the traction problem:

- A. add / remove weight to their robots to increase the normal load on the drive wheels
- B. choose drive wheels materials with higher / lower friction coefficients
- C. paid less / more attention to this background research assignment 😊

Which of the following statements are correct about ball / bucket manipulators?

- A. the two common types are fixed and moveable manipulators / grippers
- B. moveable grippers require an extra motor to control the moveable part of the mechanism
- C. a forklift is a common example of a moveable gripper
- D. fixed grippers require more accurate / sensitive positioning on the part of the driver

Which of the following statements are correct about ball hoppers?

- A. the two common types are fabricated and prefabricated (i.e. purchased)
- B. buckets and plastic containers are examples of prefabricated hoppers
- C. fabricated hoppers can be designed to meet exact geometry and strength needs
- D. a good designer considers the time and cost necessary to manufacture a custom hopper

List three common methods of sorting balls:

1. _____
2. _____
3. _____

The purpose of gears is to exchange _____ for _____ or vice-versa.

Which of the following statements are correct about design project / process used in DML?

- A. DR1 (design report #1) is where each student researches and presents their best individual ideas for solving the design problem
- B. DR2 is where each group compares their members' individual concepts and selects the best of each for their final design
- C. DR3 is where most of the detailed design and analysis work are performed to figure out how to make the selected concept work
- D. DR4 is where we take an unbiased look at how your group's design performed during the course competition

Match each gear type to its purpose:

| <i>Gear Type</i> | <i>Purpose</i> |
|------------------------|--|
| ___ 1. helical | A. most common type of gear with straight teeth and gears mounted on parallel shafts |
| ___ 2. bevel | B. angled gears for gradual engagement of teeth |
| ___ 3. spur | C. typically used for changing the direction of a shaft's rotation |
| ___ 4. rack and pinion | D. use when significant gear reductions are required, like on conveyors |
| ___ 5. worm | E. convert rotational motion into linear motion |

Match each property to its definition:

| <i>Property</i> | <i>Definition</i> |
|----------------------|---|
| ___ 1. density | A. the amount of money required to purchase and manufacture a particular part |
| ___ 2. cost | B. the ability of a material to withstand an applied stress without failure |
| ___ 3. weldability | C. the resistance of an elastic body to deformation by an applied force |
| ___ 4. ductility | D. the ability of a material to deform before fracture by tensile stress |
| ___ 5. machinability | E. the ratio of a material's mass per unit volume |
| ___ 6. stiffness | F. the ability of a material to be permanently joined to a separate piece of identical material using the application of intense heat |
| ___ 7. strength | G. the ability of a material to be machined to particular tolerance and surface finish requirements |

Match each gear type to its application:

| <i>Gear Type</i> | <i>Application</i> |
|------------------------|-------------------------|
| ___ 1. spur | A. steering, scales |
| ___ 2. helical | B. electric screwdriver |
| ___ 3. bevel | C. car differentials |
| ___ 4. worm | D. conveyor system |
| ___ 5. rack and pinion | E. car transmissions |

Match each material to its application:

| <i>Material</i> | <i>Application</i> |
|-----------------|--|
| ___ 1. steel | A. constructing hoppers and ball sorting mechanisms, which see no significant loading. |
| ___ 2. aluminum | B. often used as structural support in buildings |
| ___ 3. plastic | C. often used in boats, furniture and flooring |
| ___ 4. wood | D. often used in aircraft, automobiles, and bicycle frames |
| ___ 5. 80-20 | E. often used to construct robot frames and prototyping |

Match each material to its property:

| <i>Material</i> | <i>Property</i> |
|-----------------|---|
| ___ 1. steel | A. can be cast, pressed, extruded and machined easily |
| ___ 2. aluminum | B. its high ductility, strength, and weldability make it suitable for making rigid parts with moderate mass |
| ___ 3. plastic | C. highly modular material that makes rapid prototyping structures and mechanisms convenient |
| ___ 4. wood | D. has a relatively high machinability among metals |
| ___ 5. 80-20 | E. naturally occurring composite that can be used for moderate loads |