

***Department of Curriculum and Instruction***

***Office of Technical and Career Education***

**STEM After-School Robotics Teacher Mentor**

The Office of Technical and Career Education (TCE) appreciate your willingness to assist students in fifth grade, middle school or high school in a STEM after-school robotics challenge. Students will have the opportunity to work in teams to build a remote-controlled robot and solve problems. As a teacher mentor, you will receive workshop wages and be responsible for assisting student teams with their documentation, planning, design, construction and competition. These activities will culminate with the 5th Annual STEM Robotics Challenge (SRC) in June 2013.

**SRC Mission**: *To provide participants, with a robotics project experience, incorporating 21st century skills, problem solving and critical thinking experiences in STEM fields in order to pursue these career pathways as life-long learners.*

**Preferred Teacher Mentor Requirements:**

* A background in science, or mathematics and technology
* Strong interest in and passion for STEM and the engineering process
* Ability to work with diverse students, some who may be academically challenged
* Able to follow online learning modules to create a Level 1 robot
* Familiarity with robotics and engineering, safe and proper tool use, drawing and design concepts
* Experience in working on detailed, long-term projects with small groups of students
* Strong problem-solving skills encouraged as is critical and creative thinking along with knowledge of the design process
* Willingness to lead SRC team towards competition in all aspects including project and research based activities

**Responsibilities:** The STEM after-school robotics mentor will be responsible for recording attendance, keeping teams on task, making sure teams are well prepared, and also tracking individual student progress. Along with those tasks, the mentor will:

* Facilitate and assist student teams in following online learning modules that will instruct them on how to create their Level 1 robot;
* Assist students in preparation for all other aspects of the robot challenge;
* Encourage students to review careers or an education in a STEM field; and
* Coordinate the efforts of a club technical advisor. This is an opportunity for business and community partners to become involved in STEM.
* The mentor also coordinates parent volunteers and other school leaders involved in the project.
* As with any other special project or study, these are the basic responsibilities. Each team will have unique challenges to be faced and overcome during the course of the year. The Office of TCE will act as a resource and support for all robotics activities.

**Essential Activities**: Students will construct electronic circuit boards from a specified kit of components requiring soldering, proper wiring techniques and computer programming to name a few of the essential skills. The contest will also require construction of a remote controlled robotic manipulator and a mobile platform to perform various tasks. A portfolio of pictures and a video produced by each team will also be a requirement as part of the challenge. Banners will be designed, displayed and judged in addition to the overall robot performance.

**Organizational Methodology:**

Where to begin is an essential question**.** This challenge is best solved utilizing the engineering design process. This process is illustrated on the following page. Follow this framework to a successful outcome. Implementing this process will enable students to be successful in all aspects of the robotics challenge throughout the year.

**“Robots Rock and STEM Rules”**

The SRC ENGINEERING DESIGN Process LOOP



1. **Identify the problem** - write a detailed problem statement
2. **Research the problem** – examine current solutions, review all support processes and overall system goals, investigate related technologies, inventions and innovations
3. **Develop possible solutions** – brainstorm possible solutions, analyze ideas through prior math and science knowledge, product thumbnails sketches of possible solutions
4. **Select best possible solution** – analyze Drivers (+) and Restrainers (-), select and refine sketches into working drawings
5. **Construct a Prototype** – fabricate a testable virtual and accrual prototype
6. **Test and Evaluate** **both virtual and accrual prototype** – collect and compare data
7. **Present results and plan for production** – quantify data and flowchart the production process
8. **Review and Redesign –** Collect and review feedback, identify points of weakness

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**STEM After-School Robotics Technical Advisor**

Each robotics team should have at least one technical advisor for the entire process. This person(s) is responsible for guiding and assisting the teacher and the students in the design, construction and testing of the robot. This person is also a resource for strategic planning and competition participation. Each school’s community relations, military liaison or partner in education coordinator can assist in the location of this person. The parent teacher organization can also provide invaluable assistance in finding the right person to be the technical advisor for your team(s).

**Responsibilities:** The technical advisor will provide engineering and fabrication support and should be available for each after school meeting of the challenge team.

* Model engineering processes and safe practices in the classroom.
* Assist the teacher in the planning and construction of all aspects of the robot process.
* Provide guidance and direction to students during construction and programming.
* Facilitate troubleshooting expertise for operational problems.
* Attend STEM robotics challenge competition held in June.

**Stem Robotics Challenge School Program Calendar**

**2012 - 2013**

**September 2012:  10th through 28th  3 student meetings**

* Teachers get supplies and organize materials for use.
* Teachers have first club meetings to get students familiar with the program and to organize who does what.
* All competition rules for each different event should be discussed. All files available on the website; [www.srcvb1.weebly.com](http://www.srcvb1.weebly.com)
* Teachers meet with possible industry mentors and establish a schedule for their after school meetings.
* Students learn to solder using the practice solder boards and scrap components.
* Teachers discuss mounting techniques for components and discuss what schematic diagrams are and what they are used for.

**October 2012:  1st through November 2nd 5 student meetings**

* Teachers show their working robot to students.
* Teachers discuss the Robot Control Board (RCB) plan sheet and go over details of construction.
* Students begin building their RCB's. It should take approximately 6 to 8 lab hours for students to completely build their RCB.
* Teachers will print and distribute the plan sheets for students to use during construction. Teachers may also use their smart board to go over specific details of construction. Teachers also have the option of allowing students to use laptop computers to utilize the pdf plan sheet.
* Completed RCB's will be tested and used in conjunction with the **LED Breakout Board** for students to learn computer programming.
* Students should begin modules RM2A through RM2I on [www.srcvb1.weebly.com](http://www.srcvb1.weebly.com)

**December 2012:  3rd through 14th  2 student meetings**

* Students should be completing programming modules and any students who get ahead should be challenged to do advanced programming in chapter 5, 6 and 7 in the Propeller Education Kit Labs manual.
* Some teachers may allow some students to complete extra programming activities at home over Christmas break.

**January:   2nd through Feb 1st 5 student meetings**

* Teachers should begin construction of the basic robot by attaching servos, their RCB and the battery to the Chassis.
* Battery wiring should be taught as a lesson to the students before connecting the battery.
* Teachers should do lessons on fasteners from website.
* Teachers will need to spend some time explaining how the robot control transmitter and receiver code works.  Students need to understand how to modify the existing robot code to control servos from various pins.
* This will be a great time to discuss possible errors in robot programming.  Battery charging issues should also be discussed.
* Once the basic robots are assembled teachers should help groups of students focus on solving the technical challenges associated with the level 1 contest
* Technical challenges include making lifting arms and devices as well as gripper devices for manipulation.

**February: 4th through March 1st 4 student meetings**

* Students will be working to develop and build their arm and gripper devices.
* Teachers should encourage students to design their devices on Card Stock weighted paper to come to a solution.
* Once a solution is found, students should use the VEX materials and any scrap metal or plastic to build their devices.
* Lessons during this time should focus on simple machines, gears, pulleys, torque and mechanical advantage. (There are resources to cover these topics on the website)
* Teachers and students should attempt to COMPLETE their robots during this series of meetings so that students will be able to practice completing the task with their robots on the arena playing field.

**March: 4th through 29th 4 student meetings**

* Teachers should be working to wrap up all the robot designs and get all robots fully functional.
* Practice rounds should be planned with your schools robots playing the contest against one another.
* Students should create a checklist of; WHAT TO DO…in case (Fit your word here) happens during the contest! The day of the contest is extremely hectic and any preparation by teams to be prepared for the kinds of things that could happen will help in a big way. These are things such as; my robot won’t power up, my battery is dead, my wire is broken…, I have a broken part (How do I fix it) etc…
* Teachers should establish a routine with students and mentors so that everyone knows how to proceed in the event of a robot emergency!
* Teachers should be helping students look closely at their designs for ways to improve their existing designs.
* Contest strategies should be discussed among all the members to get the most points during each round.
* Students that have finished their robots may begin putting together their entries for the STEM video contest, The Year in Review contest

The banner contest and continue organizing club member’s duties and tasks for the SRC Club of the Year Award.

**April: 1st through May 3rd 4 student meetings**

* Teachers should continue helping students complete the STEM Video Contest Entries
* Teachers should continue helping students complete “The Year in Review” Contest entries
* Teachers should continue helping students complete their custom made school banner for the banner contest. (1 per school)
* Students should be planning for how they will stay organized during the contest to meet the criteria for the SRC Club of the Year.
* Any students that are behind on their robot development may still have time to complete their robot and get it ready to compete.

**May: 6th through 31st 3 student meetings**

* Final preparations are made to all robots and students should be ready to compete.
* Students should know all the rules for the events they are participating in.
* Students should get all the necessary forms to fill out for the event.
* Teachers should know the Bus transportation plan for the event
* Teachers should discuss SAFETY at the Contest with students and mentors
* Students may want to do their final practice rounds to be sure their robot is working as they want it to.