AORSI-100-SSB Workbook

Overview

This course explores the systems that give off-road vehicles their control and stability. Students gain knowledge of how suspensions absorb impact, how steering systems adapt to terrain, and how brake systems provide stopping power. By understanding these critical systems, operators can improve safety, vehicle longevity, and confidence in challenging environments.

Learning Objectives

- Compare different suspension systems (solid axle, independent, articulated).
- Understand how steering geometry affects maneuverability.
- Identify brake system components and perform basic checks.
- Recognize how off-road conditions stress these systems.

Module 1: Suspension Types & Functions

Suspensions are the foundation of off-road stability. Solid axles provide strength and articulation, independent suspensions improve handling and comfort, and specialty systems like long-travel or air suspensions offer extreme adaptability. Students should understand how shocks, springs, and linkages work together to absorb impact.

Instructor Guidance: Provide suspension cutaways or physical models to demonstrate movement and stress points.

Course Design Suggestion: Compare ride comfort and performance between vehicles with solid axle and independent suspensions.

Exercise: List three advantages of solid axle suspensions in off-road settings.

Reflection Question: Why does suspension design influence both safety and driver fatigue?

Module 2: Steering Systems – Rack & Pinion vs Hydraulic Assist

Steering systems determine how precisely a vehicle can be controlled over rough terrain. Rack and pinion setups are common in lighter vehicles, offering precision, while hydraulic assist and full hydraulic steering are favored in heavy-duty builds. Steering geometry (caster, camber, toe) also affects maneuverability and tire wear.

Instructor Guidance: Show examples of steering linkage wear and misalignment. Discuss the dangers of bump steer and poor geometry.

Course Design Suggestion: Have students measure toe-in and caster angles in the shop.

Exercise: Compare the pros and cons of rack and pinion steering vs hydraulic assist in rock crawling.

Reflection Question: How does improper steering geometry increase driver risk?

Module 3: Brakes – Disc, Drum, ABS, and Off-Road Considerations

Braking systems are often overlooked in off-road discussions but are critical for control. Disc brakes offer consistent stopping power, while drum brakes are still used in some vehicles for durability. ABS improves safety on-road but can reduce effectiveness on loose surfaces like gravel. Students must learn how to identify brake wear, check fluids, and understand fade in high-stress conditions.

Instructor Guidance: Provide worn vs. new brake pads and rotors for inspection practice.

Course Design Suggestion: Conduct a braking distance test on dirt vs. pavement to show how surfaces affect performance.

Exercise: Identify three signs of brake system wear that require immediate service.

Reflection Question: Why might ABS be disabled or modified in off-road builds?

Module 4: Diagnostics, Wear Points, and Field Adjustments

Suspension, steering, and brakes all suffer accelerated wear in off-road conditions. Students should learn to identify wear points such as bushings, ball joints, tie rods, and brake lines. Field adjustments may include bleeding brakes, tightening linkages, or adjusting shocks. Preventative inspections reduce failure risks.

Instructor Guidance: Walk students through a vehicle inspection checklist covering suspension, steering, and brakes.

Course Design Suggestion: Stage common faults (e.g., loose tie rod, worn brake pad) for students to diagnose and correct.

Exercise: Draft a daily inspection checklist for suspension, steering, and brake components.

Reflection Question: Why does preventative inspection save both time and cost compared to field repairs?

Final Assessment

Task: Conduct a hands-on inspection of suspension, steering, and brake systems. Identify wear points, complete a diagnostic checklist, and demonstrate proper adjustment or replacement of at least one component. Additionally, complete a short written exam including the following sample questions:
1. What are the main differences between solid axle and independent suspension systems?

2. Why is steering geometry critical to safe off-road operation?

3. What are three common brake wear indicators?

4. How do off-road conditions accelerate wear in suspension, steering, and braking systems?

5. What preventative practices reduce the likelihood of steering or brake failure in the field?

Duration: 6 hours (classroom + garage/shop setting)