

2014 Monster Truck Challenge

Design Challenge:

The student will design and build a Monster Truck with a suspension and drive train for an all wheel drive vehicle that will be able to overcome various terrain obstacles.

Objectives:

In the participation and the development of this project students will:

- Work with tools to process materials and assemble a product
- Incorporate design and engineering techniques
- Incorporate problem solving techniques
- Better understand Newton's Laws of Motion
- Better understand the characteristics of electric circuits
- Understand the characteristic of a Monster Truck Suspension
- Apply mathematical calculations and measurements
- Work individually and cooperatively

Constraints:

- Students must use project materials assigned and/or approved by the instructor; which may include but not limited to:
 - Tires and Wheels
 - Motor (1 or 2)
 - O-Rings
 - Axle Material
 - Springs
 - Traction Material
 - Motor Mounts
 - Plastic Tubing
 - Misc. Screws, Nuts and Washers
 - Sintra (plastic pvc base)
 - Wire
 - Drive Pulleys
- The vehicle must be four-wheel drive.
- The vehicle must provide 2 wires extending through the top of the body in order to connect to the overhead power cable / clips.
- The maximum vehicle width, including wheels, cannot exceed 8".
- The maximum tire diameter cannot exceed 3 ½".
- The maximum vehicle length, including wheels, cannot exceed 10".
- The wheelbase can be no less than 4", measured center-to-center of wheels.
- There is no vehicle height requirement.
- The body wheel wells profile must align to the center of the wheels within ½" center-to-center. Vertically aligned horizontally measured.
- Body width must be proportional to give the true monster truck stereo type distorted appearance of wheel width to body width ratio.
- The vehicle must have a body which will be designed and built using only vacuum formed plastic or paper and matte board. No die-cast models or other forms of body material can be used.
- Since this is a Monster Truck Challenge the vehicle body must resemble a style of truck, examples: pick-up, semi, delivery van, and/or school bus. Instructor must approve the body style before design and construction.

Safety First:

Be careful and avoid injury when working with tools. Follow all safety procedures and guidelines for each tool as provided for by the instructor and identified in the fabrication lab.

Basic Design, Build and Assembly Information:

- Keep in mind mounting points to the chassis. Read and listen to all instructions carefully first.
- Identify each of the material components provided and possible purposes they will serve.
- Brainstorm ideas for your vehicle design and placement of components.
- Draw preliminary sketches for the truck design showing locations of components and how it will work. **Note:** More views makes for an easier build.
- Select the best design from your preliminary sketches.
- Create a 3D Solid Model Assembly – Inventor .iam and .ipt files.
- Adjust body drawing to match chassis specifications. (stretch and scale)
- If making a body with paper and matte board. Design / color print body fold outs on paper. Construct, fold, and glue body into shape of vehicle utilizing matte board for internal structural strength as you assemble the body structure. Keep in mind mounting points to the chassis.
- If making a body using the Vacuum Form machine. Design the shape of your body in Inventor and convert drawing to AutoCAD (show all views). Cut out foam model with band saw and shape into the desired vehicle profile. Instructor will help student with vacuum forming procedures.
- Create 2D IDW with dimensions for all components to be made by you.
- Fabricate or alter parts per drawing dimensions in the Fab Lab. (quality and precision of each part will ensure a smooth and functional assembly process)
- Assemble parts.
- Pre-test vehicle and make needed adjustments to the suspension and power transmission systems.
- Mount vehicle body to the chassis and provide for quick release. (4) points.
- Modify if necessary and retest.

Official Testing / Grading:

Testing:

- The vehicle may be unofficially tested as much as needed without penalty. Upon deadline, vehicle **MUST** be tested.
- Student must state “**official run**” before a scored run. This must be witnessed by the instructor.
- Vehicle must complete the entire course for full points. The course surface and obstacles will vary somewhat due to positional change and prior runs. Thus the challenge will be variable and have a range of difficulty.
- Completing the course:
 - Start vehicle with four wheels on the start platform. Vehicle must travel to the end platform and rest with all four wheels on the end platform (no wheel can be in the last obstacle section) to be considered a completed run. At no time may the vehicle be touched or interfered with in any way.
 - Overruns or falloffs will be considered incomplete runs.
 - Course must be completed in less than 60 seconds.

Grading:

- Points will be earned and calculated by completing sections of the test track. Each test section is valued at 6.25 points. Number of sections completed will be multiplied by 6.25. There are 16 sections for a total of 100 points.
 - Contestants must attempt / complete (3) three runs. The sum of the total points of three runs will be averaged and this will be the total score for testing.
 - Points for each section are earned by having all four wheels in the section, breaking the plane of the next section with the wheels (not the body) will earn half a section points. Scores will be entered into the spread sheet as completed sections and automatically calculated by the spread sheet.
 - Overruns or falloffs will be considered incomplete runs. Falloff / overrun at the end platform will earn 87.5 points. No reversal extra credit attempt will be allowed. Falloff mid course will earn the point at which the falloff occurred minus 12.5 points. (watch your throttle control)
 - The design and build of the monster truck are each worth 100 points. The total project is total **points earned / 300**
 - Extra credit is earned by reversing the course **from the finish platform untouched**. You may only attempt extra credit once. You may not touch the vehicle in any way to reset the position for the reverse run. Run must be attempted from final resting position. Points will be added to the total score as follows. Each completed section will be worth 25% of its original value. This total will be added to your final averaged sum of three runs.
 - Racing speed extra credit. A 10% bonus grade will be added to the performance sum for the fastest speed in class. (bracket racing) First to the end wins in all heats.

The Monster Truck Challenge Cup

The ultimate winner between classes in an optional afterschool event will earn a custom trophy and bragging rights until the next Challenge Cup year. Each vehicle entered will require a \$5 entry fee and the cost per driver for pizza and soda. Vehicle owners may not assign a designated driver to race their vehicle if they cannot attend the evening event. "NO DRIVER.....NO RACE"

References:

- Refer to pictures of previous models located on the network drive to serve as hints in designing suspension and power transmission systems. Students are encouraged to develop their own designs.
- Review the models built by the instructors and former students.
- Search the WEB for suspension ideas.
- Refer to the provided pages for other suspension ideas. These are merely ideas as there are many options and very few limits. RESEARCH and be CREATIVE.