Working with STEM Digital Library

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## Working with STEM Digital Library: Courses

### ENGINEERING
- Materials Engineering
- Engineering Drawing
- Fluid Power
- Manufacturing Engineering
- Machine and Instrument Engineering
- Inspection, Maintenance & Quality Management
- Industrial Control

### ELECTRONICS
- Electronic Systems
- DC Circuits
- Electrical Networks
- AC Circuits
- Magnetism and Electromagnetism
- Electrical Engineering
- Linear Electronics
- Semiconductors
- Power Electronics
- Digital Electronics
- Telecommunications
- Microprocessors
- Circuit Construction and Testing

### AUTOMOTIVE
- Engine Repair
- Automatic Transmission and Transaxle
- Manual Drive Train and Axles
- Suspension
- Steering
- Brake Systems
- Brake Components
- Brake Servicing
- Automotive Electrical Fundamentals
- Automotive Starting and Charging
- Automotive Lighting
- Automotive Transducers
- Ignition Systems
- Engine Management and Control
- Fuel and Emissions
- Electric and Hybrid Vehicle Technology
- Networked Systems
- CAN Bus Lighting Systems
- CAN Bus Auxiliary Systems
- CAN Bus Starting and Charging Systems
- Automotive Heating and Air Conditioning
- Auto Shop
- Passenger Safety Systems
- Heavy Vehicle Systems
- Motorcycle Lighting
- Land Cruiser Complete Vehicle Systems
- Dynamometers

### SUPPORT
- Engineering Mathematics
- English Language Skills
- Business Skills
- Freight Logistics
- Workplace Problem Solving
LIB 3: 04 Manufacturing Engineering

Manufacturing Processes
- Manufacturing Processes
- Safety and Protective Measures
- Machine Tools and Terminology
- Primary Metal Shaping Processes
- Cutting Metal
- Turning - Processes and Machines
- Determining Data for Milling
- Grinding - Processes and Machines
- Determining Data for Grinding
- Forces on the Cutting Tool
- Cutting and Angles of Cutting
- Drilling
- Cutting Speed for Drilling
- Bending
- Bending Operation Calculations
- Forming Procedures
- Forming Calculations
- Forming - Material Use and Scrap
- Forging
- Honing
- Erosive Manufacturing Processes
- Spark Erosion
- Hard Metal Cutting
- Finishing Processes
- Environmental Protection
- Reading Machine Diagrams

Welding
- Joining with Welding
- Gas Welding
- Arc Welding
- Gas-shielded Welding
- Welding Seam Profile and Electrode Requirements

CNC Programming
- CNC and the Basics of Programming
- CNC Programming for Turning
- CNC Programming for Milling
- Multiple Axis Turning and Milling

Information Technology
- Process Planning
- Charting Data
- Planning and Organising Work Processes

Measurement
- Measuring with a Caliper, Micrometer or Dial Gauge

Joining
- Joining Procedures
- Screw Connections
- Joining with Glues
- Joining with Soldering
- Joining with Keys and Splines
- Joining with Pins, Bolts and Rivets
- Lapping
- Joining with Threads
- Forces in Threaded Joints
- Formula and Calculation of Tightening Torque
LIB 3: 05 Machine and Instrument Engineering

**Engineering Science**
- Mechanical Units
- Mass and Volume Flow Rate
- Energy, Work and Efficiency
- Calculating Work, Power and Efficiency
- Transferring Mechanical Energy
- Torque and Power
- Stress-Strain Analysis
- Stress Calculations in Joints
- Manufacturing Facilities
- Material Conversion

**Gears**
- Simple and Compound Gears
- Gear Drives
- Gear Calculations
- Gear Design Factors
- Clutches
- Traction Drives
- Adjustable Speed Transmission

**Bearings**
- Plain Bearings
- Bearings
- Rolling-Element Bearings
- Bearing Assemblies and Fit
- Calculation of Forces on Bearings
- Seals and Gaskets
- Joining Hubs to Shafts

LIB 3: 06 Inspection, Maintenance and Quality Management

**Inspection Technology and Quality Management**
- Accuracy
- Measuring Lengths
- Calculating Lengths
- Measurement Tolerances
- Tolerance Calculations
- Clearances and Fits
- Calculation of Clearances and Fits
- Quality Management
- Statistical Analysis

**Maintenance**
- Maintenance Principles
- Maintenance and Accident Prevention
- Maintenance Documentation
- Maintenance Inspection
- Diagnostics and Troubleshooting
- Mechanical Breakdown
- Fault Repair
LIB 3: 07 Industrial Control

Number Systems
- Hexadecimal and Binary Number Systems

Feedback Control Systems
- On/Off Control Systems
- The Control Loop
- Controller Responses

Fieldbus Systems
- Introduction to Fieldbus
- The AS Interface
- Profibus DP

Programmable Logic Control
- Programmable Logic Controllers (PLCs)
- Construction and Function of a PLC
- Sequence Control System
- Components of a Sequence Control System
- PLC Programming
- Converting Logical Circuit to Functional Plan
- GRAFCET Sequence Control Systems
- Using GRAFCET Diagrams
- Basic Structure of a PLC
- Connecting a PLC

PLC Conveyor System Control
- Introduction to PLCs
- Construction and Function of a PLC
- Sequence Control System
- Identifying the Requirements
- Ladder Programming
- Latches
- Latching an Airlock
- Counters
- Counting Parts
- Timers
- Memory Stores
- Analogue Inputs
- Analogue Outputs
- Using GRAFCET Diagrams
- Sorting Parts 1
- Sorting Parts 2
- Create a STEP 7 Project (Siemens Panel)
- Configure STEP 7 PLC Tags (Siemens Panel)
- Enter a STEP 7 Ladder Program (Siemens Panel)
- Run a STEP 7 Ladder Program (Siemens Panel)
- Flip-Flop Latches (Siemens Panel)
- Counting Parts (Siemens Panel)
- Timers (Siemens Panel)
- Memory Stores (Siemens Panel)
- Analogue Inputs (Siemens Panel)
- Analogue Outputs (Siemens Panel)
- Sorting Parts 1 (Siemens Panel)
- Sorting Parts 2 (Siemens Panel)

PLC Part Sorting Control
- Creating a STEP 7 Project
- Configure STEP 7 PLC Tags
- Enter a STEP 7 Ladder Program
- Run a STEP 7 Ladder Program
- Flip-Flop Latches
- Counting Parts
- Timers
- Memory Stores
- Analogue Inputs
- Analogue Outputs
- The Rotary Encoder
- Sorting Parts
LIB 3: 08 Electronic Systems

**Signal Processing**
- Systems and Sub-Systems
- Electronic Systems
- Inputs, Outputs and Processes
- Measurement of Non-Electrical Quantities
- Types of Circuit Diagrams
- Analogue Signal Processing
- Digital Signal Processing

**Components**
- Alternative Components
- Data and Selection
- System Components
- Characteristics of Non-Linear Components
- Problem Solving - Identify Electronic Components
- Problem Solving - Recognize and Select Components

**Alarm Systems**
- Components of Intruder and Fire Alarms
- Installing Intruder and Fire Alarms

**Closed Loop Control**
- An Example On/Off Control System
- Automatic Temperature Control
- RC Circuit Responses

**Energy and Power**
- Small Energy Sources
- Extending System Life

**Fault Finding Electronic Systems**
- Fault Location Techniques
- Faults and Fault Finding Aids
- Electronic Systems Maintenance
- Fault Conditions
- Problem Solving - Testing and Fault Finding on Electronic Components

LIB 3: 09 DC Circuits

**Voltage and Current**
- Electrical Principles
- Basic Electrical Quantities in Circuits
- Units, Multiples and Sub-Multiples
- Potential Difference and Voltage
- The Basic DC Circuit
- Introduction to Electric Current
- Measurement in Circuits
- Measuring Voltage
- Measuring Current in a Circuit (board)
- Handling Voltage Calculations
- Simple Circuits
- Circuit Diagrams
- Electric Current and Safety

**Resistance**
- Relationship between Voltage, Current and Resistance
- Resistance and Conductance
- Resistance and Conductance Reciprocal Calculations
- Resistors
- Colour Code and Tolerance
- Calculating Resistance Colour Code Values and Tolerance
- Measuring and Resistance
- Resistance Characteristics
- Investigating a Characteristics Graph for a Resistive Component
- Gradient of a Linear Voltage-Current Graphs
- Applications of Ohm’s Law
- Calculating the Resistor Value for an LED Lamp Circuit
- Changing the Resistance in an LED Circuit
- Resistor Characteristics and Applications
- Non-Linear Resistances

**Electrical Energy and Power**
- Electrical Power
- Calculation of Electrical Power
- Calculating Electrical Power for a Load
Capacitor Circuits
- Capacitors
- Capacitance of Capacitors
- Interconnection of Capacitors
- Calculating Total Capacitance
- Capacitors in Series and Parallel
- Charging and Discharging a Capacitor
- Capacitor Discharge Curve
- Capacitor Timing Circuits
- Resistance and the Time Constant

Inductor Circuits
- Inductors - Graphs and Equations

LIB 3: 10 Electrical Networks

Series and Parallel Lamps
- Series Circuits
- Parallel Circuits

Series and Parallel Resistors
- Resistors in Series
- Calculation of Resistors in Series
- Series Circuit Calculations
- Parallel Resistor Circuits
- Resistors in Parallel
- Calculation of Resistors in Parallel
- Parallel Circuit Calculations
- Series and Parallel Resistor Combinations
- Series and Parallel Equivalent Resistance
- Characteristics of Series and Parallel Connections
- Working with Series and Parallel Characteristic Curves
- Mathematical Approach to Series and Parallel Circuit Simplification

Kirchhoff’s Laws
- Kirchhoff’s First Law
- Current Behaviour at a Node
- Calculations using Kirchhoff’s First Law
- Kirchhoff’s Second Law
- Voltages in a DC Network
- Calculations using Kirchhoff’s Second Law

Thevenin’s Theorem
- Thevenin’s Equivalent Circuits
- Thevenin’s Equations

Superposition Principle
- The Superposition Principle
- Applying the Superposition Principle

Measuring Instruments
- Absolute and Relative Measurement Errors
- Handling Measurement Errors
- Extending the Range of a Voltmeter
- Calculating the Extension of the Range of a Voltmeter
- Measuring Current and Extending Ammeter Range
- Calculating the Extension the Range of an Ammeter

Voltage Divider Principle
- The Voltage Divider Principle
- Voltage Divider Operation

Internal Resistance
- Internal Resistance
- Internal Resistance of Power Sources
LIB 3: 11 AC Circuits

AC Principles
- Introduction to Alternating Current
- Alternating Current Equations
- Effective Values of Alternating Voltages and Currents
- Calculating the Effective Values of Alternating Voltages and Currents
- Measuring with an Oscilloscope
- Period and Frequency
- Peak, Peak-to-Peak and RMS Values

RLC Circuits
- RLC Circuits
- Graphical Representation of Equations of RLC Circuits
- Phase Difference and Power
- Graphical Representation of Phase Difference and Power
- Power in RLC Circuits
- Calculation Power in RLC Circuits
- LC Oscillator Circuit
- Calculating the Resonant Frequency of an LC Oscillator Circuit

Inductor Circuits
- Inductors in AC Circuits
- Calculations on Inductive Reactance with Graphical Representation
- RL Circuits
- Graphical Representations and Equations of RL Circuits

Capacitor Circuits
- Capacitors in AC Circuits
- Calculations on Capacitive Reactance with Graphical Representation
- RC Circuits
- Graphical Representations and Equations of RC Circuits

LIB 3: 12 Magnetism and Electromagnetism

Magnetic and Electromagnetic Principles
- Magnetic Principles
- Reed Switch and Relay
- Electromagnetism
- Hall Effect Sensor
- Field Strength of an Electromagnet
- Field Shape and Direction for an Electromagnet
- Electromagnetic Induction
- Electromagnetic Induction and the Solenoid
- Self Inductance of Inductors
- Inductors - Graphs and Equations
- Magnetic Flux and Flux Density
- Magnetic Flux and Flux Density Calculations

Transformers
- Transformers
- Transformer Voltages and Turns Ratio
- Transformer Calculations
- Transformer Power and Efficiency

DC Motor
- The DC Motor
- DC Motor Operation
- Characteristics of the DC Motor
- DC Motor-Generator

Fault Finding Electromagnetic Devices
- Fault Finding Electromagnetic Devices W1
- Fault Finding Electromagnetic Devices W2
- Fault Finding Electromagnetic Devices W3
- Fault Finding Electromagnetic Devices W4
LIB 3: 13 Electrical Engineering

Electrical Safety and Accident Prevention
- Dangers of Electric Current for Humans
- Safeguards Against Electric Shock
- Effect of Electric Current on the Human Body
- Dealing with a Victim of an Electric Shock
- Earthing Systems
- TN Earthing Systems
- Designing for Safety
- Cables and Wires
- Cables and Wires
- Voltage Drop in Cables and Wires
- Minimum Safe Cross-Sectional Area of Wires
- Circuit Breakers
- Consumer Units
- Re-Testing to Electrical Standards
- Ingress Protection and IP Codes

Electrical Connections in Buildings
- Electrical Installation in Residential Buildings
- Components of an Electrical Installation
- Light and Lighting
- Planning Lighting Systems
- Technology in the Home - Heating
- Technology in the Home - Cooling
- Technical Building Management System
- Bus System

Generating and Distributing Electric Energy
- Production, Transmission and Distribution of Electrical Energy
- Energy Distribution Calculations

LIB 3: 14 Linear Electronics

Analogue Circuits
- Types of Analogue Circuits

Operational Amplifier Circuits
- Operational Amplifiers
- Comparator
- Inverting and Non-Inverting Operational Amplifier Circuits
- Investigating Inverting Op-amp Circuits
- Investigating Non-Inverting Op-amp Circuits
- Operational Amplifier with AC Input (Simulator)
- High Frequency Performance of an Operational Amplifier

Analogue ICs
- IC Sensors
- The 555 Oscillator/Timer
- Analogue Switches
- Switched Capacitor Filters

Power Supplies
- A DC Power Supply
- Voltage Stabilisers
- Voltage Regulators

Fault Finding Linear Electronic Circuits
- Planning a Fault Location Strategy
- Fault Finding Operational Amplifier Circuits W1
- Fault Finding Operational Amplifier Circuits W2
- Fault Finding Operational Amplifier Circuits W3
- Fault Finding Operational Amplifier Circuits W4
- Fault Finding Linear Electronic Circuits W1
- Fault Finding Linear Electronic Circuits W2
- Fault Finding Linear Electronic Circuits W3
- Fault Finding Linear Electronic Circuits W4
LIB 3: 15 Semiconductors

Diodes
- Diode Operation
- Diode Characteristics
- Diode Rectifiers
- Rectifier Circuits
- Simple Rectifier Circuit
- Diode Rectifier Calculations
- Light Emitting Diodes
- Zener Diodes
- Voltage Stabilisation with Zener Diodes

SCRs
- Thyristor Operation
- Thyristor
- Characteristics of Thyristors

Display Devices
- A 7-Segment Display
- 7-Segment Display and Decoder
- Optoelectronic Display Devices

Fault Finding Semiconductor Circuits
- Test Data Records
- Fault Finding Semiconductor Circuits W1
- Fault Finding Semiconductor Circuits W2
- Fault Finding Semiconductor Circuits W3
- Fault Finding Semiconductor Circuits W4
- Fault Finding Transistor Amplifiers W1
- Fault Finding Transistor Amplifiers W2
- Fault Finding Transistor Amplifiers W3
- Fault Finding Transistor Amplifiers W4

Transistors
- Transistors
- Bipolar Transistor Characteristics
- Analysing Transistor Characteristics
- Transistor as a Switch
- PNP Transistor Switch
- Transistor Characteristics and Circuit Calculations
- Comparison of Electronic and Electromechanical Switches
- The Darlington Pair and the FET
- Field Effect Transistor Operation
- Field Effect Transistor Amplifier

Transistor Amplifiers
- Transistor Amplifier - Voltage Amplification
- The Transistor as a Voltage Amplifier
- Effects of Feedback in a Transistor Amplifier Circuit
- Transistor Amplifier - Effect of Bias
- The Emitter Follower
- Gain, Loss and Noise
- Classes of Transistor Amplifiers
- Class A Transistor Amplifier
- Biasing a Transistor Amplifier
- Class B and AB Transistor Amplifiers
- Class C Transistor Amplifier
LIB 3: 16 Power Electronics

Three-phase AC
- Generation of Three-phase AC
- Representation of Three-phase AC
- Star Connection
- Star Calculations
- Delta Connection
- Delta Calculations

Motors and Motor Control
- Electric Motors
- The Induction Motor
- Characteristics of an Induction Motor
- Motor Starting and Speed Control
- Speed Control of Induction Motors
- The Single-phase AC Motor
- Starting a Single-phase AC Motor
- Connecting a Motor
- Motor Drive Connection Components

Energy and Power
- Efficiency of Electric Motors
- Efficiency Formulas for Electric Motors

Contactors
- Construction of a Contactor
- Selection of Contactors
- Controlling Contactors
- Latching in Contactor Circuits
- Current Flow in Latching Circuits

Motor Protection
- Motor Installations and Safety
- Interlock Systems
- Motor Protection
- Motor Drive Protection Circuit

Frequency Converters
- Construction and Function of Frequency Converters
- Commissioning of Frequency Converters
- Frequency Converter Parameters
- Connecting a Frequency Converter
- EMC
- Frequency Filters

LIB 3: 17 Digital Electronics

Number Systems
- Conversions Between Number Systems
- Calculations in Binary

Interfacing
- Industry Standards
- Standard Interfaces
- Tri-State Devices and Data Access
- Tri-State Logic
- Bi-directional Line Drivers

Signal Processing
- Digital Signal Processing
- Sensors
- Physical Environment to Electrical Transformation

Combinational Logic
- Basic Logic Functions and Their Algebra
- Logic Gates
- TTL Logic Gate Input and Output Characteristics
- TTL Input and Output Characteristics
- Characteristics of a Schmitt Inverter Gate
- Characteristics of the EX-OR and EX-NOR Circuit
- Logic Families
- Boolean Algebra
- Boolean Expressions from Logic Circuits
- Combinational Logic
- Circuits Involving Combinational Logic
- Building EXOR Gates from Other Gates
- Boolean Algebra and De Morgan’s Theorems
- Equivalent Logic Circuits
- Karnaugh Maps
Sequential Logic
- Integrated Circuit Memory
- Bistable Devices
- The S-R Latch
- The S-R Latch Constructed From NAND Gates
- Characteristics of a D-Type Flip-Flop
- D-Type Flip-Flop
- Characteristics of a J-K Flip-Flop
- The J-K Flip-Flop
- Binary Counters
- Counting with Bistables (Simulator)
- Counters
- Synchronous Counters
- Shift Registers
- Characteristics of a D-Type 2-bit Shift Register

Digital Systems
- Types of Digital Circuits
- Binary Counters and 7-Segment Displays
- Binary-Coded Decimal Counters
- Encoders and Decoders
- Encoder Operation
- Multiplexers and Demultiplexers
- Multiplexer Operation
- Signal Converters
- Digital to Analogue Conversion
- Analogue to Digital Conversion
- Testing Digital Systems
- Characteristics of an Analogue Comparator

Digital Systems (continued)
- Ramp Generator
- Glitches in Digital Systems
- Decoder Operation
- Encoder-Decoder System
- Demultiplexer Operation
- Multiplexer-Demultiplexer System

Fault Finding Digital Circuits
- Calculating Expected Operating Conditions
- Fault-Finding Aids and Reporting
- Testing a Fault Logic Circuit
- Signal Tracing Techniques
- Test Instruments
- Fault Finding A/D and D/A Circuits W1
- Fault Finding A/D and D/A Circuits W2
- Fault Finding A/D and D/A Circuits W3
- Fault Finding A/D and D/A Circuits W4
- Fault Finding Encoding/Decoding Circuits W1
- Fault Finding Encoding/Decoding Circuits W2
- Fault Finding Encoding/Decoding Circuits W3
- Fault Finding Encoding/Decoding Circuits W4
- Fault Finding Multiplexing/Demultiplexing Circuits W1
- Fault Finding Multiplexing/Demultiplexing Circuits W2
- Fault Finding Multiplexing/Demultiplexing Circuits W3
- Fault Finding Multiplexing/Demultiplexing Circuits W4
- Faults in Shift Register Circuits
- Faults in Ring Counter Circuits

LIB 3: 18 Telecommunications

Electronic Communication Principles
- Electronic Communication Systems
- AM Transmission
- Optical Transmission
- Simplex and Duplex Transmission
- Phase Locked Loops

Digital Data Transmission
- Digital Data Transmission
- Transmission Protocols
- Handshaking and Flow Control

Antennas
- Installing Antenna and Broadband Connections
- Antenna and Broadband Options

Fault Finding Telecommunication Circuits
- Fault Finding Telecommunication Circuits W1
- Fault Finding Telecommunication Circuits W2
- Fault Finding Telecommunication Circuits W3
- Fault Finding Telecommunication Circuits W4
### LIB 3: 19 Microprocessors

**Microprocessor System Applications**
- Microprocessor System Applications

**Program Development**
- Entering and Running a Program
- Designing a Program

**Architecture and Operation of a Microprocessor**
- Architecture
- Principles of Operation

**Number Systems, Instructions and Subroutines**
- Number Systems
- Instruction Groups
- Subroutines and the Stack

**Developing PIC Programs**
- Debugging Programs
- Controlling a Motor
- Using Feedback
- Full Washing Machine Sequence

**Memory**
- Embedded Computers and RAM/Flash Memory

### LIB 3: 20 Circuit Construction and Testing

**Safety and Accident Prevention**
- Safety Awareness
- Safe Working Practices
- Workplace Hazards
- Risk Assessment of Electrical Dangers

**Lamp Circuit**
- Simple Lamp Circuit
- Lamp Circuit

**Simulators**
- Computer-Based Design and Testing

**Polarity Tester**
- Building and Testing a Polarity Tester
- Building and Testing a Polarity Tester (Simulator)

**Diagnosing Fault Conditions**
- Fault Rectification

**LED Lamp Circuit**
- Building an LED Lamp Circuit (Simulator)
- Building an LED Lamp Circuit
- Testing a Faulty LED Lamp Circuit (Board)

**Automatic Light Circuit**
- Building and Testing an Automatic Light Circuit
- Building and Testing an Automatic Light Circuit (Simulator)
- Testing a Faulty Automatic Light Circuit
- Testing a Faulty Automatic Light Circuit (320 Board)

**Building on Breadboard**
- Breadboarding
- Planning an Automatic Light Circuit on Breadboard
- Building the Automatic Light Circuit on Breadboard
Improved Automatic Light Circuit
- Building and Testing an Improved Automatic Light Circuit
- Building and Testing an Improved Automatic Light Circuit (Board)
- Testing a Faulty Improved Automatic Light Circuit (320 Board)

Freezer Temperature Warning Circuit
- Building the Freezer Temperature Warning Circuit on Breadboard

Intruder Alarm
- Intruder Alarm Circuit
- Intruder Alarm Circuit (Simulator)
- Simulated Latched Buzzer Circuit (Simulator)
- Latched Buzzer Circuit

Building on Stripboard
- Building Circuits on Stripboard
- Planning an Anti-Theft Device
- Building and Testing the Anti-Theft Device

Flashing Doorbell Circuit
- Flashing Doorbell Circuit
- Using an Oscilloscope (Board)
- Building a Flashing Doorbell Circuit (Simulator)
- Building a Flashing Doorbell Circuit
- Testing a Faulty Flashing Doorbell Circuit 1 (Board)
- Testing a Faulty Flashing Doorbell Circuit 2 (Board)

Building Circuits on Printed Circuit Boards
- Building Circuits on PCB
- Constructing the Continuity Tester on PCB

Elevator Door Controller
- The Elevator Door Controller
- The Elevator Door Controller (Simulator)
- Testing a Faulty Elevator Door Controller 1 (Board)
- Testing a Faulty Elevator Door Controller 2 (Board)

AC and DC Converter
- AC to DC Concepts and Principles
- Circuit Breakers and Fuses
- A Simple AC to DC Converter

Baby Alarm
- Building a Baby Alarm
- Building a Baby Alarm (Board)
- Testing a Faulty Baby Alarm 1 (Board)
- Testing a Faulty Baby Alarm 2 (Board)

Road Crossing Controller
- Road Crossing Controller

Electronic Problem Solving
- Problem Solving - Produce an Electronic Circuit Diagram (Simulator)
- Problem Solving - Plan, Construct and Test an Electronic Circuit
- Problem Solving - Construct an Electronic Circuit
LIB 3: 21 Electronic Principles (D3000 Practice)

DC Principles
- The Basic DC Circuit - Exercise 1.1

Resistance
- Ohm's Law - Exercise 2.1
- Resistor Colour Coding for Low Power Resistors - Exercise 4.1
- Resistor Colour Coding for Low Power Resistors - Worksheet 2
- Resistor Colour Coding for Low Power Resistors - Worksheet 3
- Variable Resistor Characteristics and Applications - Exercise 8.2
- Controlling a Lamp with a Variable Resistor - Exercise 9.1
- Controlling a Lamp with a Variable Resistor - Worksheet 7
- Resistance Measurement using a Wheatstone Bridge - Exercise 11.1
- Resistance Measurement using a Wheatstone Bridge - Worksheet 11
- Resistance Measurement using a Wheatstone Bridge - Worksheet 12

Electrical Networks
- Resistors in Series (Circuit Board)
- Resistors Connected in Series - Exercise 5.1
- Voltage Dividing with Series Resistors - Exercise 5.2
- Parallel Resistor Circuits (Circuit Board)
- Resistors Connected in Parallel - Exercise 6.1
- Voltage and Current Relationships for Parallel Connected Circuits - Exercise 6.2
- Series-Parallel Connected Circuits - Exercise 7.1
- Series-Parallel Connected Circuits - Worksheet 4
- Series-Parallel Connected Circuits - Worksheet 5
- Series-Parallel Connected Circuits - Worksheet 6
- Series-Parallel Circuit Exercise - Exercise 10.1
- Series-Parallel Circuit Exercise - Worksheet 9
- Series-Parallel Circuit Exercise - Worksheet 10
- Thevenin’s Equivalent Circuits (Circuit Boards)

Electrical Energy and Power
- Power in a Resistor - Exercise 3.1
- Power in a Resistor - Worksheet 1
- Power Dissipated in a Lamp Circuit - Exercise 9.2

AC Principles
- Sinusoidal Alternating Waveforms - Exercise 1.1
- Sinusoidal Alternating Waveforms Peak and RMS Values - Exercise 1.2
- Alternating Supply with Pure Resistance Loading - Exercise 2.1
- Alternating Supply with Pure Resistance Loading - Worksheet 1
- Voltage and Current Phase Relationships - Exercise 2.2
- Resistances in Series - Exercise 2.3
- Resistances in Parallel - Exercise 2.4
- Ground Return Currents - Exercise 11.3

Capacitor Circuits
- AC Supply with Pure Capacitive Loading - Exercise 4.1
- AC Supply with Pure Capacitive Loading - Worksheet 2
- Variation of Capacitive Reactance with Capacitance - Exercise 4.2
- Capacitors in Parallel on an AC Supply - Exercise 4.3
- Capacitors in Series on an AC Supply - Exercise 4.4
- Capacitor AC Voltage Divider Circuit - Exercise 4.5
- Resistance-Capacitance Circuits on AC Supplies - Series - Exercise 6.1
- Resistance-Capacitance Circuits on AC Supplies - Parallel - Exercise 6.2

Inductor Circuits
- Inductance with Square Wave and Sinusoidal Voltage Input - Exercise 3.2
- AC Supply with Pure Inductive Loading - Exercise 5.1
- AC Supply with Pure Inductive Loading - Worksheet 3
- AC Supply with Pure Inductive Loading - Worksheet 4
- Inductors in Series on an AC Supply - Exercise 5.2
- Inductors in Parallel on an AC Supply - Exercise 5.3
- Voltage Dividing with Inductors in Series on an AC Supply - Exercise 5.4
- Resistance-Inductance Circuits on AC Supplies - Series - Exercise 7.1
- Resistance - Inductance Parallel Circuits on an AC Supply - Exercise 7.2
- Resistance-Inductance Circuits on AC Supplies - Worksheet 5
- Resistance-Inductance Circuits on AC Supplies - Worksheet 6
- Resistance-Inductance Filters - Exercise 9.2
RLC Circuits
- Capacitance and Inductance fed from Square and Sinusoidal Inputs - Exercise 3.1
- Resistance-Inductance-Capacitance Circuits on AC Supplies - Exercise 8.1
- Inductance-Capacitance Parallel Circuit on an AC Supply - Exercise 8.2
- Inductance-Capacitance Parallel Circuit on an AC Supply - Exercise 8.3
- RLC Circuits on AC Supplies - Worksheet 7
- RLC Circuits on AC Supplies - Worksheet 8
- RLC Circuits on AC Supplies - Worksheet 9
- Resistance-Inductance and Resistance-Capacitance Filter Circuits - Exercise 9.1
- Resistance-Inductance and Resistance-Capacitance Filter Circuits - Worksheet 10

Transformer
- The Transformer - Exercise 10.1
- Transformer Characteristics on Load - Exercise 10.2
- Application of Transformers to Impedance Matching - Exercise 10.3
- The Transformer - Worksheet 11
- The Transformer - Worksheet 12
- Transformer Isolation - Exercise 11.1
- Transformer Isolation in a Resistor Network - Exercise 11.2

Diodes
- Diode Forward Characteristic (Board) - Exercise 1.1
- Diode Reverse Characteristic (Board) - Exercise 1.2
- Testing a Diode (Board) - Exercise 1.3
- P-N Junction Diode - Worksheet 1
- P-N Junction Diode - Worksheet 2
- Half-Wave Rectifier - Exercise 2.1
- Reservoir Capacitor - Exercise 2.2
- Negative Power Supply - Exercise 2.3
- Half-Wave Rectifier - Worksheet 3
- Bridge Rectifier - Exercise 3.1
- Effect of Reservoir Capacitor - Exercise 3.2
- Bridge Rectifier - Worksheet 4
- Zener Diode Characteristic - Exercise 4.1
- Zener Diode Stabilizer Currents - Exercise 4.2
- Variation of Load Current - Exercise 4.3
- Zener Diode - Worksheet 5

Transistors
- Bipolar Transistor Characteristics (circuit board)
- Transistor Characteristics - Current Gain - Exercise 5.1
- Transistor Output Characteristic - Exercise 5.2
- Transistor Testing - Exercise 5.3
- Transistor Characteristics - Worksheet 6
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- Kirchhoff's Voltage Law
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- Troubleshooting Resistor Networks
- The Rheostat
- The Potentiometer
- Charging and Discharging a Capacitor
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- Capacitor on a DC Supply
- Time Constant
- CR Integrator
- Troubleshooting a CR Integrator Circuit
- Kirchhoff's Voltage Law
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- Alternating Voltage Values
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- Gain-Bandwidth Product in Practice
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- The Need for Power Amplification
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- The Basic NPN/PNP Complementary Pair
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- Introduction to Engine Systems
- Four Stroke Cycle (Auto Rig)
- Position and Mounting of Engine Components (Rig)
- Front End Component Identification (Auto Rig)
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Cylinder Head and Valve Trains
- Components of the Top End
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- Engine Cycles, Valve and Ignition Timing
- Camshafts and Valve Lifters
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Engine Block
- Components of the Bottom End
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- Pressure and Volume
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- Inspect and Repair Threads (Workshop)
- Engine Removal and Replacement (Workshop)
- Cooling System Inspection, Test and Repair (Workshop)
- Manifold Vacuum Test (Workshop)
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- Automatic Transmission Systems
- Automatic Transmission Operation (Auto Rig)

Automatic Transmission Components
- Torque Converter
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- Planetary Gears, Clutches, and Bands
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Final Drives
- Drivetrain and Driveline
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- Front Wheel Final Drive Systems
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- Manual Transmission Introduction
- Manual Transmissions
- Clutch and Manual Transmission Systems
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- Manual Transmission Construction (Auto Rig)
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- Clutch System - Symptoms and Faults
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- Inspecting the Complete Transmission System of a Vehicle (Workshop)

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- Control Arms
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- Remove, Inspect, and Install Transverse Links and Strut Rods (Workshop)
- Remove, Inspect, and Install Upper and Lower Control Arms (Workshop)
- Remove, Inspect and Install Ball Joints on Suspension Systems (Workshop)
- Removal, Inspection and Installation of Coils Springs and Insulators (Workshop)
- How to Check Shock Absorbers for Leaks (Auto Rig)
- Inspect, Remove, and Replace Shock Absorbers (Workshop)
- MacPherson Strut Coil Spring Removal and Inspection (Auto Rig)
- MacPherson Strut Removal, Inspection, and Re-installation Procedures (Workshop)
- Remove, Inspect, Install and Adjust Torsion Bars (Workshop)
- Remove, Inspect and Install Stabilizer Bushings, Brackets and Links (Workshop)
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Steering System Components and Operation
- Steering Systems
- Conventional Steering System Components
- Steering Rack
- The Steering Column
- Tie Rods
- Power Steering Systems
- Electronic Steering Systems
- Introduction to the Steering and Suspension Trainer (Auto Rig)
- Using the Power Steering on the Steering and Suspension Trainer (Auto Rig)

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- Adjusting Wheel Height (Auto Rig)
- Steering Column Inspection (Auto Rig)
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- Rack and Pinion Gear Service (Workshop)
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Wheels and Tires
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- Tires
- Tire Wear and Rotation
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- Tire Changing and Wheel Balancing
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- Perform Pre-alignment Inspection (Workshop)
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LIB 3: 37 Brake Systems

Brake System Fundamentals
- Brake Systems 1
- Brake Systems 2
- Friction

Hydraulic Control
- Fluid Power Concepts
- Basic Fluid Power Engineering

Warning Systems
- Brake Warning Systems
- Brake Fluid Warning System
- Brake Fluid Warning System (Board)
- Brake Fluid Warning System (Panel)

Anti-Lock Braking Systems
- Anti-Lock Brake Systems
- Anti-Lock Brake Trainer (Panel)
- ABS Braking Cycle (Panel)
- Wheel Speed Sensors
- Inductive Sensor Investigation (Panel)
- Hall Effect Sensor Investigation (Panel)
- Troubleshooting ABS Input Devices 1 (Panel)
- Troubleshooting ABS Input Devices 2 (Panel)
- Sensors and Switches
- Brake Pedal Travel Sensor (Panel)
- Troubleshooting ABS Input Devices 3 (Panel)
- Brake Fluid Level Switch (Panel)
- Troubleshooting ABS Input Devices 4 (Panel)
- Brake Fluid Warning System
- Hydraulic Pump Motor Speed Sensor (Panel)
- Troubleshooting ABS Input Devices 5 (Panel)
- Brake Pedal Switch (Panel)
- ABS ECU Circuits and Signals
- ABS Relay (Panel)
- Troubleshooting ABS Input Devices 6 (Panel)
- ABS Warning Lamp and Diode (Panel)
- Troubleshooting ABS Output Devices 1 (Panel)
- Troubleshooting ABS Output Devices 2 (Panel)
- Troubleshooting ABS Output Devices 3 (Panel)
- Troubleshooting ABS Output Devices 4 (Panel)
- Troubleshooting ABS Output Devices 5 (Panel)
- Troubleshooting ABS Output Devices 6 (Panel)
- Hydraulic Control Unit (Panel)
- Hydraulic Pump and Motor (Panel)

Advanced Brake Systems
- Electronic Brake Systems Introduction
- Stability Control Systems
- Stability Control Electronics and Hydraulics
- Diagnosing Faults in ESP Systems

LIB 3: 38 Brake Components

Brake System Fundamentals
- Introduction to the Brake Systems Trainer (auto rig)

Drum Brakes
- Brake Drums
- Brake Shoes
- Parking Brakes
- Wheel Cylinders

Power Assistance
- Vacuum Brake Boosters
- Hydraulic Brake Boosters

Disc Brakes
- Brake Rotors
- Brake Calipers
- Brake Pads
- Integral Caliper Parking Brake

Hydraulic Control
- Hydraulics
- Basic Control Valves
- Pressure Control Valves
- The Master Cylinder
- Brake Lines and Hoses
- Brake Fluid
LIB 3: 39 Brake Servicing

Brake System Fundamentals

- Braking Forces
- Braking Calculations

Drum Brake System Servicing

- Drum Brake Removal and Inspection (Auto Rig)
- Drum Brake Removal, Disassembly and Inspection (Auto Rig)
- Brake Shoe Replacement (Auto Rig)
- Wheel Cylinder Removal and Inspection (Workshop)
- Adjusting the Parking Brake (Auto Rig)
- Machining a Drum (Workshop)

Disc Brake System Servicing

- Brake Caliper Inspection (Auto Rig)
- Brake Pad Removal and Brake Assembly Inspection (Auto Rig)
- Brake Pad Replacement (Auto Rig)
- Brake Rotor Replacement (Auto Rig)
- Measuring Brake Rotors (Auto Rig)
- Brake Pad Wear Indicator Inspection
- Integral Caliper Parking Brake Service (Workshop)
- Machining a Rotor (Workshop)

Brake Line Servicing

- Brake Line Inspection (Workshop)
- Brake Line Repair (Workshop)
- Brake Line Fabrication (Workshop)
- Fabricating Brake Lines (Workshop)

Brake System Servicing

- Brake Pedal Height
- Checking Pedal Heights and Adjusting Push Rod Length (Workshop)
- Bleed Brake System (Manual Bleed) (Workshop)
- Parking Brake Cable Replacement (Auto Rig)
- Master Cylinder Inspection (Workshop)
- Master Cylinder Removal, Bench Bleed, and Reinstall (Workshop)
- Flush Brake System (Workshop)
- Bleeding a Pressurized Anti-lock Braking System (Workshop)
- Test Vacuum Brake Booster Procedure (Workshop)
- Vacuum Leak Testing Procedure (Workshop)
- Vacuum Supply Testing Procedure (Workshop)
- ABS Servicing Procedure (Workshop)
- De-pressurize High-pressure Components of the Anti-lock Brake System (Workshop)
- Replacing ABS Component Procedure (Workshop)
- Testing the ABS Component Procedure (Workshop)
- Troubleshooting a Braking System (Workshop)
- Testing the Brake Lamp Switch Circuit (Workshop)
- Test Brake Light Switch (Workshop)
LIB 3: 40 Automotive Electrical Fundamentals

**Electrical Fundamentals**
- Simple Circuits
- Simple Battery and Lamp Circuit (Board)
- Controlling and Protecting Simple Circuits
- Simple Battery, Lamp, and Switch Circuit (Board)
- Simple Battery, Lamp, Switch and Fuse Circuit (Board)
- Common Ground Circuits and Wiring Diagrams
- Common Ground Circuits (Board)
- Wiring Diagrams (Board)
- DC and AC Current
- Current Flow in a Simple Circuit (Board)
- Power
- Continuity and Circuit Faults
- Continuity (Board)
- Circuit Faults (Board)
- Pushbutton Switches and Switch Circuits
- Pushbutton Switches (Board)
- Switches in Series and Parallel (Board)
- Changeover Switches
- Two-Position Changeover Switches (Board)
- Two-Position, Two-Pole Changeover Switches (Board)
- Resistance and Ohm’s Law
- Ohm’s Law (Board)
- Resistance (Board)
- Electricity
- Electrical Circuits
- Electromagnetic Principles
- Electrical Safety and Circuit Checks
- Introduction to Wiring Diagrams
- Control Principles
- Control Examples
- Information Flow
- Physical Environment to Electrical Transformation

**Electrical Components and Operations**
- Capacitor Types and Applications
- Diode Types and Applications
- Transistors
- Relays
- The Relay (Board)
- Signal Processing
- Sensors
- Types of Control Signals

**Electrical Supply**
- Batteries
- Battery and Fuse Investigation (Board)
- Battery and Fuse Investigation (Panel)
- Battery and Fuse Circuit Fault Investigation 1 (Board)
- Battery and Fuse Circuit Fault Investigation 1 (Panel)
- Battery and Fuse Circuit Fault Investigation 2 (Board)
- Battery and Fuse Circuit Fault Investigation 2 (Panel)

**Electrical Measurement**
- Electrical Test Equipment
- Using a Multimeter
- Voltage, Resistance, and Continuity (board)
- Measuring Current
- Reading Wiring Diagrams
- Voltage Drop
- Calculating and Adjusting Permitted Voltage Drop
- Electrical Circuit Testing (workshop)
- Symbols, Device Markings and Terminal Block Designations
LIB 3: 41 Automotive Starting and Charging

Charging System Fundamentals
- Charging Principles
- Magnetism and Electromagnetism
- Charging Systems
- Alternator Construction
- Work of the Regulator

Charging System Inspection and Test
- Alternator Output Tests
- Alternator Output Tests (Workshop)
- Alternator Output Waveforms (Board)
- Alternator Output Waveforms (Panel)
- Charging System Fault Diagnosis
- Alternator Fault Investigation 1 (Board)
- Alternator Fault Investigation 1 (Panel)
- Alternator Fault Investigation 2 (Board)
- Alternator Fault Investigation 2 (Panel)
- Alternator Service Procedure (Workshop)
- Replacing an Alternator and Drive Belt (Workshop)

Starting System Fundamentals
- Starting Systems
- Starting and Charging
- Starting and Charging (Panel)
- Starting and Charging (Board)

Starting System Inspection and Test
- Starter Motor and Solenoid Measurements (Board)
- Starter Motor and Solenoid Measurements (Panel)
- Starter Control Circuit Service (Workshop)
- Performing Voltage Drop and Current Draw Tests (Workshop)
- Starter Relay & Solenoid Testing, Starter Motor Replacement (Workshop)
- Starting System Fault Diagnosis
- Starting System Problems (Board)
- Starting System Problems (Panel)
- Wire Repair (Workshop)

LIB 3: 42 Automotive Lighting

Lighting Circuit Fundamentals
- Types of Light Sources
- Lighting Systems
- Lighting Systems (Board)
- Lighting Systems (Panel)
- Series Lamp Circuits
- Identical Lamps in Series (Board)
- Non-Identical Lamps in Series (Board)
- Parallel Lamp Circuits
- Identical Lamps in Parallel (Board)
- Identical Lamps in Parallel (Board) [700-10]
- Power in a Simple Lamp Circuit (Board)
- Three-Position Changeover Switches (Board)
- Non-Identical Lamps in Parallel (Board)

Headlight Circuits
- Headlamps 1
- Headlamps 2
- Headlights (Board)
- Headlights (Panel)
- Low and High Beam Circuits (Board)
- Headlamp Flash Circuit
- High Beam Flash Circuit (Board)
- Three-Pin Relay Headlamp Circuit (Board)
- Four-Pin Relay Headlamp Circuit (Board)
- Relay and Spot Lamp Circuit (Board)
- Automatic Lighting
- Automatic Lighting (Board)
Park and Tail Light Circuits
- Park and Tail Lighting
- Park and Tail Lamp Circuits (Board)
- Park and Tail Lights (Board)
- Park and Tail Lights (Panel)
- Park, Tail, and Headlamp Circuits 1
- Park, Tail, and Headlamp Circuits 1 (Board)
- Park, Tail, and Headlamp Circuits 2 (Board)

Stop and Backup Light Circuits
- Stop and Backup Lamps
- Stop and Backup Lamp Circuits (Board)
- Stop Lamp Circuit Investigation (Board)
- Stop Lamp Circuit Investigation (Panel)
- Backup Lamp Circuit Investigation (Board)
- Backup Lamp Circuit Investigation (Panel)

Turn Signal Circuits
- Turn Signal Systems
- Turn Signal Circuit (Board)
- Turn Signal and Hazard Warning Circuit Investigation (Board)
- Turn Signal and Hazard Warning Circuit Investigation (Panel)

Hazard Warning Lighting Circuit
- Hazard Warning Lamps
- Hazard Warning Circuit (Board)

Internal Lighting Circuits
- Internal Lighting
- Internal Lamp Circuit Investigation (Panel)
- Internal Lamp Circuits (Board)

Lighting Circuit Fault Diagnosis
- Introduction to Fault-Finding
- Lighting Fault Diagnosis
- Fault-Finding Example (Board)
- Lighting Circuit Fault Investigation 1 (Board)
- Lighting Circuit Fault Investigation 1 (Panel)
- Lighting Circuit Fault Investigation 2 (Board)
- Lighting Circuit Fault Investigation 2 (Panel)
- Lighting Circuit Fault Investigation 3 (Board)
- Lighting Circuit Fault Investigation 3 (Panel)
- Lighting Systems Fault Diagnosis 1
- Lighting Systems Fault Diagnosis 1 (Board)
- Lighting Systems Fault Diagnosis 1 (Panel)
- Lighting Systems Fault Diagnosis 2
- Lighting Systems Fault Diagnosis 3
- Headlamp Lighting Fault 1 (Board)
- Headlamp Lighting Fault 2 (Board)
- Headlamp Lighting Fault 3 (Board)
- High Beam Flash Circuit Fault (Board)
- Low and High Beam Circuit Fault (Board)
- Three Pin Relay Headlamp Circuit Fault (Board)
- Four Pin Relay Headlamp Circuit Problem Solving (Board)
- Park and Tail Lamp Circuit Fault (Board)
- Park and Tail Lighting Fault (Board)
- Park, Tail, and Headlamp Circuit Fault 1 (Board)
- Park, Tail, and Headlamp Circuit Fault 2 (Board)
- Park, Tail, and Headlamp Circuit Problem Solving (Board)
- Backup Lamp Circuit Fault (Board)
- Turn Signal Circuit Fault (Board)
- Turn Signal and Hazard Warning Circuit Fault Investigation (Board)
- Turn Signal and Hazard Warning Circuit Fault Investigation (Panel)
- Hazard Warning Circuit Fault (Board)
- Interior Lamp Circuit Fault (Board)
LIB 3: 43 Automotive Transducers

Transducer Circuits and Components
- Engine Coolant Temperature Sensor
- Coolant Temperature Sensor (Board)
- Coolant Temperature Sensor (Panel)
- Testing the Engine Coolant Temperature Sensor (Workshop)
- Mass Airflow Sensor
- Air Flow Sensor (Board)
- Air Flow Sensor (Panel)
- Intake Air Temperature Sensor
- Throttle Position Sensor
- Oxygen Sensor
- Oxygen Sensor (Board)
- Oxygen Sensor (Panel)
- Crankshaft Position Sensor
- Vehicle Speed Sensor (Board)
- Vehicle Speed Sensor (Panel)
- Performing a Gauge Circuit Test (Workshop)

Transducer Fault Diagnosis
- Fault Investigation 1 (Board)
- Transducer Fault 1 (Panel)
- Fault Investigation 2 (Board)
- Transducer Fault 2 (Board)
- Transducer Fault 2 (Panel)
- Fault Investigation 4 (Board)
- Fault Investigation 4 (Panel)

LIB 3: 44 Ignition Systems

Ignition System Fundamentals
- Introduction to Ignition Systems
- Breaker Point Ignition Systems (Board)
- Breaker Point Ignition Systems (Panel)
- Transistor Assisted Ignition Systems (Panel)
- Transistor Assisted Ignition Systems (Board)
- Ignition Coil Investigation (Panel)
- Ignition Coil Investigation (Board)
- Spark Plugs

Distributorless Electronic Ignition Systems
- Distributorless Ignition Systems
- Distributorless Ignition Systems (Panel)
- Distributorless Ignition Systems (Board)
- DIS Trainer Features (Auto Rig)
- DIS Trainer Operation (Auto Rig)
- DIS Trainer Waveforms (Auto Rig)
- DIS Trainer Temperature Sensor (Auto Rig)
- DIS Trainer Crankshaft Sensor (Auto Rig)

Distributor Electronic Ignition Systems
- Inductive Reluctance Electronic Ignition Systems (Panel)
- Inductive Reluctance Electronic Ignition Systems (Board)
- Hall Effect Electronic Ignition Systems (Panel)
- Hall Effect Electronic Ignition Systems (Board)
## Ignition System Servicing
- Inspection and Testing of the Ignition Primary Circuit (Workshop)
- Ignition Secondary Circuit Inspection (Workshop)
- Inspection and Testing of an Ignition Coil (Workshop)
- Distributor Testing (Workshop)
- The Magnetic Pulse Generating Pickup (Workshop)
- The Ignition Control Module (ICM) (Workshop)
- The Hall Effect Ignition System (Workshop)
- The Optical Ignition System (Workshop)
- Spark Plug Removal, Reading, Gapping, and Refitting (Workshop)
- Ignition System Wavepattern Investigation (Workshop)
- Ignition Timing Check and Adjustment (Workshop)
- Variable Dwell Investigation (Workshop)
- Testing Optical Ignition Systems (Workshop)

## Ignition System Diagnosis
- Lack of Power Problem (auto rig)
- Extremely Rough Idle Problem 1 (auto rig)
- Extremely Rough Idle Problem 2 (auto rig)
- No Start Problem 1 (auto rig)
- No Start Problem 2 (auto rig)
- No Start Problem 3 (auto rig)
- Troubleshooting Transistor Assisted Ignition Systems (panel)
- Troubleshooting Transistor Assisted Ignition Systems (board)
- Troubleshooting Breakerless Ignition Systems (panel)
- Troubleshooting Breakerless Ignition Systems (board)
- Troubleshooting Distributorless Ignition Systems (panel)
- Troubleshooting Distributorless Ignition Systems (board)

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### Engine Management System Fundamentals

- Engine Management System
- Engine Management System Fundamentals (Rig)
- Electronic Control Unit
- Decision Making Processes (Board)
- Decision Making Processes (Panel)
- Fuel Injection System Decisions (Board)
- Fuel Injection System Decisions (Panel)
- Ignition System Decisions (Board)
- Ignition System Decisions (Panel)
- On Board Diagnostics Two (OBDII) Systems
- Starting Management, Control, and Regulation
- Air Management in a Diesel Engine

### Sensors

- Sensors and Actuators
- Sensor Components (Rig)
- Engine Sensor Fault Diagnosis 1
- Engine Sensor Fault Diagnosis 2
- Engine Coolant Temperature
- Engine Coolant Temperature (Panel)
- Engine Coolant Temperature (Board)

### Actuators

- Actuator Components (Rig)

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### Engine Inspection

- Thermostatic Air Cleaner Inspection and Test (Workshop)
- Positive Crankcase Ventilation System - Inspection and Test (Workshop)
- Pulse Air Injection System - Inspection and Test (Workshop)
- evaporative Emissions Control Systems - Inspection and Test (Workshop)
- Retrieval and Clearing of OBD I Trouble Codes (Workshop)
- Retrieval and Clearing of OBD II Trouble Codes (Workshop)
- The Engine Coolant Temperature (ECT) Sensor (Workshop)
- The Throttle Position Sensor (TPS) (Workshop)
- The Oxygen (O2) Sensor (Workshop)
- The Intake Air Temperature (IAT) Sensor (Workshop)
- The Mass Airflow (MAF) Sensor (Workshop)
- The Idle Air Control (IAC) Valve (Workshop)
- The Digital EGR Valve (Workshop)
- Coolant Servicing (Workshop)
- Thermostat Servicing (Workshop)
Engine Management Fault Investigation

- Engine Management System Fault Diagnosis
- Diesel Engine Fault Diagnosis
- Fault Investigation 5 (Board)
- Fault Investigation 5 (Panel)
- Fault Investigation 6 (Board)
- Fault Investigation 6 (Panel)
- Engine Fault Diagnosis 1 (Rig)
- Engine Fault Diagnosis 2 (Rig)
- Engine Fault Diagnosis 3 (Rig)
- Engine Fault Diagnosis 4 (Rig)
- Engine Fault Diagnosis 5 (Rig)
- Engine Fault Diagnosis 6 (Rig)
- Engine Fault Diagnosis 7 (Rig)
- Engine Fault Diagnosis 8 (Rig)
- Engine Fault Diagnosis 9 (Rig)
- Engine Fault Diagnosis 10 (Rig)

LIB 3: 46 Fuel and Emissions

Fuel Components and Operation

- Fuel Injection Fundamentals
- Electronic Multipoint Fuel Injection Systems
- Fuel Injectors (Board)
- Fuel Injector Pulse Width (Board)
- Fuel Injector Pulse Frequency (Board)
- Fuel Injector Pulse Timing (Board)
- Fuel Injectors (Panel)
- Fuel Injector Pulse Width (Panel)
- Fuel Injector Pulse Frequency (Panel)
- Fuel Injector Pulse Timing (Panel)
- Electric Fuel Pump (Board)
- Electric Fuel Pump (Panel)
- Introduction to the EFI Demonstrator (Rig)
- Pressurized Fuel Systems (Rig)
- Fuel Injector Pulse Width (Rig)
- Fuel Injector Pulse Frequency (Rig)
- Fuel Injector Pulse Timing (Rig)
- EFI Fuel Injector Pulse Frequency (Rig)
- EFI Fuel Injector Pulse Timing (Rig)
- EFI Pressurized Fuel Systems (Rig)
- Fuel Injection Components (Rig)
- EFI Fuel Injector Pulse Width (Rig)
- Actuator Circuits and Components (Rig)

Air Induction Components and Operation

- Air Management
- Sensor Circuits and Components (Rig)
- Idle Air Control Valve (Board)
- Idle Air Control Valve (Panel)

Emission Control Systems

- Catalytic Converter
- Exhaust Gas Recirculation Systems
- Air Injection Systems
- Exhaust Emission Control Components (Rig)
- The Electronic Control Unit (ECU) (Rig)
Fuel and Emissions System Servicing

- Fuel System Inspection (Workshop)
- Intake Air System Inspection (Workshop)
- Cold Enrichment System Inspection and Test (Workshop)
- Mixture Control Solenoid Duty Cycle Investigation (Workshop)
- Idle Speed and Fuel Mixture Adjustment (Workshop)
- Inspecting and Draining a Fuel System (Workshop)
- Fuel Filter Inspection (Workshop)
- Fuel Pump Inspection & Pressure Testing (Workshop)
- Fuel Pressure on an Electronic Fuel Injection System (Workshop)
- Throttle Body Injection Servicing (Workshop)
- Checking the Operation of Solenoid Operated Fuel Injectors (Workshop)
- Throttle Body Servicing (Workshop)
- Fuel Injector - Inspection, Testing, and Cleaning (Workshop)
- Turbocharger System - Inspection and Testing (Workshop)
- Fuel Trim and Exhaust Emissions Monitoring (Workshop)
- Fuel Injection System Fault Diagnosis
- Exhaust Gas Analyser (Workshop)
- Exhaust System Inspection and Testing (Workshop)
- Investigation of Exhaust Emission Levels (Workshop)
- Catalytic Converter Inspection and Efficiency Testing (Workshop)
- Early Exhaust Recirculation System - Inspection and Test (Workshop)
- EFI Demonstrator Fault Diagnosis 1 (Rig)
- EFI Demonstrator Fault Diagnosis 2 (Rig)
- EFI Demonstrator Fault Diagnosis 4 (Rig)
- EFI Demonstrator Fault Diagnosis 5 (Rig)
- EFI Demonstrator Fault Diagnosis 6 (Rig)
- EFI Demonstrator Fault Diagnosis 7 (Rig)
- EFI Demonstrator Fault Diagnosis 8 (Rig)
- EFI Demonstrator Fault Diagnosis 9 (Rig)
- EFI Demonstrator Fault Diagnosis 10 (Rig)

Diesel Engine Management

- Common Rail Diesel Engine
- Fuel in a Diesel Engine
- Fuel Injection Management in a Diesel Engine
- Exhaust Management System
LIB 3: 47 Electric and Hybrid Vehicle Technology

Electric Vehicles
- Definition of Electric Vehicles
- Fuel Cells
- The Principle of the Fuel Cell
- Electric Motors
- Three-Phase AC
- Features of Electric Vehicles
- Range Extenders

High Voltage Electric Vehicles
- High Voltage Vehicles
- Reasons for the Development of High Voltage Vehicles
- NiMH Batteries
- Principles of NiMH Batteries
- Lithium-ion Batteries
- Principles of Lithium-ion Batteries
- Safety with Batteries
- High Voltage Wiring and Connectors
- Voltage Converters
- The Inverter Principle
- The DC to DC Converter
- The Motor-Generator
- The Rotating Magnetic Field
- Safety in High Voltage Vehicles
- Legal Regulations
- Special Equipment for High Voltage Testing and Repair
- Working on High Voltage Vehicles
- Qualifications for Working on High Voltage Vehicles

Hybrid Vehicles
- Classification of Hybrid Vehicles by Power Source
- Features of Hybrid Vehicles
- Classification of Hybrid Vehicles by Engine Arrangement
- Diagnose Insulation Measurement Faults
- Diagnose Equipotential Faults

Hybrid and Electric Vehicle Systems
- Introduction to Hybrid and Electric Vehicles
- Fuel and Emissions
- Series Hybrid Systems
- Parallel Hybrid Systems
- Series Parallel Systems and Components
- Practical Series Parallel Hybrid Systems
- Introduction to the Hybrid Vehicle Trainer
- Hybrid Vehicle Trainer Controls
- Plug-in Electric Vehicles
- Plug-in Hybrid Vehicles
- The High Voltage System
- The Low Voltage System
- Troubleshooting Introduction
- AC Motors and Generators
- Hybrid Electric Motors
- Hybrid Engines
- Electronic Circuits and Modules
- Cables, Connectors and Protection Devices
- Introduction to Electrical Storage Devices
- Lead Acid Batteries
- Lead Acid Batteries
- Nickel Metal Hydride Batteries
- Lithium-ion Batteries
- Battery Packs
- Brake Systems
- Hybrid Safety Issues and Concerns
- Troubleshooting the High Voltage System
- Disabling Hybrid Vehicle Systems
- Disabling the High Voltage System
LIB 3: 48 Networked Systems

Networked Systems Structure
- The CAN Data Bus
- The LIN Data Bus
- The MOST Data Bus

Networked Systems Data
- CAN Bus Data Processing
- Transmitting CAN Data
- CAN Signal Response
- CAN Bus Fault Diagnosis

LIB 3: 49 CAN Bus Lighting Systems

Lighting Systems Operation
- Using Auto CAN Lighting for the First Time
- CAN Bus Lighting Systems
- CAN Bus Lighting Systems (Board)
- CAN Bus Lighting Control
- CAN Bus Lighting Control (Board)
- CAN Bus Park, Tail, and Headlight Systems
- CAN Bus Park, Tail, and Headlight Systems (Board)
- CAN Bus Fog Light Systems
- CAN Bus Fog Light Systems (Board)
- CAN Bus Turn Signal and Hazard Warning Systems
- CAN Bus Turn Signal and Hazard Warning Systems (Board)
- CAN Bus Stop and Backup Light Systems
- CAN Bus Stop and Backup Light Systems (Board)
- The Lighting Systems’ CAN Bus
- The Lighting Systems’ CAN Bus (Board)

Lighting Systems Diagnosis
- CAN Bus Lighting Faults
- CAN Bus Lighting Fault 1 (Board)
- CAN Bus Lighting Fault 2 (Board)
- CAN Bus Lighting Fault 3 (Board)
- CAN Bus Lighting Fault 4 (Board)
- CAN Bus Lighting Fault 5 (Board)
- CAN Bus Lighting Fault 6 (Board)
- CAN Bus Lighting Fault 7 (Board)
- CAN Bus Lighting Fault 8 (Board)
- CAN Bus Lighting Control Fault 1 (Board)
- CAN Bus Lighting Control Fault 2 (Board)

Lighting Systems Measurement
- CAN Bus Lighting Systems Measurement
- CAN Bus Park and Tail Light System Measurement (Board)
- CAN Bus Headlight System Measurement (Board)
- CAN Bus Fog Light System Measurement (Board)
- CAN Bus Turn Signal and Hazard Warning System Measurement (Board)
- CAN Bus Stop and Backup Light System Measurement (Board)
- CAN Data Bus Measurement
- CAN Data Bus Measurement (Board)
LIB 3: 50 CAN Bus Auxiliary Systems

Auxiliary Systems Operation
- Auxiliary CAN Bus Systems
- Effect of a Disconnected CAN Bus Control Module
- The Auxiliary Systems' CAN Bus
- The Auxiliary Systems' CAN Bus (Board)
- CAN Bus Window, Mirror, and Seat Systems
- CAN Bus Window, Mirror, and Seat Systems (Board)
- CAN Bus Power Door Locking System
- CAN Bus Power Door Locking System (Board)
- Auxiliary CAN Bus Door Mirror Control Systems
- Auxiliary CAN Bus Safety Systems
- Auxiliary CAN Bus Security Systems
- Auxiliary CAN Bus Window Control Systems

Auxiliary Systems Measurement
- CAN Data Bus Measurement
- CAN Data Bus Measurement (Board)
- Multimeter Tests on an Auxiliary CAN Bus System
- CAN Bus Window, Mirror, and Seat Systems Measurement
- CAN Bus Mirror System Measurement (Board)
- CAN Bus Window System Measurement (Board)
- CAN Bus Seat System Measurement (Board)
- CAN Bus Power Door Locking System Measurement
- CAN Bus Power Door Locking System Measurement (Board)
- Oscilloscope Tests on an Auxiliary CAN Bus System
- Analyser Tests on an Auxiliary CAN Bus System

Auxiliary Systems Diagnosis
- Testing Auxiliary CAN Bus Systems
- Auxiliary CAN Bus Fault Tolerance
- Faults in Auxiliary CAN Bus Systems
- Open Circuit Auxiliary CAN Bus Faults
- Short Circuit Auxiliary CAN Bus Faults
- CAN Bus Auxiliary Faults
- CAN Bus Auxiliary Fault 1 (Board)
- CAN Bus Auxiliary Fault 2 (Board)
- CAN Bus Auxiliary Fault 3 (Board)
- CAN Bus Auxiliary Fault 4 (Board)
- CAN Bus Auxiliary Fault 5 (Board)
- CAN Bus Auxiliary Fault 6 (Board)
- CAN Bus Auxiliary Fault 7 (Board)
LIB 3: 51 CAN Bus Starting and Charging Systems

Starting and Charging Systems Operation
- CAN Bus Starting and Charging Systems
- The Starting and Charging Systems’ CAN Bus
- The Starting and Charging Systems’ CAN Bus (Board)
- CAN Bus Conventional Starting and Charging System (Board)
- CAN Bus Advanced Starting and Charging System (Board)
- Automatic Stop-Start System (Board)

Starting and Charging Systems Measurement
- CAN Data Bus Measurement
- CAN Data Bus Measurement (Board)
- CAN Bus Starting and Charging Systems Measurement
- CAN Bus Conventional Starting System Measurement (Board)
- CAN Bus Conventional Charging System Measurement (Board)
- CAN Bus Advanced Starting and Charging System Measurement (Board)
- Automatic Stop-Start System Measurement (Board)
- CAN Bus Power Consumers Measurement (Board)

Starting and Charging Systems Diagnosis
- CAN Bus Starting and Charging Faults
- CAN Bus Starting and Charging Fault 1 (Board)
- CAN Bus Starting and Charging Fault 2 (Board)
- CAN Bus Starting and Charging Fault 3 (Board)
- CAN Bus Starting and Charging Fault 4 (Board)
- CAN Bus Starting and Charging Fault 5 (Board)
- CAN Bus Starting and Charging Fault 6 (Board)
- CAN Bus Starting and Charging Fault 7 (Board)
- CAN Bus Starting and Charging Fault 8 (Board)

LIB 3: 52 Automotive Heating and Air Conditioning

Heating and Air Conditioning Fundamentals
- Air Conditioning Principles
- Air Conditioning Systems
- Air Conditioning Trainer (Auto Rig)
- Air Conditioning Trainer Operation (Auto Rig)
- Refrigeration Cycle (Panel)

HVAC Components and Operation
- Compressors
- Lines and Hoses
- Condensers
- Air Distribution Control System Investigation (Panel)
- Air Distribution Control System Troubleshooting 1 (Panel)
- Air Distribution Control System Troubleshooting 2 (Panel)
- Air Distribution Control System Troubleshooting 3 (Panel)
- HVAC Electrical Controls Investigation (Panel)
- A/C Electrical System Fault Investigation (Panel)
- Blower Motor Fault Investigation 1 (Panel)
- Blower Motor Fault Investigation 2 (Panel)
- Compressor Fault Investigation (Panel)
- Climate Control System Operation (Rig)
HVAC Servicing
- Discharging and Recharging an A/C System (Panel)
- A/C System Troubleshooting 1 (Panel)
- A/C System Troubleshooting 2 (Panel)
- Air Conditioning Practical (Auto Rig)
- Air Conditioning System Performance Test (Auto Rig)
- Inspection and Testing of Airflow Components (Workshop)
- Inspect Airflow Components on a Workshop Vehicle (Workshop)
- Testing Automatic Air Conditioning System Operation (Workshop)
- Cooling System Inspection (Workshop)
- Control Head and Component Servicing (Workshop)
- Heater and Air Management Service Procedure (Workshop)
- Testing For Leaks (Workshop)
- Testing A/C Fail Safe Switches (Workshop)
- Removal, Inspection, and Replacement of A/C Compressor Clutch (Workshop)
- Removing and Replacing the A/C Compressor (Workshop)
- Remove, Inspect, and Install A/C System Hose and Fittings (Workshop)
- Airflow Restrictions and Components (Workshop)
- Replacement and Inspection of Accumulator/Receiver-drier (Workshop)
- Servicing the FOT and TXV (Workshop)
- Inspection of A/C Evaporator Drain (Workshop)
- Filter Inspection and Installation (Workshop)
- A/C Compressor Clutch Removal (Workshop)
- Duratec Engine Air-conditioning System Servicing (Rig)
- Investigation of a FOTCC System (Panel)
- FOTCC System Troubleshooting (Panel)

LIB 3: 53 Auto Shop

Automotive Technology
- Automotive Technology

Shop and Personal Safety
- Rules and Procedures 1
- Rules and Procedures 2
- Ventilation Procedures
- Marked Safety Areas and Evacuation Routes
- Fire Safety Equipment
- Fire Fighting
- First Aid 1
- First Aid 2
- Personal Protective Equipment 1
- Personal Protective Equipment 2
- SRS, EBS, and Hybrid High Voltage Systems
- High Voltage Circuits
- Material Safety Data Sheets

Preparing Vehicle for Service
- Repair Orders
- The Three Cs (Concern, Cause, and Correction) (Workshop)
- Vehicle Care
- Vehicle Service History
- Logical Fault Diagnosis
- Door Panel Removal and Replacement (Workshop)

Tools and Equipment
- Tools and Test Equipment
- Tool Usage
- Standard and Metric Designation
- Handling Tools and Equipment
- Handling Tools and Equipment (Workshop)
- Lifting Equipment
- Measuring with a Caliper, Micrometer, or Dial Gauge (Workshop)
- Tool Cleaning, Storage, and Maintenance
- Tool Cleaning, Storage, and Maintenance (Workshop)

Preparing Vehicle for Customer
- Vehicle Preparation
LIB 3: 54 Passenger Safety Systems

SRS Components and Operation
- Airbag Safety
- Introduction to SRS (Rig)
- Airbags (Rig)
- Seat Belts (Rig)

SRS Inspection and Diagnosis
- Disabling and Enabling the Air Bag System (Workshop)
- SRS Faults (Rig)
- SRS Fault Diagnosis 1 (Rig)
- SRS Fault Diagnosis 2 (Rig)
- SRS Fault Diagnosis 3 (Rig)
- SRS Fault Diagnosis 4 (Rig)
- SRS Fault Diagnosis 5 (Rig)
- SRS Fault Diagnosis 6 (Rig)

LIB 3: 55 Heavy Vehicle Systems

CI Engine Components
- HGV Diesel Engine Component Identification (Rig)
- HGV Diesel Engine Cylinders (Rig)
- HGV Diesel Engine Pistons (Rig)
- HGV Diesel Engine Cylinder Head and Valves (Rig)
- HGV Diesel Engine Systems (Rig)

Engine Management System Fundamentals
- Electronic Control Module - Exercise 2.1
- Cruise Control - Exercise 15.1
- Cruise Control - Worksheet 22
- Cruise Control - Worksheet 23

Gearbox Components and Operation
- Transmission Construction (Rig)
- HGV Gearbox Operation (Rig)
- HGV Gears and Gear Ratios (Rig)
- Selector Lever, Rail, and Synchronizers (Rig)

Electronic Controlled Air Suspension
- Electronically Controlled Air Suspension (Rig)
- Electro-pneumatics (Rig)
- Solenoid Valve Unit (Rig)
- Height Sensor (Rig)
- Remote Control Unit (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 1 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 2 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 3 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 4 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 5 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 6 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 7 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 8 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 9 (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis 10 (Rig)
Lighting Systems
- Park, Tail, and Headlamp Circuits 1
- Turn Signal Systems
- Stop and Backup Lamps
- HGV Park, Tail and Headlights - Exercise 9.1
- HGV Park, Tail and Headlights - Worksheet 8
- HGV Turn Signal and Hazard Warning Lights - Exercise 11.1
- HGV Turn Signal and Hazard Warning Lights - Exercise 11.2
- HGV Turn Signal and Hazard Warning Lights - Worksheet 9
- HGV Brake and Backup Lights - Exercise 13.1
- HGV Brake and Backup Lights - Worksheet 10
- HGV Auxiliary Lighting - Exercise 15.1
- HGV Auxiliary Lighting - Worksheet 11

Auxiliary Electrical Systems
- Battery and Fuses - Exercise 3.1
- Battery and Fuses - Worksheet 1
- Battery and Fuses - Worksheet 2
- Horn and Relays - Exercise 7.1
- Horn and Relays - Worksheet 6
- Horn and Relays - Worksheet 7
- HGV Windshield Wiper System - Exercise 19.1
- HGV Windshield Wiper System - Worksheet 13

Starting and Charging
- Starting Management, Control, and Regulation
- Starter and Solenoid - Exercise 5.1
- Starter and Solenoid - Worksheet 3
- Starter and Solenoid - Worksheet 4
- Starter and Solenoid - Worksheet 5
- HGV Alternator Charging Systems - Exercise 17.1
- HGV Alternator Charging Systems - Worksheet 12
- HGV Cold Starting Systems - Exercise 21.1
- HGV Cold Starting Systems - Worksheet 14

Actuators
- Engine Management Actuators - Exercise 18.1
- Engine Management Actuators - Worksheet 24
- Engine Management Actuators - Worksheet 25
- Engine Management Actuators - Worksheet 26
- Engine Management Actuators - Worksheet 27
- Engine Management Actuators - Worksheet 28
- Engine Management Actuators - Worksheet 29
- Engine Management Actuators - Worksheet 30
- Engine Management Actuators - Worksheet 31
- Engine Management Actuators - Worksheet 32

Sensors
- Engine Protection - Exercise 4.1
- Engine Management Analog Sensors - Exercise 8.1
- Oil Temperature Sensor - Exercise 8.2
- Manifold Air Temperature Sensor - Exercise 8.3
- Oil Pressure Sensor - Exercise 8.4
- Ambient Air Sensor - Exercise 8.5
- Turbo Boost Pressure Sensor - Exercise 8.6
- Throttle Position Sensor - Exercise 8.7
- Engine Management Digital Sensors and Switches - Exercise 10.1
- Engine Management Active Sensors - Exercise 12.1
- Engine Management Analog Sensors - Worksheet 1
- Engine Management Analog Sensors - Worksheet 2
- Engine Management Analog Sensors - Worksheet 3
- Engine Management Analog Sensors - Worksheet 4
- Engine Management Analog Sensors - Worksheet 5
- Engine Management Analog Sensors - Worksheet 6
- Engine Management Analog Sensors - Worksheet 7
- Engine Management Analog Sensors - Worksheet 8
- Engine Management Analog Sensors - Worksheet 9
- Engine Management Analog Sensors - Worksheet 10
- Engine Management Analog Sensors - Worksheet 11
- Engine Management Analog Sensors - Worksheet 12
- Engine Management Analog Sensors - Worksheet 13
- Engine Management Digital Sensors and Switches - Worksheet 14
- Engine Management Digital Sensors and Switches - Worksheet 15
- Engine Management Digital Sensors and Switches - Worksheet 16
- Engine Management Digital Sensors and Switches - Worksheet 17
- Engine Management Digital Sensors and Switches - Worksheet 18
- Engine Management Active Sensors - Worksheet 19
- Engine Management Active Sensors - Worksheet 20
- Engine Management Active Sensors - Worksheet 21

Diesel Engine Management
- The Fuel Valve - Exercise 18.2
- Fuel Injection - Exercise 18.3
- Injector Pulse Width - Exercise 18.4
- Injector Timing - Exercise 18.5
- Idle Speed Adjustment - Exercise 18.6
- The Fan Clutch - Exercise 18.7
- Engine Exhaust Emissions - Exercise 6.1
- Fuel Injection
LIB 3: 56 Motorcycle Lighting

Lamp Circuits
- Using a Multimeter (Board)
- Low and High Beam Headlamps (Board)
- Park / Tail Lamp Circuits (Board)
- Stop Lamps (Board)
- Turn Signal Lamps (Board)
- Park / Tail Lamps and Headlamps (Board)
- Park / Tail Lamp and Headlamp Circuit Assignment (Board)
- Park / Tail Lamps and Relay Controlled Headlamps (Board)
- Instrument Panel Lighting Circuit (Board)

Relay Circuits
- Relays (Board)
- Relay-Controlled Headlamp Circuit (Board)
- Relay-Controlled Headlamp Flash Circuit (Board)
- Three Pin Relays and Headlamps (Board)
- Four Pin Relays and Headlamps (Board)
- Four Pin Relay Headlamp Circuit Assignment (Board)

Fault Finding
- Fault Finding (Board)
- Low and High Beam Circuit Fault (Board)
- Park / Tail Lamps Circuit Fault (Board)
- Park / Tail Lamp and Headlamp Circuit Fault (Board)
- Stop Lamp Circuit Fault (Board)
- Turn Signal Circuit Fault (Board)
- Three Pin Relay Headlamp Circuit Fault (Board)
- Four Pin Relay Headlamp Circuit Fault (Board)
- Park / Tail Lamp and Relay Controlled Headlamp Fault (Board)
- Relay-Controlled Headlamp Flash Circuit Fault (Board)
LIB3: 57 Land Cruiser Complete Vehicle Systems

Land Cruiser Systems
- Variable Valve Timing (rig)
- EVAP System Investigation (rig)
- Land Cruiser Driveline Investigation (rig)
- Brake System Inspection (rig)
- Ride Height Measurement (rig)
- Investigating the Power Windows (rig)
- Investigating the Door Mirror (rig)
- Winch Systems
- Military Body Panel Materials

Land Cruiser Fuel Injection
- Land Cruiser Fuel Injector Pulse Width (rig)
- Land Cruiser Fuel Injector Pulse Frequency (rig)
- Land Cruiser Fuel Injector Pulse Timing (rig)

Land Cruiser Faults
- Land Cruiser Fault Diagnosis 1 (rig)
- Land Cruiser Fault Diagnosis 2 (rig)
- Land Cruiser Fault Diagnosis 3 (rig)
- Land Cruiser Fault Diagnosis 4 (rig)
- Land Cruiser Fault Diagnosis 5 (rig)
- Land Cruiser Fault Diagnosis 6 (rig)
- Land Cruiser Fault Diagnosis 7 (rig)
- Land Cruiser Fault Diagnosis 8 (rig)
- Land Cruiser Fault Diagnosis 9 (rig)
- Land Cruiser Fault Diagnosis 10 (rig)

LIB3: 58 Dynamometers

Engine Dynamometer Measurements
- Introduction to Dynamometers
- Measuring Air Flow with Variable RPM (CI Engine) (rig)
- Measuring Air Flow with Variable RPM (SI Engine) (rig)
- Measuring Cylinder Pressure with Variable RPM (CI Engine) (rig)
- Measuring Cylinder Pressure with Variable RPM (SI Engine) (rig)
- Measuring Fuel Use with Variable RPM (CI Engine) (rig)
- Measuring Fuel Use with Variable RPM (SI Engine) (rig)
- Measuring Oil Pressure with Variable RPM (CI Engine) (rig)
- Measuring Oil Pressure with Variable RPM (SI Engine) (rig)
- Measuring the Effect of Load on Torque (CI Engine) (rig)
- Measuring the Effect of Load on Torque (SI Engine) (rig)
- Measuring Torque with Variable RPM (CI Engine) (rig)
- Measuring Torque with Variable RPM (SI Engine) (rig)
- Calculating Power with Variable RPM (CI Engine) (rig)
- Calculating Power with Variable RPM (SI Engine) (rig)

Dynamometer Software Analysis
- Introduction to Dynamometer Software
- Analyzing Air Flow with Variable RPM (CI Engine)
- Analyzing Air Flow with Variable RPM (SI Engine)
- Analyzing Torque with Variable RPM (CI Engine)
- Analyzing Torque with Variable RPM (SI Engine)
- Analyzing Power with Variable RPM (CI Engine)
- Analyzing Power with Variable RPM (SI Engine)
Support

LIB 3: 59 Engineering Mathematics

Units of Measure
■ Units of Measurement

Approximation
■ Approximations

Arithmetic
■ Multiply Sums
■ Adding and Subtracting
■ Multiplication and Division of Decimal Numbers

Fractions
■ Fractions - Addition and Subtraction
■ Fractions - Multiplication and Division
■ Use Fractions
■ Simplify Fractions
■ Expand Fractions
■ Convert Mixed Numbers into Improper Fractions
■ Convert Improper Fractions into Mixed Numbers
■ Add and Subtract Fractions with the Same Denominator
■ Add and Subtract Fractions with Different Denominators
■ Convert Fractions to Decimal Numbers
■ Convert Decimal Numbers to Fractions

Percentages
■ Percentages (Part of 100)
■ Percentages
■ Calculate Percentages of Values
■ Calculate Percentage Increases
■ Calculate Percentage Reductions
■ Parts per Thousand

Length, Area and Volume
■ Lengths, Surface Area and Volume
■ Lengths, Units and Prefixes
■ Calculate the Perimeter of a Rectangle
■ Calculate the Area of a Rectangle
■ Calculate the Area of a Complex Shape
■ Calculate Volume

Graphs and Charts
■ Graphs - Straight Line Graphs
■ Graphs - Square Law
■ Graphs - Pie Chart

Equations
■ Transposing Equations
■ Performing Calculations
■ Sign Rules for Mathematical Operations
■ Distributive Law
■ Multiply Out Brackets
■ Structure Equations
■ Transform Equations by Addition and Subtraction
■ Transform Equations by Multiplication and Division
■ Transpose Equations
■ Calculate the Unknown Variable in an Equation
■ Equating Method for Solving Simultaneous Equations
■ Addition Method for Solving Simultaneous Equations

Algebra
■ Algebra - Simple Formula
■ First, Second, and Third Order Brackets
■ Rule of Three (Direct Proportion)
■ Rule of Three (Inverse Proportion)

Factorisation
■ Simple Factorisation

Indices
■ Working with Powers and Standard Form
■ Indices - Powers of 10
■ Indices - Addition and Subtraction
■ Indices - Multiplication and Division
■ Indices - Letter Notation
■ Powers
■ Indices
■ Square Roots

Angles
■ Angular Measure
■ Measuring Angles
■ Calculating with Angles
Trigonometry
- Lengths and Pythagoras’ Theorem
- Pythagoras’ Theorem
- Basic Trigonometry

Phasors
- Phase Angles
- Phasor Diagrams

Number Systems
- Binary and Decimal Conversions

LIB 3: 60 English Language Skills

Language
- Language Acquisition

Reading
- Citing Strong and Thorough Evidence
- Identifying and Analysing Ideas in a Text
- Understanding and Interpreting a Text
- Understanding the Different Meanings of Language
- Understanding the Structure of a Text
- Determining a Writer’s Perspective
- Understanding Multiple Sources of Information
- Evaluating Arguments and Specific Claims Made in a Text

Writing
- Arguing a Perspective
- Presenting a Persuasive Perspective
- Formal Letters with a Perspective
- Creating an Informative Text
- Informing an Audience
- Writing an Informative Article
- Understanding and Using Perspective in a Narrative
- Writing Reality as a Narrative
- Writing History

Speaking and Listening
- Planning, Writing, Presenting, and Evaluating
- Discussing Different Perspectives
- Justifying Decisions with Reasoning
- Engaging in Group Discussions
- Presenting a Perspective to an Audience
- Speak on the Telephone
- How to introduce Yourself
- Listening and Understanding
- Engage in a Two-Way Conversation
LIB 3: 61 Business Skills

Fundamentals of Business Organisation
- Corporate Mission and Goals
- Business Organisational Structure
- Quality and Environmental Management
- Business Process Optimisation

Procurement
- Management of Hazardous Substances
- Stock Control and the Production Process
- Organising Procurement
- Material Requirements Planning (MRP)
- Purchasing Calculations
- Monitoring Purchasing
- International Commercial Terms and Contracts
- Warehousing
- Controlling Procurement
- Material Procurement

Production
- Production Management
- Analytical Techniques
- Product Range
- Product Range Development
- Production Planning
- Production Process Planning
- Production Process Control
- Improving Production
- Quality Control
- Controlling Production

Cost Accounting
- Marginal Cost Calculations

Economics
- Economic Systems
- Economic Flow Models
- Economic Measures
- Monetary Policy and Price Level Stability
- Production Factors
- Location Factors
- Pricing and Types of Markets
- Needs, Wants and Demand

Financial Accounting and Bookkeeping
- The Inventory
- Purchase Cost Calculations
- Balance Sheet Changes
- Balance Sheet Accounting
- Profit and Loss Accounts
- Inventory Accounting: The Perpetual Method
- Inventory Accounting: The Periodic Method
- List Price Determination
- Accruals and Pre-Payments
- Accounting - Valuation Principles
- Valuation of Balance Sheet Items

Sales and Marketing
- Marketing Planning
- Product and the Marketing Mix
- Pricing Strategies
- Advertising and the Marketing Mix
- Communications and the Marketing Mix
- Distribution and the Marketing Mix
- Control of the Customer's Order
- Sales and Marketing Measures

Social Skills
- Punctuality
- Dress Code
- Personal Space
- Handle Collective Property
- Common Courtesy

Legal Framework
- Types of Contracts
- Process Chains and Networks
- Breach of Contract
- Contracts and UN Law

Investment and Financing
- Investment Planning
- Investment Analysis
- Financing Rules
- Internal Financing
- Profit and Loss Analysis
- External Financing
- The Financial Plan and Leasing
LIB 3: 62 Freight Logistics

Basics of Storage
- The Organisation of Storage
- Storage and Warehouse Technology

Storage of Goods
- The Storage of Different Types of Goods
- Storage and Retrieval Criteria
- Storage Costs
- Storage Issues

Picking Stock
- Organisation of Picking
- Key Figures of Picking

Packaged Goods
- Packaging
- Packaging Aids
- Packaging of Goods

Efficiency and Optimisation of the Warehouse
- Storage Indicators
- Quality Management in the Warehouse

Loading
- Loading Goods Overview

Internal Transport and Loading
- Securing Loads
- Conveying
- Picking Vehicles and Lifting Equipment
- Loading Systems
- Internal Transport and Loading Overview
- Unloading Goods

Human Resources
- Accident Prevention in the Warehouse
- Handling of Hazardous Materials

Route Planning
- Legal Regulations for Shipping
- Freight Costs
- Event Driven Process Chain for Route Planning
- Transporting Hazardous Materials
- Accompanying Documents

Stowage Planning
- Stowage Calculations
- Planning for Stowage
- Stowage Planning for Dangerous Goods

Event Driven Process Chains
- EPC Diagrams

Information Processing
- The Network
- The Intranet and Internet
- Privacy Policy
- The Workstation Computer
LIB 3: 63 Workplace Problem Solving

Production
- Running a Bicycle Parts Production Line
- Running Two Production Lines for Bicycle Parts
- Paint Mixing - Calculating Materials
- Machine Productivity for Cutting Metal Shapes
- Mass Production - Calculating Quantities
- Comparing Machine Productivities
- Choosing Packaging for Parts
- Calculating Costs in a Food Factory
- Programming a Drinks Bottling Plant
- Setting Up a Paint Filling Machine

Distribution
- Calculating Shipping Costs
- Planning Logistics

Construction
- Car Park Construction - Calculating Materials
- Perimeter Fencing - Calculating Materials
- Installing a Flag Pole
- Tiling a Bathroom Floor

Sales and Marketing
- Sales Conversion - Calculating Rates
- Calculating Sales Discounts

Finance
- Upgrading a Vehicle Fleet
- Phone Contracts - Comparing Deals
- Calculating Costs for a Building Project
- Comparing Crane Hire Costs
- Calculating Stationery Costs
- Calculating VAT Rates

Customer Service
- Handling a Telephone Call

Human Resources
- Visiting a Construction Site
- Improving the Workplace
- Attending a Meeting
- Choosing a Computer Monitor
- Workforce Planning