

TO: Dr. Brent Stephens, Superintendent
FROM: Baje' Thiara, Associate Superintendent
Wyn Skeels, CTE Program Supervisor
DATE: October 19, 2019
SUBJECT: Request for Course Approval – Robotics Build, Advanced

Berkeley High School and the Career Technical Education Program are requesting approval of a new course, Robotics Build, Advanced. This will be the Capstone course in the Engineering and Technology Pathway under development.

Background Information

This course is the continuation of our Intermediate Robotics Engineering course "Robotics Build". Students will continue their work in engineering teams as they focus on advanced levels of design, build and testing of increasingly complex robots through participating in FIRST and similar robotics competitions. The course will illustrate the importance of integrating sensors, complex machine control, and examine robot learning and multi-robot systems. Students will be expected to solve challenges using physical robots and computer simulations. Students will work in teams to complete a larger design problem and participate in local and regional competitions. Special attention will be paid to the design process and its communication through both presentation and documentation. Students will explore additional hardware and software solutions to robotics problems. Students will learn advanced hardware and software techniques, as well as mathematics and physics to understand them. Students will use additional hardware and some basic software platforms to begin to understand robotics applications including arduino and parallax.

A sample of some of the units are as follows:

Advanced Safety/Advanced Construction

Students will continue their work from Robotics/Build to work in engineering teams to design, build and test increasingly complex robots. The course will stress safety first, and then overall illustrate the importance of integrating sensors, complex machine control, and briefly discuss robot learning and multi-robot systems. Students will be expected to solve challenges using physical robots and computer simulations.

Advanced Arms and Lift Systems

Students will use the principles of Force, Weight, Torque, Gears, and Mechanical advantage to design new and more robust lifting systems for their robots. Students will also be introduced to pneumatic and hydraulic actuators as a component of robotic lift systems as well as in industry. Software such as Inventor and MDSolids will be used to predict the stress/strain on parts during the lifting process. The limitations of motors and other design constraints will be approached in both a theoretical and practical manner. Special attention will be paid to build quality, adaptability, and modularity.

Advanced Sensors

Unit 3 introduces the student to closed-loop robotic navigation and lifts using sensors in both positive and negative feedback loops. This unit builds on the programming learned in Robotics Build. All students will incorporate complex feedback systems (PID control, etc) and other algorithms in the design process. Gyroscopes, accelerometers, and vex LCD modules will be added. Sensors beyond the scope of FIRST robotics will be considered as well as relevant. Students will learn the difference between analog and digital sensors and compare/contrast their uses and abilities.

FIRST Competition

Students will adapt group designs to compete in the FIRST program at both the regional level, state, and national levels. Students will finalize both Autonomous and User-Controlled programs using sensor input to compete. Students will prepare presentations to demonstrate their design process and how their robot accomplished the design task. Students will use this chance to perform outreach events to display their work and design to local school and community partners. Students will be expected to mentor less experienced teams, as well as volunteer to judge or facilitate local competition at the High School and Middle School level. Students will partner with local Middle school students to mentor these competitions.

Industry and Advanced Competition

Students will compare their designs to those that exist in the industry to apply any design changes or describe the constraints that control their use. Students will explore the possibility of additional robotics competitions (ie First Robotics) to continue their inquiries into different robotics fields.

Design Platforms

Students will investigate the potential use of platforms such as Arduino, parallax, and LabVIEW to design, program and control robotics systems. Students will apply these platforms to an advanced topic of their choosing, possibly in conjunction with other engineering classes or competitions.

This course has received UCOP “G” College Preparatory Interdisciplinary Elective credit approval.

POLICY/CODE:

FISCAL IMPACT

STAFF RECOMMENDATION