

MISSION TRAILS REGIONAL OCCUPATIONAL PROGRAM

1. COURSE TITLE: Robotics Engineering Technology
2. CBEDS TITLE: Robotics
3. CBEDS NUMBER: 5612
4. JOB TITLES: Assembler
Electronic Equipment Repairer
Fabricator
Information Technology Services Technician
Machine Setter
5. COURSE DESCRIPTION: This course trains students for post-secondary education and/or an entry-level position in a variety of related occupations, such as Robotics Technician, Machine Operator, Machinists, Tool Programmers, Computer Programmers, Computer Systems Analysis, and Robot Machine Operator.

The Introduction to Robotics Engineering Module (minimum 180 hours): Students will study the connection between applied physics principles and several branches of engineering: mechanical, computer, electronic, industrial, chemical, and materials. In addition, students will investigate the creation and use of robots in NASA exploration, industrial manufacturing, engineering design, hazardous duty, maintenance, firefighting, surgery, and military robots.

The Advanced Robotics Engineering Module (minimum 180 hours): Students will develop a deeper understanding of the topics taught in the introductory class as well as be introduced to more advanced engineering topics such as vision systems, neural networks, and multitasking robotic environments. Students will learn the manufacturing processes and design, engineering problem solving, new product development, and designing specifically for the disadvantaged.

Students may have the opportunity to compete at the For Inspiration and Recognition of Science and Technology (FIRST) competitions. In this national event, students compete as a team to solve an engineering design problem.

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| 6. HOURS: | Introductory Robotics Engineering | 180 |
| | Advanced Robotics Engineering | 180 |
| | Community Classroom/ Co-Op | 660 |
| | Total hours: | 1020 |

7. PREREQUISITES: Completion of Algebra I and Computer Science with a grade of “C” or better or permission of instructor.

8. REVISION DATE: February 7, 2007

9. CDE RECERTIFICATION:

9. COURSE OUTLINE:

a) CONTENT AREA SKILLS

i) EXPECTED STUDENT OUTCOMES

ii) HOURS OF INSTRUCTION

COURSE OUTLINE

| CONTENT AREA SKILLS | EXPECTED STUDENT OUTCOMES | HOURS | | |
|--|--|-------|----|----|
| | | CL | CC | CP |
| Instruction will include: | Student will be able to: | | | |
| 1. Introduction to robotics engineering | 1. Understand the history and evolution of technology, the development of robots, and the theory of artificial intelligence. | 20 | 10 | 10 |
| 2. The relationship between science, technology, and society. | 1. Understand the function and role robots have played in society in history through media and literature. | 20 | 10 | 10 |
| 3. Safety in the robotics laboratory | 1. Understand and follow equipment safety rules, emergency guidelines, and lab procedures. | 20 | 20 | 20 |
| 4. Sources of energy and power including energy sources, power sources, and environmental impact concerns. | 1. Understand various energy sources to include: electricity, solar, nuclear, and stored (dry cell, lead-acid, rechargeable) 2. Understand various power sources to include: electric motor, internal combustion engine, air compressor. 3. Understand renewable sources of energy, efficient use of energy, solar energy and its alternate sources plus hazardous waste concerns. | 10 | 20 | 20 |
| 5 Principles of Physics | 1. Understand friction, power, torque, and simple machines: gears (compound ratios, speed, strength), pulleys, levers. 2. Understand hydraulics and pneumatics: force, pressure, work, power and pneumatic fluid power system | 20 | 20 | 20 |
| 6. Basic concepts of electronics theory | 1. Understand voltage, watts, amps, resistance, AC/DC. 2. Understand series and parallel circuits, electric motor, control systems and microprocessors, solenoids. | 20 | 20 | 20 |

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|--|---|-----|-----|-----|
| 7. Engineering Design | <p>1. Complete multi-view drawings with AutoCAD or other software.</p> <p>2 Use two-dimensional drawings to design electrical and mechanical components</p> <p>3. Complete three dimensional drawings using parametric design concepts to test and check functionality of robot</p> <p>4 Perform computer graphics and animation to meet requirements of robotic competition</p> | 20 | 40 | 40 |
| 8. Computer programming and programming language | <p>1.Understand control flow, conditions, multi-tasking, timers, timing, conditionals</p> <p>2. Understand Loops, Boolean logic,</p> <p>3. Work in C+, Visual Basic, or similar programming language</p> <p>4. Program robot to operate autonomously and remotely</p> | 40 | 40 | 40 |
| 9. Interfacing software and hardware | <p>1.Understand light, motors, Analog and digital sensors, pneumatics, hydraulics</p> | 10 | 20 | 20 |
| 10. Engineering Technology | <p>1.Understand steps in problem solving (Identify problem, brainstorm, research, prioritize, design, assemble, test, modify, document</p> <ul style="list-style-type: none"> • Working in teams • Time Management • Resource Allocation • Information accessing • Systems analyst <p>2. Create documentation and written reports</p> <p>3. Perform computer simulation and/or build model</p> | 20 | 40 | 40 |
| 11. Robotic Design Considerations | <p>1.Understand Overview considerations: purpose, application, size/weight, physical restraints, monetary restraints, time element</p> <p>2.Create specifications: material composition, axle support, weight/balance, wheels, chassis design, cross bracing. square frame, treads, detailed parts specifications</p> <p>3.Understand Sensors: light, pressure, rotational, infrared, temperature, cameras</p> | 40 | 40 | 40 |
| 12. Machine Operations | <p>1.Use proper tools, calipers, micrometers</p> <p>2Understand properties of materials and assembly techniques.</p> <p>3. Welding technology</p> | 60 | 50 | 50 |
| 13. Exhibitions/Competitions / Final Project | <p>1. Document final project and applied scientific principles involved or be team member in robotics competition.</p> <p>2. Complete scientific journal</p> | 60 | | |
| Total Hours | | 360 | 330 | 330 |

9. COURSE OUTLINE:

b) CAREER PERFORMANCE STANDARDS

i) EXPECTED STUDENT OUTCOMES

ii) HOURS OF INSTRUCTION

COURSE OUTLINE

| CAREER PERFORMANCE STANDARDS | EXPECTED STUDENT OUTCOMES | HOURS |
|--|--|--|
| Instruction will include: | Student will be able to: | |
| <p>1. Personal Skills</p> <ul style="list-style-type: none"> ▪ Classroom policies & procedures ▪ Ethics <ul style="list-style-type: none"> → Work → Business ▪ Sexual harassment laws ▪ Personal skills, including positive attitude, self-confident, honesty, perseverance & self-discipline ▪ Professional appearance ▪ Time management ▪ Lifelong learning | <p>1. Understand how personal skill development, including positive attitude, honesty, self-confidence, time management, & other positive traits affect employability.</p> <ul style="list-style-type: none"> ▪ Demonstrate and understand classroom policies & procedures ▪ Define work and business ethics & demonstrate the importance of ethical standards & social responsibilities in the business environment. ▪ Discuss the laws applicable to sexual harassment & discuss tactics for handling harassment situations. ▪ Demonstrate personal skills in class and/or business environment: <ul style="list-style-type: none"> → Positive attitude → Self-confidence → Honesty → Perseverance → Self-discipline ▪ Demonstrate and model personal hygiene and acceptable professional attire ▪ Prioritize tasks and meet deadlines ▪ Explain the importance of lifelong learning | <p>Integrated in content area skills</p> |

| CAREER PERFORMANCE STANDARDS | EXPECTED STUDENT OUTCOMES | HOURS |
|---|---|---|
| Instruction will include: | Student will be able to: | |
| <p>2. Interpersonal Skills</p> <ul style="list-style-type: none"> ▪ Group dynamics ▪ Conflict resolution and negotiation ▪ Team work ▪ Etiquette across gender and cultural groups | <p>2. Understand principles of effective interpersonal skills, including group dynamics, conflict resolution, and negotiation.</p> <ul style="list-style-type: none"> ▪ Identify and explain the key concepts of group dynamics ▪ Discuss and demonstrate the dynamics of conflict resolution and negotiation, and their importance within the business environment ▪ Demonstrate effective teamwork, share responsibilities, accept supervision and assume leadership roles ▪ Demonstrate cooperative working relationships and proper etiquette across gender and cultural groups | <p>Integrated in content area skills</p> |
| <p>3. Thinking and Problem-Solving Skills</p> <ul style="list-style-type: none"> ▪ Critical and creative thinking skills ▪ Logical reasoning and problem-solving skills ▪ Numerical estimation, measurement, and calculation ▪ Identify, locate, and organize needed information and propose, evaluate, and select alternative solutions | <p>3. Understand the importance of critical thinking and problem-solving skills in the workplace.</p> <ul style="list-style-type: none"> ▪ Apply critical and creative thinking skills in a work environment and implement a plan of improvement as needed ▪ Demonstrate logical reasoning and problem solving skills in a work environment ▪ Apply numerical estimation, measurement and calculation skills to business applications including the following: <ul style="list-style-type: none"> → Whole number math → Decimals & fractions → Counting & monetary functions → Use of tables & graphs ▪ Recognize problem situations; identify, locate and organize needed information, and propose, evaluate and select from alternate solutions | <p>Integrated in content area skills</p> |

| CAREER PERFORMANCE STANDARDS | EXPECTED STUDENT OUTCOMES | HOURS |
|---|---|---|
| Instruction will include: | Student will be able to: | |
| <p>4. Communication Skills</p> <ul style="list-style-type: none"> ▪ Written communications ▪ Verbal and Nonverbal communications ▪ Active and effective listening ▪ Proper etiquette in business communications ▪ Writing and editing skills ▪ Use of reference material and handbooks ▪ Oral presentations | <p>4. Understand principles of effective communication.</p> <ul style="list-style-type: none"> ▪ Read and implement written instructions, technical manuals, written communication, and reference books ▪ Present a positive image of verbal and nonverbal communication through use of appropriate methods ▪ Demonstrate active and effective listening skills through verbal, nonverbal and written feedback ▪ Demonstrate proper etiquette in business communications, including an awareness of requisite for international communications (languages, customs, and time zones) ▪ Demonstrate the following writing and editing skills: <ul style="list-style-type: none"> → Use correct grammar, punctuation, capitalization, vocabulary and spelling → Write, proofread and edit → Select and use appropriate forms of communication ▪ Exhibit a proficiency in the use of reference materials such as dictionary, thesaurus, telephone directory, almanac, zip code directory, and office handbooks | <p>Integrated in content area skills</p> |
| <p>5. Occupational Safety</p> <ul style="list-style-type: none"> ▪ Good safety practices | <p>5. Understand occupational safety issues, including avoidance of physical hazards</p> <ul style="list-style-type: none"> ▪ Model and implement good safety practices including: <ul style="list-style-type: none"> → Avoidance and reporting of physical hazards in the work environment → Safe operation of equipment → Proper handling of hazardous materials | <p>Integrated in content area skills</p> |

| CAREER PERFORMANCE STANDARDS | EXPECTED STUDENT OUTCOMES | HOURS |
|--|---|---|
| Instruction will include: | Student will be able to: | |
| <p>6. Employment Literacy</p> <ul style="list-style-type: none"> ▪ Expand awareness of career opportunities ▪ Set employment goals and objectives ▪ Aptitudes, personal characteristics and interests ▪ Develop portfolio to C-TAP standards ▪ Develop interviewing techniques | <p>6. Understand career paths and strategies for obtaining employment.</p> <ul style="list-style-type: none"> ▪ Explore career opportunities and develop a career plan ▪ Identify steps for setting goals and writing personal goals and objectives ▪ Examine aptitudes related to career options; relate personal characteristics and interests to educational and occupational opportunities ▪ Develop a portfolio to include the following: <ul style="list-style-type: none"> → Letter of Introduction → Cover letter → Resume → Thank you letter → Job application → Licenses, Certificates and Awards → Transcripts → Letters of Recommendation → Work Samples | <p>Integrated in content area skills</p> |
| <p>7. Technology Literacy</p> <ul style="list-style-type: none"> ▪ Apply Industry specific technology ▪ Use Industry specific software ▪ Demonstrate Keyboarding ▪ Accessing information ▪ Lifelong enhancement of technology skills | <p>7. Understand and adapt to changing technology.</p> <ul style="list-style-type: none"> ▪ Identify and demonstrate use of appropriate technology ▪ Identify and use industry specific software ▪ Demonstrate proficiency in alphanumeric keyboarding ▪ Input and retrieve information ▪ Understand the importance of lifelong learning in adapting to changing technology | <p>Integrated in content area skills</p> |

12. ADDITIONAL RECOMMENDED /OPTIONAL ITEMS

- a. ARTICULATION: Pending with Monterey Peninsula College**

- b. VOCATIONAL CREDIT:**

- c. ACADEMIC CREDIT: 10 high school credits per year.**

- d. INSTRUCTIONAL STRATEGIES: Demonstrations, Lab, Written assignments, Written tests and quizzes.**

- e. INSTRUCTIONAL MATERIALS: Student textbook:**

- f. CERTIFICATES: Students will receive a Mission Trails ROP course certificate listing their job skill proficiencies.**