Robotics / Mechatronics

Level I Unit Outline

Unit 1: Agenda Book Review/Classroom rules
- Adhere to the school rules and expectations
- Adhere to the shop rules and expectations
- Follow protocols
- Follow routines & procedures
- Follow the protocol for each drill: fire, lockdown, shelter in place, etc.

Unit 2: Safety, First Aid, Personal Protective Equipment and Shop Attire
- Identify, discuss, locate first aid and blood borne kits
- Identify, locate and demonstrate function and purpose of the Emergency Eye Station
- Identify, discuss, locate fire extinguisher
- Identify, distribute and discuss function and uses of protective eyewear, appropriate personal protective equipment (PPE) required in shop, and acceptable shop attire
- Identify, show location and discuss function and uses of the SDS (Safety Data Sheets) and how to interpret the information about paints and aerosols, content precautions, material labeling
- Equipment safety protocols
- Identify, demonstrate shop ventilation systems where applicable
- Identify locate and discuss function of shop flammable cabinet where applicable
- Discuss and demonstrate shop housekeeping of supplies, work stations and room maintenance
- Discuss and identify electrical safety considerations in the shop area
- Compile a safety section in the student shop notebook
- Identify, demonstrate air gauge function and operation where applicable
- Completion of online safety course and successful passing of safety test(s)

Unit 3: Tools, Usage, and Maintenance I
- Identify a tool or machine, either through pictures or physical objects
- Describe the general category of use for the tool/machine
- Note one element of safe operation needed specifically for that tool
- Demonstrate the basic care, proper maintenance, and use of hand, portable, and stationary tools related to the Building and Construction trades
- Maintain a safe and healthful working environment

Unit 4: Materials I
- Application of statics to materials and material strength applications

- Material states
- Material equilibrium
- Material applications

Unit 5: Engineering Mechanics I
- Equivalent systems of forces
- Resultants and distributed forces
- Equilibrium of rigid bodies
- Centers of gravity
- Moments of inertia
- Friction
- Simple Machines

Unit 6: Fluid Mechanics
- Operate and install basic pneumatic systems
- Analyze efficiency
- Design basic pneumatic circuits
- Select and connect basic pneumatics components
- Pneumatic hoses and fittings
- Principles of pneumatic pressure and flow

Unit 7: Intro to Electricity
- Describe the basic concepts of matter, energy sources, and electrical current flow
- Test performance of electrical, electronic, mechanical, or equipment
- Maintain electronic equipment
- Causes of operational problems or failures
- Document design or operational test results

Unit 8: Basic Electronic Circuits
- Prepare engineering sketches or specifications for construction, relocation, or installation of equipment or systems
- Test electrical circuits or components for proper functioning
- Analyze the combination of Series-Parallel circuits
- Control power supply connections
- Create electrical schematics
- Understand the concepts of Voltage and Current Dividers
- Analyze information and evaluate results

Unit 9: Digital Electronics
- Explore the fundamentals of digital electronics
- Explain the basic principles of digital logic
- Differentiate Boolean and binary systems
- Describe combinatorial logic
- Use proper test and measurement equipment

Unit 10: Intro to Programming I
- Discuss and compare machine languages
- Higher-level programming languages
- Compiler
- Types of programming errors
- Demonstrate a simple program

Unit 11: Arduino & C++ Coding
- Learn how to configure hardware and software
- Develop their own sketches
- Work with built-in and custom Arduino libraries
- Explore the Internet of Things

Unit 12 Raspberry Pi & Python Coding
- Learn how to configure hardware and software
- Develop their own simple applications
- Work with built-in and custom Raspberry Pi libraries
- Explore the Internet of Things

Unit 13: Intro to Programming Programmable Logic Controller
- Design several automated closed-loop control systems
- Produce a written report of the different tradeoffs of the systems
- Build a logic control loop implemented in the PLC
- Include an emergency stop, inputs from limit switches, and at least 2 other physical sensors, that will control the movement of at least 1 motor

Unit 14: Intro to Mechanical Design and Mechanical Drawing
- Demonstrate how to hand draw mechanical designs
- Translate hand drawn design to a 3D CAD program (SOLID Works)
- Create original 3D designs and modify existing designs
- Implement design on a 3D Printer

Unit 15: Current Events in Mechatronics, Industry and Engineering
- Research and produce mechatronics current events presentations
- Produce an individual weekly slide presentation on a current event topic related to current technological and engineering trends following a rubric of required components

Unit 16: Robotic Theory
- Learn how electric motors work
- Learn how to debug a motor electrical control system
- Learn to program and control industrial robots and robot simulators

Unit 17: Career Readiness & Professionalism
- Develop personal and professional skills
- Complete an online workshop to teach and develop their professional attitudes
- Demonstrate their ability to be on time, interface professionally, work in teams and also show initiative working independently

Robotics / Mechatronics
New Jersey Student Learning Standards (NJSLS)

NJ Learning Standards CTE.9.3

CONTENT AREA:	9.3 CAREER AND TECHNICAL EDUCATION
SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®	
Number	**Standard Statement**
By the end of Grade 12, Career and Technical Education Program completers will be able to:	
CAREER CLUSTER®:	SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)
9.3.ST.1	Apply engineering skills in a project that requires project management, process control and quality assurance.
9.3.ST.2	Use technology to acquire, manipulate, analyze and report data.
9.3.ST.3	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
9.3.ST.4	Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
9.3.ST.5	Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
9.3.ST.6	Demonstrate technical skills needed in a chosen STEM field.
PATHWAY:	ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST-ET)
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.2	Display and communicate STEM information.
9.3.ST-ET.3	Apply processes and concepts for the use of technological tools in STEM.
9.3.ST-ET.4	Apply the elements of the design process.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
9.3.ST-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.
PATHWAY:	SCIENCE & MATHEMATICS CAREER PATHWAY (ST-SM)
9.3.ST-SM.1	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST-SM.3	Analyze the impact that science and mathematics have on society.
9.3.ST-SM.4	Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.