AORSI-300-IT Workbook

Overview

This course covers the role of modern technology in off-road vehicles, from GPS and sensors to telematics and off-grid power systems. Students learn how to safely integrate, maintain, and troubleshoot these systems, ensuring reliability during demanding field operations.

Learning Objectives

- Identify key onboard and aftermarket electronic systems.
- Use GPS, trail apps, and sensors effectively.
- Troubleshoot common electronic issues in the field.
- Manage off-grid power and communications equipment.

Module 1: Overview of Vehicle Electronics (OEM & Aftermarket)

Modern off-road vehicles integrate numerous electronic systems, from OEM safety features like traction control and ABS to aftermarket upgrades such as lighting, winch controllers, and telematics. Understanding how these systems interact is critical for reliability and safety. Overloading circuits or poor installation can create hazards and vehicle downtime. Instructors should emphasize proper installation practices, load calculations, and regular inspections.

Course Design Suggestion: Have students examine a vehicle and map its electrical system, identifying both OEM and aftermarket components. Discuss risks of poor wiring practices and demonstrate how to use multimeters for circuit testing.

Exercise: Create a diagram labeling at least five common aftermarket electronic upgrades and explain their purpose.

Reflection Question: How can poor electrical integration affect overall vehicle safety?

Module 2: Navigation & Trail Tech: GPS, Apps, Sensors

Navigation technology has revolutionized off-road travel. GPS units, smartphone apps, and vehicle-mounted sensors provide real-time data on terrain, vehicle performance, and environmental conditions. Students should learn to use topographic maps, satellite imagery, and apps that support offline functionality. Sensor technologies such as tire pressure monitoring, inclinometer apps, and engine diagnostics enhance situational awareness.

Course Design Suggestion: Create a field navigation exercise where students plan a route using both a GPS unit and a mobile trail app, then compare accuracy and usability.

Exercise: List three advantages of using offline GPS apps compared to always relying on cellular service.

Reflection Question: How do sensors improve both safety and decision-making in off-road operations?

Module 3: Off-Grid Power Systems (Solar, Dual-Battery, Inverters)

Extended off-road trips require independent power sources. Solar systems, dual-battery setups, and inverters provide energy for lighting, communications, and refrigeration. Proper sizing and installation prevent overloading and ensure reliability. Students should understand battery chemistry, charging systems, and power budgeting to avoid failures in remote areas.

Course Design Suggestion: Conduct a lab activity where students design a basic solar + dual-battery setup for a multi-day off-road expedition. Include calculations for daily power use.

Exercise: Design a sample power budget for a two-day trail ride using radios, GPS, and lighting equipment.

Reflection Question: Why is redundancy important when planning off-grid power systems?

Module 4: Troubleshooting & Field Repairs

Electronics can and will fail in harsh environments. Operators must be prepared to troubleshoot under field conditions with limited tools. Common issues include blown fuses, corroded connectors, drained batteries, and faulty sensors. Instructors should provide students with systematic diagnostic approaches and practice in simulated failure scenarios.

Course Design Suggestion: Set up troubleshooting stations where students rotate through mock electrical failures, such as a dead GPS, failing winch, or inverter fault. Require them to diagnose and repair the problem within a set time limit.

Exercise: Identify three common electrical problems encountered in the field and explain the step-by-step troubleshooting process for each.

Reflection Question: How can operators prepare a field toolkit to handle common electronic failures?

Final Assessment

Task: Participate in a hands-on troubleshooting scenario where electronic systems fail during a simulated trail ride. Students must diagnose the issue, apply corrective measures, and justify their solution in writing. Additionally, complete the following quiz:

1. What are three differences between OEM and aftermarket electronics?

2. Why is offline navigation capability important in trail apps?

3. What role does a dual-battery system play in off-grid power management?

4. List two common field repair challenges and how to address them.

5. How can regular inspections reduce the risk of electronic failures on the trail?

Duration: 6 hours (lab + field recommended)