Applied Technology 2: Robotics
Grades 10-12

Units of Credit: One Year (Elective)

Prerequisites: Applied Technology I

Course Description:
In this course, students build upon the knowledge and skills gained in Applied Technology 1. The focus of this course is to learn about the fundamentals of robotics. Students will learn what makes robots work, and why they are so widely used in all kinds of seemingly unrelated areas. Robots are designed to accomplish some type of complex task such as reacting to light, motion, color, sound, following a line, or anything else the mind can imagine. Robots are fabricated with metal parts, plastic parts, electronic components, lots of wires, wheels, gears, and many fasteners. They are programmed using computer software such as Labview, C+, Java, and Lego Mindstorms NXT. This course will require students to apply general math and science concepts to advanced problem solving and pre-engineering activities. Some of these activities will include creating a robotic arm, radio controlled "battlebots", small programmable robots, and a variety of smaller projects aimed at teaching basic fabrication skills. Students are assessed through observation, performance on tests, quizzes, assigned tasks and projects and by the quality of work produced.

Topics:
- Programming
- Electronics
- Drive systems
- Metal fabrication
- Troubleshooting and problem solving
- Mechanical systems
- Pneumatic and hydraulic systems
- Sensors and control systems

NOTE: Throughout this document, learning target types are identified as knowledge ("K"), reasoning ("R"), skill ("S"), or product ("P").

STANDARD 1: Students experience various career opportunities and assess personal career pathways.
Benchmark 1:
Explore and identify personal interests, aptitudes, and abilities and develop strategies to achieve tentative career goals.
Learning Targets *(Type)*:
1. I can use Montana Career Information Systems (MCIS) and/or other systems or web resources to investigate and evaluate my personal interests, aptitudes and abilities. *(S)*
2. I can formulate tentative career goals. *(R)*
3. I can evaluate approaches for meeting my goals. *(R)*

4 I can demonstrate skills and knowledge of current equipment, materials, and processes used in related careers. *(K,S)*

Benchmark 2:
Utilize local resources to research career plans.
Learning Targets *(Type)*:
1. I can identify local resources to develop career plans. *(K)*
2. I can contact my school career counselor or teacher to pursue career pathways. *(S)*

Benchmark 3:
Recognize the interrelationships of family, community, career, and leisure roles.
Learning Targets *(Type)*:
1. I can describe the importance of balance between family and community in regards to career and leisure activities. *(K)*
2. I can compare and contrast the needs of career and leisure activities and how they relate to and/or affect family and community. *(R)*

STANDARD 2: Students demonstrate an understanding and apply principles of Resource Management (i.e., financial, time, personal management).
Benchmark 1:
Prepare a budget and keep financial records.
Learning Targets (*Type*):
1. I can research and report cost of materials and time. *(R,S)*
2. I can document financial inputs and outputs. *(S)*
3. I can identify the necessity to maintain accurate financial records. *(K)*
4. I can stay within a fixed budget. *(S,P)*

Benchmark 2:
Prioritize, allocate time, prepare and follow schedules to complete a project.
Learning Targets (*Type*):
1. I can estimate the required time to complete a project. *(R)*
2. I can prioritize resources, equipment and tasks. *(R)*
3. I can reflect upon completion. *(K)*

Benchmark 3:
Apply appropriate time to task.
Learning Targets (*Type*):
1. I can implement a time schedule for task completion. *(S)*

Benchmark 4:
Use physical resources wisely to accomplish a goal.
Learning Targets (*Type*):
1. I can identify the resources necessary to accomplish the task. *(K)*
2. I can maintain the tools of the trade. *(S)*
3. I can maximize the use of my resources. *(S)*

STANDARD 3: Students acquire and utilize personal and leadership skills to become successful, productive citizens.
Benchmark 1:
Demonstrate active leadership skills by participation in group activities and projects.
Learning Targets (*Type*):

1. I can investigate various leadership styles. *(R)*
2. I can apply leadership styles in group activities and projects. *(R)*
3. I can work as part of a team to design, build, analyze, and test group projects. *(S)*

Benchmark 2:
Demonstrate positive personal and work ethics.
Learning Targets (*Type*):
1. I can arrive on time for class and work. *(S)*
2. I can develop personal and work related goals. *(K,P)*
3. I can describe ethical behavior in the workplace. *(K)*
4. I can complete a project by given project completion deadlines. *(K)*
5. I can manage my time so that I can complete assignments and projects by using my time wisely each and every class period. *(R)*

Benchmark 3:
Demonstrate skills to be a productive citizen.
Learning Targets (*Type*):
1. I can develop professional relationships with community members. *(S)*
2. I can contribute to my community in a positive manner. *(S,P)*

Benchmark 4:
Apply self-esteem building practices.
Learning Targets (*Type*):
1. I can define and provide evidence of my strengths in my career interest areas. *(K,S)*
2. I can persevere through set backs and stay focused on my goals. *(S)*

Benchmark 5:
Demonstrate appreciation for diverse perspective needs and characteristics.
Learning Targets (*Type*):
1. I can develop a working relationship with diverse populations. *(S)*
2. I can demonstrate communication skills that contribute to positive relationships. *(S)*
3. I can work to understand diverse points of view. *(R)*

Benchmark 6:
Practice several methods of effective communication.
Learning Targets (*Type*):
1. I can demonstrate good listening skills. *(S)*
2. I can effectively communicate verbally through collaborative projects. *(S,P)*
3. I can develop quality written professional communications. *(P)*

STANDARD 4: Students acquire and demonstrate current technical skills leading to an occupation.
Benchmark 1:
Practice technical skills and procedures required for an occupation.
Learning Targets (*Type*):
1. I can use the English measurement system to measure to the nearest 1/16th of an inch. *(K,S)*
2. I can interpret a technical drawing to create a small project. *(R)*
3. I can create a technical drawing of a project. *(P)*
3. I can use computer programming software such as Labview or Java to program a robot to execute specified tasks. *(K,R)*

4. I can use a problem solving model to assist with solving engineering type challenge projects. *(K)*
5. I can design and construct a pneumatic system appropriate for the required task to operate a robotic appendage. *(K,R,S,P)*

Benchmark 2:
Practice safe and appropriate use of technology.
Learning Targets (*Type*):
1. I can safely operate a band saw. *(S)*
2. I can safely operate drilling machines. *(S)*
3. I can safely operate sanding machines. *(S)*
4. I can safely work with electronic components. *(S)*
5. I can safely work with pneumatic systems *(K,R,S)*
6. I can safely work with hydraulic systems. *(K,R,S)*

Benchmark 3:
Select the appropriate tools, equipment, and procedures for the task.
Learning Targets (*Type*):
1. I can select the correct tools and equipment to most efficiently solve problems I encounter. *(K,R)*
2. I can use tools, machines, and equipment to construct small projects. *(K,R,S)*
3. I can creatively solve problems by considering the tools, equipment and resources available to successfully complete projects within the given guidelines. *(R)*

Benchmark 4:
Manage and maintain technological tools and follow troubleshooting protocol.
Learning Targets (*Type*):
1. I can recognize when tools and equipment are not functionally properly. *(K,R)*
2. I can assist in basic maintenance and repair of facility equipment. *(S)*

Benchmark 5:
Apply technical information to a variety of sources.
Learning Targets (*Type*):
1. I can use a computer search engine such as Google to research project design ideas. *(K)*
2. I can use internet resources to aid in the use of applying motion sensors. *(S)*
3. I can use tools to take measurements and convert imperial / metric measurement units. *(S)*
4. I can use mathematical and scientific formulas to calculate the design robotic mechanical systems. *(S)*

STANDARD 5: Students know and demonstrate the requirements of the workplace through authentic application.
Benchmark 1:
Practice and demonstrate academic and technical skills to a workplace setting.
Learning Targets (*Type*):
1. I can practice, and demonstrate my technical workplace skills in my school lab. *(S)*
2. I can research, write and present on the technical content utilizing academic skills found in workplace settings. *(R,S,P)*
3. I can read, apply, and critically analyze and apply specific rules for each problem-solving activity. *(R,S)*

Benchmark 2:

Apply the concepts of entrepreneurship.

Learning Targets (*Type*):
1. I can explain the concepts of entrepreneurship. *(K)*
2. I can demonstrate the concepts of entrepreneurship through a unique project. *(R,S)*
3. I can present my unique project to an authentic audience. *(S,P)*

Benchmark 3:
Identify possible outcomes and consequences of decisions.

Learning Targets (*Type*):
1. I can identify possible consequences of carelessness and horseplay. *(K)*
2. I can explain potential outcomes of not following directions, (i.e. safety, guidelines, rubrics). *(R)*

Benchmark 4:
Use acceptable industry standard equipment in a school setting.

Learning Targets (*Type*):
1. I can successfully use acceptable industry standard equipment to produce an authentic product within budget constraints. *(S,R,P)*
2. I can identify and use appropriate OSHA required safety equipment necessary when operating various tools and machines. *(R,S*