

**Course Description****ET12321C | Aerospace Systems & Propulsion | 4.00 credits**

This course introduces aeronautical and spacecraft systems, including hydraulic, pneumatic, electrical, propulsion, mechanical, HVAC, and ECLSS (Environmental Control and Life Support Systems). It covers system interactions with computer and data acquisition systems, emphasizing safety, power sources, assembly, troubleshooting, and integration for aerospace operations. Prerequisite: AFR1100C

**Course Competencies**

**Competency 1:** The student will characterize fundamentals of fluid power by:

1. Differentiating types of fluids used in fluid power
2. Identifying common fluid power terminology
3. Delineating the advantages and disadvantages of fluid power
4. Explaining the functions of fluid power systems
5. Identifying basic components and component groups in fluid power systems
6. Describing the relationship between fluid power and other power systems
7. Illustrating power transfer in a fluid power circuit

**Competency 2:** The student will identify safety requirements for fluid power systems by:

1. Characterizing safety factors for pressurized fluids
2. Characterizing safety factors for pressurized systems
3. Assessing safety measures for operating pressurized systems

**Competency 3:** The student will identify fundamental physical principles of fluid systems by:

1. Summarizing the characteristics of fluids used in fluid power systems
2. Explaining the application of Pascal's law and Bernoulli's theorem
3. Identifying flow types and potential frictional losses
4. Analyzing the effects of heat on fluid systems
5. Applying the ideal gas laws in fluid system analysis
6. Explaining the principles of siphons and aspirators

**Competency 4:** The student will analyze fluid power circuits by:

1. Recognizing symbols used to designate components in a fluid system
2. Describing the structure and use of standard graphic symbols
3. Identifying the three main types of symbols in fluid diagrams
4. Drawing diagrams for basic operational fluid power circuits
5. Analyzing a diagram showing different types of pumps, valves, cylinders, and accessories used in a complex fluid power circuit
6. Identifying basic electrical symbols for fluid system operations
7. Explaining the function of fluid logic circuits

**Competency 5:** The student will identify fluid commodities, and their characteristics used in aerospace systems by:

1. Identifying compressed gases used in aerospace systems
2. Identifying cryogenic liquids used in aerospace applications
3. Recognizing propellants used in aerospace vehicles
4. Identifying other fluids used in aerospace systems
5. Inspecting components for compatibility with fluid commodities
6. Evaluating the impact of contaminants on fluid power systems
7. Analyzing the role of filters in maintaining system integrity
8. Explaining the viscosity characteristics of hydraulic fluids
9. Outlining safety requirements for gases, cryogenic liquids, and propellants used in aerospace vehicles

**Competency 6:** The student will explain electrical control of fluid circuits by:

1. Describing types of manual electrical switches
2. Explaining the use of limit switches, pressure switches, relays, timers, and temperature switches
3. Describing the operation of electrical solenoids and other electrical actuators

**Competency 7:** The student will identify and analyze mechanical components in fluid power systems by:

1. Explaining the operation of linear actuation devices in fluid systems
2. Describing the function of single and double-acting cylinders
3. Calculating speed and force outputs of cylinders
4. Identifying common failure sources in cylinder operations
5. Explaining the operation of fluid motors and rotary actuators
6. Calculating motor load torque, displacement, and speed
7. Describing pressure, directional, and flow control devices, including valves and regulators
8. Summarizing characteristics of pipes, tubing, and flexible hoses
9. Identifying types, construction, and sizing of tubing
10. Recognizing types of fittings used in fluid systems
11. Assembling flared fitting connections for tubing
12. Identifying various types of hose ends utilized in hydraulic and pneumatic flexible hose systems
13. Assessing factors for routing tubing or hoses in fluid systems
14. Using Quick Disconnect (QD) fittings effectively
15. Assembling reusable hose fittings
16. Explaining sealing devices in fluid power systems
17. Evaluating material compatibility for sealing components
18. Identifying potential leakage paths in fluid systems

**Competency 8:** The student will analyze power sources in fluid systems by:

1. Describing types of air compressors and their functions
2. Operating air compressors safely
3. Explaining safety features of air compressors
4. Comparing different pneumatic distribution systems
5. Analyzing positive and non-positive displacement hydraulic pumps
6. Calculating input and output power for pumps
7. Identifying causes of cavitation and pump failure
8. Explaining the functions and types of accumulators
9. Evaluating pre-charge and mounting requirements for accumulators

**Competency 9:** The student will operate a fluid system project by:

1. Assembling an electrical circuit for pneumatic system control or to control a mock propellant loading operation
2. Constructing a fluid power circuit
3. Assembling a propellant loading circuit
4. Developing procedures for the operation of fluid power and propellant loading circuits
5. Demonstrating the operation of fluid power and propellant loading circuits

**Competency 10:** The student will explain different propulsion methods for aircraft, rockets, and spacecraft by:

1. Describing different types of aircraft propulsion methods and systems
2. Describing different types of rocket propulsion methods and systems
3. Describing different types of spacecraft propulsion methods and systems

**Competency 11:** The student will explain HVAC (Heating, Ventilation, and Air Conditioning) and ECLSS (Environmental Control and Life Support Systems) systems by:

1. Describing the components of an HVAC system
2. Describing the refrigeration cycle in an HVAC system
3. Describing the ECLSS system in a spacecraft and an aircraft

**Learning Outcomes:**

- Communicate effectively using listening, speaking, reading, and writing skills
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information