**Course Description**

(XXXXX)

**Strand 1. Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**Outcome 1.1. Employability Skills:** Develop career awareness and employability skills (e.g. face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

**Competencies**

1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers.

1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience.

1.1.3. Develop a career plan that reflects career interests, pathways, and secondary and postsecondary options.

1.1.4. Describe the role and function of professional organizations, industry associations, and organized labor and use networking techniques to develop and maintain professional relationships.

1.1.5. Develop strategies for self-promotion in the hiring process (e.g. filling out job applications, résumé writing, interviewing skills, portfolio development).

1.1.6. Explain the importance of work ethic, accountability, and responsibility and demonstrate associated behaviors in fulfilling personal, community, and workplace roles.

1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.

1.1.8. Identify the correlation between emotions, behavior, and appearance and manage those to establish and maintain professionalism.

1.1.9. Give and receive constructive feedback to improve work habits.

1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.

1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.

**Outcome 1.3. Business Ethics and Law:** Analyze how professional, ethical, and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

**Competencies**

1.3.1. Analyze how regulatory compliance affects business operations and organizational performance.

1.3.2. Follow protocols and practices necessary to maintain a clean, safe, and healthy work environment.

1.3.3. Use ethical character traits consistent with workplace standards (e.g. honesty, personal integrity, compassion, justice).

1.3.5. Access and implement safety compliance measures (e.g. quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], U.S. Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.

1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g. harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission).

1.3.8. Verify compliance with computer, copyright, and intellectual property laws and regulations.

1.3.9. Identify potential conflicts of interest (e.g. personal gain, project bidding) between personal, organizational, and professional ethical standards.

**Strand 8.0 Aerospace Engineering:** Learners apply principles of space flight evolution, orbital mechanics, and rocketry. They gain essential knowledge and skills in understanding space missions, applying orbital mechanics, and designing and testing rockets.

**Outcome 8.1 Evolution of Space Flight:** Understand and describe the contributions, significance, and key figures of major space missions and advancements.

**Competencies**

8.1.1 Describe contributions and the significance of the Mercury Missions

8.1.2 Describe contributions and the significance of the Gemini Missions

8.1.3 Describe contributions and the significance of the Apollo Missions

8.1.4 Describe contributions and the significance of the Shuttle Missions

8.1.5 Describe accomplishments and significance of space telescopes.

8.1.6 Describe accomplishments and significance of the International Space Station

8.1.7 Describe current and future astronautical advancements and their significance

8.1.8 Recall and explain the accomplishments and significance of unmanned space missions (e.g. Sputnik, Voyager, etc.)

8.1.9 Identify the pilots involved in the missions above and the significance to the evolution of space flight (e.g. Armstrong, Glenn, Yeager)

**Outcome 8.2 Orbital Mechanics:** Understand and apply orbital mechanics principles

**Competencies**

8.2.1 Explain the orbital mechanics of the moon

8.2.2 Describe the conditions that must be met in order to visually identify satellites

8.2.3 Visually identify satellites and ground trace the orbital path

8.2.4 Compare and contrast different types of satellite orbital paths.

8.2.5 Identify the benefits of a telescope in space vs a telescope on Earth.

8.2.6 Describe how the earth's rotational speed determines a rocket's direction of travel during launch

8.2.7 Calculate the speed of Earth's rotation and determine the location that creates the most efficient escape velocity.

8.2.8 Define the reentry corridor for a space vehicle.

8.2.9 Describe the relationship between potential and kinetic energy for an object in orbit.

8.2.10 Describe the function of heat shields and their effect on total energy dissipation during reentry to earth's atmosphere.

**Outcome 8.3 Rocketry:** Design, build, and test rockets, understanding their mechanics and performance.

**Competencies**

8.3.1 Describe the requirements and specifications for a launch site including safety

8.3.2 Calculate the G-Force a rocket experiences during launch

8.3.3 Define terminal velocity

8.3.4 Describe Max Q and the effects on a rocket body breaking through the sound barrier

8.3.5 Describe solid, hybrid, and cryogenic liquid rocket motors.

8.3.6 Describe hypergolic fuels

8.3.7 Describe the designs of solid rocket motors and how it affects force (e.g. internal shape, nozzle)

8.3.8 Explain drag coefficient and how it affects apogee

8.3.9 Determine the directional vector a rocket will travel based on different wind conditions (weather cocking).

8.3.10 Manually identify a rockets center of gravity and its center of pressure

8.3.11 Use a computer simulation to determine a rocket's margin of stability.

8.3.12 Explain how atmospheric conditions affect the ascent and descent rate of a rocket.

8.3.13 Calculate a vehicle's drag and descent rate during re-entry.

8.3.14 Design, build, and test a rocket

**Strand 9 Technical Math and Science:** Learners develop a comprehensive understanding of the fundamental principles and applications of technical mathematics and scientific concepts. Learners will perform precise measurements, interpret technical drawings, and apply scientific principles to solve engineering and manufacturing problems.

**Outcome 9.1 Physics of Engineering:** Learn the fundamentals of physics as it relates to engineering.

**Competencies**

9.1.1 Display and interpret numbers in scientific notation and logarithmic scales

9.1.2 Describe and convert SI and US system units of measurement.

9.1.3 Identify and use both metric and inch rules.

9.1.4 Express physical quantities with an appropriate number of significant digits, units and dimensions.

9.1.5 Perform operations on whole numbers, fractions and mixed numbers.

9.1.6 Analyze measurements and perform technical calculations.

9.1.7 Read and interpret charts and tables to analyze data and formulate outcomes.

9.1.17 Compare and contrast weight vs mass

9.1.18 Explain Newton's three laws of motion and identify their relationship to a specified topic

**Outcome 9.2 Physics of Flight:** Understand and apply the principles of flight dynamics and aerodynamics.

**Competencies**

9.2.1 Describe the layers of the atmosphere

9.2.2 Explain Bernoulli's Principle and the four forces of flight; thrust, drag, lift, and weight.

9.2.3 Describe gravity and microgravity

9.2.4 Compare gravitational forces of different planets and objects.

9.2.5 Define aerodynamics and the design factors affecting flight.

9.2.6 Describe how the properties of air flow impact flight (e.g. velocity, inclination to flow, viscosity, compressibility and Reynold's number)

9.2.7 Identify the speed of sound and explain why air pressure, density and temperature affect its value

9.2.8 Compare and contrast the speed of lightning vs speed of light.

9.2.9 Calculate launch force, thrust to weight ratio and describe the relationship to specific impulse.

9.2.10 Interpret thrust curves.

9.2.11 Determine the altitude of a projectile using a clinometer.

9.2.12 Calculate the peak velocity of an object

9.2.13 Calculate projectile motion in a vacuum.

9.2.14 Define free return trajectory

9.2.15 Calculate potential, kinetic and total energy.