AORSI Instructor Guide

Course Title: Vehicle Dynamics & Terrain Physics (VEH)

Duration: 5 Hours (with field demos recommended)

Audience: Off-road operators, trainers, and instructors

Course Overview

This course explains how off-road vehicles behave across different terrains, introducing key physics concepts such as traction, torque, and weight distribution. By studying these principles, students can better predict vehicle behavior and apply safe driving strategies in real-world off-road scenarios.■195†AORSI-100-VEH Workbook†L1-L9■

Learning Objectives (Instructor Notes)

- Understand how terrain affects traction and control.

- Learn about torque management, wheel slip, and center of gravity.

- Apply knowledge to safe maneuvering in real-world scenarios.

Module 1: Vehicle Physics 101 – Motion, Torque, and Friction (1.25 hrs)

- Teach torque, friction, wheel slip, momentum, resistance.

- Course Design Suggestion: Lab comparing traction of tires on gravel, mud, pavement.

- Exercise: Define torque and explain low-speed crawling in rocks.

- Reflection: Why is friction both a friend and obstacle in off-road driving?■195†AORSI-100-VEH Workbook†L11-L24■

Module 2: Terrain Types – Sand, Mud, Rock, Snow, Water (1.25 hrs)

- Teach strategies for different terrains and recovery implications.

- Course Design Suggestion: Students build terrain strategy guides.

- Exercise: List two best practices for crossing mud/water.

- Reflection: Why does one vehicle excel in sand but struggle in snow?■195†AORSI-100-VEH Workbook†L26-L39■

Module 3: Weight Transfer & Center of Gravity (1.25 hrs)

- Teach pitch, roll, yaw, and impacts of modifications on stability.

- Course Design Suggestion: Drive with varied loads to observe handling changes.

- Exercise: Identify three factors increasing rollover risk.

- Reflection: How does weight distribution affect climbing/descending hills?■195†AORSI-100-VEH Workbook†L41-L54■

Module 4: Managing Traction & Stability (1.25 hrs)

- Teach traction aids, throttle control, recovery from traction loss.

- Course Design Suggestion: Demonstrate traction control intervention on gravel.

- Exercise: Compare open vs locked differential on hill climb.

- Reflection: Why is smooth throttle more effective than aggressive acceleration?■195†AORSI-100-VEH Workbook†L56-L71■

Instructor–Student Alignment Chart

This chart aligns instructor activities with student workbook exercises for easy reference.■195†AORSI-100-VEH Workbook†L11-L71■

Module	Instructor Focus	Student Workbook Activity
1: Vehicle Physics	Demonstrate torque, momentum, and wheel slip	Define torque and explain crawling■195†AORSI-100-VEH W
2: Terrain Types	Show case studies of terrain strategies	List practices for mud/water crossings■195†AORSI-100-VEI
3: Weight Transfer	Demonstrate rollover risks with models	Identify rollover factors■195†AORSI-100-VEH Workbook†L4
4: Traction & Stability	Show traction control demos	Compare open vs locked differentials■195†AORSI-100-VEH

Final Assessment

Task: Students demonstrate vehicle control across terrain sections, applying correct physics-based strategies. Written exam includes:■195†AORSI-100-VEH Workbook†L73-L83■

- What is torque, and why is it important for off-road driving?
- How should tire pressure be adjusted for sand driving, and why?
- What factors contribute to rollover risk?
- How do traction control systems improve stability?
- Why is momentum management essential in mud and sand?

Instructor Preparation Checklist

- Prepare visual demonstrations (torque wrench, rolling objects).
- Collect terrain videos or case studies.
- Provide scaled models for rollover demos.
- Stage traction control demonstrations on gravel.

Suggested Timing

- Introduction – 10 min
- Module 1 – 75 min
- Module 2 – 75 min
- Module 3 – 75 min
- Module 4 – 75 min
- Final Assessment – 30 min
- Wrap-up & Questions – 10 min