DRAFT SYLLABUS FOR

BROAD BASED COMMON BASIC TRAINING

IN

HEAT ENGINE

TRADE GROUPS

AS APPROVED BY

TRADE COMMITTEE

HELD DURING JANUARY 1982

AT MADRAS.
LIST OF TRADE COMMITTEE MEMBERS FOR HEAT ENGINE TRADE GROUP
COTTON BASIC TRAINING PROGRAMME

Members & Designation

1. Shri. V. U. Purushothaman, Joint Director (CT)
2. Shri. C. Venkataraman, Works Manager
3. Shri. M. Srinath, Service Engineer
4. Shri. V. Mahadevan, Service Engineer
5. Shri. R. Srinivasan, Superintendent (Service)
6. Shri. P. R. Subramaniam, Director
7. Shri. Anbalagan, Divisional Manager, (Operations-North)
8. Shri. R. Janakiraman

Representing

Directorate of Employment & Training, Mairas-600005.
Govt. Automobile Central Workshop, Motor Vehicle Maintenance, Organisation, Mairas-600032.
Shri. Ramakrishna Mission Technical Institute, Mylapore, Mairas-600004.
Pallavan Transport Corporation Ltd., (Metro) Mairas-600002.
Retired Assistant Engineer, M/s. Pallavan Trans, Corporation, Mairas-600002.

Regional Directorate of Apprenticeship Training Programme, Mairas-600032.

Secretary:

Shri. V. M. Raghavan, Regional Director.

Invitees:

1. Shri. M. K. Gayan, Vice Principal
2. Shri. S. Kunjithapadam, Deputy Director
3. Shri. V. V. Narayanan, Training Officer

Regional Directorate of Apprenticeship Training Programme, Mairas-600032.

Central Training Institute, Mairas-600032.

Regional Directorate of Apprenticeship Training Programme, Mairas-600032.

Regional Directorate of Apprenticeship Training Programme-Mairas-600032.
Second year Training would be on modular system. The trainees could opt for different modules of specialisation on selective basis annexure III(a) The design/testing and certification of standard modules would be controlled by DGS&T Apart from this the Institutes could organise modules of local relevance for which testing and certification has to be done by Local authorities.

### BASIC TRAINING
(Uniform rotation in the 8 skill areas listed opposite)

<table>
<thead>
<tr>
<th>Area</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC FITTING</td>
<td>6 Weeks</td>
</tr>
<tr>
<td>MEASUREMENTS</td>
<td>4 Weeks</td>
</tr>
<tr>
<td>SHEET METAL HARD FORGING &amp; WELDING</td>
<td>8 Weeks</td>
</tr>
<tr>
<td>BASIC ELECTRICITY</td>
<td>6 Weeks</td>
</tr>
<tr>
<td>PETROL ENGINES</td>
<td>5 Weeks</td>
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<tr>
<td>DIESEL ENGINES</td>
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<tr>
<td>TRANSMISSION SYSTEMS</td>
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<tr>
<td>SUSPENSION STEERING &amp; BRAKE</td>
<td>6 Weeks</td>
</tr>
</tbody>
</table>

Restructured Training for Heat Engine Trades Group at Industrial Training Institutes
Induction Training
1. Orientation with shop layout and machinery used in the trade, and safety equipment and tools and equipment in the shop. Exercises on marking out, location of the position of holes, scribing lines on chalked surfaces with the help of steel rule, dividers, end calipers, and scribers. Dot punching the lines and holes. Drilling the holes.

2. Exercises on chipping and filing flat and square to faces marking out for saw cuts with the help of hampuni-calipers. Sawing along the lines with certain limits of straightness. Removing of sawn strips. Filing and cleaning to complete and finish the gap to dimensions, measuring with callipers and steel rule.

3. Exercises on marking out according to simple blue prints, using surface gauge, steel rule, engineers' square and marking off table. Finding the centre of a round bar with the help of "V" blocks and surface gauge. Marking out lines by parallel edges. Gripping suitably in vice jaws for sawing to dimensions sawing various metals of different sections. Practising blind hammering.

4. Chipping and filing the edges flat and square to the faces. Checking up with engineers' square. Filing square the four edges. Use of vice-clamps and checking up overall dimensions with calipers and steel rule. Exercises on preparation of one of the flat surface as master surface. Filing two of the adjoining sides square to the master surface as well as between special type drills.

Trade Theory
Importance of safety and general precautions. Linear measurements and its units, rules, scribers method of scribing with the help of steel rule. Construction of dividers, calipers-inside and outside, hampuni-calipers, their use and care. Centre punch and dot punch, construction and use. Use of marking media—hammers—types and use.

Hacksaw frames and hack-saw blades; their construction, description, use and care. Surface gauge, vee-blocks, marking off table, engineers' square, bench vice and vice clamps.


5. Filing flat the work piece, squaring edges in relation to the master face, marking out the position of drill holes to tapping sizes and dot punching. Deepening the points with centre punch and checking up concentricity for true drilling. Internal threading with threading taps. Cutting of external threads with threading dies. Preparing insert and fitting a slot. Working to close tolerances.

Checking and measuring with Vernier calipers and outside micrometer. Identification of threads—use of thread gauge.

6. Practice on grinding chisels, drill and dot punches. Exercises involving preparation of one of the flat surfaces as master surface, filing two of the adjoining sides, square marking out with vernier height gauge—drilling open and file fitting of finished pieces against opening.

Use of Vernier caliper and micrometer for checking. Selection of tools—use of different types of Pullers, spanners—stud extractor, stud remover, Pliers and screwdrivers.

Achievements

On completion of this module, the trainee should be able to:

1. Use Fitters hand tools
2. Do marking out according to blue prints
3. Do filing, Hacksawing—chipping and drilling and simple fitting
4. Read and use precision instruments as prescribed in the syllabus
5. Use protractor head to an accuracy of 1 degree and file and finish to an accuracy of ± 0.1 mm
Module II

DRAFT COURSE CONTENTS

Week No. Practical

1. Measuring lengths and diameter of objects, using steel rule, outside and inside calipers-finding centre of round bar, marking line on flat piece-drawing parallel lines to the given plate edge-marking square on cylindrical objects and marking keyways on shafts using Jenny calipers & scribing Block & combination set (objects to be chosen: King pins/Shackle pins/Chackle Bushes/axle Shafts/Flat pieces/Round Bar).

2. Measuring diameters of journals and pins using outside micrometer-checking error on micrometer with standard length pieces. Measuring inside diameters of bores using inside micrometers. Measuring depth of stepped bores, using depth micrometer and flatness using dial micrometer (object to be chosen: Crank pins/Main journals/king pins/cylinder liners/cylinder bores/wheel cylinder bore/hot cylinder bore/connecting rod and main bearing, parent bore/valve guide/combustion chambers)

3. Measuring diameter of cylinder bores using vernier calipers-measuring diamensions of crank pins and main journals using 0.001 calipers and vernier calipers-measuring angles using vernier Bevel protractor (Valve angles can be measured) Measuring water pump shafts with vernier micrometer (outside) and valve guide bores using vernier micrometer (inside)

Trade Theory

Introduction to measuring of objects and their importance in the trade-measuring standards normally used—measurements of Units CGS, FPS and MKS system steel construction and use of steel rule graduations in metric and Inch—Description of try square, dividers, Jenny calipers, Calipers, combination set and scribing block—function and uses—Care and maintenance of the marking tools.

Micrometers—internal & external—construction and types—their importance in measuring objects—depth micrometer—dial micrometer—their description and use—errors on micrometers and rectification methods—care and maintenance of micrometers to maintain accuracy

Vernier calipers—Description and function and use—importance of vernier scales and graduations of Inch and metric vernier micrometer—constructions—graduation & its application—vernier bevel protractor—construction function & use Different applications care and maintenance of the above to maintain accuracy.

Measuring depth of valve port and height of valve guides in cylinder head using vernier depth gauge. Measuring tappet bores using small hole gauge measuring timing distance in flange mounted single cylinder F.I pump using depth gauge.

**ACHIEVEMENTS**

On completion of the Module the trainees should be able to

1. Use steel rule and calipers and measure objects
2. Measure precision objects with the help of vernier instruments
3. Measure precision objects with the help of micrometer
4. Use depth gauges and dial test indicators & small bore gauges in measuring objects.

**Theory**

- Importance of dial test indicator—description and function and its use—care and maintenance
  - Vernier depth gauge and ordinary depth gauge—description—function and use—care and maintenance
  - Use of small bore gauge in measuring small bores in cylinder block—care and maintenance
**Module III**

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Practical</th>
<th>Trade Theory</th>
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<tbody>
<tr>
<td>1.</td>
<td>Introduction to the Trade-importance of acquiring skill practice in reading steel rule (Metric &amp; English) Scribing of straight lines, bisecting of straight lines on sheet metal using marking tools.</td>
<td>Importance of safety and general precautions. Importance of the trade &amp; what is related instructions - metals and non-metals. Classification and uses of sheet metals.</td>
</tr>
<tr>
<td>2.</td>
<td>Practice in drawing simple geometrical shapes. Practice in cutting sheet metal to these shapes. Practice in making and cutting of sheets to various angles.</td>
<td>Mild steel and non-ferrous metals. Marking and layout tools - dividers, trammels.</td>
</tr>
<tr>
<td>3.</td>
<td>Lap joints-cutting with different types of snips, cutting of notches, inside and outside curves.</td>
<td>Various types of snips &amp; shears and their uses - Table: HODSWEL shears Description - care and maintenance</td>
</tr>
<tr>
<td>4.</td>
<td>Soldering of joints &amp; sleeves on pipes - use of soldering flux, flaring of small tubes/pipes with pipe flaring tool. Cutting and bending of pipes - Joining pipes - fitting unions and sleeves on pipes.</td>
<td>Sheet metal workers tool bench vice, soft jaws, clamps, pliers bench stakes, holders - various types and their uses.</td>
</tr>
<tr>
<td>5.</td>
<td>Bending sheet metal to 90 degrees using wooden mallet, clamps. On bench, Practice in filing, coning parts of a box-bending sheet metal to angles other than 90 degrees practice in rivetting plates and joints.</td>
<td>Files - various types, cut, grade, length ... and classification. Files used on soft metals. Meaning of solder - use of fluxes their effects on different metals. Rivets - different types - rivetted joints - uses.</td>
</tr>
<tr>
<td>6.</td>
<td>Prepare forge-lighting - maintenance and up-keep of forge, method of heating iron. Use of various fire zones, hammering practice forging sq. to sq. (Use of hand tools and anvil)</td>
<td>Bellows - blowers &amp; their working. Forge Parts and their uses. Anvil &amp; other common hand tools - brief description, their use and maintenance.</td>
</tr>
</tbody>
</table>
7. Introduction to welding types of jobs made by the trainees-safety in handling tools & equipment-setting gas apparatus-lighting and adjustment of oxyacetylene flame & fusion runs with and without filler rod on 2 to 3 mm thick MS sheet in flat position (Gas)
   IS 1393-1961-IS 817-1966
   IS 818-1968-IS 1179-1967

8. Edge joint with or without filler rod on MS sheet (2 to 3 mm) 45° butt joint MS sheet (1.6 mm) open corner joint MS sheet 2 to 3 mm inflation gas
   IS 1393-1961

**ACHIEVEMENTS** - On completion of this module
Trainees should be able to

1. Use various hand tools
2. Mark off, cut sheet metals and make joints
3. Solder the joints
4. Bend sheet metal with hand tools
5. Do simple riveting
6. Make square through forging
7. Do simple welding (gas) in flat position.
**Major Trade Group:** Heat Engine Trade  
**Training Period:** 48 weeks.

**Minor Trade Area:** Basic Electricity  
**Training Period:** 6 weeks.

**Module:** IV

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**BRIEF COURSE CONTENT**

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<tr>
<td></td>
<td>1. Orientation, familiarization with shop layout, hand tools &amp; machines - safety precautions &amp; first aid-Making joints on single &amp; Stranded conductors</td>
<td>Safety precautions and first aid-care and maintenance of tools. Common terms used in the trade-conductors and insulators. Selected symbols and signs used in Electrical Technology.</td>
</tr>
<tr>
<td></td>
<td>4. Measurement of current, voltage power and energy by using Voltmeter, ammeter, Wattmeter.</td>
<td>Common electrical terms such as AC DC Inductance, capacitance frequency, phases - Battery specifications and constructional details - Description of batteries-care and maintenance of batteries.</td>
</tr>
<tr>
<td></td>
<td>5. Practice in fixing &amp; connecting electrical accessories such as switches, holders, fuses plug sockets on T.W. boards. Making a simple testing board.</td>
<td></td>
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<td></td>
<td>6. Practice in removing and fitting the batteries - Cleaning and maintenance of Batteries- Testing the Batteries with Hydrometer &amp; cell Taster. Topping up Battery with Distilled water - Connect Batteries for Charging.</td>
<td></td>
</tr>
</tbody>
</table>

**Achievements:**

1. Protect himself from electrical shock and observe electrical safety precautions while working on machines.
2. Form simple electrical circuits, operate basic controlling protective electrical devices e.g. Main switch, fuses-select and connect common electrical accessories.
COMMON BASIC TRAINING PROGRAMME

Major Trade Group: Heat Engine Trades
Minor Trade Area: Petrol Engines

TRAINING PERIOD

- Training period 48 weeks
- Training Period 6 weeks

MODULE V

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Practical</th>
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<tbody>
<tr>
<td>1</td>
<td>Familiarisation with the hand tools, machinery and type of work done in the trade. Safety precautions in the use of hand tools and equipment on shop floor. Safety equipment and its use.</td>
<td>Introduction to the trade safety and general precautions to be observed in the trade in storing and handling fuels, brake fluids, oil, greases. Description of safety equipment, its purpose and use. Elementary first aid.</td>
</tr>
<tr>
<td>3</td>
<td>Identifying various petrol engines auxiliaries. Practice on starting and stopping of the engine. Adjusting speeds in idling and running conditions. Running the engine on load and checking temperature, fuel, oil pressure and speed. Testing engine compression and vacuum with gauges.</td>
<td>Precautions in starting, running and stopping a petrol engine. Difference between 2 stroke and four stroke engines. Brief description of engine auxiliaries and functions of various gauges used with the engine.</td>
</tr>
</tbody>
</table>
5. Dismantling an old 4 stroke petrol engine. Examine inner details of moving parts, their materials and other working details. Assemble the engine.


6. Clean spark plugs, adjust correct gaps and refit, service oil filters, air cleaner and change oil in engine. Start the engine and carry out minor adjustments on carburettor.

6. Ignition system of petrol engines purpose of induction coil, distributor and spark plug. Elementary functions of the Carburettor and adjustments. Importance of correct air-fuel mixture on the engine performance

ACHIEVEMENTS

On completion of the Module the trainees should be able to:

1. Identify various engine parts and auxiliaries.
2. Dismantle and assemble old 2 & 4 stroke petrol engines.
3. Start and stop engine and carry out minor adjustments repairs and servicing of the engine.

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6. Dismantling & assembling oil pump, servicing oil filters, air cleaners-changing oil in engine, repairs to oil flow, pipe lines and unions. Flushing of cooling system in Engine.

Types of fuel filters, cleaning and replacement, procedure of removing air lock from diesel line, maintenance procedure and maintaining engine log book.

**Achievements:**

On completion of this Module the trainees should be able to:

1. Clean, lubricate and check different assemblies.

2. Decarbonise the cylinder head. Adjust tappets and start the engine.

3. Measure cylinder wear, piston clearances

4. Service oil filters, air cleaners, oil pump, cooling system

5. Dismantle and assemble engine components

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<td>Types of fuel filters, cleaning and replacement, procedure of removing air lock from diesel line, maintenance procedure and maintaining engine log book.</td>
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Achievements:

- On completion of this Module the trainees should be able to:
  - check
  1. Clean, lubricate and check different assemblies.
  2. Decarbonise the cylinder head. Adjust tappets and start the engine.
  3. Measure cylinder wear, piston clearances
  4. Service oil filters, air cleaners, oil pump, cooling system
  5. Dismantle and assemble engine components

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[Stamp: National Skill Training Institute Jodhpur]
### Brief Course Content

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<tr>
<th>Week No.</th>
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<tbody>
<tr>
<td>1.</td>
<td>Practice in Jacking up the Vehicle - Removing wheel assembly - Dismantling cleaning, reassembling and refitting Wheel assembly - Checking and hot patching puncture in a tube - Checking and inflating tyres to recommended pressure - Rotating wheels in a vehicle - Care and Lubrication of front suspension units.</td>
<td>General description of conventional suspension system - Wheels and tyres and tubes - Sizes and Applications - Leaf and coil Springs - Shock Absorbers Description and Function - Care and Maintenance.</td>
</tr>
<tr>
<td>2.</td>
<td>Checking alignment of frame, wheel Base and track - Removing and refitting a leaf spring as assembly in a vehicle - Changing rubber bushes of shock absorbers and independent front suspension Lower &amp; Upper Arms - Removing cleaning, lubricating, and adjusting front wheel bearings.</td>
<td>Definition of wheel base and track - Description of frame - Types and Functions I.F.P. systems - Types Description and Functions Care and Maintenance.</td>
</tr>
<tr>
<td>3.</td>
<td>Inspection, Lubrication, and adjusting of steering Linkages for wear and play - Removing, cleaning, refitting and adjusting Tie rod ends. Removing and refitting steering boxes from Vehicle-checking and refilling oil in steering box.</td>
<td>Lay out of steering Assembly and linkages in different vehicles - Name &amp; Function of each part - Description and function of steering Boxes - Lubrication of Linkages &amp; steering box.</td>
</tr>
<tr>
<td>4.</td>
<td>Checking &amp; adjusting camber angle and Toe in-checking of king pin angle and castor angle with wheel alignment gauge - Checking and adjusting steering wheel play, Back lash - and steering column and play.</td>
<td>Steering geometry - Ackerman angle - Castor, Camber, King pin inclination - Toe in-toe-out on turns - Description and purpose - Checking and correcting with instruments - Common steering troubles and remedy.</td>
</tr>
</tbody>
</table>
5. Checking and adjusting hand brakes and pedal play in foot brakes - topping up master cylinder - removing, dismantling, cleaning, reassembling and adjusting wheel brake Assembly.

6. Removing a Master Cylinder and wheel cylinder from a vehicle - dismantling, cleaning, reassembling with new replacement kit and testing on bench - refitting the same in the vehicle, bleeding and balancing brakes.

General Layout of Braking System - Mechanical and Hydraulic Brakes - Purpose of hand brakes - description, function and care and maintenance of each part of the braking system.

Principle of Hydraulic Brakes - Description and working of Master Cylinder and types in use - Purpose of check valve and compensating port - description and working of wheel cylinder and types in use - Common troubles in brake system and their remedy.

Achievements

On completion of this module -

The trainee should be able to:

1. Jack up a vehicle and remove and refit wheel assembly
2. Repair a puncture in a tube and refit the tube in the tyre
3. Check alignment of front wheels and frame
4. Remove and refit steering box and lubricate steering joints
5. Check and adjust hand and foot brakes
6. Dismantle Master Cylinder and wheel cylinder units and reassemble them.

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## COMMON BASIC TRAINING PROGRAMME

**Major Trade Group:** Heat Engine Trades  
**Minor Trade Area:** Suspension, Steering & Brakes  
**Duration:** 48 weeks  

**Module:** VII  

**BRIEF COURSE CONTENT**

<table>
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<tr>
<th>Week No.</th>
<th>Practical</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Practice in Jacking up the Vehicle - removing wheel assembly - Dismantling cleaning, reassembling and refitting Wheel assembly - checking and hot patching puncture in a tube - Checking and inflating tyres to recommended pressure - rotating wheels in a vehicle - care and Lubrication of front suspension Units.</td>
<td>General description of conventional suspension system - wheels and tyres and tubes - sizes and applications - leaf and coil springs - shock absorbers - description and function - care and maintenance.</td>
</tr>
<tr>
<td>2</td>
<td>Checking alignment of frame, wheel base and track - removing and refitting a leaf spring as assembly in a vehicle - changing rubber bushes of shock absorbers and independent front suspension Lower &amp; Upper Arms - removing cleaning, lubricating, and adjusting front wheel bearings.</td>
<td>Definition of wheel base and track - description of frame - types and functions I.F. systems - types Description and functions care and maintenance.</td>
</tr>
<tr>
<td>3</td>
<td>Inspection, lubrication, and adjusting of steering linkages for wear and play - removing, cleaning, refitting and adjusting. Tie rod ends. Removing and refitting steering boxes from vehicle checking and refilling oil in steering box.</td>
<td>Lay out of steering Assembly and linkages in different vehicles - name &amp; function of each part - description and function of steering boxes - Lubrication of Linkages &amp; Steering box.</td>
</tr>
<tr>
<td>4</td>
<td>Checking &amp; adjusting camber angle and Toe in - checking of king pin angle and caster angle with wheel alignment gauge checking and adjusting steering wheel play, Back lash - and steering column and play.</td>
<td>Steering geometry - Ackerman angle - caster, camber, king pin inclination - Toe in - Toe-out on turns - Description and purpose - checking and correcting with instruments - common steering troubles and remedy.</td>
</tr>
</tbody>
</table>
# COMMON BASIC TRAINING PROGRAMME

**Major Trade Group:** Heat Engine Trades  
**Duration:** 48 weeks  
**Minor Trade Area:** Transmission systems  
**Duration:** 6 weeks  
**Module:** VIII

## BRIEF COURSE CONTENT

<table>
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<tr>
<th>Week No.</th>
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<tbody>
<tr>
<td></td>
<td>Dismantling a clutch assembly, clean and inspect parts for wear and damage. Changing pressure plate and fly wheel relining a clutch plate.</td>
<td>Description of single plate and multiplate clutches, functions of different parts of the clutch assembly. Material for linings. Bonded linings and riveted linings. Precautions while relining the clutch plates.</td>
</tr>
<tr>
<td></td>
<td>Assembling of pressure plate, assembly with springs, testing the springs for uniform tension, adjusting the fingers and aligning clutch with flywheel.</td>
<td>Purpose of Damper springs in the clutch plate, freeplay in the operation of clutch. Function of the pilot (solgot) bearing. Causes and remedies of clutch troubles.</td>
</tr>
<tr>
<td></td>
<td>Stripping a 4 speed and 3 speed sliding mesh gear box, cleaning, inspecting and assembling.</td>
<td>Purpose of the gear box, gear ratios and function of a sliding mesh gear-box. Common troubles and their remedies. Lubrication system in a gear box.</td>
</tr>
</tbody>
</table>
|          | Stripping a synchromesh gear box, cleaning and inspecting parts. Assembling and testing for correct functioning. | Description and advantage of  
(1) Constant mesh gear box  
(2) Synchromesh Gear box.  
Common troubles and remedies. Types of synchromesh gear box and their special features. |
|          | Cleaning, assembling gear shaft mechanism, changing oil in the gear box. Studying different types of oil seals and bearings used in the gear boxes. Studying the gear ratios in the gear box. | Functioning of the gear shaft lever. Type of lubricating oil used in gear boxes. Types of seals and bearings used in gear boxes. Material used for gears, back lash of gears. Inspection of old gears for determining their usage. |

Achievements: On completion of this module, the trainee should be able to:

1. Reline a clutch plate and adjust clutch play.
2. Do minor repairs to clutch, gear box and rear axle.
3. Check oil seals, bearings and gears for their serviceability.
4. Check differential tooth contact and backlash.
5. Follow safety precautions while performing the above jobs.

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