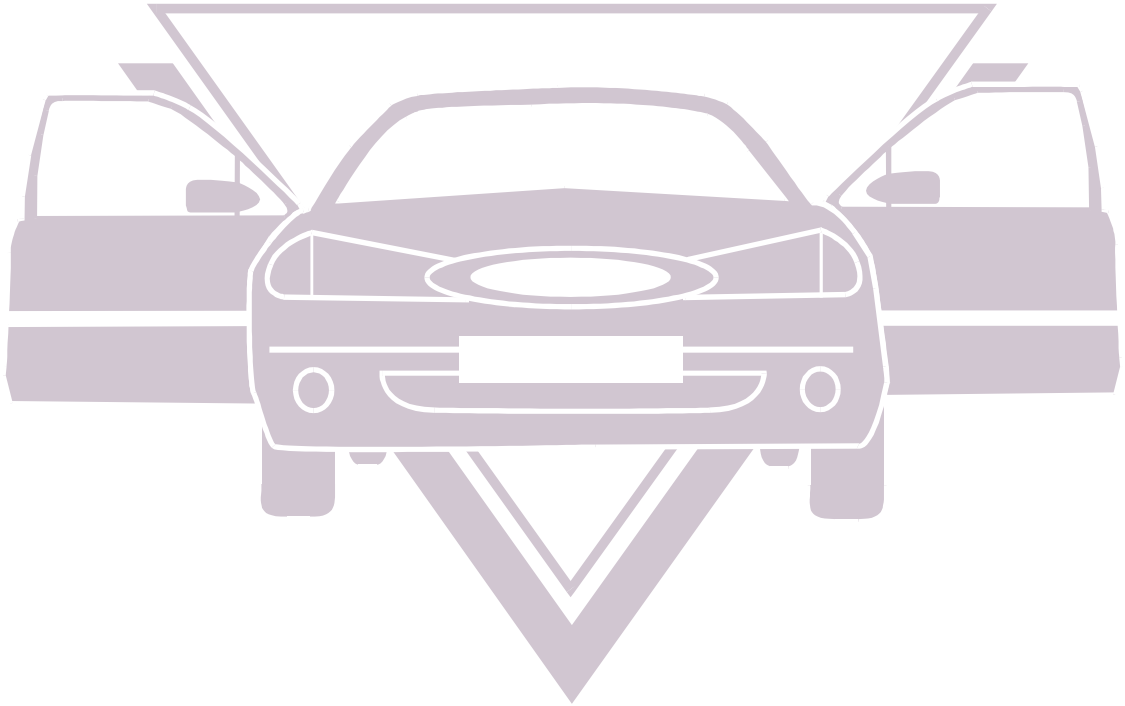


# autOLAB



## Laboratory Management Guide

Issue: ME1346/B

---

Copyright © 2002, LJ Technical Systems. No part of this publication may be adapted or reproduced in any material form, without the prior written permission of LJ Technical Systems.

**Written by:** LJ Technical Dept.



# Contents

	<b>page</b>
Introduction .....	2
The AutoLAB Program .....	3
Instructors Materials .....	5
Pod Content .....	6
Braking Systems .....	6
Automotive Electrical/Electronic Systems .....	68
Engine Performance .....	128
Steering and Suspension Systems .....	188
Specialty Pod .....	248
Installation at a Student Workstation .....	308
Installation at the Instructor’s Management PC .....	308
Using a Student Workstation .....	309
Rotation Planning .....	310
Workshop Practical Activities .....	326
Required Tools .....	327

## Introduction

This *AutoLAB Laboratory Management Guide* contains information on setting up and running an AutoLAB Laboratory that uses the ClassAct computer managed learning system. It includes examples of how an AutoLAB class can rotate, and module details to help in the structuring of the course.

This guide should be used in conjunction with the Instructors Guide supplied with an AutoLAB module, which will contain specific instructions for installing the module.

Information on setting up and running the *ClassAct* computer managed learning system is contained in the *ClassAct Laboratory Management Instructor's Guide ST520*, supplied with the *ClassAct* software. This contains tutorials on the facilities available in the *ClassAct* system and should be referred to for information on using *ClassAct* in the AutoLAB Laboratory.

## The AutoLAB Program

The AutoLAB Program is designed to provide hands-on training in the key areas of automotive engineering required by car dealerships and service centers.

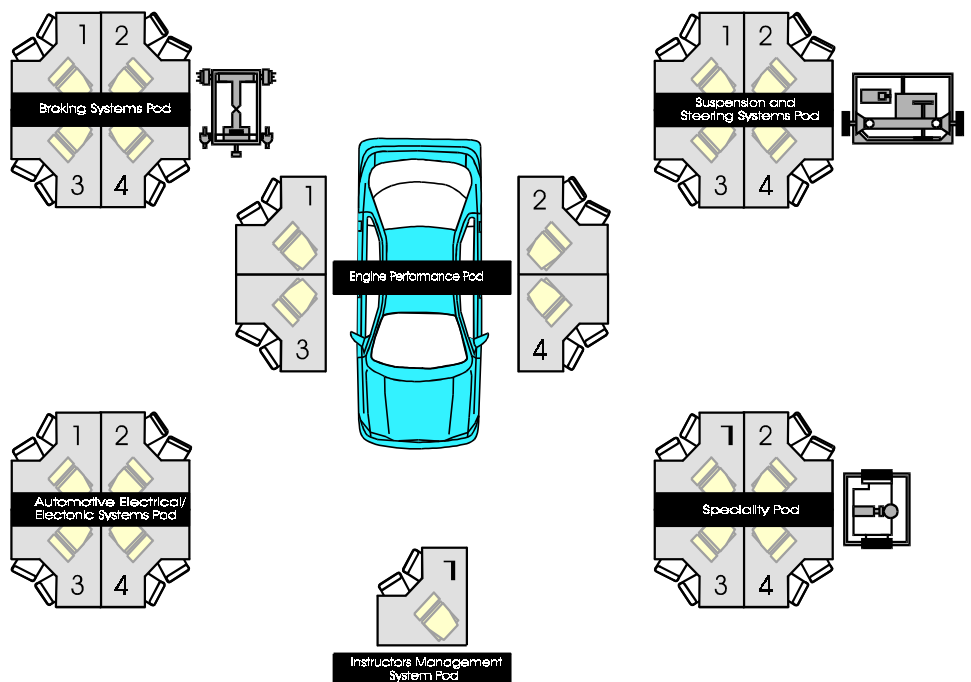
The material provided in an AutoLAB laboratory can be defined in two areas; Instructor materials and student materials.

The instructor materials allow the instructor to give presentations to the whole class. These are provided as PowerPoint presentations. For more details on these presentations please refer to the section ‘Instructors Materials’ within this guide.

An instructor’s workstation will provide the instructor with access to the ClassAct management system. This is identified in diagram 1.

The student-centered curriculum provides on-screen laboratory assignments containing theory support material, hands-on practical activities and direction to use of various resources. This material is installed on workstations around the classroom, where each workstation is a dedicated resource area for a topic of study. This is called an AutoLAB module.

A classroom should be organized into pods. A pod will contain 4 modules. Specific hardware will be required at certain workstations, which will be provided with the module. The general layout of an AutoLAB laboratory is shown in diagram 1.



**Diagram 1** – Typical AutoLAB layout.

Additional tools may be required but not supplied for the following modules that use real vehicle trainers.

BS2 – Disc and Drum Brake Systems (Brake trainer)

SSS2 – Suspension and Steering Systems 1 (Steering and Suspension Trainer)

ACS2 – Air Conditioning Components and Operation (Air Conditioning Trainer)

EP3 – Ignition System Components and Operation (Ignition Turret)

For more details about the tools that will be required for these modules please refer to the instructor's guide for the appropriate module.

Where appropriate the student will be required to carry out practical activities on real vehicles. This practical work is to be carried out in a fully equipped workshop.

The student will be provided with procedures to carry out in the form of a student worksheet. The student should take their worksheet with them into the workshop.

Due to the nature of Automotive Technology the student is required to request instructor supervision for some of the tasks they have to undertake in the workshop.

All AutoLAB modules are specifically designed for use with the *ClassAct* computer managed learning system, with the students running the laboratory assignments from the Workstation Launcher.

The *ClassAct* management system records their results from experiments and their responses to questions answered during the module.

Each module has pre-defined competence objectives to which all questions are linked. The *ClassAct* system then allows you to generate reports to assess the student's understanding of the module based on these competence objectives.

## Instructors Materials

The instructors materials cover the full range of automotive engineering. They are for use as theoretical presentation materials by the instructor. Each module contains a number of PowerPoint-based presentations that are accessed via a menu system. These presentations do not need PowerPoint to be installed on the computer.

These modules also contain PowerPoint theory support materials, which are an extension of the presentations and can be used as notes by the instructor when giving the presentation. PowerPoint is required on the computer for these to be opened.

The presentation and support materials for each module are contained on one CD-ROM. Each CD-ROM also contains PDF versions of the presentation and support material for the instructor to print off as notes for either themselves or for their students.

The following list identifies the content of each instructor material module:

- APP01 – Automotive Electrical/Electronic Systems
- APP02 – Automotive Components and Operation
- APP03 – Automotive Transmission Systems
- APP04 – Braking Systems
- APP05 – Automotive Electrical/Electronic Fundamentals
- APP06 – Engine Performance
- APP07 – Heating and Air Conditioning Systems
- APP08 – Steering and Suspension Systems

## Pod Content

The following information is provided to identify which modules are used in each pod. For each module a table is provided to identify the objective of each assignment together with an estimated indication of the amount of time it will be expected for the student to spend in the Laboratory and in the Workshop.

### Braking Systems Pod

The Braking Systems Pod covers the following topic areas:

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	1 Introduction to Hydraulics and the Hydraulics Trainer

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Principles of hydraulics Task 2 - Safety procedures Task 3 - Hydraulics trainer overview Task 4 - Connecting the hoses Task 5 - Using the hydraulics trainer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	2 Compressibility of Fluids

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Types of substance Task 2 - Air shock absorber Task 3 - Liquid shock absorber

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	1 Introduction to Hydraulics and the Hydraulics Trainer

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Principles of hydraulics Task 2 - Safety procedures Task 3 - Hydraulics trainer overview Task 4 - Connecting the hoses Task 5 - Using the hydraulics trainer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	2 Compressibility of Fluids

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Types of substance Task 2 - Air shock absorber Task 3 - Liquid shock absorber

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	3 Basic Hydraulic Laws

Natef Area	Natef Level	Natef Objective
V-B1	P-1	Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law)

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Hydraulic laws Task 2 - Controlling pressure Task 3 - Pascal's Law

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	4 Using Hydraulic Circuit Symbols

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Comparison of components to symbols Task 2 - Hydraulic system using symbols Task 3 - Making a system from a circuit diagram

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	5 Control Valves

Natef Area	Natef Level	Natef Objective
V-B9	P-2	Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves.
V-B10	P-3	Inspect, test, and adjust height (load) sensing proportioning valve.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Control Valves Theory Task 2 - Flow Control Valve Task 3 – Directional Control Valve Task 4 - Check Control Valve Task 5 - On-vehicle Hydraulic Valves

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	6 Cylinders

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 – Actuators Task 2 - Cylinder action Task 3 - Load lifting Task 4 - Changing load carrying capacity

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	7 Brake Cylinders

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Master Cylinder Components Task 2 - Master Cylinder Operation Task 3 - Caliper Components Task 4 - Caliper Operation Task 5 - Wheel Cylinder Components Task 6 - Wheel Cylinder Operation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	8 Fluid Flow

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Volume and Capacity Task 2 - Flow and Pressure Task 3 - Measuring Flow Task 4 - Cylinders and Flow

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	9 Hydraulic Pumps and Levers

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Hydraulic Pumps Task 2 - Pump Operation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	10 Motion and Control of Cylinders

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Motion of Cylinders Task 2 - Extension and Retraction of Cylinders Task 3 - Cylinder Leverage and Springs

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulic Systems
<b>Assignment Number and Title:</b>	11 High Pressure Hydraulics

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Exploring High Pressure Hydraulics Task 2 - Pressure Control Valves Task 3 - Absorbing Shocks

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulics Systems
<b>Assignment Number and Title:</b>	12 Sequencing Hydraulics

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Hydraulic Sequencing Components Task 2 - Operation of Sequencing Hydraulics Task 3 - Sequencing Hydraulics and Safety

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulics Systems
<b>Assignment Number and Title:</b>	13 Hydraulic Systems and Heat

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Hydraulic Heat Sources Task 2 - Hydraulic Heat Generation Task 3 - Hydraulic Heat Dissipation Task 4 - Hydraulic Performance and Reliability

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulics System
<b>Assignment Number and Title:</b>	14 Hydraulic Cylinder Selection

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Sizing Hydraulic Cylinders Task 2 - Comparing Cylinder Types Task 3 - Selecting Hydraulic Cylinders Task 4 - Use of Energy

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS1 Fundamental Hydraulics Systems
<b>Assignment Number and Title:</b>	15 Hydraulic Problem Solving

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-B5	P-1	Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D280 Hydraulics Trainer
<b>Lab Tasks:</b>	Task 1 - Hydraulic Solution Task 2 - Hydraulic Braking Systems Fault Finding

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake Systems
<b>Assignment Number and Title:</b>	1 Friction Brake Theory

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - What is friction Task 2 - Kinetic energy Task 3 - Putting friction to work Task 4 - Factors affecting friction Task 5 - Heat removal Task 6 - Other braking factors Task 7 - Friction members

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake Systems
<b>Assignment Number and Title:</b>	2 Components and Operation of Drum Brakes

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Drum Brake Systems and Components
<b>Lab Tasks:</b>	Task 1 - Principles of brakes Task 2 - Divided systems Task 3 - Drum brake operation Task 4 - Emergency brake Task 5 - Brake linings and shoes Task 6 - Backing plate Task 7 - Wheel cylinder

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake Systems
<b>Assignment Number and Title:</b>	3 Components and Operation of Disc Brakes

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Disc Brake Systems and Components
<b>Lab Tasks:</b>	Task 1 - Disc brake operation Task 2 - Disc brake rotor Task 3 - Front disc brake caliper Task 4 - Rear disc brake caliper Task 5 - Disc brake pads

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake Systems
<b>Assignment Number and Title:</b>	4 Wheel Removal and Installation

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-C7, V-D11	P-1	Install wheel, torque lug nuts, and make final checks and adjustments.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Road Wheels Task 2 - Wheel Removal and Installation

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	A real vehicle that has four wheels and a spare wheel. Vehicle service manual. General wrench, socket and screwdriver set. Torque wrench. Wheel chocks. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Road Wheel Removal and Installation

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake Systems
<b>Assignment Number and Title:</b>	5 Drum Brake Servicing

Natef Area	Natef Level	Natef Objective
V-C2	P-1	Remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed.
V-C4	P-1	Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
V-C5	P-2	Remove, inspect, and install wheel cylinders.
V-C6	P-1	Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: AutoBrakes Technology Braking Systems Trainer Socket Set with Breaker Bar and Torque Wrench Pliers Set of Wrenches Brake Servicing Kit
<b>Lab Tasks:</b>	Task 1 - Introduction to the Brake Trainer Task 2 - Drum brake servicing techniques theory Task 3 - Wheel cylinder servicing theory Task 4 - Drum servicing Task 5 - Drum brake component servicing

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	6 Machining Brake Drums

Natef Area	Natef Level	Natef Objective
V-C3	P-1	Refinish brake drum.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Machining a drum theory

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand Tools Brake drum micrometer Brake drum lathe Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Machining Brake Drums

<b>Vehicle Requirements</b>
A suitable brake drum for students to refinish.

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	7 Disc Brake Pads Servicing

Natef Area	Natef Level	Natef Objective
V-D4	P-1	Remove, clean and inspect pads and retaining hardware; determine necessary action.

<b>Time in Lab (hrs):</b>	Remove, clean and inspect pads and retaining hardware; determine necessary action.
<b>Lab Inventory:</b>	Book: AutoBrakes Technology Braking Systems Trainer Socket Set with Allen Keys and Torque Wrench Pliers Set of Wrenches Brake Servicing Kit
<b>Lab Tasks:</b>	Task 1 - Disc brake pad theory Task 2 – Pad service

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	8 Disc Brake Caliper Servicing

Natef Area	Natef Level	Natef Objective
V-D2	P-1	Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action.
V-D3	P-1	Clean and inspect caliper mounting and slides for wear and damage; determine necessary action.
V-D5	P-2	Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts.
V-D6	P-1	Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: AutoBrakes Technology Braking Systems Trainer Socket Set with Allen Keys and Torque Wrench Pliers Set of Wrenches Brake Servicing Kit
<b>Lab Tasks:</b>	Task 1 - Disc brake caliper theory Task 2 - Disc brake caliper servicing

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	9 Disc Brake Rotor Servicing

Natef Area	Natef Level	Natef Objective
V-D7	P-1	Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace.
V-D8	P-1	Remove and reinstall rotor.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Braking Systems Trainer Socket Set with Allen Keys and Torque Wrench Set of Screwdrivers Set of Wrenches Dial Indicator
<b>Lab Tasks:</b>	Task 1 - Disc Brake Rotor Theory Task 2 - Rotor Measurement Theory Task 3 - Measuring Disc Brake Rotors Task 4 - Disc Brake Rotor Repair

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	10 Machining Disc Brake Rotors

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-D9	P-1	Refinish rotor according to manufacturer's recommendations.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Machining Rotors Theory Task 2 - Machining Rotor Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand Tools Brake disc micrometer Brake rotor lathe Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Refinishing disc brake rotor

<b>Vehicle Requirements</b>
Separate disc brake rotor, or vehicle equipped with rotor for refinishing

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	11 Disc Brake Rotor Replacement

Natef Area	Natef Level	Natef Objective
V-D8	P-1	Remove and reinstall rotor.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology Braking Systems Trainer Socket Set with Allen Keys and Torque Wrench Screwdrivers Set of Wrenches Dial Indicator
<b>Lab Tasks:</b>	Task 1 - Disc Brake Rotor Theory Task 2 - Disc Brake Rotor Replacement

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	12 Parking Brake Service

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-F3	P-2	Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed.
V-F4	P-1	Check parking brake operation; adjust as needed.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology Braking Systems Trainer Socket Set and Torque Wrench Screwdrivers Set of Wrenches Pliers
<b>Lab Tasks:</b>	Task 1 - Parking Brake Components Task 2 - Parking Brake Cable Replacement

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	13 Calipers with Integral Parking Brake Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-D10	P-3	Adjust calipers equipped with an integrated parking brake system.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Integral Caliper Parking Brake Components Task 2 - Integral Caliper Parking Brake Adjustments

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	<b>Personal safety equipment</b> <b>Common hand tools</b> <b>Vehicle hoist or jack and stands</b> <b>Parking brake caliper adjusting tool</b> Service manual
<b>Workshop Tasks:</b>	Testing the parking brake cable Resetting the caliper. Reassemble the brakes

<b>Vehicle Requirements</b>
Vehicle fitted with integral parking brake calipers

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	14 Brake Fault Finding

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-C1, V-D1	P-1	Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Disc Brake faults Task 2 - Drum Brake faults Task 3 - Recommendations for Repair

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS2 Disc and Drum Brake System
<b>Assignment Number and Title:</b>	15 Problem Solving Braking Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-A1	P-1	Identify and interpret brake system concern; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Brake Troubleshooting Task 2 - Typical Troubleshooting Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	<b>Personal safety equipment</b> <b>Common hand tools</b> <b>Vehicle hoist or jack and stands</b> Service manual Any additional information
<b>Workshop Tasks:</b>	Troubleshooting a Braking System

<b>Vehicle Requirements</b>
Vehicle with a pre-determined braking problem

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	1 Introduction to ABS and the ABS Trainer

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - What is ABS? Task 2 - Introduction to the ABS Panel Trainer Task 3 - Simple Experiment with the ABS Panel Trainer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	2 ABS Hydraulic Operation

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	PT7.8 Panel Trainer
<b>Lab Tasks:</b>	Task 1 - Typical anti-lock brake systems Task 2 - Normal braking Task 3 - ABS Braking Cycle: Pressure Isolate Task 4 - ABS Braking Cycle: Pressure Dump Task 5 - ABS Braking Cycle: Pressure Build

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	3 ABS Sensors and Switches

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Active sensors Task 2 - Analog sensors Task 3 - Digital sensors Task 4 - Inductive sensors Task 5 - Hall effect sensors Task 6 - Brake pedal travel sensor Task 7 - Brake fluid level switch

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	4 Testing Anti-lock Brake Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G1	P-1	Identify and inspect antilock brake system (ABS) components; determine necessary action.

<b>Time in Lab (hrs):</b>	1.0
<b>Lab Inventory:</b>	CDX: Braking Systems and Components – ABS Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - System Tests Task 2 - Component Tests Task 3 - Rectification Recommendation

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Vehicle hoist or jack and stands Vehicle protection kit. Multimeter Vehicle service manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Testing of a typical anti-lock brake system

<b>Vehicle Requirements</b>
Vehicle with ABS system.

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	5 ABS Fault Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G2	P-2	Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Oscilloscope Digital Multimeter Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - ABS Diagnosis Task 2 - Fault Diagnosis 1 Task 3 - Fault Diagnosis 2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	6 De-pressurization of ABS High Pressure System

Natef Area	Natef Level	Natef Objective
V-G4	P-3	Depressurize high-pressure components of the antilock brake system

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - ABS Systems Task 2 - High Pressure Components Task 3 -The Accumulator Task 4 - De-pressurization Procedure

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	Hand tools. Vehicle protection kit. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	De-pressurize high-pressure components of the anti-lock brake system

<b>Vehicle Requirements</b>
Vehicle with integral pressure accumulator.

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	7 Further ABS Sensors and Switches

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Oscilloscope Digital Multimeter CDX: Braking Systems and Components – ABS
<b>Lab Tasks:</b>	Task 1 - Advanced Components Task 2 - On Vehicle Components Task 3 - Hydraulic Pump Motor Speed Sensor Task 4 - The Brake Pedal Switch Task 5 - Fault Diagnosis

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	8 ABS Electrical Fault Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G3	P-1	Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Fault Diagnosis 1 Task 2 - Fault Diagnosis 2 Task 3 - Fault Diagnosis 3

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	9 Bleeding Anti-lock Braking Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G5	P-2	Bleed the anti-lock brake system's (ABS) front and rear hydraulic circuits.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Braking Systems and Components – ABS Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Bleeding ABS Task 2 - ABS Bleeding Procedures

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Brake bleeding equipment Vehicle protection kit. Personal protective equipment (gloves, safety glasses, heavy-duty boots). Vehicle lifting equipment Vehicle service manual
<b>Workshop Tasks:</b>	Bleed a pressurized ABS brake system

<b>Vehicle Requirements</b>
Vehicle with suitable ABS

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	10 Replacing ABS Components

Natef Area	Natef Level	Natef Objective
V-G6	P-3	Remove and install anti-lock brake system (ABS) electrical/electronic and hydraulic components.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Replacing ABS Components Task 2 - Replacing ABS Components Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Workbench Vehicle protection kit. Syringe. Brake bleeding kit and fluid. Vehicle lifting equipment Vehicle service manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	11 ABS Servicing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G7	P-1	Test, diagnose and service ABS speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO)(includes output signal, resistance, shorts to voltage/ground, and frequency data).

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - ABS Servicing Task 2 - ABS Servicing Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Vehicle hoist or jack and axle stands Service manual Brake fluid tester Fluid catch bottle Clear plastic tube Hand tools New Fluid Pressure bleed kit Compressed air supply Multimeter Scan tool
<b>Workshop Tasks:</b>	ABS component servicing

<b>Vehicle Requirements</b>
Vehicle with pressurized ABS.

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	12 ECU Controlled ABS Devices

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - ABS System Components Task 2 - The ABS Relay Task 3 - ABS Warning Lamp and Diode Task 4 - Hydraulic Control Unit Task 5 - Hydraulic Pump and Motor

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	13 Fault Finding ABS Devices Controlled by the ECU

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G7	P-1	Test, diagnose and service ABS speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO)(includes output signal, resistance, shorts to voltage/ground, and frequency data).

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Component Review Task 2 - Fault Finding 1 Task 3 - Fault Finding 2 Task 4 - Fault Finding 3

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	14 Further Fault Diagnosis in ECU Controlled ABS Devices

Natef Area	Natef Level	Natef Objective
V-G7	P-1	Test, diagnose and service ABS speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO)(includes output signal, resistance, shorts to voltage/ground, and frequency data).
V-G8	P-3	Diagnose antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc)

<b>Time in Lab (hrs):</b>	
<b>Lab Inventory:</b>	Digiac PT7.8 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Component Review Task 2 - Fault Finding 1 Task 3 - Fault Finding 2 Task 4 - Fault Finding 3

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS3 Braking Systems and ABS Applications
<b>Assignment Number and Title:</b>	15 Traction Control Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-G9	P-3	Identify traction control system components.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - The Purpose of Traction Control Systems Task 2 - Components of Traction Control Systems Task 3 - Traction Control System Diagnosis Task 4 - Traction Control Improvements - Stability Control

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	1 Measuring and Adjusting Pedal Height

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-B2	P-2	Measure brake pedal height; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Procedure for measuring pedal height

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Sharpened measuring probe (or plain probe + measuring tape) or yardstick, depending on method specified in service manual. Open-end wrench to fit push rod lock nut.
<b>Workshop Tasks:</b>	Measuring brake pedal height Adjusting push rod length

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	2 Brake Fluid, Master Cylinder Checks and Brake Boosters

Natef Area	Natef Level	Natef Objective
V-B3	P-2	Check master cylinder for internal and external leaks and proper operation; determine necessary action.
V-B8	P-1	Select, handle, store, and install brake fluids to proper levels.

<b>Time in Lab (hrs):</b>	1.25
<b>Lab Inventory:</b>	Book: Modern Automotive Technology Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Brake fluid Task 2 - Working with brake fluid Task 3 - Master cylinder principles Task 4 - Master cylinder inspection Task 5 - Master cylinder operation Task 6 - Vacuum power assist units (brake boosters) Task 7 - Hydraulic power assist units

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	Cleaning rags Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Checking for master cylinder external leaks Checking for master cylinder internal leaks Checking for master cylinder correct operation

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	3 Master Cylinder Removal and Repair

Natef Area	Natef Level	Natef Objective
V-B4	P-1	Remove, bench bleed, and reinstall master cylinder.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Master Cylinder Operation Task 2 - Master Cylinder Removal

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual Cleaning rags Hand tools Output port plugs Bleeder kit or universal bleeder tubes Consumable: Clean brake fluid Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Remove, bench bleed, and reinstall master cylinder.

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	4 Brake Lines and Fittings

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-B6	P-2	Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Brake Line Theory

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Brake line inspection

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	5 Brake Line Fabrication

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-B7	P-2	Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Brake Line, Hose and Fitting Service Task 2 - Brake Line Fabrication

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Personal protective equipment (gloves, safety glasses, heavy-duty boots). Pipe-flaring tools Pipe cutter Pipe wrench Consumable: Brake line Consumable: Brake line connectors Consumable: Brake fluid
<b>Workshop Tasks:</b>	Construct a brake line and fit to a vehicle.

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	6 Brake Warning Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-B11	P-3	Inspect, test, and/or replace components of the brake warning light system.
V-F5	P-3	Check operation of parking brake indicator light system.
V-F6	P-1	Check operation of brake stop light system; determine necessary action.

<b>Time in Lab (hrs):</b>	0.75
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Types of Brake Warning Systems Task 2 - Component Testing Procedures Task 3 - Computerized System Testing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Vehicle service manual. Vehicle protection kit. Multimeter. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Testing of a typical brake light switch

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	7 Bleeding Braking Systems

Natef Area	Natef Level	Natef Objective
V-B12	P-1	Bleed (manual, pressure, vacuum or surge) brake system.

<b>Time in Lab (hrs):</b>	1.0
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Inspecting Hydraulic Braking Systems Task 2 - Bleeding Procedures Task 3 - Testing Braking System Hydraulics

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle Hoist or jack and stands. Vehicle service manual. Vehicle protection kit. Manual brake bleed kit (pressure) Personal protective equipment (gloves, safety glasses, heavy-duty boots). Consumable: Brake fluid
<b>Workshop Tasks:</b>	Bleed the brake system

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	8 Flush Hydraulic Brake System

Natef Area	Natef Level	Natef Objective
V-B13	P-3	Flush hydraulic system.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Brake Systems and Components – Disc
<b>Lab Tasks:</b>	Task 1 - Testing Hydraulic Fluid Task 2 - Flushing Procedures Task 3 - Checking and Testing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle Hoist or jack and stands. Vehicle service manual. Vehicle protection kit. Manual brake bleed kit Personal protective equipment (gloves, safety glasses, heavy-duty boots). Consumable: Brake fluid
<b>Workshop Tasks:</b>	Flush hydraulic brake system

Vehicle Requirements
Any shop vehicle.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	9 Power Assist Braking Systems

Natef Area	Natef Level	Natef Objective
V-E1	P-2	Test pedal free travel with and without engine running; check power assist operation.
V-E4	P-3	Inspect and test hydro-boost system and accumulator for leaks and proper operation; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Vacuum Brake Booster Task 2 - Hydraulic Brake Booster Task 3 - Test Vacuum Brake Booster Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Tape measure or ruler Vehicle protection kit Service manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Test vacuum brake booster

<b>Vehicle Requirements</b>
Vehicle with vacuum brake booster

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	10 Vacuum Supply on Power Assist Braking Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-E2	P-2	Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Inlet Manifold Vacuum Task 2 - Vacuum Pumps Task 3 - Vacuum Supply Testing procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Hand tools Vacuum gauge Service manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Testing vacuum supply

<b>Vehicle Requirements</b>
Vehicle with vacuum brake booster

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	11 Vacuum-type Power Booster

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-E3	P-2	Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Service Vacuum-type Booster Task 2 - Check Valve Operation Task 3 - Vacuum Leak Testing Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Hand tools Vacuum gauge Service manual Soapy water or leak detecting solution Exhaust extraction Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Vacuum Leak Testing

<b>Vehicle Requirements</b>
Vehicle with vacuum brake booster

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	12 Wheel Bearing Types and Construction

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
V-F1	P-1	Diagnose wheel bearing noise, wheel shimmy, vibration concerns; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book – Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Wheel Bearing Operation Task 2 - Wheel Bearing Loads Task 3 - Wheel Bearing Types Task 4 - Wheel Bearing Identification Task 5 - Wheel Bearing Lubrication and Seals Task 6 - Wheel Bearing Problems

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	13 Wheel Bearing and Race Replacement

Natef Area	Natef Level	Natef Objective
V-F2	P-1	Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings.
V-F7	P-1	Replace wheel bearing and race.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book – Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Wheel Bearing Replacement Techniques Task 2 - Wheel Bearings Replacement Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Bearing and seal fitting tools or soft drift. Hammer. General wrench, socket and screwdriver set. Torque wrench. Vehicle jacking equipment or a wheel free hoist. Bearing grease. Bearing cleaning equipment. Vehicle protection kit. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Wheel Bearing Replacement

<b>Vehicle Requirements</b>
Vehicle with taper roller bearing hubs.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	14 Sealed Wheel Bearing Replacement

Natef Area	Natef Level	Natef Objective
V-F9	P-2	Remove and reinstall sealed wheel bearing assembly.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book – Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Sealed Bearing Replacement Techniques Task 2 - Sealed Bearing Replacement Procedure

<b>Time in Workshop (hrs):</b>	1.5
<b>Workshop Inventory:</b>	Vehicle service manual. Bearing press and fitting tools. Hammer. Ball joint pullers General wrench, socket and screwdriver set. Torque wrench. Vehicle jacking equipment or a wheel free hoist. Vehicle protection kit. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Sealed Wheel Bearing Replacement

<b>Vehicle Requirements</b>
Vehicle with sealed type wheel bearings.

<b>Module ID and Title:</b>	BS4 Braking Components and Operation
<b>Assignment Number and Title:</b>	15 Wheel Stud Replacement

Natef Area	Natef Level	Natef Objective
V-F8	P-1	Inspect and replace wheel studs.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book – Auto Brakes Technology
<b>Lab Tasks:</b>	Task 1 - Road Wheel Fixings Task 2 - Wheel Stud Replacement Techniques Task 3 - Wheel Stud Replacement Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Bearing press and fitting tools. New stud and lug nut. General wrench, socket and screwdriver set. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Wheel Stud Replacement

Vehicle Requirements
Vehicle hub (removed from vehicle with damaged or insecure stud).

## Automotive Electrical/Electronic Systems

The Automotive Electrical/Electronic Systems Pod covers the following topic areas:

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	1 Electrical Safety and Equipment Familiarization

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.5 Experiment Card 2mm Connecting Leads and Links
<b>Lab Tasks:</b>	Task 1 - Electrical Safety Task 2 - Powering the D3000 Base Unit Task 3 - The Experiment Card Master Board Task 4 - Loudspeaker Circuit Task 5 - Connecting D3000 Experiment Cards Task 6 - Light Bulb Circuit

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	2 The Basic DC Circuit

Natef Area	Natef Level	Natef Objective
VI-A1	P-1	Identify and interpret electrical/electronic system concern; determine necessary action.
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A6	P-1	Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.5 Experiment Card 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Electrical Principles Task 2 - Electrical Circuits Task 3 - Measuring Voltage and Current Task 4 - Measuring Voltages in a Circuit Task 5 - Measuring Currents in a Circuit

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	3 Resistance and Ohm's Law

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Check current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
VI-A10	P-1	Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.5 Experiment Card 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Resistance and Color Coding Task 2 - Measurement of Resistance Task 3 - Ohm's Law

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	4 Series/Parallel and Variable Resistors

Natef Area	Natef Level	Natef Objective
VI-A4	P-1	Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law)
VI-A10	P-1	Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.5 Experiment Card 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Different Resistor Configurations Task 2 - Resistors in Series Task 3 - Resistors in Parallel Task 4 - Series-Parallel Combinations Task 5 - The Rheostat Task 6 - The Potentiometer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	5 AC Measurements

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.5 Experiment Card 2mm Connecting Leads and Links Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - AC & Oscilloscopes Task 2 - AC Voltages Task 3 - Alternating Voltage Values

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	6 Capacitor Charge, Discharge and Timing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.6 Experiment Card 2mm Connecting Leads and Links Digital Multimeter Oscilloscope Signal (function) Generator
<b>Lab Tasks:</b>	Task 1 - Capacitor Operation Task 2 - Charging and Discharging a Capacitor Task 3 - Capacitor Charge Time Task 4 - Capacitor on a DC Supply Task 5 - Capacitor on an AC Supply

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	7 AC Resistors and Capacitors

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.8 Experiment Card 2mm Connecting Leads and Links Digital Multimeter Signal (function) Generator
<b>Lab Tasks:</b>	Task 1 - AC Effects on Resistors and Capacitors Task 2 - Resistors in AC Task 3 - Kirchoffs Laws Task 4 - Capacitors in AC

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	8 CR Circuits

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.6 Experiment Card 2mm Connecting Leads and Links Oscilloscope Signal (function) Generator
<b>Lab Tasks:</b>	Task 1 - CR Circuit Principles Task 2 - Time Constant Task 3 - CR Integrator Task 4 - Troubleshooting a CR Integrator

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	9 Permanent Magnets and the Electromagnet

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.20 Experiment Card 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Magnetism Task 2 - Attraction and Repulsion Task 3 - Other Magnetic Materials Task 4 - The Magnetic Plot Task 5 - Electromagnetic Field Plot Task 6 - Magnetizing Effect on Core Materials

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	10 Electromagnetic Induction

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.20 Experiment Card 2mm Connecting Leads and Links Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - Electromagnetic Principles Task 2 - Electromagnetic Induction Task 3 - Solenoid

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	11 Transformers

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.20 Experiment Card 2mm Connecting Leads and Links Digital Multimeter Signal Generator
<b>Lab Tasks:</b>	Task 1 - Transformer Principles Task 2 - A Simple Transformer Task 3 - The Tapped Transformer Task 4 - Troubleshooting the Transformer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	12 DC Motors and Generators

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.20 Experiment Card 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Electromagnetic Effects Task 2 - The DC Motor Task 3 - The DC Generator Task 4 - Troubleshooting the DC Motor

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	13 Relays

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.20 Experiment Card and Accessory Kit 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Relay Principles Task 2 - Relay Measurements Task 3 - Relay Circuits Task 4 - Relay Faults

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	14 Diodes and Rectification

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.5 Experiment Card and Accessory Kit Oscilloscope 2mm Connecting Leads and Links Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Diode Construction Task 2 - Diode Operation Task 3 – Rectification Task 4 - Rectification Circuit Task 5 - Zener Diode

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES1 Electrical/Electronic Fundamentals
<b>Assignment Number and Title:</b>	15 Transistors

Natef Area	Natef Level	Natef Objective
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D3000 Series 9 Base Unit 9.8 Experiment Card Oscilloscope 2mm Connecting Leads and Links Digital Multimeter x 2 Signal (function) Generator
<b>Lab Tasks:</b>	Task 1 - Transistor Construction Task 2 - Transistor Amplifiers Task 3 - Transistor Operation Task 4 - Amplification

<b>Time in Workshop (hrs):</b>	N/A
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	1 Ignition System Components

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Ignition Systems
<b>Lab Tasks:</b>	Task 1 - Ignition Supply voltage Task 2 - Ignition Coil Task 3 - High Voltage Ignition Task 4 - Spark Plug Operation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	2 Contact Breaker Ignition Systems - 1

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.2 Panel Trainer Connecting Leads and Links Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - Contact Breaker Ignition System Task 2 - The Ignition Coil Task 3 - The Contact Breaker

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	3 Contact Breaker Ignition Systems - 2

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.2 Panel Trainer Connecting Leads and Links Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - CB Ignition Task 2 - Troubleshooting-1 Task 3 - Troubleshooting-2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	4 Electronic Ignition Systems - 1

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.2 Panel Trainer PT7.2 Accessory Kit CDX: Electrical Principles Oscilloscope
<b>Lab Tasks:</b>	Task 1 - Electronic Ignition Systems Task 2 - Transistor Assisted Contacts Task 3 - Hall Effect Ignition Task 4 - Inductive Reluctance Ignition Task 5 - Distributorless Ignition System

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Changing and Basic Ignition Systems
<b>Assignment Number and Title:</b>	5 Electronic Ignition Systems - 2

Natef Area	Natef Level	Natef Objective
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.2 Panel Trainer PT7.2 Accessory Kit Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - Modern Ignition Systems Task 2 - Fault finding in a transistor assisted ignition system Task 3 - Fault finding in a breakerless ignition system Task 4 - DIS fault finding

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and basic Ignition Systems
<b>Assignment Number and Title:</b>	6 Starting and Charging System Components

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Starting, Charging and Lighting Systems Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - The Charging System Task 2 - Different Charging Systems Task 3 - The Starting System Task 3 - The Starting System

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	7 Alternator Charging Systems

Natef Area	Natef Level	Natef Objective
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.2 Panel Trainer PT7.2 Accessory Kit Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - Charging System Principles Task 2 - AC Waveforms Task 3 - Alternator Fault 1 Task 4 - Alternator Fault 2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	8 Alternator Output Tests

Natef Area	Natef Level	Natef Objective
VI-D1	P-1	Perform charging system output test; determine necessary action.
VI-D2	P-1	Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.

<b>Time in Lab (hrs):</b>	0.75
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Output Tests Task 2 - Alternator Output Test Procedures Task 3 - Oscilloscope Checks Task 4 - Oscilloscope Test Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Vehicle protection kit. Multimeter. A carbon pile regulator device (if available). Inductive ammeter. Oscilloscope Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Testing the output of a vehicle charging system Voltage Output Test Current Output Test Oscilloscope Test

<b>Vehicle Requirements</b>
A real vehicle containing an alternator charging system.

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic ignition Systems
<b>Assignment Number and Title:</b>	9 Alternator Inspection

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-D3	P-2	Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.
VI-D4	P-1	Remove, inspect and install generator (alternator).

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Inspection of Alternator and Drive Belt Task 2 - Replacing the Alternator

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Vehicle protection kit. Multimeter. Personal protective equipment (gloves, safety glasses, protective apron). General wrench, socket and screwdriver set. Workbench
<b>Workshop Tasks:</b>	Replacing an Alternator and Drive Belt

<b>Vehicle Requirements</b>
A real vehicle containing an alternator charging system.

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	10 Alternator Repair

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Repair Procedure Task 2 - Testing Alternator Components

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	A serviceable alternator. Vehicle service manual. Vehicle protection kit. Multimeter (with diode test function, if possible). Personal protective equipment (gloves, safety glasses, protective apron). General wrench, socket and screwdriver set. Scriber or suitable marker. Small pry bar. Vernier caliper or similar measuring instrument. A sturdy level workbench. Clean cloths. High-temperature bearing grease. An Allen key (wrench). Torque wrench. Pulley extractor or vise. A press. A fine grain (400) polishing cloth. Solder & soldering iron.
<b>Workshop Tasks:</b>	Alternator service

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	11 Starting and Charging Efficiency Tests

Natef Area	Natef Level	Natef Objective
VI-D5	P-1	Perform charging circuit voltage drop tests; determine necessary action.
VI-C1	P-1	Perform starter current draw tests; determine necessary action.
VI-C2	P-1	Perform starter circuit voltage drop tests; determine necessary action.
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Charging System Voltage Drop Tests Task 2 - Voltage Drop Test Procedure Task 3 - Starting System Volt Drop & Current Tests

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Vehicle protection kit. Multimeter. Inductive type ammeter. General wrench, socket and screwdriver set. Remote starter switch. Clean cloths. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Charging System Voltage Drop Tests Starter Current Draw Test Starter Motor Voltage Drop Tests

<b>Vehicle Requirements</b>
A real vehicle containing operational starting and charging systems.

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	12 Crank Conditions

Natef Area	Natef Level	Natef Objective
VI-C5	P-2	Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.
VI-C6	P-2	Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/a
<b>Lab Tasks:</b>	Task 1 - Identifying Cranking Problems Task 2 - Electrical Cranking Problems Task 3 - Mechanical Cranking Problems Task 4 - Cranking Fault – 1 Task 5 - Cranking Fault – 2 Task 6 - Cranking Fault - 3

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	13 Starter Replacement, Relay and Solenoid Testing

Natef Area	Natef Level	Natef Objective
VI-C3	P-2	Inspect and test starter relays and solenoids; determine necessary action.
VI-C4	P-1	Remove and install starter in a vehicle.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Starter Relay By-pass Test Task 2 - Starter Motor Replacement Task 3 - Starter Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Vehicle protection kit. Multimeter. Remote starter switch. Personal protective equipment (gloves, safety glasses, protective apron). General wrench, socket and screwdriver set.
<b>Workshop Tasks:</b>	Starter Relay & Solenoid Tests Starter Motor Removal and replacement

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic Ignition Systems
<b>Assignment Number and Title:</b>	14 Starter Circuits

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A15	P-1	Inspect and test switches, connectors, relays, solid state devices and wires of electrical/electronic circuits; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Starting System Inspection Task 2 - Starting System Tests

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Vehicle protection kit. Multimeter. Personal protective equipment (gloves, safety glasses, protective apron). General wrench, socket and screwdriver set.
<b>Workshop Tasks:</b>	Visual Inspection of the Starter System Starting System Voltage Drop Testing

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES2 Starting, Charging and Basic ignition Systems
<b>Assignment Number and Title:</b>	15 Wiring Repair

Natef Area	Natef Level	Natef Objective
VI-C5	P-2	Inspect and test switches, connectors and wires of starter control circuits; perform necessary action.
VI-A16	P-1	Repair wiring harnesses and connectors.
VI-A17	P-1	Perform solder repair of electrical wiring.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Soldering Task 2 - Harness Repair Task 3 - Connector Repair

<b>Time in Workshop (hrs):</b>	1.5
<b>Workshop Inventory:</b>	Multi-strand wire, AWG gauge size 16 or similar. Single wire connectors. Heat shrink tubing. Insulation tape. Soldering iron or soldering gun. Soldering iron/gun holder. Resin core solder. Personal protective equipment (gloves, safety glasses, protective apron). Wire strippers. Wire cutters. Crimps. Heat gun or similar.
<b>Workshop Tasks:</b>	Soldering Fitting a Single Connector

Vehicle Requirements

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	1 Electromagnetic Principles

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Electrical Principles
<b>Lab Tasks:</b>	Task 1 - Magnetism Task 2 - Electromagnetism Task 3 - Electromagnetic Devices

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	2 Testing Electrical Circuits

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A7	P-2	Check electrical circuits with a test light; determine necessary action.
VI-A11	P-2	Check electrical circuits using fused jumper wires; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Electricity and Electronics Technology
<b>Lab Tasks:</b>	Task 1 - Electricity and Common Problems Task 2 - Wiring Diagrams Task 3 - Simple Electrical Tests

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	3 Transducers and Instrumentation

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Electricity and Electronics Technology Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Transducers Task 2 - Gauges Task 3 - Gauge and Sensor Circuits

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	4 Instrument Cluster

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer Digital Multimeter Oscilloscope
<b>Lab Tasks:</b>	Task 1 - Instrument Cluster Task 2 - Tachometer Task 3 - Speedometer Task 4 - The Speaker

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	5 Testing Gauge Circuits

Natef Area	Natef Level	Natef Objective
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-F2	P-3	Inspect and test connectors, wires, and printed circuit boards of gauge circuits ; determine necessary action.
VI-F4	P-2	Inspect and test sensors, connectors and wires of electronic instrument circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Auto Electricity and Electronics Technology
<b>Lab Tasks:</b>	Task 1 - Testing Gauge Circuits Task 2 - Gauge Circuit Test Procedures

<b>Time in Workshop (hrs):</b>	1.5
<b>Workshop Inventory:</b>	Multimeter. Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver set.
<b>Workshop Tasks:</b>	Performing a Gauge Circuit Test

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	6 Gauge Testing

Natef Area	Natef Level	Natef Objective
VI-F1	P-2	Inspect and test gauges and gauge sending units for cause of intermittent, high, low or no gauge readings; determine necessary action.
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach Digiac PT7.4 Panel Trainer Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Gauge Circuits Task 2 - Fuel Gauge Task 3 - Engine Temperature Gauge Task 4 - Gauge Circuit Tests

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	7 Troubleshooting Warning Devices

Natef Area	Natef Level	Natef Objective
VI-F3	P-1	Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Driver Information Task 2 - Oil Pressure Warning Light Task 3 - Brake Fluid Warning Light Task 4 - Driving Light Fault Identification Task 5 - Troubleshooting

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	8 Passenger Safety

Natef Area	Natef Level	Natef Objective
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Driver Safety Circuits Task 2 - Door Open Detection Task 3 - Seat Belts Task 4 - Air Bag

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	9 Safety Device Servicing

Natef Area	Natef Level	Natef Objective
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-H5	P-2	Diagnose supplemental restraint system (SRS) concerns; determine necessary action. (Note: Follow manufacturer's safety procedures to prevent accidental deployment.)
VI-H6	P-1	Disarm and enable the airbag system for vehicle service.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer Digital Multimeter Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Seat Belt Service Task 2 - Air Bag Service Task 3 - Seat Belt Warning Fault Task 4 - Air Bag Fault

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	10 Trip Computer

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer
<b>Lab Tasks:</b>	Task 1 - Trip Computer Components Task 2 - Trip Computer Operation Task 3 - Trip Computer Variables

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	11 Windshield Wiper Servicing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-G2	P-2	Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.
VI-G3	P-2	Diagnose incorrect washer operation; perform necessary action.
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer Digital Multimeter Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Wiper Principles Task 2 - Wiper Operation Task 3 - Auto-park Function Task 4 - Wiper Service Task 5 - Wiper Fault

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	12 Vehicle Radio Systems

Natef Area	Natef Level	Natef Objective
VI-H7	P-3	Diagnose radio static and weak, intermittent or no radio reception; determine necessary action.
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.4 Panel Trainer Digital Multimeter Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Radio Operation Task 2 - Reception Problems and Service Task 3 - Radio Investigation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	13 Sound Systems and Accessories

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Entertainment Systems Task 2 - Sound and Speakers Task 3 - Fitting and Installation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	14 Anti-theft Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-H11	P-2	Diagnose the cause of false, intermittent, or no operation of anti-theft system.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Anti-theft Devices Task 2 - Anti-theft Inputs Task 3 - Anti-theft Outputs Task 4 - Anti-theft Problem Diagnosis

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES3 Vehicle Displays and Accessories
<b>Assignment Number and Title:</b>	15 Door Panels

Natef Area	Natef Level	Natef Objective
VI-H8	P-1	Remove and reinstall door panel.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Door Panel Replacement Task 2 - Door Panel Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. General wrench, socket and screwdriver set.
<b>Workshop Tasks:</b>	Door Panel Removal Door Panel Replacement

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	1 Basic Electricity

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Electrical Principles
<b>Lab Tasks:</b>	Task 1 – Electricity Task 2 - Simple circuits Task 3 - Measurements Task 4 - Devices Task 5 - Semiconductor Devices

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	2 Batteries and Fuses

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Batteries and Fuses (Theory) Task 2 - Batteries and Fuses (Practical) Task 3 - Battery and Fuse Combined Task 4 - Troubleshooting Task 5 - Troubleshooting

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	3 Battery State of Charge Test

Natef Area	Natef Level	Natef Objective
VI-B1	P-1	Perform battery state-of-charge test; determine necessary action.
VI-B2	P-1	Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
VI-B3	P-1	Maintain or restore electronic memory functions.
VI-B5	P-2	Perform slow/fast battery charge.
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Electricity and Electronics Technology
<b>Lab Tasks:</b>	Task 1 - Charge Test Task 2 - Voltage Test Task 3 - Capacity Testing a Battery Task 4 - Procedure for Testing a Battery Task 5 - Battery Charging

<b>Time in Workshop (hrs):</b>	1.5
<b>Workshop Inventory:</b>	Vehicle service manual. Cleaning rags. General Wrench, Socket and Screwdriver set. Personal protective equipment (gloves, safety glasses, protective apron). Hydrometer. Multimeter. Thermometer Battery lifting strap (may not be required if a handle is provided). Battery charger. Fast charger. A code saver device if required. Battery capacity (load) tester or voltage drop tester. Vehicle protection kit.
<b>Workshop Tasks:</b>	Perform a Hydrometer Test Capacity Test a Battery Battery Charging

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	4 Battery Service

Natef Area	Natef Level	Natef Objective
VI-B4	P-2	Inspect, clean, fill and replace battery.
VI-B6	P-1	Inspect and clean battery cables, connectors, clamps and hold-downs; repair or replace as needed.
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Auto Electricity and Electronics Technology
<b>Lab Tasks:</b>	Task 1 - Inspecting the Battery Task 2 - Battery Cable Servicing Task 3 - Battery Removal, Inspection and Cleaning Task 4 - Cleaning and Servicing a Battery Task 5 - Replacing a Battery

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. Vehicle protection kit. General wrench, socket and screwdriver set. Alkaline based cleaner. Abrasive cleaning materials (carborundum paper, wire brush etc). A drip tray. Battery lifting strap (may not be required if a handle is provided). Multimeter. Personal protective equipment (gloves, safety glasses, protective apron). Petroleum jelly or similar. Distilled (de-ionized) water.
<b>Workshop Tasks:</b>	Testing for voltage drop in battery cables Cleaning and Servicing a Battery Cleaning and Servicing Battery Cables and Fixings Battery Replacement

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	5 Jump Starting

Natef Area	Natef Level	Natef Objective
VI-B7	P-1	Start a vehicle using jumper cables and a battery or auxiliary power supply.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Jump Starting Task 2 - Jump Starting Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	General wrench, socket and screwdriver set. Booster battery or auxiliary power supply. Jumper cables. Vehicle protection kit. Vehicle service manual. Personal protective equipment (gloves, safety glasses).
<b>Workshop Tasks:</b>	Jump Start a Vehicle Using Jumper Cables or an Auxiliary Power Supply

Vehicle Requirements
A vehicle containing a discharged battery.

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	6 Testing Circuit Protection Devices

Natef Area	Natef Level	Natef Objective
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-A14	P-1	Inspect and test fusible links, circuit breakers and fuses; determine necessary action.

<b>Time in Lab (hrs):</b>	0.75
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Fusible Links, Circuit Breakers and Fuses Task 2 - Test and Inspect a Fusible Link Task 3 - Testing and Inspecting Circuit Breakers Task 4 - Testing and Inspecting Fuses

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Multimeter. Personal protective equipment (gloves, safety glasses, protective apron). Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver set.
<b>Workshop Tasks:</b>	Testing and Inspecting Fusible Links/Maxi Fuses Inspection and Testing of Fuses

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	7 Starter and Solenoid

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
VI-A10	P-1	Check continuity and measure resistance in electrical/electronic circuits and components with an ohmmeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter CDX: Starting, Charging and Lighting
<b>Lab Tasks:</b>	Task 1 - Starter Motor Principles Task 2 - Starter Switching Task 3 - Starter Motor and Solenoid Measurements Task 4 - Starter and Solenoid Operation Task 5 - Starting System Problems

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	8 Battery Drain and Leakage Tests

Natef Area	Natef Level	Natef Objective
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
VI-A9	P-1	Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-A13	P-1	Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Leakage and Drain Tests Task 2 - Battery Drain Test Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. General Wrench, Socket and Screwdriver set. Hydrometer, if a serviceable battery is used. Personal protective equipment (gloves, safety glasses, protective apron). Multimeter. An inductive clamp type ammeter, if available.
<b>Workshop Tasks:</b>	Battery Leakage Test Battery Drain Test

<b>Vehicle Requirements</b>
A real vehicle containing a serviceable battery.

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	9 Testing Electrical Circuits

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-A15	P-1	Inspect and test switches, connectors, relays, solid state devices, and wires of electrical/electronic circuits; perform necessary action.
VI-H2	P-3	Diagnose incorrect heated glass operation; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Testing Basic Electrical Components Task 2 - Repairing Wires and Connectors

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. General Wrench, Socket and Screwdriver set. Multimeter. Jumper wires. Test light. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Electrical Circuit Tests

<b>Vehicle Requirements</b>
A real vehicle containing a heated rear screen system.

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	10 Horn Circuit Service

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-G1	P-2	Diagnose incorrect horn operation; perform necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Horn Introduction Task 2 - Horn Operation Task 3 - Horn Fault 1 Task 4 - Horn Fault 2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	11 Lighting Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter CDX: Starting, Charging and Lighting
<b>Lab Tasks:</b>	Task 1 - Lamp Operation Task 2 - Tail and Headlamp Operation Task 3 - Park and Taillights Task 4 - Headlamps

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	12 Lighting System Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-E1	P-1	Diagnose the cause of brighter than normal, intermittent, dim or no light; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Lighting Diagnosis Task 2 - Lighting Circuit Diagnosis – 1 Task 3 - Lighting Circuit Diagnosis – 2 Task 4 - Lighting Circuit Diagnosis – 3

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	13 Lighting Service

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-E2	P-2	Inspect, replace and aim headlights and bulbs.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Headlamp Removal Task 2 - Headlamp Inspection and Replacement Task 3 - Aiming Adjustment

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual. General wrench, socket and screwdriver set. Eye protection. Headlamp alignment test equipment. A soft clean cloth.
<b>Workshop Tasks:</b>	Headlamp bulb removal Headlamp cluster removal Headlamp bulb installation Headlamp cluster installation Headlamp alignment

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	14 Turn and Hazard Light Operation

Natef Area	Natef Level	Natef Objective
VI-A5	P-1	Use wiring diagrams during diagnosis of electrical circuit problems.
VI-A12	P-1	Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
VI-E3	P-2	Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Turn Indicator Components Task 2 - Turn and Hazard Circuit Task 3 - Fault Finding

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EES4 Automotive Electrics
<b>Assignment Number and Title:</b>	15 Brake, Backup and Interior Lighting

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VI-A8	P-1	Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.1 Panel Trainer PT7.1 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Brake and Backup Lights Task 2 - Brake Light Operation Task 3 - Backup Light Operation Task 4 - Interior Lighting Task 5 - Interior Lights

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

## Engine Performance Pod

The Engine Performance Pod covers the following topic areas:

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	1 Engine Management System Fundamentals

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: EFI Engine Management CDX: EFI Principles
<b>Lab Tasks:</b>	Task 1 - Engine Management - The ECU Task 2 - Engine Management Input Devices Task 3 - Engine Management Operation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	2 The Electronic Control Unit (ECU)

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.3 Panel Trainer Oscilloscope
<b>Lab Tasks:</b>	Task 1 - The Electronic Control Unit Task 2 - Decisions Making Processes Task 3 - Injection System Decisions Task 4 - Ignition System Decisions

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	3 Transducer Circuits and Components

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.3 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Transducers & Sensors Task 2 - Vehicle Speed Sensor Task 3 - Coolant Temperature Sensor Task 4 - Airflow Sensor Task 5 - Oxygen Sensor

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	4 Transducer Circuits and Components – Fault Diagnosis

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.3 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Fault Investigation 1 Task 2 - Fault Investigation 2 Task 3 - Fault Investigation 3 Task 4 - Fault Investigation 4

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	5 Actuator Components and Circuits

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.3 Panel Trainer Oscilloscope Digital Multimeter CDX: EFI Components
<b>Lab Tasks:</b>	Task 1 - Actuator Types Task 2 - Injectors Task 3 - Injector Pulse Width Variations Task 4 - Injector Pulse Frequency Task 5 - Injector Pulse Timing

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	6 Actuator Circuits and Components – Fault Diagnosis

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.3 Panel Trainer Oscilloscope Digital Multimeter
<b>Lab Tasks:</b>	Task 1 -The Idle Air Control Valve Task 2 - The Electric Fuel Pump Task 3 - Fault Investigation 1 Task 4 - Fault Investigation 2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	7 The Exhaust System

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D11	P-2	Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
VIII-D12	P-1	Perform exhaust system back-pressure test; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Intake and Exhaust Systems
<b>Lab Tasks:</b>	Task 1 - Exhaust System Components and Operation Task 2 - Exhaust System Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vacuum gauge Pressure gauge capable of reading at least 15 PSI, with heat resistant hose Tachometer Inspection lamp Hammer or mallet Lift/hoist Vehicle service manual A means of tapping into an exhaust system to measure pressure (aftermarket or fabricated tool) Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Exhaust System Inspection Exhaust System Back Pressure Test

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	8 Vehicle Emissions

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-A12	P-1	Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Vehicle Emissions Task 2 - Measurement of Exhaust Gas Emissions

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	An exhaust gas analyzer, capable of measuring 5 exhaust gases Tachometer (if not part of exhaust gas analyzer) Vehicle service manual Notification of legal emissions limits for test vehicle at idle speed and 2500 rpm Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Exhaust Gas Analysis

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	9 Intake Air Temperature Control Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E4/1	P-3	Diagnose emissions and driveability problems resulting from malfunctions in the intake air temperature control system; determine necessary action.
VIII-E4/2	P-3	Inspect & test components of intake air temperature control system; perform necessary action.
VIII-E5/1	P-3	Diagnose emissions and driveability problems resulting from malfunctions in the early fuel evaporation control system; determine necessary action.
VIII-E5/2	P-3	Inspect & test components of early fuel evaporation control system; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Intake and Exhaust Systems
<b>Lab Tasks:</b>	Task 1 - Intake Air Temperature Control Systems Task 2 - Intake Air Temperature Control Systems - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Thermometer Small mirror Vehicle service manual Vacuum hand pump Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Thermostatic Air Cleaner Inspection and Test

<b>Vehicle Requirements</b>
Workshop vehicle, fitted with vacuum operated air temperature control valve

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	10 Positive Crankcase Ventilation Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E1/1	P-2	Diagnose oil leaks, emissions, and driveability problems resulting from malfunction in the positive crankcase ventilation (PCV) system; determine necessary action.
VIII-E1/2	P-2	Inspect, test, and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Emission Control Systems
<b>Lab Tasks:</b>	Task 1 - Positive Crankcase Ventilation Systems Task 2 - Positive Crankcase Ventilation Systems - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for workshop vehicle Stiff paper Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	PCV System Inspection PCV System Test

<b>Vehicle Requirements</b>
Workshop vehicle, fitted with closed PCV system

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	11 Air Injection Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E3/1	P-2	Diagnose emissions and driveability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action.
VIII-E3/2	P-3	Inspect and test mechanical components of secondary air injection systems; perform necessary action.
VIII-E3/3	P-3	Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Air Injection Systems Task 2 - Air Injection Systems - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manuals for both workshop vehicles Digital multimeter Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Pulse Air Injection System - Inspection and Test Air Pump Air Injection System - Inspection and Test Testing the output of the air pump Testing the diverter valve Testing the air switching valve (may be part of the diverter valve housing) Testing check valves

<b>Vehicle Requirements</b>
Workshop vehicle, fitted with an air injection system that uses aspirator (pulse) valves Workshop vehicle, fitted with an air injection system that uses an air pump and solenoid operated diverter/air switching vacuum valves

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	12 Exhaust Gas Recirculation Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E2/1	P-1	Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action.
VIII-E2/2	P-2	Inspect , test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.
VIII-E2/3	P-2	Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Exhaust Gas Recirculation Systems Task 2 - Exhaust Gas Recirculation Systems - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for workshop vehicle Digital multimeter with duty cycle feature Vacuum gauge Tachometer Vacuum hand pump Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Early Exhaust Recirculation System - Inspection and Test Testing the vacuum supply Testing EGR operation Computer Controlled EGR System - Inspection and Test Testing the vacuum supply and EGR valve operation

<b>Vehicle Requirements</b>
Workshop vehicle, fitted with an early EGR system. Vacuum controlled by a temperature operated device Workshop vehicle, fitted with an EGR system that has computer controlled solenoids to regulate the vacuum supply

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	13 Evaporative Emissions Control Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E6/1	P-1	Diagnose emissions and driveability problems resulting from malfunctions in the evaporative emissions control system; perform necessary action.
VIII-E6/2	P-2	Inspect and test components and hoses of evaporative emissions control system; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Evaporative Emissions Control Systems Task 2 - Evaporative Emissions Control Systems - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for the workshop vehicle, plus up-to-date service information from TSBs and electronic data sources (CD-ROMs, the internet, etc.). Hoist. Safety glasses. Digital multimeter with duty cycle feature (or low voltage test lamp or oscilloscope). Vacuum hand pump with/and vacuum gauge. Aftermarket pressure test equipment (if available in workshop).
<b>Workshop Tasks:</b>	Evaporative Emissions Control Systems Inspection Evaporative Emissions Control Systems Testing

<b>Vehicle Requirements</b>
Workshop vehicle fitted with an EVAP system.

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	14 The Catalytic Converter

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E3/1	P-2	Diagnose emissions and driveability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action.
VIII-E3/4	P-1	Inspect and test catalytic converter performance.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - The Catalytic Converter Task 2 - The Catalytic Converter - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Inspection lamp. Rubber mallet. Lift/hoist. Safety glasses. Pyrometer. Exhaust gas analyzer.
<b>Workshop Tasks:</b>	Inspection and Rattle Tests Backpressure Test Temperature Test Emissions Test

<b>Vehicle Requirements</b>
Workshop vehicle fitted with a catalytic converter.

<b>Module ID and Title:</b>	EP1 Engine Management Systems
<b>Assignment Number and Title:</b>	15 Troubleshooting Emissions Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-E1/1	P-2	Diagnose oil leaks, emissions, and driveability problems resulting from malfunctions in the positive crankcase ventilation (PCV) system; determine necessary action.
VIII-E2/1	P-1	Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action.
VIII-E3/1	P-2	Diagnose emissions and driveability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action.
VIII-E4/1	P-3	Diagnose emissions and driveability problems resulting from malfunctions in the intake air temperature control system; determine necessary action.
VIII-E5/1	P-3	Diagnose emissions and driveability problems resulting from malfunctions in the early fuel evaporation control system; determine necessary action.
VIII-E6/1	P-1	Diagnose emissions and driveability problems resulting from malfunctions in the evaporative emissions control system; perform necessary action.
VIII-E6/3	P-1	Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - OBD II Diagnostic Monitors Task 2 - Emissions Systems Trouble Code Interpretation and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for the vehicle, plus up-to-date service information from TSBs and electronic data sources (CD-ROMs, the internet, etc.). Clean engine oil. Timing light. Safety glasses. Vacuum gauge. Exhaust gas analyzer.
<b>Workshop Tasks:</b>	Ignition Timing test Manifold Vacuum test Tailpipe Emissions test Intake Air Supply test PCV System test Dipstick Test EGR System test Manifold Leak test

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	1 Basic Engine Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-A5	P-2	Diagnose abnormal engine noise or vibration concerns; determine necessary action.
VIII-A6	P-2	Diagnose abnormal exhaust color, odor, and sound; determine necessary action.
I-A5	P-2	Diagnose engine noise or vibration concerns; determine necessary action.
I-A6	P-2	Diagnose the cause of excessive oil consumption, unusual exhaust color, odor, and sound; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - A Logical Approach to Basic Engine Diagnosis Task 2 - Typical Diagnostic Procedures Task 3 - Service Information Task 4 - Typical Diagnostic Tests and Equipment

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	2 Engine Leak Inspection

Natef Area	Natef Level	Natef Objective
VIII-A4	P-2	Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
I-A4	P-1	Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
VIII-A14	P-1	Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Oil Leaks Task 2 - Coolant Leaks Task 3 - Fuel Leaks

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Cooling system pressure tester Inspection lamp Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Visual inspection of the cooling system Pressure test the cooling system Visual inspection of the fuel system Visual inspection of the lubrication system

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	3 Manifold Pressure and Cylinder Compression Tests

Natef Area	Natef Level	Natef Objective
VIII-A7	P-1	Perform engine absolute (vacuum/boost) manifold pressure test; determine necessary action.
VIII-A9	P-1	Perform cylinder compression test; determine necessary action.
I-A7	P-1	Perform engine vacuum test; determine necessary action.
I-A9	P-1	Perform cylinder compression test; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Vacuum Test Task 2 - Compression Test

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vacuum gauge Pressure gauge Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Manifold Vacuum Test Cylinder Compression Test

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	4 Cylinder Power Balance and Leakage Tests

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-A8	P-1	Perform cylinder power balance test; determine necessary action.
I-A8	P-1	Perform cylinder power balance test; determine necessary action.
VIII-A10	P-1	Perform cylinder leakage test; determine necessary action.
I-A10	P-1	Perform cylinder leakage test; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Cylinder Power Balance Test Task 2 - Cylinder Leak Test

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Cylinder balance tester (may be part of an engine analyzer) Cylinder leakage tester (may be part of an engine analyzer) Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Cylinder Power Balance Test Cylinder Leakage Test

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	5 Valve Adjustment and Camshaft Timing

Natef Area	Natef Level	Natef Objective
VIII-F1	P-1	Adjust valves on engines with mechanical or hydraulic lifters.
VIII-F2	P-1	Remove and replace timing belt; verify correct camshaft timing.
I-B11	P-1	Adjust valves (mechanical or hydraulic lifters).
VIII-A15	P-2	Verify correct camshaft timing.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Valve Clearance - Check and Adjustment Task 2 - Camshaft Timing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Feeler Gauge Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Camshaft Timing Verification Adjustment of Valve Clearances on an OHC Engine

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with an OHC engine (valve clearances to be mechanically adjustable)

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	6 Retrieval of OBD I and OBD II Trouble Codes

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-B1	P-2	Retrieve and record stored OBD I diagnostic trouble codes; clear codes.
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Diagnostic Trouble Codes - Early Systems Task 2 - On Board Diagnostics Two (OBD II) Systems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Scan tool and operating instructions (handbook) Vehicle Service Manuals Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Retrieval and Clearing of OBD I Trouble codes Retrieval and Clearing of OBD II Trouble codes

<b>Vehicle Requirements</b>
A workshop vehicle having an OBD I system from which trouble codes can be retrieved and cleared, without using a scan tool A workshop vehicle with an OBD II system

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	7 Inspection and Testing of Actuators and Transducers - 1

Natef Area	Natef Level	Natef Objective
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B7	P-1	Obtain and interpret scan tool data.
VIII-A13	P-1	Verify engine operating temperature; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Engine Coolant Temperature Sensor Service Task 2 - Throttle Position Sensor Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Scan tool Digital multimeter (DMM) Oscilloscope Vehicle Service Manuals Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Checking the Engine Coolant Temperature (ECT) Sensor Checking the Throttle Position Sensor (TPS)

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with engine coolant temperature and throttle position sensors

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	8 Inspection and Testing of Actuators and Transducers - 2

Natef Area	Natef Level	Natef Objective
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B7	P-1	Obtain and interpret scan tool data.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Oxygen Sensor Service Task 2 - Intake Air Temperature Sensor Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Scan tool Digital multimeter (DMM) Oscilloscope Vehicle Service Manuals Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Checking the Oxygen (O2) Sensor Checking the Intake Air Temperature (IAT) Sensor

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with oxygen and intake air temperature sensors

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	9 Inspection and Testing of Actuators and Transducers - 3

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B7	P-1	Obtain and interpret scan tool data.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Mass Airflow Sensor Service Task 2 - Idle Air Control Valve Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the vehicle. Scan tool Digital multimeter (DMM) Oscilloscope Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Checking The Mass airflow (MAF) Sensor Checking The Idle Air Control Valve

<b>Vehicle Requirements</b>
A post 1996 workshop vehicle fitted with a MAF sensor and an IAC valve.

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	10 Inspection and Testing of Actuators and Transducers - 4

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B7	P-1	Obtain and interpret scan tool data.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Crankshaft Sensor Service Task 2 - Digital EGR Valve Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the vehicle. Scan tool Digital multimeter (DMM) Oscilloscope Fused test lead and ground test lead. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Checking The Crankshaft Sensor Checking The Digital EGR Valve

<b>Vehicle Requirements</b>
A workshop vehicle fitted with a crankshaft sensor and a digital EGR valve (e.g. Oldsmobile/ GM V6).

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	11 Diagnose Faults in Actuator and Transducer Circuits - 1

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B3	P-1	Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine controls with stored diagnostic trouble codes.
VIII-B4	P-1	Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B8	P-1	Access and use service information to perform step-by-step diagnosis.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	autoFAULT vehicle data book
<b>Lab Tasks:</b>	Task 1 - AutoFAULT - Vehicle Fault Diagnosis Simulation Task 2 - Fault Diagnosis using AutoFAULT - 1

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	12 Diagnose Faults in Actuator and Transducer Circuits - 2

Natef Area	Natef Level	Natef Objective
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B3	P-1	Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine controls with stored diagnostic trouble codes.
VIII-B4	P-1	Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B8	P-1	Access and use service information to perform step-by-step diagnosis.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	autoFAULT vehicle data book
<b>Lab Tasks:</b>	Task 1 - Diagnosis of a Higher Than Normal Engine Idle Speed Problem Task 2 - Diagnosis of a Rough Engine Idle Speed Problem Task 3 - Diagnosis of a Poor Fuel Consumption Problem

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	13 Diagnose Faults in Actuator and Transducer Circuits - 3

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B3	P-1	Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine controls with stored diagnostic trouble codes.
VIII-B4	P-1	Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B8	P-1	Access and use service information to perform step-by-step diagnosis.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	autoFAULT vehicle data book
<b>Lab Tasks:</b>	Task 1 - Diagnosis of a Cooling System Problem Task 2 - Diagnosis of an Engine Misfire Problem Task 3 - Diagnosis of a No Starting Problem

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	14 Diagnose Faults in Actuator and Transducer Circuits - 4

Natef Area	Natef Level	Natef Objective
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B3	P-1	Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine controls with stored diagnostic trouble codes.
VIII-B4	P-1	Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B8	P-1	Access and use service information to perform step-by-step diagnosis.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	autoFAULT vehicle data book
<b>Lab Tasks:</b>	Task 1 - Diagnosis of an Erratic Engine Performance Problem Task 2 - Diagnosis of an Excessive Engine Vibration Problem Task 3 - Diagnosis of a Surging or Hesitation Problem

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP2 Vehicle Diagnosis
<b>Assignment Number and Title:</b>	15 Diagnose Faults in Actuator and Transducer Circuits - 5

Natef Area	Natef Level	Natef Objective
VIII-B2	P-1	Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
VIII-B3	P-1	Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine controls with stored diagnostic trouble codes.
VIII-B4	P-1	Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action.
VIII-B6	P-1	Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, & circuits using a graphing multimeter (GMM)/ digital storage oscilloscope (DSO); perform necessary action.
VIII-B8	P-1	Access and use service information to perform step-by-step diagnosis.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	autoFAULT vehicle data book
<b>Lab Tasks:</b>	Task 1 - Diagnosis of a Poor Engine Performance Problem Task 2 - Illuminated Check Engine Warning Lamp Diagnosis 1 Task 3 - Illuminated Check Engine Warning Lamp Diagnosis 2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operations
<b>Assignment Number and Title:</b>	1 Ignition System Fundamentals

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Ignition Systems
<b>Lab Tasks:</b>	Task 1 - Contact Breaker Ignition Systems Task 2 - Breakerless Ignition Systems Task 3 - Distributorless Ignition Systems Task 4 - Spark Plugs

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operations
<b>Assignment Number and Title:</b>	2 The Ignition Primary Circuit

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-C3	P-2	Inspect and test ignition primary circuit wiring and solid state components; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Inspection of the Ignition Primary Circuit Task 2 - Testing the Ignition Primary Circuit

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Digital multimeter (DMM) Inspection Lamp Personal protective equipment (gloves, safety glasses, protective apron). Vehicle Service Manual
<b>Workshop Tasks:</b>	Inspection of the Ignition Primary Circuit Testing of the Ignition Primary Circuit

<b>Vehicle Requirements</b>
Workshop vehicle with contact breaker ignition system and ballast resistor

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	3 The Ignition Secondary Circuit

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-C5	P-2	Inspect and test ignition secondary circuit wiring and components; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Inspection of the Ignition Secondary Circuit Task 2 - Testing of the Ignition Secondary Circuit

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Digital multimeter (DMM) Oscilloscope Personal protective equipment (gloves, safety glasses, protective apron). Vehicle Service Manual
<b>Workshop Tasks:</b>	Ignition Secondary Circuit Inspection Ignition Secondary Circuit Testing

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with a distributor

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operatoin
<b>Assignment Number and Title:</b>	4 Ignition Coils

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-C6	P-1	Inspect and test ignition coil(s); perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - The Ignition Coil Task 2 - Ignition Coil Inspection Procedures Task 3 - Ignition Coil Test Procedures

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Digital multimeter (DMM) Personal protective equipment (gloves, safety glasses, protective apron). Vehicle Service Manual
<b>Workshop Tasks:</b>	Ignition Coil Inspection Ignition Coil Test

<b>Vehicle Requirements</b>
Workshop vehicle with an oil filled ignition coil

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	5 Distributors

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-C4	P-3	Inspect, test and service distributor.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - The Distributor

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Off vehicle distributor, complete with cap, rotor arm and contact breakers Distributor tester or synchrograph, with operating instructions Service manual containing distributor specifications (must include distributor advance curves) Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Testing of a Distributor

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	6 Introduction to Distributor Electronic Ignition Systems

Natef Area	Natef Level	Natef Objective
VIII-C3	P-2	Inspect and test primary circuit wiring and solid state components; perform necessary action.
VIII-C8	P-2	Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Magnetic Pulse Generator Ignition Systems Task 2 - The Ignition Control Module

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Digital multimeter (DMM) Oscilloscope 1.5V flashlight battery Heat gun Personal protective equipment (gloves, safety glasses, protective apron). Vehicle Service Manual
<b>Workshop Tasks:</b>	Magnetic Pulse Generating Pickup Inspection The Ignition Control Module (ICM) Inspection

Vehicle Requirements
A workshop vehicle, fitted with an ignition system that uses a magnetic pulse generating pickup

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	7 Further Distributor Electronic Ignition Systems

Natef Area	Natef Level	Natef Objective
VIII-C3	P-2	Inspect and test primary circuit wiring and solid state components; perform necessary action.
VIII-C8	P-2	Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Hall Effect Pulse Generating Ignition Systems Task 2 - Optical Pulse Generating Ignition Systems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Digital multimeter (DMM) Oscilloscope 12V battery/power source Personal protective equipment (gloves, safety glasses, protective apron). Vehicle Service Manuals
<b>Workshop Tasks:</b>	Hall Effect Ignition System Inspection

<b>Vehicle Requirements</b>
Vehicle fitted with a Hall effect pulse generating ignition system. A workshop vehicle, fitted with an optical pulse generating ignition system

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	8 Spark Plugs

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Spark Plug Construction, Heat Range and Types Task 2 - Spark Plug Servicing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Round wire feeler gauge Spark plug socket, extension bar and ratchet/torque wrench High temperature grease Personal protective equipment (gloves, safety glasses, protective apron). Vehicle Service Manual
<b>Workshop Tasks:</b>	Spark Plug Removal, Reading, Gapping and Refitting

<b>Vehicle Requirements</b>
Workshop vehicle with gasoline fuel system

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	9 Ignition System Wavepatterns

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Primary and Secondary Wavepatterns Task 2 - Using Wavepatterns to Diagnose Ignition System Problems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the test vehicle Oscilloscope, or engine analyzer with oscilloscope Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Ignition System Wavepatterns investigation

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with an ignition system that uses a distributor

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	10 Ignition Timing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C7	P-3	Check and adjust ignition system timing and timing advance/retard (where applicable)

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Ignition Systems
<b>Lab Tasks:</b>	Task 1 - Ignition Timing Task 2 - Checking and Adjusting Ignition Timing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the test vehicle Timing light Tachometer Set of feeler gauges Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Ignition Timing Check and Adjustment Contact breaker condition check Dynamic ignition timing test Mechanical advance mechanism test Vacuum advance mechanism test

<b>Vehicle Requirements</b>
Vacuum advance mechanism test

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	11 Computer Based Electronic Ignition Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Distributor Electronic Ignition System Improvements Task 2 - Introduction to Distributorless Ignition Systems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the test vehicle Dual trace oscilloscope, or engine analyzer with oscilloscope Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Variable Dwell Investigation

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with a variable dwell ignition system (for example, Ford TFI-VI, with ECU/ICM communication using PIP/SPOUT signals)

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	12 Introduction to the DIS Trainer

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	DIS Ignition System Trainer CDX: Ignition Systems Oscilloscope and Leads Power Source e.g. 12V Battery Timing Light HV Probes
<b>Lab Tasks:</b>	Task 1 - Identify the features of the DIS Trainer Task 2 - Operation of the DIS Trainer Task 3 - Examine waveforms on the DIS Trainer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP3 Ignition System Components and Operation
<b>Assignment Number and Title:</b>	13 Further Electronic Ignition Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	DIS Ignition System Trainer Probes / T-pins Oscilloscope and Leads Power Source e.g. 12V Battery Heat Source / Hot Water Multimeter Thermometer Timing Light HV Probes
<b>Lab Tasks:</b>	Task 1 - Other Types of Electronic Ignition Systems Task 2 - DIS Trainer Temperature Sensor Investigation Task 3 - DIS Trainer Crankshaft Sensor Investigation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP3 Ignition System Components and Opertaion
<b>Assignment Number and Title:</b>	14 Diagnosing Ignition System Problems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-C1	P-1	Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor milage, and emissions concerns on vehicles with electronic ignition (distributorless) systems; determine necessary action.
VIII-C2	P-1	Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor milage, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	DIS Ignition System Trainer T-pins Oscilloscope and Leads Power Source e.g. 12V Battery Digital Multimeter HV Probes
<b>Lab Tasks:</b>	Task 1 - Ignition Related Driveability and Emissions Concerns Task 2 - No Start Problems Task 3 - Lack of Power Problems Task 4 - Extremely Rough Idle Problems

<b>Time in Workshop (hrs):</b>	
<b>Workshop Inventory:</b>	
<b>Workshop Tasks:</b>	

<b>Vehicle Requirements</b>

<b>Module ID and Title:</b>	EP3 Ignition System Components and operation
<b>Assignment Number and Title:</b>	15 Diagnosing Ignition System Driveability and Emission Concerns

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-C1	P-1	Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor milage, and emissions concerns on vehicles with electronic ignition (distributorless) systems; determine necessary action.
VIII-C2	P-1	Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor milage, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	DIS Ignition System Trainer T-pins Oscilloscope and Leads Power Source e.g. 12V Battery Digital Multimeter HV Probes
<b>Lab Tasks:</b>	Task 1 - Driveability and Emissions Concerns 2 Task 2 - Extremely Rough Idle Problems Task 3 - No Start Problems Task 4 - Further No Start Problems

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	1 Fundamentals of Fuel Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Carburetor Fuel Systems
<b>Lab Tasks:</b>	Task 1 - Fuel Types Task 2 - Storage Tanks, Breathers and Fillers Task 3 - Fuel Pipes and Filters Task 4 - Fuel Pumps

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	2 Fuel Systems Inspection

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Fuel tank service Task 2 - Fuel tank drainage Task 3 - Fuel tank removal and replacement Task 4 - Fuel pipes Task 5 - Fuel pipe removal and servicing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Fire extinguisher. Vehicle Service Manual Cleaning rags. General Wrench, Socket and Screwdriver set. Fuel siphoning equipment (if available). An approved sealed fuel storage container. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Inspecting and Draining a Fuel System Fuel System Inspection Fuel Tank Inspection

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP4 Fuel System Components and Opertaion
<b>Assignment Number and Title:</b>	3 Fuel Contamination

Natef Area	Natef Level	Natef Objective
VIII-D3	P-3	Check fuel for contaminants and quality; determine necessary action.
VIII-D5	P-1	Replace fuel filters.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Fuel Contamination and Tests Task 2 - Fuel Filters

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Fire extinguisher. Vehicle Service Manual Cleaning rags. General Wrench, Socket and Screwdriver set. Marked measuring container. An approved sealed fuel storage container. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Fuel Filter Inspection Gasohol Test

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	4 Fuel Pump Inspection and Tests

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D4	P-1	Inspect and test mechanical and electrical fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Fuel Pump Types and Operation Task 2 - Fuel Pump Faults Task 3 - Testing Fuel Pumps

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Fire extinguisher. Vehicle Service Manual Cleaning rags. General Wrench, Socket and Screwdriver set. Marked measuring container. An approved sealed fuel storage container. Personal protective equipment (gloves, safety glasses, protective apron). Vacuum & Pressure gauge and adapters. Multimeter (for electrical pumps only).
<b>Workshop Tasks:</b>	Fuel Pump Inspection Pressure Testing Fuel Pump Removal and Replacement

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP4 Fuel system Components and Operation
<b>Assignment Number and Title:</b>	5 Intake Air Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Intake Air System Components Task 2 - Intake Air Temperature Control System

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Vehicle protection kit. Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Intake Air System Inspection

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	6 Carburetor Fundamentals

Natef Area	Natef Level	Natef Objective
VIII-D6	P-3	Inspect and test cold enrichment system and components; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Carburetor Fuel Systems Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Carburetor Construction and Operation Task 2 - Basic Carburetor Circuits Task 3 - Cold Enrichment Systems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Digital Multimeter (DMM). Test Light. Hand Vacuum Pump. Choke Unloader Adjustment Device (gauge/rod or drill bit). Vehicle Service Manual
<b>Workshop Tasks:</b>	Cold Enrichment System Inspection and Test

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with a non-tamperproof choke.

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	7 Carburetor Types and Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Types of Carburetors Task 2 - Feedback Carburetor Systems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Oscilloscope. Digital multimeter with dwell feature or dwell meter. Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Mixture Control Solenoid Duty Cycle Investigation

<b>Vehicle Requirements</b>
A workshop vehicle with a computer controlled carburetor (engine cold).

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	8 Carburetor Service and Diagnosis

Natef Area	Natef Level	Natef Objective
VIII-D1	P-3	Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems; determine necessary action.
VIII-D9	P-2	Check idle speed and fuel mixture.
VIII-D10	P-3	Adjust idle speed and fuel mixture.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Carburetor Problems and Diagnosis Task 2 - Carburetor Removal, Rebuilding and Reassembly Task 3 - Carburetor Adjustment and Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Exhaust gas analyzer. Tachometer (if not part of the exhaust gas analyzer). Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Idle Speed and Fuel Mixture Adjustment

<b>Vehicle Requirements</b>
A workshop vehicle with a carburetor.

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	9 Fuel Injection Fundamentals

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D4	P-1	Inspect and test mechanical and electrical fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.

<b>Time in Lab (hrs):</b>	0.75
<b>Lab Inventory:</b>	CDX: EFI Principles CDX: EFI Components CDX: EFI Engine Management
<b>Lab Tasks:</b>	Task 1 - Types of Fuel Injection Systems Task 2 - Fuel Delivery and Regulation

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Pressure gauge with adapters. Approved gasoline container. Fire extinguisher. Hand vacuum pump. Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Testing Fuel Pressure on an Electronic Fuel Injection System

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with an electronic fuel injection system and vacuum operated pressure regulator.

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operatoin
<b>Assignment Number and Title:</b>	10 Single Point Fuel Injection Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D7	P-2	Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Single Point Fuel Injection Systems Task 2 - Single Point Fuel Injection Systems - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the vehicle. Oscilloscope. Digital multimeter. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Single Point Fuel Injection Inspection Mounting Block, Intake Manifold and Throttle Body inspection Single Point Fuel Injection Testing

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with a single point fuel injection system.

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	11 Electronic Multipoint Fuel Injection Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: EFI Components
<b>Lab Tasks:</b>	Task 1 - Early EFI Systems Task 2 - Improvements and Changes to EFI Systems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the vehicle. Oscilloscope. Digital multimeter. Test/Noid lamp. Stethoscope. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Solenoid Operated Fuel Injectors Checks

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with a multipoint EFI system that does not have resistors in the injector signal lines (injectors are switched between 12 and 0 volts).

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	12 Gasoline Fuel Injection Systems Service and Diagnosis 1

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D7	P-2	Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Service and Diagnosis Task 2 - Throttle Body Service

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service/workshop manual for the vehicle. Engine analyzer. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Throttle Body Servicing

<b>Vehicle Requirements</b>
A workshop vehicle, fitted with a multiport EFI system and serviceable throttle body (adjustable idle screw/throttle valve home position).

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	13 Gasoline Fuel Injection Systems - Service and Diagnosis 2

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D8	P-2	Inspect and test fuel injectors.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Fuel Injector Servicing - On Vehicle Task 2 - Fuel Injector Servicing - Off Vehicle

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for the workshop vehicle, plus up-to-date service information from TSBs and electronic data sources (CD-ROMs, the internet, etc.). Balance tester. Fuel pressure gauge. Fuel injector flow test bench and cleaning tank. Safety glasses.
<b>Workshop Tasks:</b>	Injector Balance Testing Fuel Injector Removal Fuel Injector Inspection Fuel Injector Testing and Cleaning  Fuel Injector Refitting

<b>Vehicle Requirements</b>
Workshop vehicle fitted with a multipoint electronic fuel injection system.

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	14 Forced Induction Systems and Service

Natef Area	Natef Level	Natef Objective
VIII-D13	P-3	Test the operation of turbocharger/supercharger systems; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Turbochargers and superchargers Task 2 - Turbochargers and superchargers - Service and Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for the workshop vehicle, plus up-to-date service information from TSBs and electronic data sources (CD-ROMs, the internet, etc.). Flashlight. Small mirror. Safety glasses. Gauge and hoses to measure turbo boost (air) pressure. Dial indicator. Equipment to provide pressurized air (e.g. clean coolant pressure tester and hoses).
<b>Workshop Tasks:</b>	Turbocharger System Inspection Turbocharger Inspection Boost Pressure Testing Wastegate Valve Actuator Testing

Vehicle Requirements
Workshop vehicle fitted with a serviceable turbocharger.

<b>Module ID and Title:</b>	EP4 Fuel System Components and Operation
<b>Assignment Number and Title:</b>	15 Troubleshooting Fuel Injection Systems

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VIII-D2	P-1	Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Fuel Trim and Exhaust Emissions Task 2 - Fuel Injection Systems - Driveability and Emissions Problems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Service manual for the workshop vehicle, plus up-to-date service information from TSBs and electronic data sources (CD-ROMs, the internet, etc.). Scan tool. Exhaust gas analyzer (5 gas, if available). Safety glasses.
<b>Workshop Tasks:</b>	Fault Investigation

<b>Vehicle Requirements</b>
Workshop vehicle fitted with an OBD II engine management system and multipoint fuel injection.

## Steering and Suspension Systems Pod

The Suspension and Steering Systems Pod covers the following topic areas:

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	1 Simple Gear Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Gears Task 2 - Safety procedures Task 3 - Mechanisms trainer overview Task 4 - Using gears

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	2 Mechanical Science Principles

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Ruler
<b>Lab Tasks:</b>	Task 1 - Force and pressure Task 2 - Levers Task 3 - Resultant of a forces Task 4 - Gear ratio Task 5 - Types of force Task 6 - Center of gravity

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	3 Spur Gears

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Spur gear trains Task 2 - Fastening gears to the motor plate Task 3 - Simple spur gear trains Task 4 - Three gear trains Task 5 - Simple powered gear train

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	4 Compound Gear Trains

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Compound gear trains Task 2 - Comparison of gear trains Task 3 - Further compound gear trains

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	5 Pulley Belt Drives

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Basic pulley belt drive theory Task 2 - Simple pulley belt drive Task 3 - Changing speed Task 4 - Changing direction Task 5 - Belt slippage

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	6 Timing Pulley Drives

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Timing Pulley Drive Theory Task 2 - Timing Pulley Drive Practical Task 3 - Belt Tension

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	7 Belt Speeds

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Review of compound gear train ratios Task 2 - Combining mechanisms Task 3 - Combined ratios and speeds Task 4 - Predicting the outputs

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	8 Bevel Gears

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - How bevels work Task 2 - Gear direction change Task 3 - Turning bevel gears

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	9 Cams

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit 12" Ruler
<b>Lab Tasks:</b>	Task 1 - Cams theory Task 2 - Cam actions Task 3 - Constant cam speeds

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	10 Levers

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Technology of First Order Levers Task 2 - Measuring Forces

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	11 2nd and 3rd Order Levers

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Second and Third Order Levers Task 2 - Varying Fulcrum Distance Task 3 - Measuring Effort

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	12 Pulley Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Identify Simple Pulleys Task 2 - Identify Further Pulleys Task 3 - Investigate Simple Pulleys Task 4 - Investigate Further Pulleys

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	13 Inclined Planes

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Identify Inclined Planes Task 2 - Investigate Inclined Planes

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	14 Winch Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Identify Winch Systems Task 2 - Investigate a Winch System Using a Large Gear Task 3 - Investigate a Winch System Using a Small Gear Task 4 - Investigate a Winch System Using an electric motor

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS1 Fundamental Mechanical Systems
<b>Assignment Number and Title:</b>	15 Mechanism Problem Solving

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	
<b>Lab Inventory:</b>	D260 Mechanisms Trainer D260 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Identify Mechanical Problems Task 2 - Investigate an Electric Winch System Using an a Gear and Pulley Belt Drive Task 3 - Investigate an Electric Winch System Using a Gear and Timing Belt Drive Task 4 - Investigate a Manual Winch System Combined with a Compound Pulley

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	1 Steering and Suspension Fundamentals

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Steering Systems and Components
<b>Lab Tasks:</b>	Task 1 - Principles of Steering Task 2 - Steering Layouts Task 3 - Basic Steering Systems Task 4 - Suspension Systems

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	2 Steering and Suspension Trainer Introduction

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer
<b>Lab Tasks:</b>	Task 1 - Steering and Suspension trainer introduction Task 2 - Adjusting the wheel height Task 3 - Using the Power Steering

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components
<b>Assignment Number and Title:</b>	3 Steering Column Assembly Inspection

Natef Area	Natef Level	Natef Objective
IV-B6	P-2	Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism and steering wheel; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Steering Systems and Components
<b>Lab Tasks:</b>	Task 1 - Steering column components Task 2 - Removal and replacement Task 3 - Steering column disassembly

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	General hand tools Personal protective equipment
<b>Workshop Tasks:</b>	Steering Column Inspection Steering column removal. Steering column disassembly. Steering column reassembly. Steering column installation.

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	4 Rack and Pinion Steering Gear Service

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Terminology used in the service of the rack and pinion steering gear Task 2 - Disassemble the steering gear Task 3 - Inspect components of rack and pinion steering gear Task 4 - Reassemble steering gear

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vise with soft jaw protectors Special tools (consult workshop manual). Drip tray. Hand tools. Steel rule. Rack and Pinion Steering gear
<b>Workshop Tasks:</b>	Disassemble Rack and Pinion Steering Gear Inspect Components of Rack and Pinion Steering Gear Reassemble Rack and Pinion Steering Gear

<b>Vehicle Requirements</b>
N/a. Separate component required

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	5 Rack and Pinion Steering Gear Replacement

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-B8	P-1	Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer Ball Joint Splitter Socket and Wrench Set Power Steering Fluid Safety Glasses Pipe Clamps Pipe Bungs Personal protective equipment (gloves, safety glasses, protective apron). Drain Pan
<b>Lab Tasks:</b>	Task 1 - Rack and Pinion Parts Task 2 - Procedure for removing rack Task 3 - Procedure for inspecting/replacing rack

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	6 Rack and Pinion Steering Gear Adjustment

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer Socket and Wrench Set Vise Grips Personal protective equipment (gloves, safety glasses, protective apron).
<b>Lab Tasks:</b>	Task 1 - Parts you will use Task 2 - Manual rack and pinion gear adjustment Task 3 - Steering wheel adjustment

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	7 Tie Rod Ends and Bellows Boots Service

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-B9	P-1	Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer Socket and Wrench Set Vise Grips Retainer Clips (Inner and Outer) Personal protective equipment (gloves, safety glasses, protective apron). Ball Joint Splitter Plier Set
<b>Lab Tasks:</b>	Task 1 - Parts used Task 2 - Servicing the rack and pinion tie rods and bellow boots Task 3 - Inspection procedure Task 4 - Replacing the components

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	8 Power Steering Fluid

Natef Area	Natef Level	Natef Objective
IV-B10	P-1	Inspect power steering fluid levels and condition.
IV-B11	P-2	Flush, fill and bleed power steering system.
IV-B12	P-2	Diagnose power steering fluid leakage; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer Socket and Wrench Set Personal protective equipment (gloves, safety glasses, protective apron). Power Steering Fluid Drain Pan
<b>Lab Tasks:</b>	Task 1 - Inspecting power steering fluid Task 2 - Flushing the power steering system Task 3 - Bleeding the power steering system

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	9 Power Steering Pump Systems

Natef Area	Natef Level	Natef Objective
IV-B13	P-1	Remove, inspect, replace and adjust power steering pump belt.
IV-B14	P-3	Remove and reinstall power steering pump.
IV-B15	P-3	Remove, inspect and replace power steering pump pulley; check pulley and belt alignment alignment.
IV-B16	P-2	Inspect and replace power steering hoses and fittings.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - PAS belt replacement Task 2 - PAS pump replacement Task 3 - PAS pulley replacement Task 4 - PAS hoses replacement

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Workbench and vise with soft jaw protectors. Hand tools Drip tray Steel rule Torque wrench Belt Tension Gauge Technical information Vehicle manual Jack and axle stands.
<b>Workshop Tasks:</b>	Power steering Belt Removal, Inspection, Replacement and Tensioning Check the Power Steering Pump Check the Power Steering Pump Pulley Check Power Steering Hose and Fittings

<b>Vehicle Requirements</b>
Vehicle with power assisted steering

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	10 Coil Springs

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C2/1	P-2	Remove, inspect and install coil springs and spring insulators.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer CDX: Suspension Systems and Components Personal protective equipment (gloves, safety glasses, protective apron). Coil Spring Clamps Socket and Wrench Set
<b>Lab Tasks:</b>	Task 1 - Coil Spring Fundamentals Task 2 - Coil Spring Removal and Installation Task 3 - Coil Spring and Insulator Service Techniques

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	11 Tie Rods

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-B18	P-1	Inspect, replace and adjust tie rod ends (sockets), tie rod sleeves and clamps.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer CDX: Steering Systems and Components Vise Grips Socket and Wrench Set Ball Joint Splitter Personal protective equipment (gloves, safety glasses, protective apron). Torque Wrench
<b>Lab Tasks:</b>	Task 1 - Function of Tie Rod Ends Task 2 - Tie Rod End Servicing Techniques

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	12 Upper and Lower Control Arms

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/3	P-3	Remove, inspect and install upper and lower control arms, bushings, shafts and rebound bumpers.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Identify Upper and Lower Control Arms and Related Components Task 2 - Remove Control Arms Task 3 - Inspect Control Arms Task 4 - Install Control Arms

<b>Time in Workshop (hrs):</b>	
<b>Workshop Inventory:</b>	Hand tools Hoist Hydraulic press Vehicle protection kit Vehicle service manual Personal protective equipment (gloves, safety glasses etc).
<b>Workshop Tasks:</b>	Control Arm Removal Control Arm Inspection Control Arm Installation

<b>Vehicle Requirements</b>
Vehicle that has control arm type suspension.

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	13 Strut Rods and Bushings

Natef Area	Natef Level	Natef Objective
IV-C1/4	P-2	Remove, inspect, install and adjust strut (compression/tension) rods and bushings.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Identify Strut Rods and Bushings Task 2 - Remove Strut Rods and Bushings Task 3 - Inspect Strut Rods and Bushings Task 4 - Install Strut Rods and Bushings Task 5 - Adjust Strut Rods

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Hoist Vehicle protection kit Vehicle service manual Personal protective equipment (gloves, safety glasses etc).
<b>Workshop Tasks:</b>	Strut Rod Removal Strut Rod Inspection Strut Rod Installation Caster Adjustment

<b>Vehicle Requirements</b>
Vehicle must have strut rods.

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components and Operation
<b>Assignment Number and Title:</b>	14 Steering Knuckles

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/6	P-2	Remove, inspect and install steering knuckle assemblies.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Steering and Suspension Trainer Socket and Wrench Set Ball Joint Splitter Personal protective equipment (gloves, safety glasses, protective apron).
<b>Lab Tasks:</b>	Task 1 - Steering Knuckle Construction Task 2 - Removing Steering Knuckles Task 3 - Steering Knuckle Inspection Task 4 - Installing Steering Knuckles

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS2 Steering and Suspension Components
<b>Assignment Number and Title:</b>	15 Shock Absorbers

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C3/1	P-1	Inspect, remove and replace shock absorbers.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Shock Absorber Construction and Operation Task 2 - Inspecting Shock Absorbers Task 3 - Removing Shock Absorbers Task 4 - Replacing Shock Absorbers

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Hoist Vehicle protection kit Vehicle service manual Personal protective equipment (gloves, safety glasses etc).
<b>Workshop Tasks:</b>	Shock Absorber Inspection Shock Absorber Removal Shock Absorber Replacement

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	1 Fundamentals of Suspension Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Basic suspension principles Task 2 - Basic suspension components Task 3 - Conventional steering

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	2 Steering Wheel and Air Bag Removal and Refitting

Natef Area	Natef Level	Natef Objective
IV-B1	P-1	Disable and enable supplemental restraint system (SRS).
IV-B2	P-1	Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Vehicle service manual.
<b>Lab Tasks:</b>	Task 1 - SRS disable and enable Task 2 - Steering wheel removal and replacement

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle service manual Hand tools Steering wheel puller Vehicle protection kit Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Airbag disable Steering wheel removal and replacement

<b>Vehicle Requirements</b>
Vehicle fitted with air bag

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	3 Steering Column Fault Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-B3	P-2	Diagnose steering column noises, looseness and binding concerns (including tilt mechanisms); determine necessary action.
IV-C1/11	P-2	Lubricate steering and suspension systems.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Steering Column Terminology Task 2 - Diagnose Steering Column Problems

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Inspection light Wheel free hoist Vehicle protection kit Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Steering column fault diagnosis

<b>Vehicle Requirements</b>
Vehicle fitted with air bag

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	4 Non Rack and Pinion Worm Bearing Adjustment

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-B7	P-3	Adjust manual or power non-rack and pinion worm bearing preload and sector lash.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Terminology Task 2 - Adjustment procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Spring balance Vehicle protection kit Wheel free hoist or inspection pit Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Adjustment of Steering Box Pre-Load

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension and Systems
<b>Assignment Number and Title:</b>	5 Power Steering Gear

Natef Area	Natef Level	Natef Objective
IV-B4	P-3	Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering and fluid leakage concerns; determine necessary action.
IV-B5	P-3	Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering and fluid leakage concerns; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Diagnose power steering binding and hard steering Task 2 - Diagnose power steering looseness and fluid leakage

<b>Time in Workshop (hrs):</b>	1.5
<b>Workshop Inventory:</b>	Hand tools Spring balance Torque wrench Protractor or set square Ball joint splitter Pressure gauge Splined adapter for steering rack pinion Vehicle hoist or jack and axle stands. Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Diagnose power steering gear binding and hard steering Diagnose power steering looseness and fluid leakage

<b>Vehicle Requirements</b>
Any shop vehicle with power steering

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	6 Ball Joints

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/5	P-2	Remove, inspect and install upper and/or lower ball joints.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Components Task 2 - Pre Removal Check Task 3 - Removal of Ball Joint Task 4 - Inspeccion of Ball Joint Task 5 - Replacement of Ball Joint

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Wheel-free hoist or jack and axle stands Ball joint splitter Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Removal, inspection and installation of ball joints on a typical short or long arm suspension system

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	7 Short and Long Arm Suspension Coil Springs

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/7	P-2	Remove, inspect and install short and long arm suspension system coil springs and spring insulators.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Principles of coil suspension Task 2 - Removal, inspection and replacement of short and long arm suspension system coil spring

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Drip tray Hand tools Rubber grease Wheel free hoist or jack and axle stands Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Removal, Inspection and Installation of Coils Springs and Insulators

<b>Vehicle Requirements</b>
Vehicle with long and short arm suspension coil springs

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	8 Torsion Bars

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/8	P-3	Remove, inspect, install and adjust suspension system torsion bars; inspect mounts.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Torsion bar function Task 2 - Remove torsion bar Task 3 - Inspect torsion bar and its mountings Task 4 - Install the bar

<b>Time in Workshop (hrs):</b>	2.0
<b>Workshop Inventory:</b>	Hand tools Wheel free hoist or jack and axle stands Steel rule Grease gun and loose grease Torque wrench Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Remove, Inspect, Install and Adjust Torsion Bar

<b>Vehicle Requirements</b>
Vehicle fitted with torsion bar suspension

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	9 Stabilizer Bars

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/9	P-3	Remove, inspect and install stabilizer bar bushings, brackets and links.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Stabilizer bar function Task 2 - Remove the stabilizer bar Task 3 - Inspection of bar, bushes and brackets Task 4 - Install the stabilizer bar

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Hoist or jack and axle stands Jacking beam Ball joint splitter Rope and pry bar Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Removal, Inspection and Installation of Stabilizer Bushings, Brackets and Links

<b>Vehicle Requirements</b>
Vehicle with stabilizer bar.

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	10 Suspension Noises

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C1/1	P-1	Diagnose short and long arm suspension system noises, body sway and uneven riding height concerns; determine necessary action.
IV-C1/2	P-1	Diagnose strut suspension system noises, body sway and uneven riding height concerns; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Suspension Systems and Components
<b>Lab Tasks:</b>	Task 1 - Short and Long Arm Suspension Noises Task 2 - Suspension Noises from MacPherson Struts Task 3 - Body Sway and Vehicle Ride Height Concerns

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	11 Conventional Steering Components

Natef Area	Natef Level	Natef Objective
IV-B17	P-2	Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings and steering linkage damper.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Steering Systems and Components
<b>Lab Tasks:</b>	Task 1 - Conventional Steering Systems Task 2 - Servicing Conventional Steering System Components

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Wheel free hoist or jack and axle stands Two leg puller Ball joint splitter Torque wrench Vehicle service manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Remove, Inspect, and Replace Conventional Steering Components

Vehicle Requirements
Vehicle with conventional steering system

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	12 Transverse Links and Strut Rods

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C2/2	P-2	Remove, inspect and install transverse links, control arms, bushings and mounts.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Suspension Systems and Components
<b>Lab Tasks:</b>	Task 1 - Transverse Links and Strut Rods Task 2 - Transverse Links and Strut Rod Service Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle hoist Hydraulic press Vehicle protection kit Vehicle service manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Remove, Inspect, and Install Transverse Links

<b>Vehicle Requirements</b>
Vehicle with transverse links

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	13 Leaf Springs

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C2/3	P-3	Remove, inspect and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings and mounts.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Identify the Basic Components of a Leaf Spring Task 2 - Remove a Leaf Spring Task 3 - Inspect a Leaf Spring Task 4 - Reinstall a Leaf Spring

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Hoist Hydraulic press Vehicle protection kit Vehicle service manual
<b>Workshop Tasks:</b>	Leaf spring removal Leaf spring inspection Leaf spring installation

<b>Vehicle Requirements</b>
Rear wheel drive vehicle with leaf springs

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	14 MacPherson Struts

Natef Area	Natef Level	Natef Objective
IV-C2/4	P-2	Remove, inspect and install strut cartridge or assembly, strut coil spring and insulators (silencers).
IV-C1/10	P-1	Remove, inspect and install strut cartridge or assembly, strut coil spring and insulators (silencers), and upper strut bearing mount.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Identify the Basic Components of a MacPherson Strut Task 2 - Remove a Strut Task 3 - Disassemble and Inspect a Strut Task 4 - Reinstall a Strut

<b>Time in Workshop (hrs):</b>	2.0
<b>Workshop Inventory:</b>	Hand tools Hoist Coil spring compressor Vehicle protection kit Vehicle service manual
<b>Workshop Tasks:</b>	Strut removal Strut inspection Strut installation

<b>Vehicle Requirements</b>
A vehicle fitted with MacPherson struts

<b>Module ID and Title:</b>	SSS3 On-vehicle Steering and Suspension Systems
<b>Assignment Number and Title:</b>	15 Electronically Controlled Suspension and Steering

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C3/3	P-3	Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action.
IV-A19	P-3	Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Identify the Basic Components of Electronically Controlled Steering Systems Task 2 - Diagnose Components of Electronically Controlled Steering Task 3 - Inspect Components of Electronically Controlled Steering Task 4 - Adjust Components of Electronically Controlled Steering Task 5 - Repair or Replace Components of Electronically Controlled Steering

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Diagnostic tools Hoist Vehicle protection kit Vehicle service manual
<b>Workshop Tasks:</b>	Electrically controlled steering and suspension inspection

<b>Vehicle Requirements</b>
A vehicle fitted electronically controlled suspension and or steering

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	1 Fundamentals of Wheels and Tires

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Construction & Design Task 2 - Fixings Task 3 - Tire Construction (Basic Function) Task 4 - Tire Identification Task 5 - Tubeless and Tube Type Tires

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	2 Tire Inspection

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-E1	P-1	Diagnose tire wear patterns; determine necessary action.
IV-E2	P-1	Inspect tires; check and adjust air pressure.
IV-E6	P-2	Diagnose tire pull (lead) problem; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Tire problems Task 2 - Tire wear patterns Task 3 - Tire inflation pressures

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	Air line or air compressor Tire pressure gauge Vehicle Service Manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Tire Inspection Check and Adjust Tire Pressures

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	3 Prealignment Inspection

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-D3	P-1	Perform prealignment inspection; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Wheel alignment principles Task 2 - Prealignment inspection

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	Vehicle hoist Inspection lamp Hand tools
<b>Workshop Tasks:</b>	Prealignment Inspection

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	4 Vehicle Riding Height

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-D4	P-1	Measure vehicle riding height; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Vehicle Service Manual
<b>Lab Tasks:</b>	Task 1 - Vehicle Ride Height Theory

<b>Time in Workshop (hrs):</b>	0.5
<b>Workshop Inventory:</b>	Safety glasses Pressure gauge Tape measure
<b>Workshop Tasks:</b>	Measure vehicle ride height

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	5 Front Wheel Alignment

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-D5	P-1	Check and adjust front and rear wheel camber; perform necessary action.
IV-D6	P-1	Check and adjust caster; perform necessary action.
IV-D7	P-1	Check and adjust front wheel toe; adjust as needed.
IV-D13	P-2	Check for front wheel setback; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Principles Task 2 - Wheel alignment procedures Task 3 - Setback procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Wheel alignment Turntables Caster gauge Camber gauge Vehicle Jack Axle stands Tracking gauge Vehicle Service Manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Caster, Camber, Toe and Setback checks and adjustment

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	6 Wheel Alignment – Non-Adjustable Angles

Natef Area	Natef Level	Natef Objective
IV-D9	P-2	Check toe-out on turns (turning radius); determine necessary action.
IV-D10	P-2	Check SAI (steering axis inclination) and included angle; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Wheel alignment principles Task 2 - Check SAI and toe-out on turns

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle Jack Axle stands SAI gauge Steering turntables Vehicle protection kit Tracking gauge Vehicle Service Manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Check Steering Axis Inclination and Toe-Out On Turns

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	7 Rear Wheel Alignment

Natef Area	Natef Level	Natef Objective
IV-D8	P-1	Center steering wheel.
IV-D11	P-2	Check and adjust rear wheel toe.
IV-D12	P-2	Check rear wheel thrust angle; determine necessary action.

<b>Time in Lab (hrs):</b>	1.0
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Rear wheel thrust angle Task 2 - Adjusting rear wheel thrust angle Task 3 - Adjusting rear wheel toe Task 4 - Centering the steering wheel

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Steering wheel puller (if applicable) Steering alignment equipment Brake pedal depressor Hoist Vehicle protection kit Vehicle Service Manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Check Rear Wheel Thrust Angle Check and Adjust Rear Wheel Toe Center Steering Wheel

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	8 Front Cradle Alignment

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-D14	P-3	Check front cradle (subframe) alignment; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - The front cradle Task 2 - Adjusting the front cradle

<b>Time in Workshop (hrs):</b>	0.1
<b>Workshop Inventory:</b>	Alignment tools Hand tools Hoist Vehicle protection kit Vehicle Service Manual Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Check front cradle (subframe) alignment.

<b>Vehicle Requirements</b>
Any workshop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	9 Vehicle Direction Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-D2	P-1	Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer and steering return concerns; determine necessary action.

<b>Time in Lab (hrs):</b>	1.50
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Steering system diagnosis - Manual steering gear (conventional steering system) Task 2 - Power steering gear (conventional steering system) Task 3 - Manual rack and pinion steering gear Task 4 - Power rack and pinion steering gear

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS4    Wheels and Tires
<b>Assignment Number and Title:</b>	10      Wheel and Tire Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-E3	P-2	Diagnose wheel/tire vibration, shimmy and noise; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Tire and Wheel Problems Task 2 - Diagnosis Task 3 - Problem Diagnosis

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	11 Rotating Tires

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-E4	P-1	Rotate tires according to manufacturer's recommendations.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Tire Wear Task 2 - Tire Rotation Considerations Task 3 - Wheel Removal and Installation

<b>Time in Workshop (hrs):</b>	0.75
<b>Workshop Inventory:</b>	Vehicle service manual. General wrench, socket and screwdriver set. Torque wrench. Vehicle jacking equipment or a wheel free hoist. Wheel chocks. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Tire rotation

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	12 Wheel and Tire Runout

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-E5	P-2	Measure wheel, tire, axle and hub runout; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Wheels and Tires
<b>Lab Tasks:</b>	Task 1 - Wheel, Tire and Hub Runout Task 2 - Runout and Wheel Construction Task 3 - Measurement Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Dial test indicator Vehicle service manual. Inspection lamp Vehicle hoist Vehicle protection kit Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Measure wheel and tire runout Measure axle and hub/rotor runout

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	13 Wheel Balancing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-E7	P-1	Balance wheel and tire assembly (static and dynamic).

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Wheel Balancing Principles Task 2 - Balancing Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Balancing machine Wheel weights Wheel weight pliers Hoist or jack and axle stands Vehicle protection kit Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Wheel balancing

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	14 Tire Repair

Natef Area	Natef Level	Natef Objective
IV-E8	P-2	Dismount, inspect, repair and remount tire on wheel .
IV-E9	P-1	Reinstall wheel; torque lug nuts.
IV-E10	P-2	Inspect and repair tire.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Tire Damage Task 2 - Tire Repair Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Tire mounting machine Repair plugs Adhesive Portable adhesive wheel Tread depth gauge Jack and axle stands or wheel free hoist Vehicle protection kit Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Wheel removal Tire inspection Tire repair Wheel installation

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	SSS4 Wheels and Tires
<b>Assignment Number and Title:</b>	15 Wheel Bearings

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
IV-C3/2	P-1	Remove, inspect and service or replace front and rear wheel bearings.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - The Purpose of Wheel Bearings Task 2 - Wheel Bearing Maintenance

<b>Time in Workshop (hrs):</b>	1.5
<b>Workshop Inventory:</b>	Vehicle service manual. Chisel. Hammer. General wrench, socket and screwdriver set. Torque wrench. Vehicle jacking equipment or a wheel free hoist. Bearing grease. Vehicle protection kit. Personal protective equipment (gloves, safety glasses, heavy-duty boots).
<b>Workshop Tasks:</b>	Wheel bearing removal Wheel bearing inspection Wheel bearing installation

<b>Vehicle Requirements</b>
Any shop vehicle

## Specialty Pod

The Specialty Pod covers the following topic areas:

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	1 Principles of Heating and Air Conditioning

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - Principles of Heat Transfer Task 2 - Heating System Basics Task 3 - Air Conditioning Basics Task 4 - Basic A/C Components

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	2 Refrigeration Cycle and Fixed Orifice Tube Cycling Clutch System

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C1	P-2	Diagnose temperature control problems in the heater / ventilation system; determine necessary action.
VII-D4	P-2	Diagnose malfunctions in the vacuum and mechanical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.5 Panel Trainer PT7.5 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - The F.O.T.C.C. System Task 2 - The Refrigeration Cycle Task 3 - F.O.T.C.C. System Task 4 - Troubleshooting an F.O.T.C.C. System

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	3 Climate Control Systems Service

Natef Area	Natef Level	Natef Objective
VII-C1	P-2	Diagnose temperature control problems in the heater / ventilation system; determine necessary action.
VII-D4	P-2	Diagnose malfunctions in the vacuum and mechanical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.
VII-E4	P-1	Label and store refrigerant.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.5 Panel Trainer PT7.5 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Service Equipment and Components Task 2 - Discharging and Recharging Operation Task 3 - Discharging and Recharging the System Task 4 - A/C Troubleshooting-1 Task 5 - A/C Troubleshooting-2

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	4 Air Distribution Control

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C1	P-2	Diagnose temperature control problems in the heater / ventilation system; determine necessary action.
VII-D4	P-2	Diagnose malfunctions in the vacuum and mechanical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.
VII-D7	P-3	Inspect A/C-heater ducts, doors, hoses, cabin filters and outlets; perform necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.5 Panel Trainer PT7.5 Accessory Kit
<b>Lab Tasks:</b>	Task 1 - Air Distribution Control Task 2 - Air Distribution Control Investigation Task 3 - Air Distribution Control Systems Troubleshooting – 1 Task 4 - Air Distribution Control Systems Troubleshooting – 2 Task 5 - Air Distribution Control Systems Troubleshooting – 3

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACSI Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	5 Cooling System Airflow Components

Natef Area	Natef Level	Natef Objective
VII-C7	P-1	Inspect and test cooling fan, fan clutch , fan shroud, air dams; perform necessary action.
VII-C8	P-1	Inspect and test electrical cooling fan, fan control system and circuits; determine necessary action.
I-D10	P-2	Inspect and test fans (electrical and mechanical), fan clutch, fan shroud, air dams.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Introduction to Air Flow Components Task 2 - Inspection and Testing of Air Flow Components

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Timing light Tachometer Inspection lamp Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Inspection of Airflow Components Testing of a fan clutch

<b>Vehicle Requirements</b>
Workshop vehicle fitted with fluid coupled fan clutch

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	6 Electrical Controls

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C9	P-2	Inspect and test heater control valve(s); perform necessary action.
VII-D1	P-2	Diagnose malfunctions in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action.
VII-D2	P-1	Inspect and test A/C -heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.5 Panel Trainer PT7.5 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Electrical Controls Theory Task 2 - Electronic Controls Investigation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	7 Failures in Electrical Controls

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-D1	P-2	Diagnose failures in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action.
VII-D2	P-1	Inspect and test A/C -heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Digiac PT7.5 Panel Trainer PT7.5 Accessory Kit Digital Multimeter
<b>Lab Tasks:</b>	Task 1 - Diagnosing Electrical System Faults Task 2 - Diagnosing Blower Electrical Faults Task 3 - Diagnosing Blower Motor Faults Task 4 - Diagnosing Compressor Faults

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	8 Vehicle Ventilation, Ducting and Filtration

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-D7	P-3	Inspect A/C-heater ducts, doors, hoses, cabin filters and outlets; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Vehicle Ventilation systems Task 2 - Purpose and Operation of Cabin Air Filters Task 3 - Further Ventilation Failures

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle protection kit Vehicle service manual General wrench, socket and screwdriver set Inspection light Exhaust extraction system Thermometer Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Airflow Component Inspection

<b>Vehicle Requirements</b>
Vehicle with Air Conditioning and CAF

<b>Module ID and Title:</b>	ACSI Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	9 Automatic HVAC Problem Diagnosis

Natef Area	Natef Level	Natef Objective
VII-D8	P-3	Check operation of automatic and semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach Book: Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - Semi automatic and Automatic Systems Task 2 - Automatic HVAC and the ECU Task 3 - Actuators and Servos Task 4 - Climate Control Diagnosis

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle protection kit. Vehicle service manual. Inspection light. Exhaust extraction system. Thermometer. A/C Diagnostic scan tool. Digital Multimeter. General wrench, socket and screwdriver set. Manifold gauge set (if undertaking a system performance test). Hose adapters and fittings for manifold gauge set. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Testing Automatic Air Conditioning System Operation

Vehicle Requirements
Real vehicle with Automatic Air Conditioning / Climate Control.

<b>Module ID and Title:</b>	ACSI Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	10 Cooling System Service Checks

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C2	P-1	Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Identify coolant condition Task 2 - Pressure tests Task 3 - Recovery system checks Task 4 - Combustion leak test

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver set. Inspection light. Exhaust extraction system. Thermometer. Digital Multimeter Heat resistant gloves. Hydrometer or Refractometer. Cooling system hand pressure test equipment. Carbon Dioxide engine block tester / sniffer. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Pressure Cap Test Cooling System Pressure Test Engine Coolant Temperature Check Cylinder Leak Test Using A Leak Detector

<b>Vehicle Requirements</b>
Vehicle with a fully operational cooling system and Coolant Recovery system.

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	11 Cooling System Hoses and Belts

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C3	P-1	Inspect engine cooling and heater system hoses and belts; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Heating and Air Conditioning CDX: Engine Cooling Systems and Components
<b>Lab Tasks:</b>	Task 1 - Drive belt inspection Task 2 - Further drive belt considerations Task 3 - Coolant hose Task 4 - Hose inspection and replacement

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver set. Inspection light. Exhaust extraction system. Belt tension gauge. Hose driver. Personal protective equipment (gloves, safety glasses, protective apron).
<b>Workshop Tasks:</b>	Belt Inspection Cooling and Heater System Hose Inspection

<b>Vehicle Requirements</b>
Vehicle with operational cooling system and preferably V and Polly-V belt systems.

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	12 Thermostats

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C4	P-1	Inspect, test, and replace thermostat and housing.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Thermostat Construction Task 2 - Thermostat Operation Task 3 - Thermostat Servicing Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Feeler gauges Clean drip tray Thermometer Heating plate Steel rule Vehicle technical information Personal protective equipment
<b>Workshop Tasks:</b>	Thermostat removal Thermostat inspection and test Thermostat installation

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	13 Coolant

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-C5	P-1	Determine coolant condition and coolant type for vehicle application; drain and recover coolant.
VII-C6	P-1	Flush system; refill system with recommended coolant; bleed system.
I-D7	P-1	Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Coolant Fundamentals Task 2 - Coolant Usage Task 3 - Coolant Servicing Procedure

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Anti-freeze tester Hand tools Antifreeze Vehicle protection kit Personal protective equipment
<b>Workshop Tasks:</b>	Coolant testing Coolant flushing Coolant installation

<b>Vehicle Requirements</b>
Any shop vehicle.

<b>Module ID and Title:</b>	ACS1 Heating and Air Conditioning Systems
<b>Assignment Number and Title:</b>	14 HVAC Control

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-D6	P-3	Inspect and test A/C-heater control cables and linkages; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - The Control Head Task 2 - Control Panel Assembly Inspection Task 3 - Linkages and Cables Inspection

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Digital or analog thermometer
<b>Workshop Tasks:</b>	Control Head Inspection

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	ACS1 Heating and Ar Conditioning Systems
<b>Assignment Number and Title:</b>	15 Heating and Air Management Servicing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-D5	P-3	Inspect and test A/C-heater control panel assembly; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Heater Servicing Task 2 - Air Management Servicing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Vehicle service manual Vacuum pump Vacuum Gauge
<b>Workshop Tasks:</b>	Heater Inspection Air Management Inspection

<b>Vehicle Requirements</b>
Any shop vehicle

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	1 Air Conditioning Trainer Familiarization

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Air Conditioning Trainer 12 Volt Battery Eye Protection
<b>Lab Tasks:</b>	Task 1 - Air Conditioning trainer Task 2 - Operation of the trainer

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	2 Air Conditioning System Performance Testing

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-A4	P-1	Performance test AC system; diagnose A/C system malfunctions using principles of refrigeration.
VII-A6	P-1	Identify refrigerant type; conduct a performance test of the A/C system; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Air Conditioning Trainer 12 Volt Battery Eye Protection Thermometer Manifold Gauge Set Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Service Ports Task 2 - Performance Test

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	3 Air Conditioning Servicing - 1

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-A6	P-1	Identify refrigerant type; conduct a performance test of the A/C system; determine necessary action.
VII-A8	P-2	Inspect the condition of discharged oil; determine necessary action.
VII-B1/4	P-1	Remove and reinstall A/C compressor and mountings; measure oil quantity; determine necessary action.
VII-E1	P-1	Perform correct use and maintenance of refrigerant handling equipment.
VII-E2	P-1	Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant.
VII-E4	P-1	Label and store refrigerant.
VII-E6	P-1	Evacuate and charge A/C system

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Operation and Maintenance Task 2 - Identification, Recovery, Recycling Task 3 - Evacuation and Recharging

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	4 Leak Testing an Air Conditioning System

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-A7	P-1	Leak test A/C system; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Air Conditioning Trainer 12 Volt Battery Eye Protection Leak Test Equipment Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Different leak tests Task 2 - Vacuum leak test

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	5 Air Conditioning Servicing - 2

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-A8	P-2	Inspect the condition of discharged oil; determine necessary action.
VII-E3	P-1	Recycle refrigerant.
VII-E4	P-1	Label and store refrigerant.
VII-E5	P-1	Test recycled refrigerant for non-condensable gases.
VII-E6	P-1	Evacuate and charge A/C system.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Air Conditioning Trainer 12 Volt Battery Manifold Gauge Set Evacuation or Vacuum Pump Refrigerant Recycling Equipment Charging Equipment Approved container for Recovery and Recycling of R-134a Refrigerant Eye Protection Gloves
<b>Lab Tasks:</b>	Task 1 - Air conditioning servicing practical

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	6 Electrical Compressor Controls

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-B1/1	P-2	Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.
VII-D3	P-1	Test and diagnose A/C compressor clutch control systems; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - A/C Protection devices Task 2 - Identify A/C cut out switches Task 3 - PCM interface with the A/C system Task 4 - Test Equipment Review

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Multimeter Vehicle protection kit General wrench, socket and screwdriver set Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Testing A/C Fail Safe Switches

<b>Vehicle Requirements</b>
Vehicle with Air Conditioning

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	7 Removing A/C Compressor Belts and Pump

Natef Area	Natef Level	Natef Objective
VII-B1/2	P-2	Inspect A/C compressor drive belts; replace and adjust as needed.
VII-B1/4	P-1	Remove and reinstall A/C compressor and mountings; measure oil quantity; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - Identify Drive belt types Task 2 - Drive Belt Adjustment Task 3 - A/C Pump Removal Task 4 - Real Vehicle Pump Removal

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	General wrench, socket and screwdriver sets Inspection light Suitable Air Conditioning service station. Suitable clear oil container Suitable belt tensioning equipment for vehicle. Vehicle protection kit. Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Removal of A/C Compressor Replacement of A/C Compressor

Vehicle Requirements
Vehicle with Air Conditioning

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	8 Air Conditioning Compressor Clutches

Natef Area	Natef Level	Natef Objective
VII-B1/3	P-2	Inspect, test, and/or replace A/C compressor clutch components and/or assembly.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - Compressor types Task 2 - Compressor clutch removal Task 3 - Compressor clutch tests

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Suitable air conditioning service station, if required. Digital multimeter Suitable belt tensioning equipment for vehicle. Gloves for use with A/C Station, if required. Relevant clutch puller, for compressor clutch. Feeler gauges, for checking air gap. Straight edge. Coil puller, if required for coil removal. Torque wrench suitable for compressor clutch re-tightening. Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Removal of A/C Compressor (If required) Inspection of clutch on vehicle Dismantle compressor clutch from compressor Inspection of dismantled clutch Replacement of A/C compressor (If required)

<b>Vehicle Requirements</b>
Real vehicle with Air Conditioning (with facility to remove compressor clutch without removing compressor).

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	9 Air Conditioning System Hoses and Lines

Natef Area	Natef Level	Natef Objective
VII-B2/2	P-2	Remove and inspect A/C system mufflers, hoses, lines, fittings, o-rings, seals, and service valves; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - A/C system hoses and lines Task 2 - Hose and line fittings Task 3 - Hose and fitting repair Task 4 - Service valve inspection

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Suitable air conditioning service station. Gloves for use with A/C Station. Torque wrench. Torque wrench crows foot / adapters for relevant pipe fittings. O-rings and gaskets for service / replacement of chosen pipe. Refrigerant oil. Cleaning cloths. Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Inspect A/C lines, hoses and fittings Remove and inspect A/C system hose and fittings Install A/C system hose and fittings

Vehicle Requirements
Real vehicle with air conditioning.

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	10 Air Conditioning Condenser Airflow

Natef Area	Natef Level	Natef Objective
VII-B2/3	P-1	Inspect A/C condenser for airflow restrictions; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - Condenser Construction Task 2 - Fans and Shrouds Task 3 - Condenser Blockages

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Vacuum cleaner. Digital multimeter General vehicle wash and hose facility. Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Checking for airflow restrictions Inspection of Airflow Components

<b>Vehicle Requirements</b>
Real vehicle with air conditioning.

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	11 Servicing A/C Driers

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-B2/4	P-1	Remove and install receiver/drier or accumulator/drier; measure oil quantity; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - The Receiver Drier Task 2 - The Accumulator Task 3 - Replacing the Accumulator / Drier

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Gloves. Vehicle refrigerant recovery station. Refrigerant oil. Torque wrench. Replacement seals. Replacement accumulator / receiver-drier (if applicable). Leak detection equipment.
<b>Workshop Tasks:</b>	Replacing the Accumulator / Receiver-drier Inspection of Completed Accumulator / Receiver-drier Replacement

<b>Vehicle Requirements</b>
Any shop vehicle with air conditioning

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operatoins
<b>Assignment Number and Title:</b>	12 Servicing the FOT and TXV

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-B2/5	P-2	Remove and install expansion valve or orifice (expansion) tube.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - Operation of the TXV Task 2 - Operation of the FOT Task 3 - Replacement of the TXV or FOT

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Gloves. Vehicle refrigerant recovery station. Refrigerant oil. Torque wrenches. Replacement seals. Replacement FOT or TXV(if applicable). Leak detection equipment. Thermal bulb insulation.
<b>Workshop Tasks:</b>	TXV inspection TXV replacement FOT inspection FOT replacement

<b>Vehicle Requirements</b>
Any shop vehicle with air conditioning

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	13 Evaporator Water Drain Service

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-B2/6	P-3	Inspect evaporator housing water drain; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning CDX: Heating and Air Conditioning Systems
<b>Lab Tasks:</b>	Task 1 - Evaporator Moisture Formation Task 2 - System Odors Task 3 - Draining the Evaporator Housing

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Hand tools. Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Gloves. Protective clothing. Eye protection. Evaporator cleaning agents. COSH specifications for above. Flexi-line for clearing water drain.
<b>Workshop Tasks:</b>	Inspection of A/C Evaporator Drain

<b>Vehicle Requirements</b>
Any shop vehicle with air conditioning.

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	14 Air Conditioning System Filters

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-B2/1	P-3	Determine need for an additional A/C system filter; perform necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - In-line filters Task 2 - Installing a filter

<b>Time in Workshop (hrs):</b>	
<b>Workshop Inventory:</b>	Hand tools. Vehicle protection kit. Vehicle service manual. General wrench, socket and screwdriver sets. Inspection light. Gloves. Protective clothing. Eye protection. In-line system filter. Vehicle A/C service station. Torque wrench.
<b>Workshop Tasks:</b>	In-line Filter Installation Inspection of Old Filter

<b>Vehicle Requirements</b>
Any shop vehicle with air conditioning.

<b>Module ID and Title:</b>	ACS2 Air Conditioning Components and Operation
<b>Assignment Number and Title:</b>	15 A/C System Noise Diagnosis

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
VII-A5	P-2	Diagnose abnormal operating noises in the A/C system; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Heating and Air Conditioning
<b>Lab Tasks:</b>	Task 1 - A/C system inspection Task 2 - A/C system noise problems Task 3 - A/C system noises

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	1 Clutch Construction and Operation

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Clutches and Manual Transmissions
<b>Lab Tasks:</b>	Task 1 - Clutch Basics Task 2 - Clutch Operation Task 3 - Multi-plate clutches

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	2 Clutch Diagnosis and Repair

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
III-B1	P-1	Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Clutch Faults Task 2 - Clutch Servicing

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	3 Manual Transmission Components and Operation

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Clutches and Manual Transmissions
<b>Lab Tasks:</b>	Task 1 - Transmisson basics Task 2 - Compound gearsets Task 3 - Transmission construction Task 4 - Synchronizers Task 5 - Transmission operation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	4 Manual Transmission Diagnosis and Repair

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Clutches and Manual Transmissions Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Manual Transmission Faults Task 2 - Bearings and Seals Task 3 - Transmission Servicing and Repair

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	5 Automatic Transmission Principles

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Automatic Transmissions - Principles Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Torque Converters Task 2 - Planetary Gears Task 3 - Planetary Gear Operation

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	6 Automatic Transmission Operation

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Automotic Transmissions - Layout and Operation
<b>Lab Tasks:</b>	Task 1 - Auto Transmission Operation Task 2 - The Hydraulic System Task 3 - Control Solenoids and Clutches

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	7 Automatic Transmission Diagnosis

Natef Area	Natef Level	Natef Objective
II-A1	P-1	Identify and interpret transmission/transaxle concern; assure proper engine operation; determine necessary action.
II-A4	P-1	Diagnose fluid leakage, level, and condition concerns; determine necessary action.
II-A5	P-1	Perform pressure tests; determine necessary action.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Automatic transmission diagnosis Task 2 - Unusual transmission fluid conditions Task 3 - System pressure tests Task 4 - Linkages and cable adjustments

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit General wrench, socket and screwdriver set Tachometer Vacuum gauge / test equipment Vehicle jacking equipment or a wheel free hoist Wheel chocks Flashlight Vehicle Service Manual Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Automatic Transmission Diagnostic Checks

<b>Vehicle Requirements</b>
Workshop vehicle with automatic transmission

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	8 Drive Shafts

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Final Drives and Drive Shafts
<b>Lab Tasks:</b>	Task 1 - RWD drive shafts Task 2 - CV joints Task 3 - FWD drive shafts Task 4 - Rear wheel drive shafts Task 5 - FWD & RWD shafts

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	9 Servicing Drive Shafts

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Final Drives and Drive Shafts
<b>Lab Tasks:</b>	Task 1 - C V Joint Service Task 2 - Universal Joint Service Task 3 - C V Joint Boot Replacement Task 4 - Universal Joint Replacement

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Hand tools C V Boot kit Service manual Vehicle lifting hoist or jack and stands
<b>Workshop Tasks:</b>	C V Joint Boot Replacement Procedure Universal Joint Replacement Procedure

<b>Vehicle Requirements</b>
Front wheel drive vehicle

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	10 Final Drive Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Final Drives and Drive Shafts
<b>Lab Tasks:</b>	Task 1 - Final Drive Introduction Task 2 - Differential Introduction Task 3 - RWD Final drive Task 4 - Axle Shafts Task 5 - 4WD Systems

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	11 Final Drive Diagnosis and Repair

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Diagnostic and Repair Procedures Task 2 - Disassemble a Final Drive Task 3 - Diagnose Component Parts Task 4 - Setting Drive Pinion Depth and Preload Task 5 - Setting Ring and Pinion Gear Backlash Task 6 - Setting Ring and Pinion Gear Mesh Task 7 - Reassemble the Final Drive

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	12 Transaxle Components and Operation

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Modern Automotive Technology CDX: Final Drives and Driveshafts CDX: Automatic Transmissions - Principles
<b>Lab Tasks:</b>	Task 1 - Transaxle Introduction Task 2 - Manual Transaxle Construction and Operation Task 3 - Automatic Transaxle Construction and Operation Task 4 - Transaxle Electronic Controls Task 5 - Continuously Variable Transaxles

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	13 Transaxle Diagnosis and Repair

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach Book: Modern Automotive Technology
<b>Lab Tasks:</b>	Task 1 - Diagnosis of Transaxle Faults Task 2 - Manual Transaxle Service and Repair Task 3 - Automatic Transaxle Service and Repair

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	14 Four-Wheel Drive Transmission Systems

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Final Drives and Driveshafts
<b>Lab Tasks:</b>	Task 1 - Four-Wheel Drive Operation Task 2 - Four-Wheel Drive Servicing Task 3 - Passenger car 4WD and AWD Systems

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	TS1 Automotive Transmission Systems
<b>Assignment Number and Title:</b>	15 Complete Vehicle Transmission Inspection

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Transmission System Inspection Review

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Vehicle protection kit Hand tools Brake/clutch bleed equipment Service manual Vehicle lifting hoist Appropriate transmission fluid Brake fluid Appropriate final drive fluid
<b>Workshop Tasks:</b>	Visual Inspection of the Transmission/Transaxle Checking Transmission/Transaxle Fluid Level Inspection and Service of Manual Transmission/Transaxle Clutch Inspection and Checks of Drive Shafts and Joints Visual Inspection of the Final Drive and Axle Shaft Checking Final Drive Fluid Level

Vehicle Requirements
Front-wheel drive vehicle Rear-wheel drive vehicle

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	1 Engine Operation and Cycles

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - 4-Stroke Cycle Task 2 - 2-Stroke Cycle Task 3 - Valve Timing Cycle

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	2 Constructional Engine Components

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Cylinder Block Task 2 - Cylinder Head Task 3 - Cylinder Arrangements

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	3 Pistons and Crankshafts

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Pistons Task 2 - Crankshafts and Bearings

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	4 Valve Train Assemblies

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	CDX: Engine Internal Components and Assemblies
<b>Lab Tasks:</b>	Task 1 - Introduction to Valve Trains Task 2 - Valve Train Components Task 3 - Camshafts and Valve Timing

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	5 Engine Size and Performance Measurements

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	N/A
<b>Lab Tasks:</b>	Task 1 - Engine Size Measurements Task 2 - Engine Performance Measurements

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	6 Principles of Lubrication

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Engine Lubrication Systems and Components
<b>Lab Tasks:</b>	Task 1 - Oil Function Task 2 - Oil types and additives Task 3 - Oil pressure system Task 4 - Types of oil pumps Task 5 - The oil filter

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	7 Principles of the Cooling System

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Engine Cooling Systems and Components
<b>Lab Tasks:</b>	Task 1 - Function of the cooling system Task 2 - The water pump Task 3 - The radiator Task 4 - The radiator pressure cap Task 5 - The Thermostat

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	8 Basic Engine Diagnostic Techniques

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
I-A6	P-2	Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Abnormal Operating Temperatures Task 2 - Abnormal Lubrication Conditions Task 3 - Engine Noise Concerns Task 4 - Basic Diagnostic Tools

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	9 Basic Engine Servicing Techniques

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
I-A4	P-1	Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Checking for oil leaks Task 2 - Checking for coolant leaks Task 3 - Checking for fuel leaks

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	General wrench, socket sets. De-burring equipment. Straight edge. Torque wrench set. Inspection lamp. Suitable gaskets for sump replacement. Suitable liquid gasket sealant. Cleaning equipment. Coolant hydrometer. Cooling system pressure test equipment. Digital multimeter Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Oil Leak Inspection Oil Pan Removal and Replacement Coolant Leak Inspection Fuel Leak Inspection

<b>Vehicle Requirements</b>
Front wheel drive vehicle

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	10 Lubrication Service Techniques

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach CDX: Engine Lubrication Systems and Components
<b>Lab Tasks:</b>	Task 1 - Oil Filter Types Task 2 - Oil Change Procedure Task 3 - Priming the Lubrication System Task 4 - Oil Pressure Testing

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	11 Inspect and Repair Threads

<b>Natef Area</b>	<b>Natef Level</b>	<b>Natef Objective</b>
I-C3	P-2	Inspect internal and external threads; restore as needed (includes installing thread inserts).

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Hand and Power Tools P-Z
<b>Lab Tasks:</b>	Task 1 - Threads and thread forms Task 2 - Basic thread repair Task 3 - Thread repair using inserts

<b>Time in Workshop (hrs):</b>	1.0
<b>Workshop Inventory:</b>	Pillar drill / hand drill. Drill bit set. General wrench, socket sets. Helicoil or thread insert kits. Cutting compound. T-handles & tap wrenches De-burring equipment Tapping drill and screw charts. Square edge. Suitable component for thread repair. Personal protective equipment (gloves, safety glasses, protective apron)
<b>Workshop Tasks:</b>	Thread Insert Preparation Thread Cutting and Fitment Insertion

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	12 Engine Removal and Disassembly

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Engine Configurations Task 2 - Engine Pre-Removal Preparations Task 3 - Engine Removal

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	13 Engine Block Service

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Engine Disassembly Task 2 - Inspect Engine Block Task 3 - Rebuilding the Engine Block

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

Vehicle Requirements
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	14 Cylinder Head Service

Natef Area	Natef Level	Natef Objective

<b>Time in Lab (hrs):</b>	1.5
<b>Lab Inventory:</b>	Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Cylinder Head Disassembly Task 2 - Cylinder Head Inspection Task 3 - Assembling the Cylinder Head Task 4 - Refit the Cylinder Head to the cylinder block

<b>Time in Workshop (hrs):</b>	0.0
<b>Workshop Inventory:</b>	N/A
<b>Workshop Tasks:</b>	N/A

<b>Vehicle Requirements</b>
N/A

<b>Module ID and Title:</b>	COS1 Automotive Components, Operation and Servicing
<b>Assignment Number and Title:</b>	15 Engine Service and Installation

Natef Area	Natef Level	Natef Objective
I-A11	P-1	Remove and reinstall engine in a late model front-wheel drive vehicle (OBDI or newer); reconnect all attaching components and restore the vehicle to running condition.
I-A12	P-3	Remove and reinstall engine in a late model rear-wheel drive vehicle (OBDI or newer); reconnect all attaching components and restore the vehicle to running condition.
I-B12	P-2	Inspect camshaft drives (including gear wear and backlash, sprocket and chain wear); determine necessary action.
I-B13	P-1	Inspect and replace timing belts (chains), overhead camdrive sprockets, and tensioners; check belt/chain tension; adjust as necessary.

<b>Time in Lab (hrs):</b>	0.5
<b>Lab Inventory:</b>	CDX: Engine Internal Components Book: Automotive Technology a Systems Approach
<b>Lab Tasks:</b>	Task 1 - Timing Chains and Belts Task 2 - Timing Belt Replacement Task 3 - Engine Replacement Task 4 - Installing Engine Components

<b>Time in Workshop (hrs):</b>	2.0
<b>Workshop Inventory:</b>	General wrench and socket sets. Gloves. Goggles. Vehicle service manual. Suitable engine lifting/lowering equipment. Air conditioning recovery/recharging equipment (if A/C is fitted to vehicle). Vehicle protection kit. Coolant and oil containers. Suitable replacement fluids. Brake bleeding equipment, if required. Belt tensioner Any specialist tools stated in the vehicle service manual regarding engine removal and replacement.
<b>Workshop Tasks:</b>	Engine removal Engine replacement

<b>Vehicle Requirements</b>
Any shop vehicle.

## Installation at a Student Workstation

Please refer to the appropriate Instructors Guide for detailed instructions on installing software and hardware at a student workstation.

## Installation at the Instructor's Management PC

Before the student can begin working with a module, components must be installed at the instructor's management PC

### Installation of Lesson Modules.

The following instructions assume that the *ClassAct* computer managed learning system has already been successfully installed on the management PC:

1. If the *ClassAct* software is running, exit *ClassAct*.
2. Insert the *ClassAct AutoLAB Lesson Module Templates Disk* (SD3084) into the disk drive.
3. Run the *Data Safe Installer* utility.
4. Uncheck the *Show New Modules ONLY* check box (below the *Disk Catalog*).
5. Select the appropriate module(s) from the *Disk Catalog* list.
6. Click the *Add* button and check that the required item(s) appear(s) in the *Items to Install* list.
7. Click the *Install Listed Items* button. The installation process will begin.
8. Once the installation process is complete, exit the *Data Safe Installer*.

Detailed installation information for a specific AutoLAB module is given in the *Instructors Guide* for that module. If the procedure given in the *Instructors Guide* is followed, then the installation will be complete and correct.

Information on the installation and running of the *ClassAct* system can be found in the *ClassAct Laboratory Management Guide ST520* supplied with the *ClassAct* software.

## Using a Student Workstation

It is assumed that before starting an AutoLAB module, the student is already familiar with how to operate the student workstation at which they will be working. If using a workstation configuration for the first time, they should first work through the relevant student tutorial for the equipment that will be used.

A student tutorial on using a Student PC Workstation is provided with the *ClassAct* software.

The tutorial will familiarize the student with the system and tell them how to:

- Log onto the management system and request work.
- Make responses to questions in a computer managed environment.
- Hand in their work when completed.
- Log off at the end of the work session.

## Rotation Planning

AutoLAB is designed as a modular automotive training course. The following section outlines an example of how the course may be used in a classroom rotation sequence.

Students should work through modules and accumulating workshop activities. Workshop activities should be performed with all members of the class performing workshop practicals at the same time as outlined in the plan below.

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S.1	Rotation 1				Rotation 2				Rotation 3				Rotation 4				Wk. 1	

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S.2	Rotation 5				Rotation 6				Rotation 7				Rotation 8				Wk. 2	

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S.3	Rotation 9				Rotation 10				Wk. 3	Rotation 11				Rotation 12				

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S.4	Wk. 4	Rotation 13				Rotation 14				Wk. 5	Rotation 15				Wk. 6			

### Key

S.1 – Semester 1

S.2 – Semester 2

S.3 – Semester 3

S.4 – Semester 4

Wk. – Workshop only sessions

Rotation 1		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/1	
2	BS2/1	
3	BS3/1	
4	BS4/1	BS4/1
5	EES1/1	
6	EES2/1	
7	EES3/1	
8	EES4/1	
9	EP1/1	
10	EP2/1	
11	EP3/1	
12	EP4/1	
13	SSS1/1	
14	SSS2/1	
15	SSS3/1	
16	SSS4/1	
17	ACS1/1	
18	ACS2/1	
19	COS1/1	
20	TS1/1	

Rotation 2		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/2	
2	BS2/2	
3	BS3/2	
4	BS4/2	BS4/2
5	EES1/2	
6	EES2/2	
7	EES3/2	EES3/2
8	EES4/2	
9	EP1/2	
10	EP2/2 EP2/3	EP2/2 EP2/3
11	EP3/2 EP3/3	EP3/2 EP3/3
12	EP4/2 EP4/3	EP4/2 EP4/3
13	SSS1/2	
14	SSS2/2	
15	SSS3/2 SSS3/3	SSS3/2 SSS3/3
16	SSS4/2 SSS4/3	SSS4/2 SSS4/3
17	ACS1/2	
18	ACS2/2	
19	COS1/2	
20	TS1/2	

Rotation 3		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/3	
2	BS2/3	
3	BS3/3	
4	BS4/3 BS4/4	BS4/3 BS4/4
5	EES1/3	
6	EES2/3	
7	EES3/3	
8	EES4/3 EES4/4	EES4/3 EES4/4
9	EP1/3	
10	SSS1/3	
11	SSS2/3	
12	ACS1/3	
13	ACS2/3	
14	COS1/3	
15	TS1/3	
16	Workshop activity	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 4		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/4	
2	BS2/4	BS2/4
3	BS3/4	BS3/4
4	EES1/4	
5	EES2/4	
6	EES3/4	
7	EP1/4	
8	EP2/4 EP2/5	EP2/4 EP2/5
9	EP3/4 EP3/5	EP3/4 EP3/5
10	EP4/4 EP4/5	EP4/4 EP4/5
11	SSS1/4	
12	SSS2/4	SSS2/4
13	SSS3/4	SSS3/4
14	SSS4/4 SSS4/5	SSS4/4 SSS4/5
15	ACS1/4	
16	ACS2/4	
17	COS1/4	
18	TS1/4	
19	Workshop activity	
20	Workshop activity	

Rotation 5		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/5	
2	BS2/5	
3	BS3/5	
4	BS4/5 BS4/6	BS4/5 BS4/6
5	EES1/5	
6	EES2/5	
7	EES3/5 +Extension	EES3/5
8	EES4/5 EES4/6	EES4/5 EES4/6
9	EP1/5	
10	SSS1/5	
11	SSS2/5	
12	SSS3/5	
13	ACS1/5	
14	ACS2/5	
15	COS1/5	
16	TS1/5	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 6		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/6	
2	BS2/6	BS2/6
3	BS3/6	BS3/6
4	EES1/6	
5	EES2/6	
6	EES3/6	
7	EP1/6	
8	EP2/6 EP2/7	EP2/6 EP2/7
9	EP3/6 EP3/7	EP3/6 EP3/7
10	EP4/6 EP4/7	EP4/6 EP4/7
11	SSS1/6	
12	SSS2/6	
13	SSS3/6 SSS3/7	SSS3/6 SSS3/7
14	SSS4/6 SSS4/7	SSS4/6 SSS4/7
15	ACS1/6	
16	ACS2/6 ACS2/7	ACS2/6 ACS2/7
17	COS1/6	
18	TS1/6	
19	Workshop activity	
20	Workshop activity	

Rotation 7		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/7	
2	BS2/7	
3	BS3/7	
4	BS4/7 BS4/8	BS4/7 BS4/8
5	EES1/7	
6	EES2/7	
7	EES3/7	
8	EES4/7	
9	EP1/7 EP1/8	EP1/7 EP1/8
10	SSS1/7	
11	SSS2/7	
12	ACS1/7	
13	COS1/7	
14	TS1/7	TS1/7
15	Workshop activity	
16	Workshop activity	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 8		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/8	
2	BS2/8	
3	BS3/8	
4	EES1/8	
5	EES2/8 EES2/9	EES2/8 EES2/9
6	EES3/8	
7	EP2/8 EP2/9	EP2/8 EP2/9
8	EP4/8 EP4/9	EP4/8 EP4/9
9	SSS1/8	
10	SSS2/8	
11	SSS3/8 SSS3/9	SSS3/8 SSS3/9
12	SSS4/8 SSS4/9	SSS4/8 SSS4/9
13	COS1/8	
14	TS1/8	
15	Workshop activity	
16	Workshop activity	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 9		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/9	
2	BS2/9	
3	BS3/9 BS3/10	BS3/9 BS3/10
4	BS4/9 BS4/10	BS4/9 BS4/10
5	EES1/9	
6	EES3/9	
7	EES4/8 EES4/9	EES4/8 EES4/9
8	EP1/9 EP1/10	EP1/9 EP1/10
9	EP3/8 EP3/9	EP3/8 EP3/9
10	SSS1/9	
11	SSS2/9	
12	COS1/9	COS1/9
13	TS1/9 TS1/10	TS1/9 TS1/10
14	ACS1/8 ACS1/9	ACS1/8 ACS1/9
15	ACS2/8 ACS2/9	ACS2/8 ACS2/9
16	Workshop activity	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 10		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/10	
2	BS2/10	BS2/10
3	EES1/10	
4	EES2/10 EES2/11	EES2/10 EES2/11
5	EES3/10	
6	EES4/10	
7	EP2/10	EP2/10
8	EP3/10	EP3/10
9	EP4/10 EP4/11	EP4/10 EP4/11
10	SSS1/10	
11	SSS2/10 + Extension Activity	SSS2/10
12	SSS3/10	
13	SSS4/10	
14	ACS1/10 ACS1/11	ACS1/10 ACS1/11
15	ACS2/10 ACS2/11	ACS2/10 ACS2/11
16	COS1/10	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 11		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/11	
2	BS2/11	
3	BS3/11	BS3/11
4	BS4/11	BS4/11
5	EES1/11	
6	EES3/11	
7	EES4/11	
8	EP1/11 EP1/12	EP1/11 EP1/12
9	EP2/11	
10	EP3/11	
11	SSS1/11	
12	SSS2/11	
13	SSS3/11 SSS3/12	SSS3/11 SSS3/12
14	SSS4/11 SSS4/12	SSS4/11 SSS4/12
15	COS1/11	COS1/11
16	TS1/11	TS1/11
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 12		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/12	
2	BS2/12	
3	BS3/12	
4	BS4/12	
5	EES1/12	
6	EES2/12 EES2/13	EES2/12 EES2/13
7	EES3/12	
8	EES4/12	
9	EP2/12	
10	EP3/12	
11	EP4/12	EP4/12
12	SSS1/12	
13	SSS2/12	
14	ACS1/12 ACS1/13	ACS1/12 ACS1/13
15	ACS2/12 ACS2/13	ACS2/12 ACS2/13
16	COS1/12	
17	TS1/12	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 13		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/13	
2	BS2/13	BS2/13
3	BS3/13	
4	BS4/13 BS4/14	BS4/13 BS4/14
5	EES1/13	
6	EES3/13	
7	EES4/13	EES4/13
8	EP1/13 EP1/14	EP1/13 EP1/14
9	EP2/13	
10	EP3/13	
11	EP4/13	
12	SSS1/13	
13	SSS2/13	
14	SSS3/13 SSS3/14	SSS3/13 SSS3/14
15	SSS4/13 SSS4/14	SSS4/13 SSS4/14
16	COS1/13	
17	TS1/13 TS1/14	TS1/13 TS1/14
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 14		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/14	
2	BS2/14	
3	BS3/14	
4	EES1/14	
5	EES2/14 EES2/15	EES2/14 EES2/15
6	EES3/14 EES3/15	EES3/14 EES3/15
7	EES4/14	
8	EP2/14	
9	EP3/14	
10	EP4/14 EP4/15	EP4/14 EP4/15
11	SSS1/14	
12	SSS2/14	
13	ACS1/14 ACS1/15	ACS1/14 ACS1/15
14	ACS2/14	ACS2/14
15	COS1/14	
16	Workshop activity	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

Rotation 15		
Session	Lab Work to Complete	Workshop Sheets Accumulated
1	BS1/15	BS1/15
2	BS2/15	BS2/15
3	BS3/15	BS3/15
4	BS4/15	BS4/15
5	EES1/15	
6	EES4/15	
7	EP1/15	EP1/15
8	EP2/15	
9	EP3/15	
10	SSS1/15	
11	SSS2/15	SSS2/15
12	SSS3/15	SSS3/15
13	SSS4/15	SSS4/15
14	ACS2/15	
15	COS1/15	
16	TS1/15	
17	Workshop activity	
18	Workshop activity	
19	Workshop activity	
20	Workshop activity	

## Workshop Practical Activities

Students working through an AutoLAB program will have to complete practical tasks based in a fully equipped workshop. The following list defines the tools and equipment recommended for a complete AutoLAB program.

All tools and equipment within the workshop environment must address the following issues:

**Safety** - Equipment and tools must have all shields, guards, and other safety devices in place, operable, and used.

**Type and Quality** - The tools and equipment used in a certified program must be of the type and quality found in industry. They must also be adequate and in sufficient quantity to meet the program goals and student performance objectives.

**Consumable Supplies** - Supplies should be in sufficient quantity to assure continuous instruction. Consumable supplies, such as solvents, sand paper, etc. are not listed.

**Maintenance** - A preventive maintenance schedule should be used to minimize equipment down time.

**Replacement** - A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards.

**Inventory** - An inventory system should be used to account for tools, equipment, parts, and supplies.

**Parts Purchasing** - A systematic parts-purchasing system should be used - from work order to supplier.

**Hand Tools** - Each student should be encouraged to purchase a hand tool set during the period of instruction.

**Storage** - Adequate storage of tools should be provided. Space for storage of the students' hand tools should be provided.

## Required Tools

The following section outlines Hand Tools required in the workshop. The list is compiled from the requirements set out by NATEF for certification.

### Hand Tools

(Contained in individual sets or the tool crib in sufficient quantities to permit efficient instruction)

Adjustable Wrench - 6" and 12"

Air Blow Gun (meeting OSHA requirements)

Allen (Wrench or Socket) Set - Standard (.050" - 3/8")

Allen (Wrench or Socket) Set - Metric (2mm - 7mm, 10mm, 12mm)

Battery Post Cleaner

Battery Terminal Pliers

Battery Terminal Puller

Brake Spoon

Chisels:

    Cape 5/16"

    Cold 3/8", 3/4"

Chisel Holder

Claw Type Pickup Tool

Combination Wrenches:

    Standard (1/4" - 1 1/4")

    Metric (7mm - 24mm)

Crowfoot Wrench Set - Metric

Crowfoot Wrench Set - Standard

Ear Protection

Feeler Gauge (Blade Type):

    .002" - .040"

    .006mm - .070mm

Files:

    Coarse       6" and 12"

    Fine         6" and 12"

    Half Round  12"

    Round       6" and 12"

Flare Nut (tubing) Wrenches:

    3/8" - 3/4"

    10mm - 17mm

Flashlight

Fuse Puller

Hack Saw

Hammers:

    16 oz. Ball Peen

    Brass

    Dead Blow Plastic Mallet

    Plastic Tip

    Rubber Mallet

Inspection Mirror

Jumper Wire Set (with various adapters)

Magnetic Pickup Tool

Pliers:

Combination 6"

Hose Clamp

Locking Jaw

Needle Nose 6"

Side Cutting

Slip Joint (Water Pump)

Pry Bars:

Rolling Head

Straight

Punches:

Center

Brass Drift

Pin 1/8", 3/16", 1/4", 5/16 "

Taper 3/8", 1/2", 5/8"

Safety Glasses (meeting OSHA requirements)

Scraper:

Carbon 1"

Gasket 1"

Screwdriver - Blade Type:

Stubby

6", 9", 12"

Offset

Screwdriver - Phillips:

Stubby #1, #2

6" #1, #2

12" #3

Offset #2

Screwdriver - Impact Driver Set

Screw Starter:

Phillips

Standard

Socket Set - 1/4" Drive:

1/4" - 1/2" Standard Depth

1/4" - 1/2" Deep

6mm - 12mm Standard Depth

6mm - 12mm Deep

Flex/Universal Type

3", 6" Extensions

Ratchet

Socket Set - 3/8" Drive:

5/16" - 3/4" Standard Depth (6 point)

3/8" - 3/4" Deep (6 point)

10mm - 19mm Standard Depth

10mm - 19mm Deep

3", 5", 10" Extensions

- Flexhead Ratchet
- Ratchet
- Spark Plug Sockets 5/8", 13/16"
- Speed Handle
- Universal Joint
- Flexible Socket Set 3/8" - 3/4"
- Flexible Socket Set 10mm - 19mm
- Socket Set - 1/2" Drive:
  - 7/16" - 1 1/8" Standard Depth
  - 7/16" - 1 1/8" Deep
  - 10mm - 24mm Standard Depth
  - 10mm - 24mm Deep
  - 3", 6", 12" Extensions
  - Flex Handle (Breaker Bar)
  - Ratchet
- Spark Plug Feeler Gauge (Gap Tool)
- Tape Measure – Standard and Metric
- Test Light (12V)
- Tire Pressure Gauge
- Torque Wrench:
  - 3/8" Drive (10 - 250 lb. in.)
  - 3/8" Drive (5 - 75 lb. ft.)
  - 1/2" Drive (50 - 250 lb. ft.)
- Torx® Set (screwdrivers and/or sockets):
  - T-8 to T-60
- Wire Brush

Air Chisel Set (various bits)  
Air Compressor and Hoses  
Air Pressure Regulator  
Air Ratchet (3/8" drive)  
Automotive Stethoscope (electronic recommended)  
Axle Stands (Safety Stands)  
Battery Charger  
Battery/Starter/Charging System Tester  
Bearing Packer (hand operated)  
Belt Tension Gauge  
Bench or Pedestal Grinder  
Compression Tester  
Computer Scan Tool (hand held) or Personal Computer (PC) with interface capability for on-board diagnostics (OBD II compliant recommended)  
Coolant/Combustion Gas Detector (Recommended)  
Coolant Tester  
Cooling System Pressure Tester and Adapters  
Constant Velocity Joint (CV) Service Tools:  
    Boot Installation Tool  
    Boot Clamp Pliers or Crimping Ring Creeper  
Cylinder Leakage Tester  
Dial Indicator with Flex Arm and Clamp Base  
Digital Multi-meter with various lead sets  
Drain Pans  
Drill - 3/8" variable speed, reversible  
Drill - 1/2" variable speed, reversible  
Electric Heat Gun  
Engine Coolant Recovery Equipment or Recycler or Coolant Disposal  
Contract Service  
Extension Cords  
Face Shields  
Fender Covers  
Floor Jack (1½ Ton Minimum)  
Hand Held Vacuum Pump  
Hoist(s)  
Hydraulic Press with adapters  
Impact Socket Sets - 3/8" Drive (Standard and Metric)  
Impact Sockets – 1/2" Drive (7/16" - 1 1/8")  
Impact Sockets – 1/2" Drive (12mm – 24mm)  
Impact Sockets – 1/2" Drive Deep (30 mm, 32 mm, 36mm)  
Impact Wrench – 1/2"  
Drive Impact Wrench - 3/8" Drive  
Jumper Cables  
Master Puller Set  
Micrometer (Depth)  
Micrometers - 0-1", 1-2", 2-3", 3-4", 4-5" (Outside Type)  
Oil Can - Pump Type  
Oil Filter Wrench  
Oxy-Acetylene Torch

Parts Cleaning Tank and Gloves (non-solvent based cleanser suggested)  
Remote Starter Switch  
Screw Extractor Set  
Seat Covers  
Snap Ring Pliers Set – external  
Snap Ring Pliers Set - internal  
Soldering Gun  
Soldering Iron (25 Watt Pencil Tip)  
Spark Plug Boot Puller  
Tach/Dwell Meter  
Tap and Die Set - Standard  
Tap and Die Set - Metric  
Thread Repair Insert Kit  
Tire Inflator Chuck  
Trouble/Work Lights (Fluorescent Preferred)  
Tube Quick Disconnect Tool Set  
Tubing Bender  
Tubing Cutter/Flaring Set (Double-lap and ISO)  
Twist Drill Set - 1/64" - 1/2"  
Valve Core Removing Tool  
Vernier Calipers 0 - 6" 0 - 125mm  
Waste Oil Receptacle with extension neck and funnel  
Wheel Chocks  
Workbenches with vises

### **Specialty Tools and Equipment**

This section covers the tools and equipment a lab/shop should have for training in any given specialty area. This equipment is specialized and it must be available in the lab/shop or to the program.

### **Steering & Suspension**

Ball Joint Press and other Special Tools  
Brake Pedal Depressor  
Hand Grease Gun  
Inner Tie Rod End Tool  
Pitman Arm Puller  
Power Steering Pump Pulley Special Tool Set (appropriate for units being taught)  
Shock Absorber Tools  
Spring/Strut Compressor Tool  
Steering Column Special Tool Set (appropriate for teaching units being utilized)  
Tie Rod Puller  
Tire Mounting Machine (rim clamp suggested)  
Wheel Alignment Equipment-4 wheel (including alignment tools)  
Wheel Balancer - Electronic Type  
Wheel Weight Pliers

### **Brakes**

Brake Bleeder, Pressure  
Brake Disc Micrometer  
Brake Drum Micrometer and Calibration Equipment  
Brake Lathe (with disc and drum service attachments - mobile or stationary)  
Brake Shoe Adjusting Gauge  
Brake Spring Remover/Installer  
Brake Spring Pliers  
Bearing Seal and Race Drive Set

### **Heating and Air Conditioning**

A/C Compressor Clutch Service Tools  
A/C Service Port Adapter Set  
Leak Detector (SAE Standard)  
Manifold Gauge Set or equivalent (R-12 and HFC-134a)  
Refrigerant Charging Station (R-12 and HFC-134a) or equivalent  
Refrigerant Identification Equipment (suggested)  
Refrigerant Recovery/Recycling Machine (R-12 and HFC-134a)

Thermometer

### **Engine Performance**

Dual Trace Lab Scope  
Engine Analyzer (with ignition display capability)  
Four or Five Gas Exhaust Analyzer  
Fuel Injection Cleaner  
Fuel Injection Pressure Gauge Sets with Adapters  
Injector Pulse Tester  
Logic Probe (suggested)  
Oxygen Sensor Socket  
Pinch-off Pliers  
Sending Unit Socket(s)  
Spark Plug Thread Tap  
Spark Tester  
Static Strap  
Timing Advance Light  
Vacuum/Pressure Gauge

### **Automatic Transmission/Transaxle**

Hydraulic Pressure Gauge Set  
Front Wheel Drive Engine Support Fixture  
Transaxle Removal and Installation Equipment  
Transmission Jack(s)  
Transmission/Transaxle Holding Fixtures  
Transmission/Transaxle Special Tool Sets (appropriate for units being utilized)

### **Electrical/Electronic Systems**

Battery Hydrometer  
Connector Pick Tool Set  
Headlight Aimer or Screen  
Wire and Terminal Repair Kit

### **Manual Drive Train and Axles**

Clutch Alignment Set  
Clutch Pilot Bearing/Bushing Puller/Installer  
Front Wheel Drive Engine Support Fixture  
Transaxle Removal and Installation Equipment  
Special Tools for Transmissions/Transaxles (appropriate for units being taught)  
Transmission/Transaxle Holding Fixtures  
Transmission Jack(s)  
Universal Joint Tools

### **Engine Repair**

Ball (Small Hole) Gauges  
Cam Bearing Driver Set (suggested)  
Cylinder Deglazer  
Dial Bore Indicator  
Engine Stands/Benches  
Inside Micrometer Set:  
    0 - 6"  
    0 - 125mm  
Oil Pressure Gauge (or equivalent)  
Oil Priming Tool (oil pump drive)  
Outside Micrometer Set:  
    0 - 6"  
    0 - 125mm  
Portable Crane - 1/2 Ton  
Ridge Reamer  
Ring Compressor  
Ring Expander  
Ring Groove Cleaner  
Straight Edge  
Telescopic Gauge Set  
Torque Angle Gauge  
Transaxle Removal and Installation Equipment  
V-Blocks  
Valve and Valve Seat Resurfacing Equipment  
Valve Guide Repair Tools  
Valve Spring Compressor  
Valve Spring Tester