Background

- Students at Brookline High School from all backgrounds should be exposed to computing before they graduate. After introductory computing courses, robotics courses provide a pathway to further studies.
- Autonomy in robotics (being self-directed) implies computing. All robotics courses should stress *autonomous* robotics, because that is the future of robotics — for example, self-driving cars. Therefore, robotics courses are also computing courses.
- A robot is anything with sensors and actuators. Robotics (and computing) courses should encompass all types of robots: driving robots, assistive robots, prosthetic robots, wearable robots, sculptural robots, walking robots, grasping robots, flying robots, *etc.*.
- Robotics (and computing) courses should include a consideration of ethics and the choices posed in the design, implementation, and deployment of robots and the software controlling them.
- Robotics (and computing) courses should incorporate creativity, one of the *7 Big Ideas of Computer Science* (http://j.mp/7-big-ideas). Making computational artifacts, including robots and software, is inherently a creative endeavor.
- The study of robotics is inherently project-based and the projects can be student-directed, once students master basic skills in computing and mechanics. In this approach, task-oriented projects can include autonomous driving (wayfinding, maze solving, mapping, tailing), prosthetic devices, wearables, kinetic sculptures, legged robots, aerial robots, and Botball.
- Botball® is an autonomous robotics program with both regional and global competitions. Competitions could be incorporated for two reasons: they establish deadlines and they provide a task to accomplish every year that incorporates important aspects of autonomous robotics (odometry & route planning, vision, mechanical design, contingency and error recovery, strategy, ...) While some students may be interested in competition, it need not be a required element of the study of robotics.

Notes

- Robotics I should be scheduled in the fall and Robotics II should be schedules in the spring.
- The budget for supplies (excluding one-time startup costs) could be funded through the Perkins grant awarded annually to the CTE department. The introduction of this course would not require additional FTEs.

Course catalog descriptions

CE4XXX	**Autonomous Robotics I**	
Autonomous Robotics I is a project-based course where students develop computing and mechanical design skills and apply them to design and build autonomous robots that use sensors and actuators to perform simple tasks in response to their environment. Students also explore ethical and aesthetic questions in robotics and computing as they apply to designing, building, and deploying their robots to solve real-world problems.		

Skills developed in *Autonomous Robotics I* include: block- and text-based computing for embedded and robotics systems, mechanical design, autonomous goal planning & execution, sensor data acquisition & analysis, actuator control, error detection & recovery, *etc.*. Projects in *Autonomous Robotics I* include: maze solving, odometry, object identification & categorization, prosthetic & assistive technologies, wearables, kinetic sculpture & lighting, *etc.*.

Students interested in pursuing robotics throughout high school can elect *Autonomous Robotics* more than once, with skills developed in one semester applied to projects in subsequent semesters.

Level: N		Grade: 9-12
Prerequisite:	Exploring Computer Science or Introduction to Computer Science	Credit: 5

CE4YYY	**Autonomous Robotics II**	

Autonomous Robotics II is a project-based course where students build upon computing and mechanical design skills developed in *Autonomous Robotics I* and apply them to design and build autonomous robots that use sensors and actuators to perform tasks in response to their environment.

Students also explore ethical and aesthetic questions in robotics and computing as they apply to designing, building, and deploying their robots to solve real-world problems.

In *Autonomous Robotics II* students apply skills developed in previous *Autonomous Robotics* semesters to projects in robotics, including autonomous driving (wayfinding, maze solving, mapping, tailing), prosthetic devices, wearables, legged robots, aerial robots, and the potential to participate in Botball®. Students interested in the Botball autonomous robotics challenge will prepare robots for the New England regional competition in May.

Students interested in pursuing robotics throughout high school can elect *Autonomous Robotics* more than once, with skills developed in one semester applied to projects in subsequent semesters.

Level: N		Grade: 9-12
Prerequisite:	Autonomous Robotics I	Credit: 5