Robotics / Mechatronics

Level IV 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 IV
- 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 Properties & Applications II

- Objects and materials have different characteristics or properties
- Testing materials can help identify their properties
- To compare their properties, different materials need to be tested in the same way

Unit 5: Engineering Mechanics IV

- Reintroducing students to Newton's 3 laws
- Introduce kinematical analysis of rigid bodies
- Creation of equations of motion for particles and rigid bodies in planar motion
- Discuss mechanics and general momentum conservation problems
- Introduce energy-based approaches to determining system motion

Unit 6: Fluid Mechanics Applications II

- Introduce fundamental aspects of fluid flow behaviour
- Develop steady state mechanical energy balance equation for fluid flow systems
- Estimate pressure drop in fluid flow systems
- Determine performance characteristics of fluid machinery

Unit 7: Electricity Systems II

- The intended purpose and use of electrical drives
- Design considerations and construction techniques, materials, and components
- Understanding of how systems operate

Unit 8: Electronic Circuits II

- Explain what electricity is
- Explain how it is produced
- Explain what will happen if we run out
- Build and compare simple circuits with a focus on how connections are made
- Identify the essential components of an electric circuit and understand their functions

Unit 9: Analog Electronics II

- 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: Programming Applications

- Discuss how an IPO chart and pseudocode improve program logic

- Explain how to write pseudocode for a simple, everyday task
- Explain basic Java syntax rules
- Define Java objects, attributes, methods, and values
- Explain how to write and compile a simple Java program

Unit 11: Arduino & C++: Coding & Hardware Applications
- 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 & Hardware Applications
- 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: PLCs II
- Learn the major components of a Programmable Logic Controller (PLC)
- Learn the functions of the CPU, input modules, and output modules in a PLC
- Be familiar with binary number and decimal number systems
- Learn basic logic functions: AND, OR, and NOT
- Be familiar with the operation and scan cycle of a PLC
- Learn bit instructions and their functions

Unit 14: Mechanical 3D Assembly & Simulations
- Demonstrate how to hand draw mechanical designs
- Translate a 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 IV
- 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 Applications II
- 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 IV
- 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

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.